TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
400 Chestnut Street Tower II

February 6, 1984

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of	)	Docket Nos. 50-390
Tennessee Valley Authority	)	50-391

By Generic Letter 81-07 dated December 19, 1983, TVA was requested to provide information on Watts Bar Nuclear Plant concerning NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." Enclosed is TVA's response to section 2.1 of the referenced generic letter. TVA expects to provide the information requested in sections 2.2, 2.3, and 2.4 six months before the first refueling outage.

If you have any questions concerning this matter, please get in touch with D. P. Ormsby at FTS 858-2682.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

L. M. Mills

L. M. Mills, Manager
Nuclear Licensing

Sworn to and subscribed before me
this 6th day of Feb., 1984

Bryant M. Lowery
Notary Public
My Commission Expires 4/8/86

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Mr. James P. O'Reilly, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30303

B030
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QUESTION 2.1 RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON CONTROL OF HEAVY LOADS FOR WATTS BAR NUCLEAR PLANT

TABLE OF CONTENTS

2.1-1 RESPONSE

The following is a submittal of the 2.1-1 response which identifies all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal.

The lift systems have been given unique identifier numbers and have also been analyzed for the effects of dynamic loading. The actual dynamic load due to hook/load acceleration or deceleration is determined through the use of the Crane Industrial Standard, CMAA-70, which addresses the question of dynamic loading on cranes. For those lift systems having a dynamic load of 15 percent of the static load or less, no additional considerations for impact were made.

LIFT SYSTEM IDENTIFICATION
2.1-1 Response

Lift System No.	Type Lift System	Location (Building)	Description	TVA Drawing Number	Dynamic Loading %[1]
CR1-CZ-M	Overhead Crane	RB	175-ton Polar Crane - Main Hoist	44N230 - 235	2.0
CR1-CZ-A	Overhead Crane	RB	175-ton Polar Crane - Aux Hoist	44N230 - 235	10.0
CR2-CZ-M	Overhead Crane	AB	125-ton Aux Bldg Crane - Main Hoist	44N300 - 304	3.0
CR2-CZ-A	Overhead Crane	AB	125-ton Aux Bldg Crane - Aux Hoist	44N300 - 304	12.0
JB1-CZ[2]	JIB Crane	RB	3-ton JIB/w 3-ton Hoist and Trolley[2]	47W200-11/44N384	12.5
JB2-CZ	JIB Crane	IPS	20-ton Hydraulic Pedestal Crane	44N310	20.0
MR1-CZ	Monorail	AB	5 ton/w 5 ton Hoist and Trolley	48N1276-3 Mk 306 44N389 & 391 Mk 8	15.0
MR2-CZ	Monorail	AB	4 ton/w 4 ton Hoist and Trolley	48N1276-3 Mk 307 44N389-390 Mk 1	12.5
MR3-CZ	Monorail	AB	4 ton/w 4 ton Hoist and Trolley	48N1276-2 Mk 224 44N389	12.5

1. This percentage relates a static load increase, based on the dynamic characteristics of the hoisting system in question.

   RB - Reactor building
   AB - Auxiliary building
   IPS - Intake pumping station
   CZ - Identifies a lift system operating in critical zones

2. This lift system handles miscellaneous equipment into and out of the reactor building, refer to pages 5-7 of appendix D for further information.

2.1-2 RESPONSE

In response to question 2.1-2, this is a list of overhead handling systems from which a load drop would not result in damage to any system required for plant shutdown or decay heat removal for one of the following reasons:

a. There is sufficient physical separation from any system or component required for safe shutdown or decay heat removal.

b. The system or component over which the load is carried is out of service while load handling system is used.

c. The load weighs less than 2,000 pounds and is not considered a heavy load.

2.1-2 RESPONSE

Lift System No.	Load Handling System	TVA Drawing No.	Reason for Exclusion
MR 1	1-ton Monorail	Mk 100 48N1276-1	B
MR 2	1-ton Monorail	Mk 101 48N1276-1	B
MR 3	4-ton Monorail	Mk 104 48N1276-1	B
MR 4	4-ton Monorail	Mk 105 48N1276-1	B
MR 5	4-ton Monorail	Mk 106 48N1276-1	B
MR 6	4-ton Monorail	Mk 107 48N1276-1	B
MR 7	4-ton Monorail	Mk 108 48N1276-1	B
MR 8	4-ton Monorail	Mk 109 48N1276-1	B
MR 9	4-ton Monorail	Mk 110 48N1276-1	B
MR 10	4-ton Monorail	Mk 111 48N1276-1	B
MR 11	4-ton Monorail	Mk 112 48N1276-1	B
MR 12	4-ton Monorail	Mk 114 48N1276-1	B
MR 13	4-ton Monorail	Mk 115 48N1276-1	B
MR 14	4-ton Monorail	Mk 116 48N1276-1	B
MR 15	4-ton Monorail	Mk 118 48N1276-1	B
MR 16	4-ton Monorail	Mk 119 48N1276-1	B
MR 17	4-ton Monorail	Mk 120 48N1276-1	B
MR 18	4-ton Monorail	Mk 121 48N1276-1	B
MR 19	5-ton Monorail	Mk 122 48N1276-1	B
MR 20	4-ton Lifting Eye Pump 1A-A	Mk 7B 48N1276-1	B
MR 21	4-ton Lifting Eye Pump 1B-B	Mk 7B 48N1276-1	B
MR 22	4-ton Lifting Eye Pump 2A-A	Mk 7B 48N1276-1	B
MR 23	4-ton Lifting Eye Pump 2B-B	Mk 7B 48N1276-1	B
MR 24	5-ton Monorail	Mk 201 48N1276-2	B
MR 25	4-ton Monorail	Mk 202 48N1276-2	B
MR 26	4-ton Monorail	Mk 203 48N1276-2	B
MR 27	4-ton Monorail	Mk 204 48N1276-2	B
MR 28	6-ton Monorail	Mk 205 48N1276-2	B
MR 29	6-ton Monorail	Mk 206 48N1276-2	B
MR 30	4-ton Monorail	Mk 207 48N1276-2	B
MR 31	4-ton Monorail	Mk 208 48N1276-2	B
MR 32	4-ton Monorail	Mk 209 48N1276-2	B
MR 33	2-ton Monorail	Mk 210 48N1276-2	B
MR 34	2-ton Monorail	Mk 211 48N1276-2	B
MR 35	2-ton Monorail	Mk 212 48N1276-2	B
MR 36	2-ton Monorail	Mk 213 48N1276-2	B
MR 37	5-ton Monorail	Mk 214 48N1276-2	A
MR 38	5-ton Monorail	Mk 215 48N1276-2	B
MR 39	2-ton Monorail	Mk 216 48N1276-2	B

2.1-2 RESPONSE (Continued)

Lift System No.	Load Handling System	TVA Drawing No.	Reason for Exclusion
MR 40	2-ton Monorail	Mk 217 48N1276-2	B
MR 41	2-ton Monorail	Mk 218 48N1276-2	B
MR 42	2-ton Monorail	Mk 219 48N1276-2	B
MR 43	3-ton Monorail	Mk 220 48N1276-2	A
MR 44	4-ton Monorail	Mk 221 48N1276-2	B
MR 45	4-ton Monorail	Mk 222 48N1276-2	B
MR 46	4-ton Monorail	Mk 223 48N1276-2	B
MR 47	5-ton Monorail	Mk 225 48N1276-2	B
MR 48	6-ton Monorail	Mk 301 48N1276-3	A
MR 49	6-ton Monorail	Mk 302 48N1276-3	A
MR 50	3-ton Monorail	Mk 303 48N1276-3	A
MR 51	3-ton Monorail	Mk 304 48N1276-3	A
MR 52	4-ton Monorail	Mk 308 48N1276-3	A
MR 53	5-ton Monorail	Mk 310 48N1276-3	B
MR 54	5-ton Monorail	Mk 311 48N1276-3	B
MR 55	3-ton Monorail	Mk 312 48N1276-3	B
MR 56	3-ton Monorail	Mk 313 48N1276-3	B
MR 57	5-ton Monorail	Mk 314 48N1276-3	B
MR 58	5-ton Monorail	Mk 315 48N1276-3	B
MR 59	8-ton Monorail	Mk 1 & 2 44N375	A
MR 60	8-ton Monorail	Mk 1 & 2 44N375	A
MR 61	8-ton Monorail	Mk 1 & 2 44N375	A
MR 62	8-ton Monorail	Mk 1 & 2 44N375	A
MR 63	10-ton Monorail	Mk 1 44N376	A
MR 64	10-ton Monorail	Mk 1 44N376	A
MR 65	1/2-ton Monorail	Mk 2 44N376	C
MR 66	10-ton Monorail	Mk 1 44N377	A
MR 67	10-ton Monorail	Mk 1 44N377	A
MR 68	5-ton Monorail	Mk 2 & 3 44N377	A
MR 69	5-ton Monorail	Mk 2 & 3 44N377	A
MR 70	5-ton Monorail	Mk 1 & 2 44N378	A
MR 71	5-ton Monorail	Mk 1 & 2 44N378	A
MR 72	6-ton Monorail	Mk 3 44N378	A
MR 73	1-ton Monorail	Mk 1 44N380	A
MR 74	2-ton Monorail	Mk 2 44N380	A
MR 75	3-ton Monorail	Mk 3 44N380	A
MR 76	3-ton Monorail	Mk 4 44N380	A
MR 77	1-ton Monorail	Mk 5 44N380	A
MR 78	1-ton Monorail	Mk 5 44N380	A
MR 79	1-ton Monorail	Mk 7 44N380	A
MR 80	1-ton Monorail	Mk 8 44N380	A
MR 81	3-ton Monorail	Mk 9 44N380	A
MR 82	1-ton Monorail	Mk 10 44N380	A
MR 83	3-ton Monorail	Mk 11 44N380	A

Lift System No.	Load Handling System	TVA Drawing No.	Reason for Exclusion
MR 84	3-ton Monorail	Mk 11 44N380	A
MR 85	3-ton Monorail	Mk 12 44N380	A
MR 86	1-ton Monorail	Mk 13 44N380	A
MR 87	1-ton Monorail	Mk 13 44N380	A
MR 88	1-ton Monorail	Mk 13 44N380	A
MR 89	1/2-ton Monorail Unit 2B-B	44N382	B
MR 90	1/2-ton Monorail Unit 1B-B	44N382	B
MR 91	1/2-ton Monorail Unit 2A-A	44N382	B
MR 92	1/2-ton Monorail Unit 1A-A	44N382	B
MR 93	1-ton Monorail Unit 2B-B	44N382	B
MR 94	1-ton Monorail Unit 2B-B	44N382	B
MR 95	1-ton Monorail Unit 1B-B	44N382	B
MR 96	1-ton Monorail Unit 1B-B	44N382	B
MR 97	1-ton Monorail Unit 2A-A	44N382	B
MR 98	1-ton Monorail Unit 2A-A	44N382	B
MR 99	1-ton Monorail Unit 1A-A	44N382	B
MR 100	1-ton Monorail Unit 1A-A	44N382	B
MR 101	5-ton Monorail	44N392	A
MR 102	5-ton Monorail	44N392	A
MR 103	5-ton Monorail	44N392	A
MR 104	5-ton Monorail	44N392	A
MR 105	2-ton Lifting Lug	44N392	A
MR 106	2-ton Lifting Lug	44N392	A
MR 107	2-ton Lifting Lug	44N392	A
MR 108	5-ton Monorail	Mk 1 44N393	A
MR 109	3-ton Monorail	Mk 2 44N393	A
MR 110	3-ton Monorail	Mk 3 44N393	A
MR 111	3-ton Monorail	Mk 4 44N393	A
MR 112	1-1/2-ton Monorail	Mk 5 44N394-6	A
MR 113	2-ton Monorail	Mk 1 & 2 44N395	A
MR 114	2-ton Monorail	Mk 1 & 2 44N395	A
MR 115	1/2-ton Monorail	Mk 3 & 4 44N395	A
MR 116	1-ton Monorail	Mk 305 44N389	C
MR 117	1-ton Monorail	Mk 309 44N389	C

2.1-2 RESPONSE (Continued)

Lift System No.	Load Handling System	TVA Drawing No.	Reason for Exclusion
CR1	Single-trolley, electric motor-operated overhead traveling crane w/200 ton hoist	44N200 - 44N202	A
CR2	10-ton Capacity, underhung crane w/motor driven bridge and trolley	44N207	A
CR3	15-ton Top running crane w/double girder bridge	44N209	A
CR4	5-ton Underhung crane	44N220	A
CR5	6-ton Underhung crane	44N306	A
CR6	6-ton Overhead crane	44N307	A
MGC1	Mobile gantry crane w/30 ton dual hooks and 15 ton capacity single hook	44W256-1, -2 44W254-1, -2, -3 44W255-1, -2, -3	A
JB1	6-ton Jib crane	Mk 1 44N394-6	A

2.1-3a and c RESPONSE

The following table is the response to questions 2.1-3a and 2.1-3c concerning the design and operation of heavy-load handling systems in the containment and spent fuel pool area.

Question 2.1-3a requires submittal of drawings sufficient to clearly identify the location of safe load paths for lifts in critical areas.

Question 2.1-3c requires a tabulation of heavy loads to be handled by each lift system. It shall include load identification, load weight, its designated lifting device, and verification that the handling of such loads is governed by a written procedure incorporating the guidelines of NUREG 0612.

Refer to appendices A and B and respective footnote sheet when reviewing this table.

Watts Bar Administrative Instruction AI-6.4 will be revised to define all 'heavy loads' handled by the cranes listed in the response to 2.2-1, the load weights, the designated special lifting devices or slings, safe load paths, special restrictions or precautions, and will reference related procedures governing the handling of these loads. Also, the following maintenance instructions will be revised as needed and any additional load handling procedures will be developed to address the special precautions specified in the response in Appendices D and E. All required procedure revisions and additional procedures will be developed and implemented before unit 1 fuel loading.

Load	Procedure (Maintenance Instruction
ERCW Pump	MI-67.1
ERCW Pump Motor	MI-67.3
Reactor Vessel Head	MI-68.1
Missile Shields	MI-68.1
Canal Gates	MI-68.1
Reactor Vessel Upper Internals	MI-68.1
Reactor Vessel Lower Internals	MI-68.3
Reactor Coolant Pump Motor	MI-68.5

TABULATION OF HEAVY LOADS
2.1-3a and c RESPONSE

Lift No.	Item Lifted (Weight-tons) See appendix A	Lifting Device See appendix B	Lift System	Reference Procedures	Safe Load Path
1	R1 (92)	LD2	CR1-CZ-M	(1)	See appendix D
2	R2 (73)	LD2	CR1-CZ-M	(1)	See appendix D
3	R3 (56)	LD3	CR1-CZ-M	(1)	See appendix D
4	R4 (41)	LD1	CR1-CZ-M	(1)	See appendix D
5	R5 (41)	LD1	CR1-CZ-M	(1)	See appendix D
6	R6 (41)	LD1	CR1-CZ-M	(1)	See appendix D
7	R7 (146.5)	LD5	CR1-CZ-M	(1)	See appendix D
8-1	R8-1 (65)	LD6	CR1-CZ-M	(1)	See appendix D
8-2	R8-2 (129.3)	LD6	CR1-CZ-M	(1)	See appendix D
9	R9 (13.3)	LD4	CR1-CZ-A	(1)	See appendix D
10	R10 (10)	LD4	CR1-CZ-A	(1)	See appendix D
11	R11 (41.2)	LD7	CR1-CZ-M	(1)	See appendix D
12	R12 (27.6)	LD8	CR1-CZ-M	(1)	See appendix D

TABULATION OF HEAVY LOADS
2.1-3a and c Response (Continued)

Lift No.	Item Lifted (Weight-tons) See appendix A	Lifting Device See appendix B	Lift System	Reference Procedures	Safe Load Path
13(2)	R13 (87.5) (Main) (17.5) (Aux.)	LD9	CR1-CZ-M CR1-C2-A	(1)	See appendix D
14	A1 (50)	LD10	CR2-CZ-M	(1)	See appendix E
15	A2 (50)	LD10	CR2-CZ-M	(1)	See appendix E
16	A3 (50)	LD10	CR2-CZ-M	(1)	See appendix E
17	A4 (2)	LD11	CR2-CZ-A	(1)	See appendix E
18	A5 (3.6)	LD12	CR2-CZ-A	(1)	See appendix E
19	A6 (3.2)	LD13	CR2-CZ-A	(1)	See appendix E
20	A7 (10.4)	LD14	CR2-CZ-M	(1)	See appendix E
21-1	A8-1 (1.7)	LD15	CR2-CZ-A	(1)	See appendix E
21-2	A8-2 (3.3)	LD15	CR2-CZ-A	(1)	See appendix E
22	A9 (100)	LD16	CR2-CZ-M	(1)	See appendix E
23(3)	A10 (Not Available)	LD17	(3)	(1)	See appendix E
24	A11 (1.6)	LD18	CR2-CZ-A	(1)	See appendix E

Lift No.	Item Lifted (Weight-tons) See appendix A	Lifting Device See appendix B	Lift System	Reference Procedures	Safe Load Path
25	A12 (1.3)	LD19	CR2-CZ-A	(1)	See appendix E
26	A13 (1.3)	LD20	CR2-CZ-A	(1)	See appendix E
27-1	A14 (6.5)	LD21	CR2-CZ-A	(1)	See appendix E
27-2	A15 (5)	LD21	CR2-CZ-A	(1)	See appendix E
27-3	A25 (2.4)	LD21	CR2-CZ-A	(1)	See appendix E
28	----------- No Lift Identified with this Number ----------------				
29[4]	A16 (62.5) (Main) (5) (Aux.)	LD22	CR2-CZ-M CR2-CZ-A	(1)	See appendix E
30	A17 (10.5)	LD23	CR2-CZ-M	(1)	See appendix E
31	A18 (4.1)	LD24	CR2-CZ-A	(1)	See appendix E
32	A19 (10)	LD25	CR2-CZ-M	(1)	See appendix E
33-1	A20-1 (4.3)	LD26	CR2-CZ-A	(1)	See appendix E
33-2	A20-2 (3.5)	LD26	MR1-CZ	(1)	See appendix E
34	A21 (3.2)	LD27	MR2-CZ	(1)	See appendix E
35	A22 (3.8)	LD28	MR3-CZ	(1)	See appendix E
36	A23 (1.7)	LD29	MR3-CZ	(1)	See appendix E

TABULATION OF HEAVY LOADS
2.1-3a and c Response (Continued)

Lift No.	Item Lifted (Weight-tons) See appendix A	Lifting Device See appendix B	Lift System	Reference Procedures	Safe Load Path
37-1	I1-1 (10.9)	LD30-1	JB2-CZ	(1)	See appendix C
37-2	I1-2 (5)	LD30-2	JB2-CZ	(1)	See appendix C
38	I2 (6.9)	LD31	JB2-CZ	(1)	See appendix C
39-1	I3-1 (10)	LD32-1	JB2-CZ	(1)	See appendix C
39-2	I3-2 (1.7)	LD32-2	JB2-CZ	(1)	See appendix C
40	I4 (2.1)	LD33	JB2-CZ	(1)	See appendix C
41	I5 (8.1)	LD34	JB2-CZ	(1)	See appendix C
42	I6 (5.7)	LD35	JB2-CZ	(1)	See appendix C
43	I7 (6.8)	LD36	JB2-CZ	(1)	See appendix C
44	I8 (2.9)	LD37	JB2-CZ	(1)	See appendix C
45	I9 (1.6)	LD38	JB2-CZ	(1)	See appendix C
46-1	I10-1 (3.5)	LD39-1	JB2-CZ	(1)	See appendix C
46-2	I10-2 (2.6)	LD39-2	JB2-CZ	(1)	See appendix C
47-1	I11-1 (4.0)	LD40-1	JB2-CZ	(1)	See appendix C
47-2	I11-2 (2.4)	LD40-2	JB2-CZ	(1)	See appendix C
48	I12 (7)	LD41	JB2-CZ	(1)	See appendix C

TABULATION OF HEAVY LOADS
FOOTNOTES
(2.1-3a and c)

1. Watts Bar Administrative Instruction AI-6.4..

2. This lift addresses miscellaneous items that may be handled in the reactor building by the main and auxiliary hoist of the polar crane; the maximum weight of these items are limited to 50 percent of the main and auxiliary hoist's rated capacity, thus providing an equivalent minimum factor of safety of 10:1.

3. This lift is for the failed fuel container, which has not been purchased to date. A sling will be designed and procured in accordance with ANSI Standard B30.9-1971 when the container is furnished.

4. This lift addresses miscellaneous items that may be handled in the auxiliary building by the main and auxiliary hoist of this crane; the maximum weight of these items are limited to 50% of the main and auxiliary hoist's rated capacity; thus providing an equivalent minimum factor of safety of 10:1.

2.1-3b RESPONSE

All procedures for handling of heavy loads will be revised to ensure that the lifts remain within safe load paths by requiring the cognizant person supervising the lift to walk the designated safe load path before each lift is made or to discuss in detail with the flagman the safe load path to be taken. The crane operator will also be required to have a copy of the safe load path instruction in this cab.

2.1-3d RESPONSE

The following table is the response to question 2.1-3d, which verifies that the lifting devices identified in the response to question 2.1-3c comply with the requirements of ANSI N14.6-1978, or ANSI B30.9-1971 as appropriate. Also a planned corrective action for each device which does not meet these standards is listed in this table.

All lifting devices submitted in the response to question 2.1-3c were considered as governed by ANSI N14.6-1978. Section 3.2.5 of ANSI N14.6-1978 recommends that those devices or components made from wire rope should comply to the standards of ANSI B30.9-1971.

Refer to appendices A and B and respective footnote sheet when reviewing this table.

Lift No.	Item Lifted	Lifting Device	Factor Safety Ultimate 5:1[1][2]	Factor Safety Yield 3:1[1]	%Proof Test 200%[2]	%Proof Test 150%[1]	QA Program Yes/No	Compliance Yes/No	Planned Corrective Action For Noncomplying Lifting Devices
1	R1	LD2	3.57:1	NR[2]	138	NR[2]	No[3]	No	Replace sling by September 1, 1984 (rope and attachments are under-designed).
2	R2	LD2	4.50:1	NR[2]	174	NR[2]	No[3]	No	The same as in lift No. 1.
3	R3	LD3	5.05:1	NR[2]	151	NR[2]	No[3]	No	Although ANSI B30.9 requires 200%, 151% should suffice according to Browns Ferry TER C5506-337/338/339, Guideline 4 Exception 2.
4	R4	LD1	6.40:1	NR[2]	200	NR[2]	No[3]	Yes	
5	R5	LD1	6.40:1	NR[2]	200	NR[2]	No[3]	Yes	
6	R6	LD1	6.40:1	NR[2]	200	NR[2]	No[3]	Yes	
7	R7	LD5	6.70:1	5.20:1	NR	125	Yes	Yes	
8-1	R8	LD6	11.40:1	9.6:1	NR	125	Yes	Yes	
8-2	R8	LD6	5.17:1	4.8:1	NR	125	Yes	Yes	
9	R9	LD4	4.00:1	NR[2]	156	NR[2]	No[3]	No	Replace sling by September 1, 1984 (rope is under-designed).
10	R10	LD4	5.33:1	NR[2]	207	NR[2]	No[3]	Yes	
11	R11	LD7	6.50:1[1]	4.38[1]	NR[1]	No[1]	No[1]	No[1]	Perform 150% prooftest on lift beam by unit 1 first refueling outage.
			4.76:1[2]	NR[2]	133[2]	NR[2]	No[2][3]	No[2]	Replace sling by September 1, 1984 (rope is under-designed).

NR - Information Not Required.

Lift No.	Item Lifted	Lifting Device	Factor Safety Ultimate 5:1[1][2]	Factor Safety Yield 3:1[1]	%Proof Test 200%[2]	%Proof Test 150%[1]	QA Program Yes/No	Compliance Yes/No	Planned Corrective Action For Noncomplying Lifting Devices
12[4]	R12	LD8	(4)	(4)	(4)	(4)	(4)	(4)	
13[5]	R13	LD9	(5)	(5)	(5)	(5)	(5)	(5)	
14	A1	LD10	4.11:1[1] 4.26:1[2]	2.55:1[1] NR[2]	NR[1] 192[2]	No[1] NR[2]	No[1] No[3]	No[1] No[2]	Modify lifting beam and replace lift hooks. and prooftest to 150%. To be completed by unit 1 first refueling outage.
15	A2	LD10	4.11:1[1] 4.26:1[2]	2.55:1[1] NR[2]	NR[1] 192[2]	No[1] NR[2]	No[1] No[3]	No[1] No[2]	The same as in lift number 14.
16	A3	LD10	4.11:1[1] 4.26:1[2]	2.55:1[1] NR[2]	NR[1] 192[2]	No[1] NR[2]	No[1] No[3]	No[1] No[2]	The same as in lift number 14.
17	A4	LD11	4.31:1	NR[2]	No	NR[2]	No[3]	No	Replace sling by September 1, 1984 (rope is under-designed).
18	A5	LD12	5.72:1	NR[2]	186	NR[2]	No[3]	No	Although ANSI B30.9 requires 200%, 186% should suffice according to Browns Ferry TER C5506-337/338/339, Guideline 4 Exception 2.
19[6]	A6	LD13	(6)	(6)	(6)	(6)	(6)	(6)	
20[6]	A7	LD14	(6)	(6)	(6)	(6)	(6)	(6)	
21-1[6]	A8-1	LD15	(6)	(6)	(6)	(6)	(6)	(6)	
21-2[6]	A8-2	LD15	(6)	(6)	(6)	(6)	(6)	(6)	
22[6]	A9	LD16	(6)	(6)	(6)	(6)	(6)	(6)	

NR - Information Not Required.

Lift No.	Item Lifted	Lifting Device	Factor Safety Ultimate 5:1(1)(2)	Factor Safety Yield 3:1(1)	%Proof Test 200%(2)	150%(1)	QA Program Yes/No	Compliance Yes/No	Planned Corrective Action For Noncomplying Lifting Devices
23(6)	A10	LD17	(6)	(6)	(6)	(6)	(6)	(6)	
24(7)	A11	LD18	(7)	(7)	(7)	(7)	(7)	(7)	
25(8)	A12	LD19	(8)	(8)	(8)	(8)	(8)	(8)	
26(8)	A13	LD20	(8)	(8)	(8)	(8)	(8)	(8)	
27-1	A14	LD21	10.90:1	NR(2)	No	NR(2)	Yes	No	Since this is a QA sling with a high safety factor no proof test is needed.
27-2	A15	LD21	13.09:1	NR(2)	No	NR(2)	Yes	No	Same as lift No. 27-1.
27-3	A25	LD21	30.00:1	NR(2)	No	NR(2)	Yes	No	Same as lift No. 27-1.
29(5)	A16	LD22	(5)	(5)	(5)	(5)	(5)	(5)	
30(8)	A17	LD23	(8)	(8)	(8)	(8)	(8)	(8)	
31(8)	A18	LD24	(8)	(8)	(8)	(8)	(8)	(8)	
32	A19	LD25	5.27:1	3.10:1	NR(1)	No(1)	No	No	Perform proof test of 150% by unit 1 first refueling outage.
33-1	A20-1	LD26	6.20:1	NR(2)	No	NR(2)	Yes	Yes	Perform prooftest by unit 1 first refueling outage.
33-2	A20-2	LD26	7.56:1	NR(2)	No	NR(2)	Yes	Yes	Perform prooftest by unit 1 first first refueling outage.

NR - Information Not Required.

Lift No.	Item Lifted	Lifting Device	Factor Safety Ultimate 5:1 (1)(2)	Factor Safety Yield 3:1 (1)	%Proof Test 200% (2)	%Proof Test 150% (1)	QA Program Yes/No	Compliance Yes/No	Planned Corrective Action For Noncomplying Lifting Devices
34 (8)	A21	LD27	(8)	(8)	(8)	(8)	(8)	(8)	
35 (8)	A22	LD28	(8)	(8)	(8)	(8)	(8)	(8)	
36 (8)	A23	LD29	(8)	(8)	(8)	(8)	(8)	(8)	
37-1 (8)	I1-1	LD30-1	(8)	(8)	(8)	(8)	(8)	(8)	
37-2 (8)	I1-2	LD30-2	(8)	(8)	(8)	(8)	(8)	(8)	
38	I2	LD31	2.50:1	1.60:1	NR (1)	No (1)	No	No	Modify lift beam (hooks are under-designed) and perform prooftest 150% by unit 1 first refueling outge.
39-1 (8)	I3-1	LD32-1	(8)	(8)	(8)	(8)	(8)	(8)	
39-2 (8)	I3-2	LD32-2	(8)	(8)	(8)	(8)	(8)	(8)	
40 (8)	I4	LD33	(8)	(8)	(8)	(8)	(8)	(8)	
41 (8)	I5	LD34	(8)	(8)	(8)	(8)	(8)	(8)	
42 (8)	I6	LD35	(8)	(8)	(8)	(8)	(8)	(8)	
43 (9)	I7	LD36	(9)	(9)	(9)	(9)	(9)	(9)	
44 (9)	I8	LD37	(9)	(9)	(9)	(9)	(9)	(9)	

NR - Information Not Required.

LIFTING DEVICE VERIFICATION
2.1-3d Response (Continued)

Lift No.	Item Lifted	Lifting Device	Factor Safety Ultimate 5:1[1][2]	Factor Safety Yield 3:1[1]	%Proof Test 200%[2]	%Proof Test 150%[1]	QA Program Yes/No	Compliance Yes/No	Planned Corrective Action For Noncomplying Lifting Devices
45[8]	I9	LD38	(8)	(8)	(8)	(8)	(8)	(8)	
46-1[8]	I10-1	LD39-1	(8)	(8)	(8)	(8)	(8)	(8)	
46-2[8]	I10-2	LD39-2	(8)	(8)	(8)	(8)	(8)	(8)	
47[8]	I11	LD40	(8)	(8)	(8)	(8)	(8)	(8)	
48[8]	I12	LD41	(8)	(8)	(8)	(8)	(8)	(8)	

NR - Information Not Required.

LIFTING DEVICE VERIFICATION
FOOTNOTES
(2.1-3d)

1. This is a requirement of ANSI N14.6-1978.

2. This is a requirement of ANSI B30.9-1971.

3. No Quality Assurance Program is required per ANSI B30.9-1971.

4. The reactor coolant pump has been identified by the manufacturer as being repaired in place, thus eliminating the need for making a critical lift (i.e. loads more than 2000 lb). This was clarified by the manufacturer November 15, 1983 stating that for general maintenance such as seal replacements, no removal of the reactor coolant pump parts is required. However, for In-Service-Inspection of the RCP internals a removal of these items from the casing is required. A qualified device will be provided/designated to make this lift by the first refueling outage for unit 1 or as needed on an emergency basis.

5. No devices have been identified for these miscellaneous lifts, however, ANSI Standard B30.9-1971 will be used for the design and procurement of any miscellaneous slings.

6. This fuel handling item has not been purchased to date. Upon acquisition of this item the appropriate sling will be designed and procured per ANSI Standard B30.9-1971.

7. See footnote 4 of Appendix B.

8. The lifting device for this lift has been designed to ANSI Standards N14.6-1978 or ANSI B30.9-1971 as appropriate, with a purchase requisition to be issued by March 31, 1984. TVA anticipates delivery of these lifting devices by April!1, 1985. In the event any devices are needed before April!1, 1985, they will be procured on an emergency basis.

9. This item is worked on in place with all assembly parts weighing less than 2000 lb. No special lifting device is needed for this lift.

.1-3e RESPONSE

The polar cranes and Auxiliary Building crane are inspected, tested, and maintained as specified by Watts Bar Maintenance Instructions MI-271.4 and MI-271.1, respectively, and AI-6.4 in accordance with Division Procedures Manual (DPM) N74M15, which implements the requirements of ANSI B30.2.0-1976. The cranes are governed by MI-57.28 for daily inspections.

The monorail hoists are inspected, tested, and maintained as specified by Watts Bar MI-271.5 and AI-6.4 in accordance with DPM N74M15 which implements the requirements of ANSI B30.11-1973 and B30.16-1973.

The requirements for inspection, testing, and maintenance of the hydraulic pedestal crane are addressed in AI-6.4, which states the requirements of ANSI B30-15.1973 shall be observed.

The three ton jib crane is inspected, tested, and maintained in accordance with AI-6.4 and DPM N74M15 which implement the requirements of ANSI B30.11-1973 and B30.16-1973.

2.1-3f RESPONSE

The load handling systems listed by TVA in response to question 2.1-1 includes two cranes, the reactor building 175-ton polar crane (CR1) and the auxiliary building 125-ton crane (CR2), which qualify for verification under this question. The other systems listed do not qualify for compliance with CMAA-70 and Chapter 2-1 of ANSI B30.2-1976 because they are not overhead traveling cranes.

The pertinent design requirements of CMAA-70 and ANSI B30.2-1976 section 2-1 will be listed and the compliance will be indicated by a (C), non-compliance by (NC), and equivalency (E). Only certain listed requirements marked by an asterisk (*) are essential to load drop integrity, others are primarily for operator safety, building requirements, and electrical controls; however, all subsections were reviewed. A comprehensive review of the CMAA-70 was completed for both cranes. The requirements of ANSI B30.2 section 2-1 were compared directly with CMAA-70. Only comparative exceptions to asterisked items in CMAA-70 were comprehensively reviewed.

<u>CRANE</u> <u>DESIGN</u> <u>COMPLIANCE</u>
<u>VERIFICATION</u>

Pertinent Sections	Polar Crane (CR1-CZ-M, CR1-CZ-A)	Aux Bldg. Crane (CR2-CZ-M, CR2-CZ-A)	Comments
<u>CMAA-70</u>			
1.2 Building	C	C	
1.3 Clearance	C	C	
1.4 Runway	C	C	
1.5 Conductors	C	C	
1.6 Rated Capacity*	C	C	
1.7 Design Stresses*	C	C	
1.9 Painting	C	C	
1.11 Testing*	C	C	Acceptance/Preop Test Preformed
3.1 Material*	C	C	
3.2 Welding*	C	C	TVA specifies AWS D1.1
3.3 Girders*	C	C	
3.4 Bridge Trucks*	C	C	
3.5 Footwalks, H'Rails	C	C	
3.6 Operator Cab	C	C	
3.7 Trolley Frame*	C	C	
3.8 Rails*	C	C	
4.1 Load Blocks*	C	C	
4.2 Hoist Ropes*	C	C	
4.3 Sheaves*	C	C	
4.4 Drums*	C	C	
4.5 Gearing*	C	C	AGMA
4.6 Bearings	C	C	
4.7 Brakes*	C	C	
4.8 Bridge Drives*	C	C	
4.9 Shafts*	C	C	
4.10 Couplings*	C	C	
4.11 Wheels*	C	C	
4.12 Bumpers	C	C	
5.1 Electrical	C	C	
5.2 Motors AC-DC	C	C	
5.3 Motor Brakes	C	C	
5.4 Controllers	C	C	
5.5 Resistors	C	C	
5.6 Protection	C	C	
5.7 Cab Masterswitch	C	C	
5.9 Hoist Limit Switch*	C	C	
5.10 Installation	C	C	
5.11 Bridge Conductors	C	C	

CRANE DESIGN COMPLIANCE VERIFICATION (Continued)

Pertinent Sections	Polar Crane (CR1-CZ-M, CR1-CZ-A)	Aux Bldg. Crane (CR2-CZ-M, CR2-CZ-A)	Comments
ANSI B30.2.0 1976			
2-1.1 Marking	C	C	
2-1.2 Clearances	C	C	
2-1.3.2 Runways	C	C	
2-1.4.1 Welding*	C	C	AWS D.1.1 used
2-1.4.2 Girders*	C	C	Complies w/CMAA-70
2-1.5.1 Cabs	C	C	
2-1.5.3 Access	C	C	
2-1.5.5 Fire Extinguishers	C	C	
2-1.5.6 Lighting	C	C	
2-1.6.1 Lubrication	C	C	
2-1.7.1 Footwalks	C	C	
2-1.7.2 Footwalk Const	C	C	
2-1.7.3 Handrails Toeboards	C	C	
2-1.7.4 Ladders Stairways	C	C	
2-1.7.5 Egress	C	C	
2-1.8.1 Trolley Stops	C	C	
2-1.8.2 Bridge Bumpers	C	C	
2-1.8.3 Trolley Bumpers	C	C	
2-1.8.4 Railsweeps	C	C	
2-1.8.5 Rope Guards	C	C	
2-1.8.6 Wheel and Truck*	C	C	
2-1.8.7 Guards	C	C	
2-1.9.1 Hoist Brakes*	C	C	
2-1.9.2 Holding Brakes*	C	C	
2-1.9.3 Control Braking*	C	C	
2-1.9.4 Trolley/Bridge Brakes	C	C	
2-1.9.5 Braking Means	C	C	
2-1.9.6 Brake Application Trolley	C	C	
2-1.9.7 Brake Application Bridge	C	C	
2-1.10.1 General-Elec.	C	C	
2-1.10.2 Equipment-Elec.	C	C	
2-1.10.3 Elec. Controllers	C	C	
2-1.10.4 Resistors	C	C	
2-1.10.5 Switches	C	C	
2-1.10.6 Collectors	C	C	

CRANE DESIGN COMPLIANCE
VERIFICATION (Continued)

Pertinent Sections	Polar Crane (CR1-CZ-M, CR1-CZ-A)	Aux Bldg. Crane (CR2-CZ-M, CR2-CZ-A)	Comments
2-1.10.7 Receptacle	C	C	
2-1.11 Sheaves*	C	C	
2-1.11.2 Ropes*	C	C	
2-1.11.3 Equalizers*	C	C	
2-1.11.4 Hooks*	C	C	
2-1.12 Warning Devices	C	C	

2.1-3g RESPONSE

Operator training and qualification requirements for all load handling systems are stated in DPM N74M15, which complies with ANSI B30.2-1976 for polar and Auxiliary Building crane operators, ANSI B30.15-1973 for hydraulic pedestal crane operators, and ANSI B30.11-1973 and B30.16-1973 for monorail and jib crane operators.

APPENDIX A

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
R1	RB	48W934-2	Missile Shield PC-1	92
R2	RB	48W934-2	Missile Shield PC-2	73
R3	RB	48W934-2	Missile Shield PC-6	56
R4	RB	48W934-1	Canal Gate PC-3	41
R5	RB	48W934-1	Canal Gate PC-4	41
R6	RB	48W934-1	Canal Gate PC-5	41
R7	RB	(16)	Reactor Vessel Head	146.5
R8-1	RB	(16)	Reactor Vessel Upper Internals	65
R8-2	RB	(16)	Reactor Vessel Lower Internals	129.3
R9	RB	48N923	Reactor Coolant Pump Plug	13.3
R10	RB	48N923	Hatch Plug	10
R11	RB	114E920(1) 114E921	Reactor Coolant Pump Motor	41.2
R12	RB	114E920(1) 114E921	Reactor Coolant Pump	27.6

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
R13[2]	RB	(2)	Miscellaneous Equipment in Critical Lift Zone	(87.5) (Main) (17.5) (Aux.)
A1	AB	48N1288	Removable Shield Wall Plug A	50
A2	AB	48N1288	Removable Shield Wall Plug B	50
A3	AB	48N1288	Removable Shield Wall Plug C	50
A4	AB	44N331	Fuel Pool Gates	2
A5	AB	48N1244	New Fuel Storage Vault Cover	3.6
A6[3]	AB	(3)	Irradiated Specimen Shipping Cask	3.2

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
A7[3]	AB	(3)	Spent Resin Liner	10.4
A8-1[3]	AB	(3)	New Fuel Shipping Containers - Empty	1.7
A8-2[3]	AB	(3)	New Fuel Shipping Containers - With Fuel	3.3
A9[3]	AB	(3)	Spent Fuel Shipping Cask	100
A10[3]	AB	(3)	Failed Fuel Container	Not Available
A11	AB	22407-7[1]	Fuel Transfer Carriage	1.6
A12	AB	48N1250-2 Mark 18	Hatch Cover	1.3
A13	AB	48N1250-2 Mark 19	Hatch Cover	1.3
A14	AB	44N394-3 Mark 22	Drum Cask (Intermediate Level Radwaste for 55-gal Drum)	6.5
A15	AB	44N394-3 Mark 23	Drum Cask (Low Level Radwaste for 55-gal Drum)	5
A16[2]	AB	(2)	Miscellaneous Equipment	62.5 (Main) 5 (Aux.)
A17	AB	48N1262-1	Containment Spray Heat Exchanger Shield Plug	10.5
A18	AB	48N1262-1	Residual Heat Exchanger Shield Plugs	4.1

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
A19	AB	5647(1)	Containment Spray Heat Exchanger Shell	10
A20-1	AB	44N394-3 Mark 1	Transfer Cask - Fully Assembled	4.3
A20-2	AB	44N394-3 Mark 1	Transfer Cask - Bottom Section Left Off	3.5
A21	AB	105D-908(1)	Rod Drive Motor-Generator Sets	3.2
A22	AB	C-76564(4)	Component Cooling System - Pump	3.8
A23	AB	C-76564(4)	Component Cooling System - Motor	1.7
A24	AB	C-76564(4)	Component Cooling System - Base(5)	1.2
A25	AB	44N394-4	Drum Cask (Low Level Radwaste for 30-gal Drum)	2.4

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
I1-1	IPS	IF-7872, 2E-2373[7]	Essential Raw Cooling Water Pump	10.9
I1-2	IPS	55-937-005-411[8]	Essential Raw Cooling Water Pump - Motor	5
I2	IPS	34N300	Stoplog	6.9
I3-1	IPS	34N210,483978-1[6]	Traveling Water Screen - Head Section	10
I3-2	IPS	483978-7[6]	Traveling Water Screen - Bottom Section	1.7
I4	IPS	H5516[9]	Screen Wash Pump	2.1
I5	IPS	17772, 17993 17994-1[10]	ERCW Strainer	8.1
I6	IPS	8278D75, 8278D76, 8285D56[11]	Transformer	5.7
I7	IPS	6941D48 thru D54 6947D01,6947D02[11]	Main Board	6.8
I8	IPS	45D57236, 105D507 SKD-7468 SKD-7478[12]	Motor Control Center (MCC)	1.5
I9	IPS	17779-1 thru -3[13]	Fire Protection Strainer	1.9

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION

Load No.	Location	Drawing No.	Item Lifted	Weight-tons
I10-1	IPS	D2081(14)	Fire Protection Pump	3.5
I10-2	IPS	51-812-868-401(14)	Fire Protection Pump - Motor	2.6
I11-1	IPS	H-5337-D(15)	Raw Cooling Water Pump	4.0
I11-2	IPS	6-279453-X, 15501841-0000(15)	Raw Cooling Water Pump - Motor	2.4
I12	IPS	38N216 thru 218	Missile Shield Roof Section	7.0

RB - Reactor Building
AB - Auxiliary Building
IPS - Intake Pumping Station

CRITICAL LIFT IDENTIFICATION
FOOTNOTES

1. These are vendor drawings from contract No. 71C62-54114-1.

2. These are miscellaneous items that may be handled in this building and weigh no less than 2000 lb, but not more than 50% of the cranes rated capacity; this limit provides a minimum equivalent factor of safety of 10:1.

3. This fuel handling item has not been purchased to date. Upon acquisition of this item the appropriate sling will be designed and procured per ANSI Standard B30.9-1971.

4. This is a vendor drawing from contract No. 71K31-83173.

5. This base will not be removed once installed.

6. This is a vendor drawing from contract No. 74C38-85143.

7. These are vendor drawings from contract No. 76K31-83158.

8. These are vendor drawings from contract No. 76C4-820089.

9. This is a vendor drawing from contract No. 76K31-820344.

10. These are vendor drawings from contract No. 76K33-820229.

11. These are vendor drawings from contract No. 74C2-84647.

12. These are vendor drawings from contract No. 74C5-84646.

13. These are vendor drawings from contract No. 76K38-820262.

14. These are vendor drawings from contract No. 76K35-83224.

15. These are vendor drawings from contract No. 76K31-820190.

16. These items are furnished by Westinghouse under an NSSS contract, No. 71C62-54114-1.

APPENDIX B

LIFTING DEVICE IDENTIFICATION

Lifting Device No.	Max Rated Capacity Tons	TVA Drawing No.	Vendor Contract No.	Vendor Drawing No.	Reference Standards	Items Lifted
LD1	41	44N267-Mk 1 Single Leg	77K74-822472 N3H-42	4	ANSI B30.9-1971	Canal Gate - PC3, PC4, and PC5 Two Mk 1 slings are used
LD2	92	44N267-Mk 2 Double Leg	77K74-822472 N3H-42	4	ANSI B30.9-1971	Missile Shield PC-1 and PC-2 Two Mk 2 slings are used
LD3	56	44N267-Mk 3 Double Leg	77K74-822472 N3H-42	4	ANSI B30.9-1971	Missile Shield PC-6 Two Mk 3 slings are used
LD4	13.3	44N267-Mk 4 Four Leg	77K74-822472 N3H-42	4	ANSI B30.9-1971	Reactor Coolant Pump Hatch and Hatch Plug One Mk 4 sling is used
LD5	160	44W274 Lift Rig	71C62-54114-1	1098E58	ANSI N14.6-1978	Reactor Vessel Head
LD6	140	44W275 Lift Rig	71C62-54114-1	1141E17	ANSI N14.6-1978	Upper and Lower Internals
LD7	41.2	44N261 Lift Rig	73C38-84056-1 N3H-4-1	11691100 11691101 11691102	ANSI N14.6-1978	Reactor Coolant Pump Motor Requires Lifting Beam and a Three Legged Sling Combination
LD8(1)	27.6	(1)	(1)	(1)	(1)	Reactor Coolant Pump
LD9(2)	87.5	(2)	(2)	(2)	ANSI B30.9-1971	Reactor Building Miscellaneous Lifts
LD10	50	44N357	77K74-822472 N3H-42	3	ANSI N14.6-1978	Removable Shield Walls - Plug A, B, and C. Lifting Beam and Grommet Sling are used

LIFTING DEVICE IDENTIFICATION

Lifting Device No.	Max Rated Capacity Tons	TVA Drawing No.	Vendor Contract No.	Vendor Drawing No.	Reference Standards	Items Lifted
LD11	2	44N332-Mk 7 Single Leg	76K70-820601 N3H-34	6-104-3	ANSI B30.9-1971	Fuel Pool Gates
LD12	3.6	44N358-Mk 5 Four Leg	77K74-822472	1	ANSI B30.9-1971	New Fuel Storage Vault Cover One Mk 5 Sling is Used
LD13(3)	3.2	(3)	(3)	(3)	(3)	Irradiated Specimen Shipping Cask
LD14(3)	10.4	(3)	(3)	(3)	(3)	Spent Resin Liner
LD15(3)	3.3	(3)	(3)	(3)	(3)	New Fuel Shipping Containers With and Without Fuel
LD16(3)	100	(3)	(3)	(3)	(3)	Spent Fuel Shipping Cask
LD17(3)	(3)	(3)	(3)	(3)	(3)	Failed Fuel Container
LD18(4)	1.6	(4)	(4)	(4)	(4)	Fuel Transfer Carriage
LD19(5)	1.3	(5)	(5)	(5)	(5)	Hatch Cover
LD20(5)	1.3	(5)	(5)	(5)	(5)	Hatch Cover
LD21	6.5	44N394-Mk 10 Three Leg	78K61-823156 N3H-45	9044C10	ANSI B30.9-1971	Drum Cask - Mks 22, 23, and 24 One Mk 10 Sling is Used
LD22	62.5	(2)	(2)	(2)	(2)	Auxiliary Building Misc. Lifts

LIFTING DEVICE IDENTIFICATION

Lifting Device No.	Max Rated Capacity Tons	TVA Drawing No.	Vendor Contract No.	Vendor Drawing No.	Reference Standards	Items Lifted
~~LD23~~(5)	10.5	(5)	(5)	(5)	(5)	Containment Spray Heat Exchanger Shield Plugs
~~LD24~~(5)	4.1	(5)	(5)	(5)	(5)	Residual Heat Exchanger Shield Plugs
LD25	10	44N358 Lift Beam	77K74-822472 N3H-63	1	ANSI N14.6-1978	Containment Spray Heat Exchanger A Lifting Beam with Turnbuckle
LD26	4.3	44N394-3 Mk 8 Three Leg	78K61-823156 N3H-45	9044C2	ANSI B30.9-1971	Transfer Cask - With and Without Bottom Section One Mk 8 Sling is Used
~~LD27~~(5)	3.2	(5)	(5)	(5)	(5)	Rod Drive Motor-Generator Sets
~~LD28~~(5)	3.8	(5)	(5)	(5)	(5)	Pump for Component Cooling System
~~LD29~~(5)	1.7	(5)	(5)	(5)	(5)	Motor For Component Cooling System
~~LD30-1~~(5)	10.9	(5)	(5)	(5)	(5)	Essential Raw Cooling Water Pump
~~LD30-2~~(5)	5	(5)	(5)	(5)	(5)	Essential Raw Cooling Water Pump - Motor
LD31	6.9	34N350	75K72-87081 N3H-26	VS-34N350-00	ANSI N14.6-1970	Stop Logs and Trash Racks

LIFTING DEVICE IDENTIFICATION

Lifting Device No.	Max Rated Capacity Tons	TVA Drawing No.	Vendor Contract No.	Vendor Drawing No.	Reference Standards	Items Lifted
LD32-1 (5)	10	(5)	(5)	(5)	(5)	Travel Water Screen-Head Section
LD32-2 (5)	1.1	(5)	(5)	(5)	(5)	Travel Water Screen-Bottom Section
LD33 (5)	2.1	(5)	(5)	(5)	(5)	Screen Wash Pump
LD34 (5)	8.1	(5)	(5)	(5)	(5)	ERCW - Strainer
LD35 (5)	5.7	(5)	(5)	(5)	(5)	Transformers
LD36	6.8	(6)	(6)	(6)	(6)	Main Board
LD37	2.9	(6)	(6)	(6)	(6)	Motor Control Center (MCC)
LD38	1.6	(5)	(5)	(5)	(5)	Fire Protection Strainer
LD39-1	3.5	(5)	(5)	(5)	(5)	Fire Protection Pumps
LD39-2	2.6	(5)	(5)	(5)	(5)	Fire Protection Pumps - Motor
LD40-1	4.0	(5)	(5)	(5)	(5)	Raw Cooling Water Pump
LD40-2	2.4	(5)	(5)	(5)	(5)	Raw Cooling Water Pump - Motor
LD41	7.0	(5)	(5)	(5)	(5)	Missile Shield Roof Section

LIFTING DEVICE IDENTIFICATION
FOOTNOTES

1. The reactor coolant pump has been identified by the manufacturer as being repaired in place, thus elminating the need for making a critical lift (i.e., loads more than 2000 lb). This was clarified by the manufacturer November 15, 1983 stating that for general maintenance such as seal replacements, no removal of the reactor coolant pump parts is required. However, for In-Service-Inspection of the RCP internals a removal of these items from the casing is required. A qualified device will be provided/designated to make this lift by the first refueling outage for unit 1 or as needed on an emergency basis.

2. No devices have been identified for miscellaneous lifts, however, ANSI Standard B30.9-1971 will be used for the design and procurement of any slings purchased in the future to make a miscellaneous lift.

3. This is a fuel handling lifting device that will not be purchased until the item to be lifted has been purchased; ANSI B30.9-1971 will be used for the design and procurement of these type devices at that time.

4. No device has been designed especially for the fuel transfer cart. Should the cart need to be removed from the canal, slings rated for at least twice the load of the cart will be used. This will meet the intent of single-failure proof as outlined in item 5 on page C-3 of appendix C in NUREG-0612.

5. Lifting devices for these lifts have been designed to ANSI Standards N14.6-1978 or ANSI B30.9-1971 as appropriate, with a purchase requisition to be issued by March 31, 1984.

6. This item is worked on in place with all the assembly parts weighing less than 2000 lb. No special lifting device is needed for this lift.

APPENDIX C

Response to NUREG 0612 Question 2.1-3a

EN DES CALCULATIONS 85-K.C003

TITLE	UNID SYSTEM(S)	PLANT/UNIT
Intake Pumping Station (Concrete)		Watts Bar 1 and 2 SAR SECTION(S) 3.8

PREPARING ORGANIZATION CDB	REV	(FOR MEDS USE)	MEDS ACCESSION NUMBER
Special Projects Concrete #2	R0		
APPLICABLE DESIGN DOCUMENTS: 31N221-1 thru -5; 31N222-1 thru -13; WB-DC-20-19 — BRANCH/PROJECT IDENTIFIERS: 85-K-C0003	R1	7910158 0005	CDB '79 0801 002
	R2	8210198 0001 5C	SWP '82 1018 034
KEY NOUNS: Pumping station; intake	R3		WBP '83 0720 007

REV	R0	R1	R2	R3
DATE	April 9, 79	July 31, 1979	Sept 8, 1982	JULY 20, 1983
PREPARED **	[signature]	[signature]	M. Glenn Rievley	R. W. Bendall
CHECKED **	W. L. King	W. Glenn Rievley	S. K. Doyle	P. K. Lester
SUBMITTED	M. H. Miller	M. H. Miller	M. H. Miller	G. W. Whittier
APPROVED	N. A. Liakonis	N. A. Liakonis	N. A. Liakonis	A. Sorenson
ATTACHMENTS MICROFILMED:				
LIST ALL PAGES* ADDED BY THIS REV:		418-422	382.1-382.4	1-21
LIST ALL PAGES* DELETED BY THIS REV:				
LIST ALL PAGES* CHANGED BY THIS REV:			379	

STATEMENT OF PROBLEM

This book contains the design calculations for the intake pumping station structural conrete.

ABSTRACT

**For additional preparers and checkers, see calculations.
***The stability analysis is in book 85-K-C001.

R1 added 8-inch fire protection wall, ECN 1784

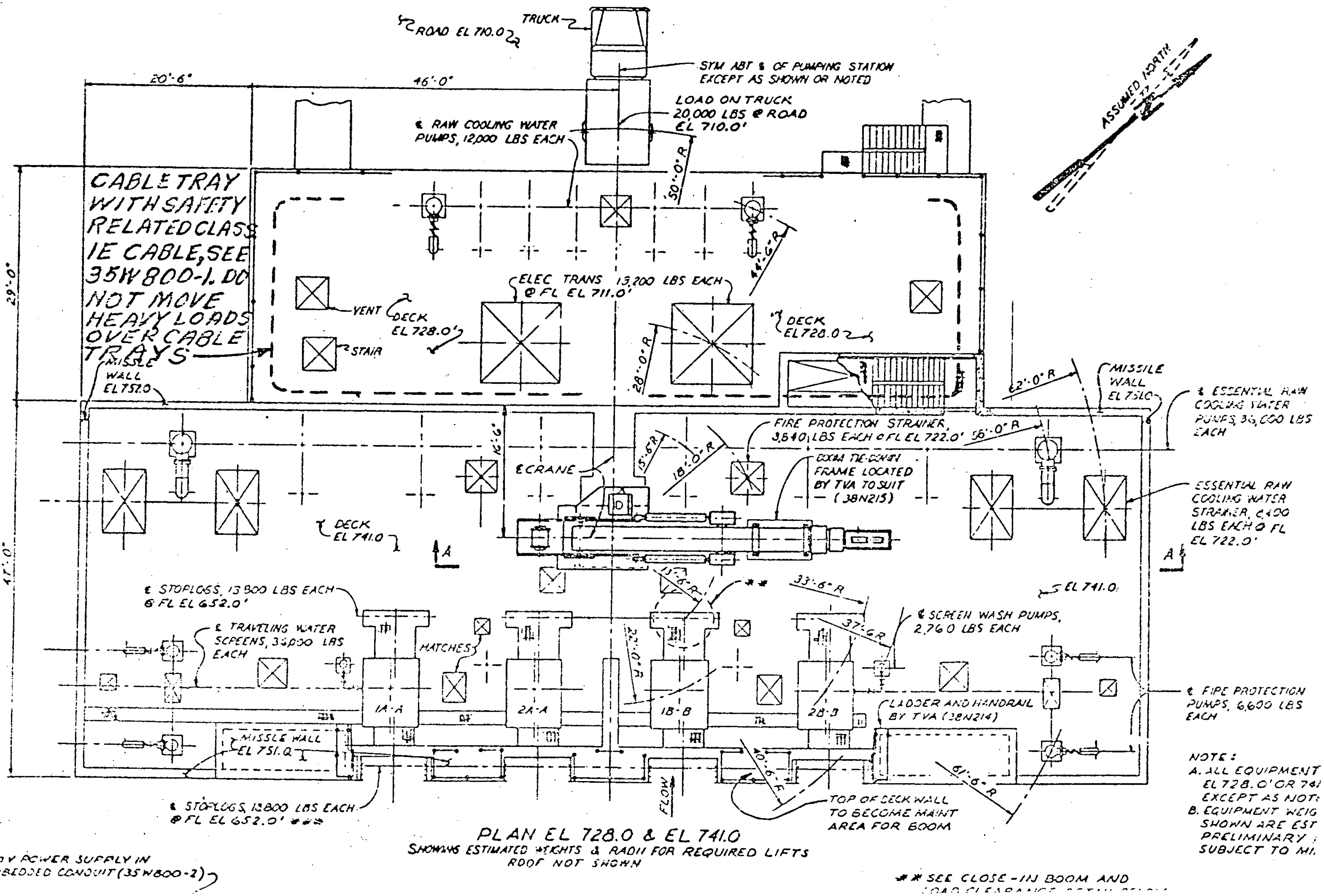
R2 added statement clarifying tornado missile requirements.

R3 ADDED HEAVY LOAD DROP ANALYSIS SECTION FOR NU REG 0612

TVA 10697 (ENDES-7-78) *Use revision log (form TVA 10534) if more room is required

8072 F 108

3



PLAN EL 728.0 & EL 741.0
SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN

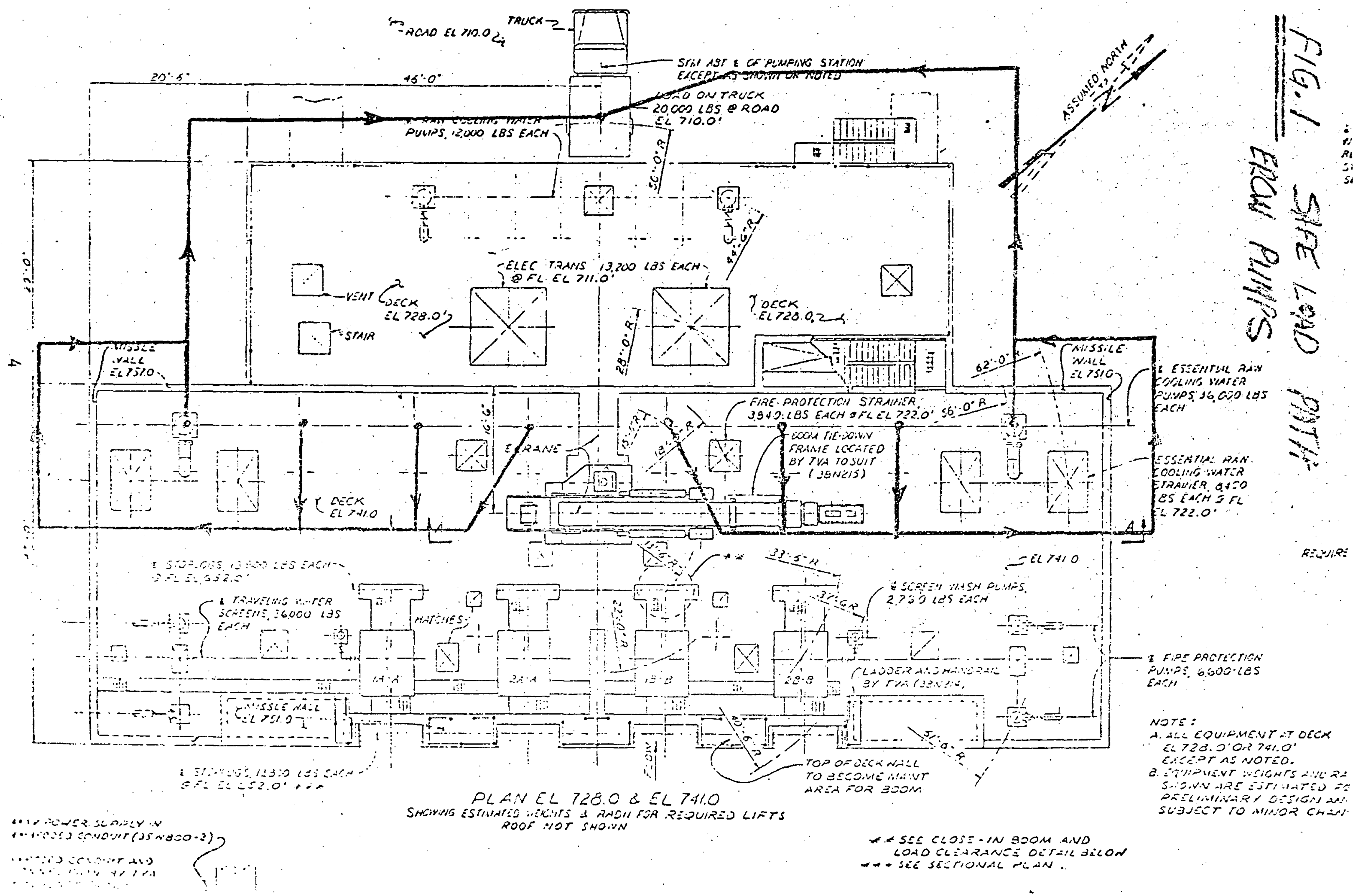


FIG. 1 SAFE LOAD PATH
ERCW PUMPS
TRUCK
ROAD EL 710.0
STA AST ℄ OF PUMPING STATION EXCEPT AS SHOWN OR NOTED
LOAD ON TRUCK 20,000 LBS @ ROAD EL 710.0'
PUMPS, 12,000 LBS EACH
ASSUMED NORTH
20'-6"
46'-0"
56'-0" R
44'-6" R
ELEC TRANS 13,200 LBS EACH @ FL EL 711.0'
VENT
DECK EL 728.0'
STAIR
DECK EL 728.0
28'-0" R
62'-0" R
MISSILE WALL EL 751.0
MISSILE WALL EL 751.0
℄ ESSENTIAL RAW COOLING WATER PUMPS, 36,000 LBS EACH
FIRE PROTECTION STRAINER, 3840 LBS EACH @ FL EL 722.0'
56'-0" R
BOOM TIE-DOWN FRAME LOCATED BY TVA TO SUIT (38N215)
CRANE
ESSENTIAL RAW COOLING WATER STRAINER, 8450 LBS EACH @ FL EL 722.0'
DECK EL 741.0
REQUIRE
℄ STOPLOGS, 13,800 LBS EACH @ FL EL 652.0'
33'-6" R
EL 741.0
℄ TRAVELING WATER SCREENS, 36,000 LBS EACH
HATCHES
℄ SCREEN WASH PUMPS, 2,750 LBS EACH
37'-6" R
℄ FIRE PROTECTION PUMPS, 6,600 LBS EACH
1A-A
2A-A
1B-B
2B-B
LADDER AND HANDRAIL BY TVA (38N214)
MISSILE WALL EL 751.0
FLOW
40'-6" R
51'-6" R
℄ STOPLOGS, 13,800 LBS EACH @ FL EL 652.0'
TOP OF DECK WALL TO BECOME MAINT AREA FOR BOOM
PLAN EL 728.0 & EL 741.0
SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN
NOTE:
A. ALL EQUIPMENT AT DECK EL 728.0' OR 741.0' EXCEPT AS NOTED.
B. EQUIPMENT WEIGHTS AND RA... SHOWN ARE ESTIMATED FO... PRELIMINARY DESIGN AN... SUBJECT TO MINOR CHAN...
** SEE CLOSE-IN BOOM AND LOAD CLEARANCE DETAIL BELOW
*** SEE SECTIONAL PLAN
POWER SUPPLY IN EMBEDDED CONDUIT (35N800-2)

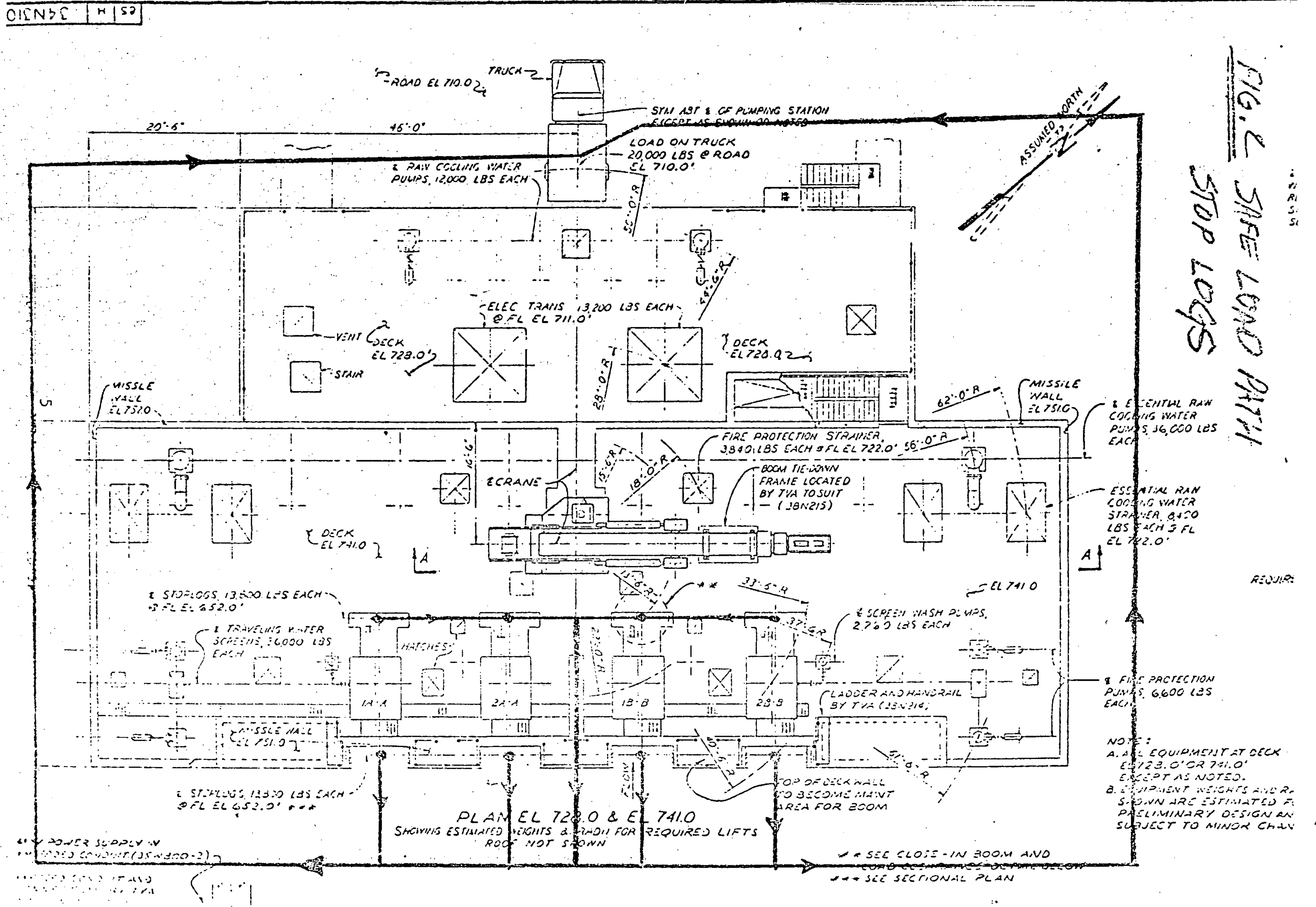


FIG. 2 SAFE LOAD PATH
STOP LOGS

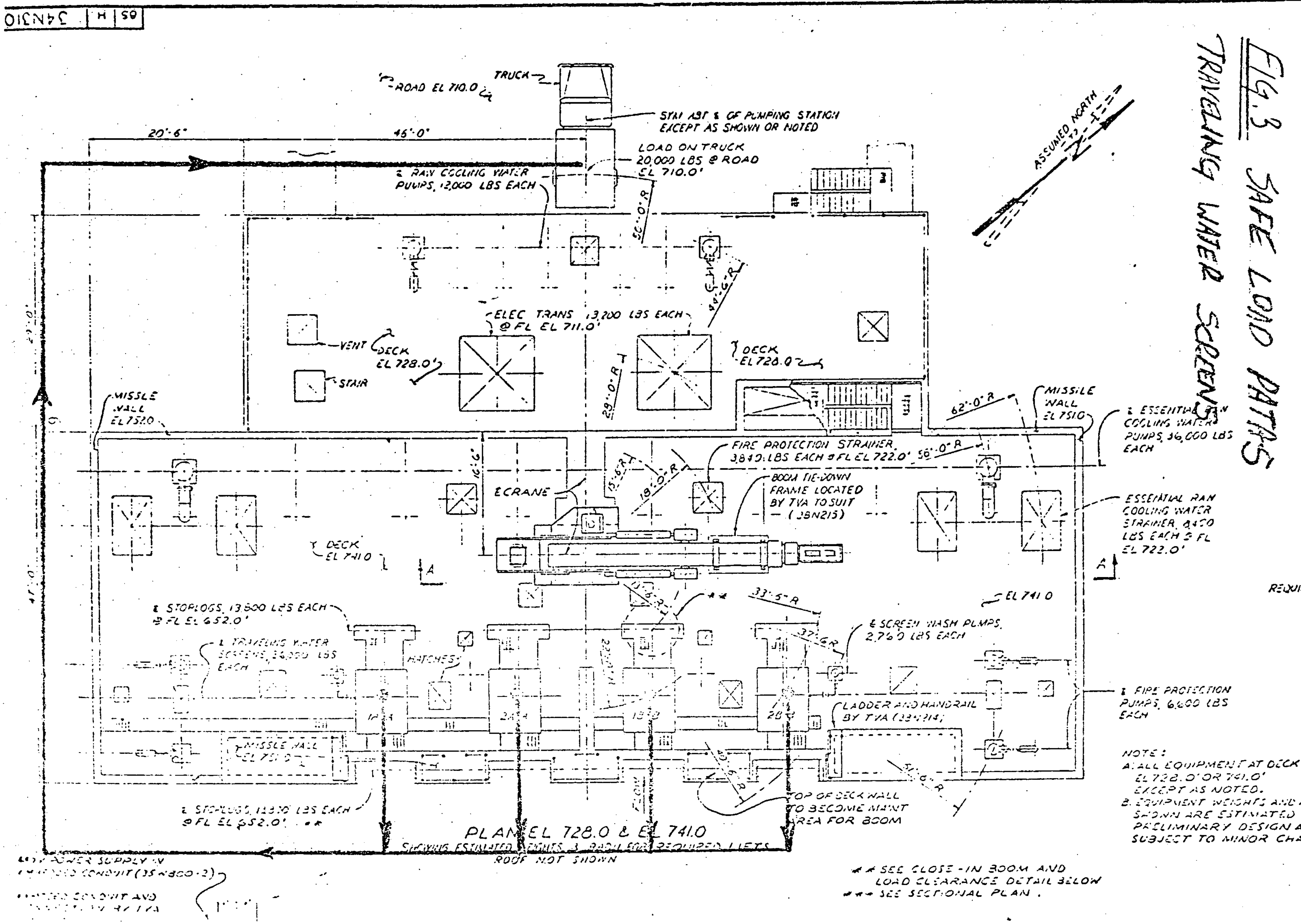


Fig. 3 SAFE LOAD PATHS
TRAVELING WATER SCREENS

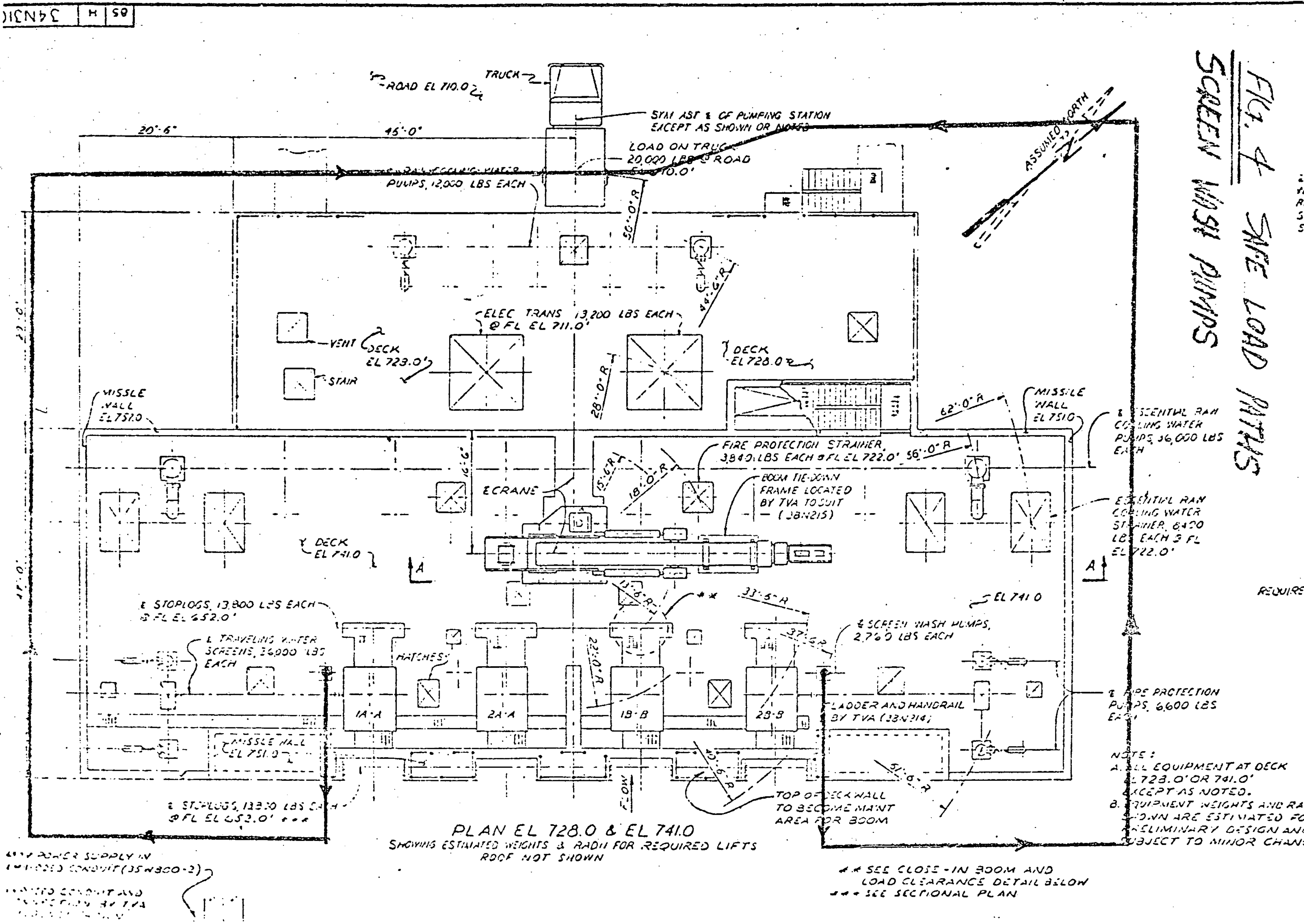


FIG. 4 SAFE LOAD PATHS
SCREEN WASH PUMPS

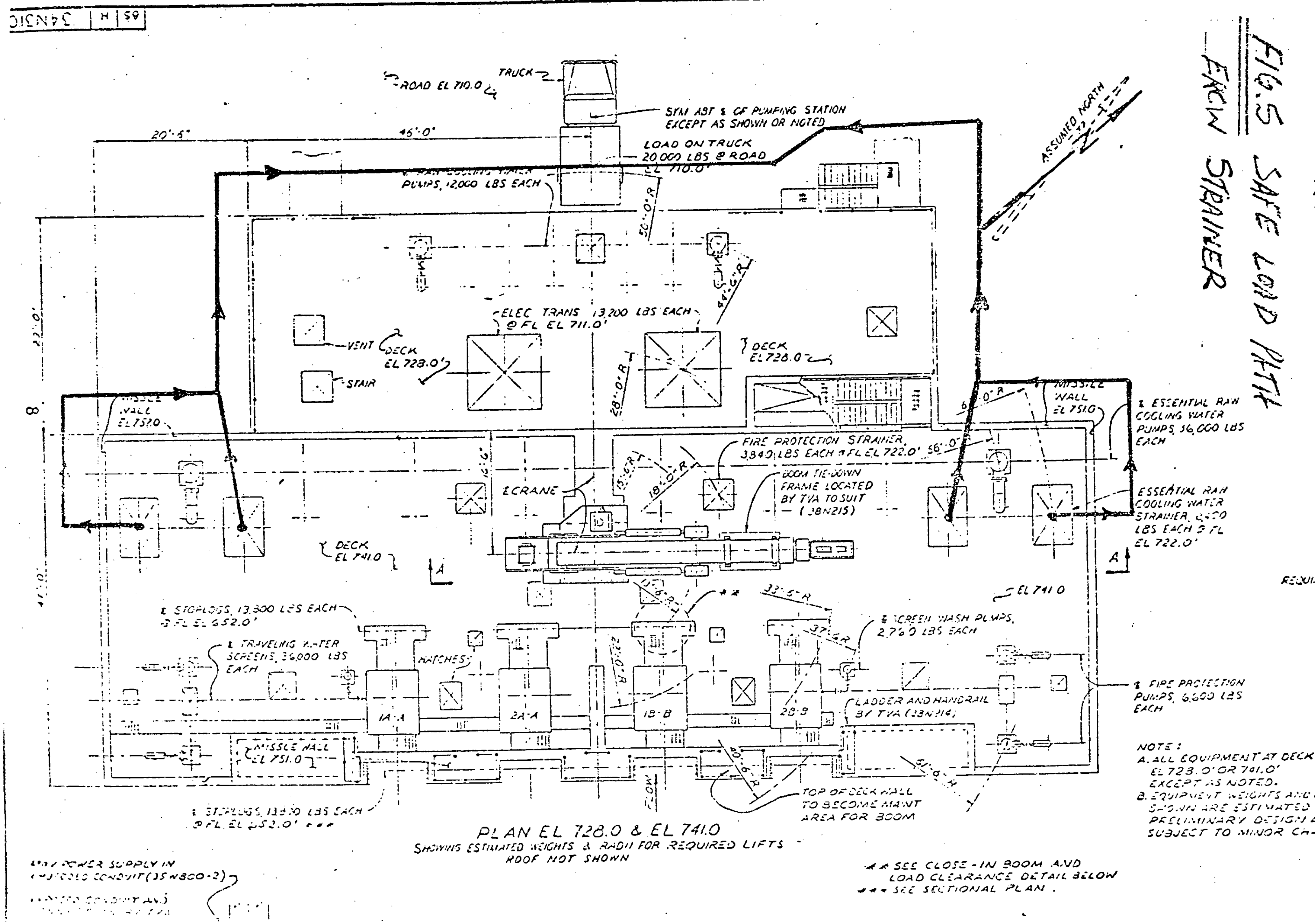
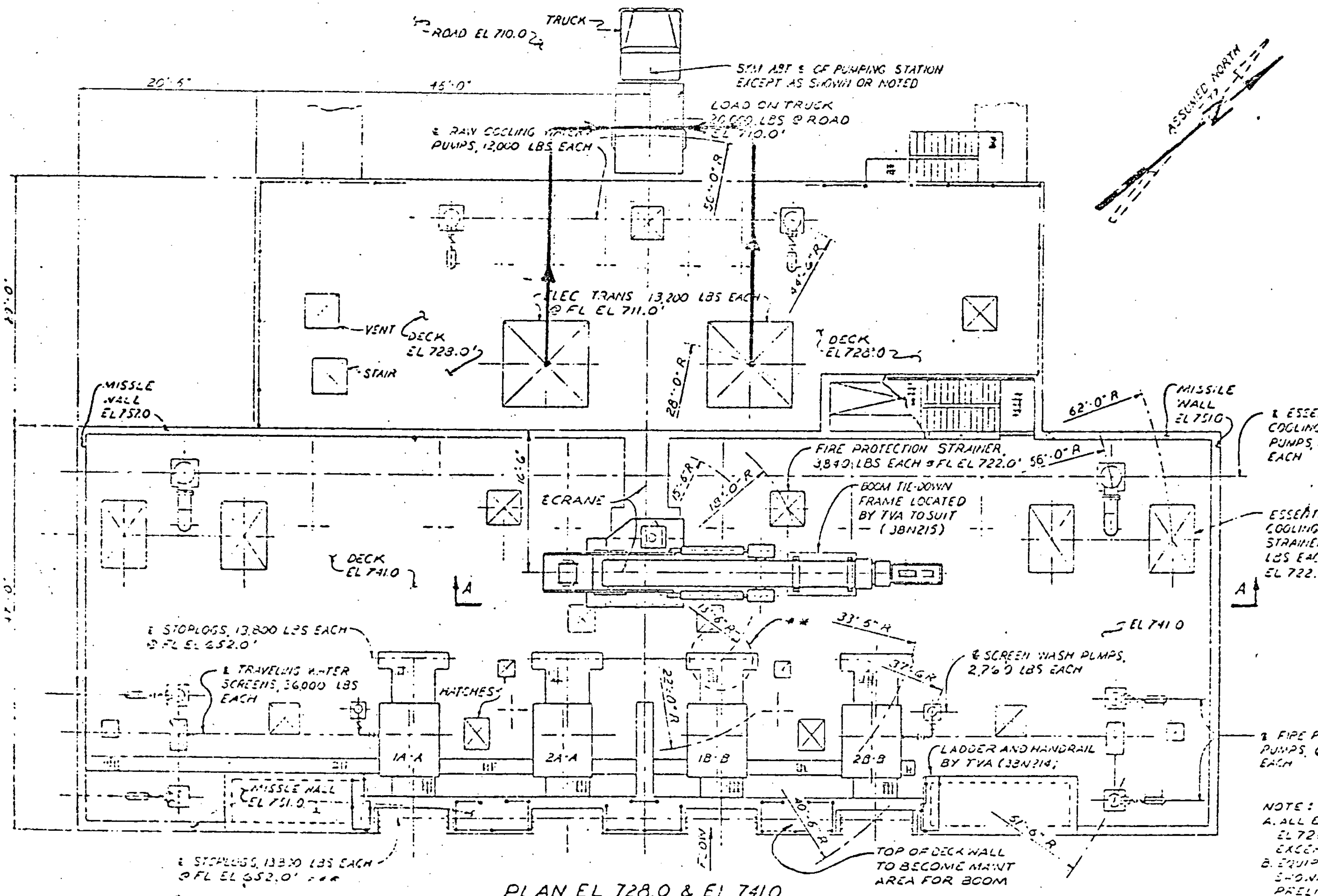


FIG. 5 SAFE LOAD PATH
ERCW STRAINER

FIG. 6 SAFE LOAD PATH - TRANSFORMERS



PLAN EL 728.0 & EL 741.0

SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN

NOTE:
A. ALL EQUIPMENT AT DECK EL 728.0' OR 741.0' EXCEPT AS NOTED.
B. EQUIPMENT WEIGHTS AND R. SHOWN ARE ESTIMATED F PRELIMINARY DESIGN A. SUBJECT TO MINOR CHAN.

** SEE CLOSE-IN BOOM AND LOAD CLEARANCE DETAIL BELOW
*** SEE SECTIONAL PLAN

... POWER SUPPLY IN EMBEDDED CONDUIT (35 N 800-2)

... CONDUIT AND ... BY TVA

REQUIR

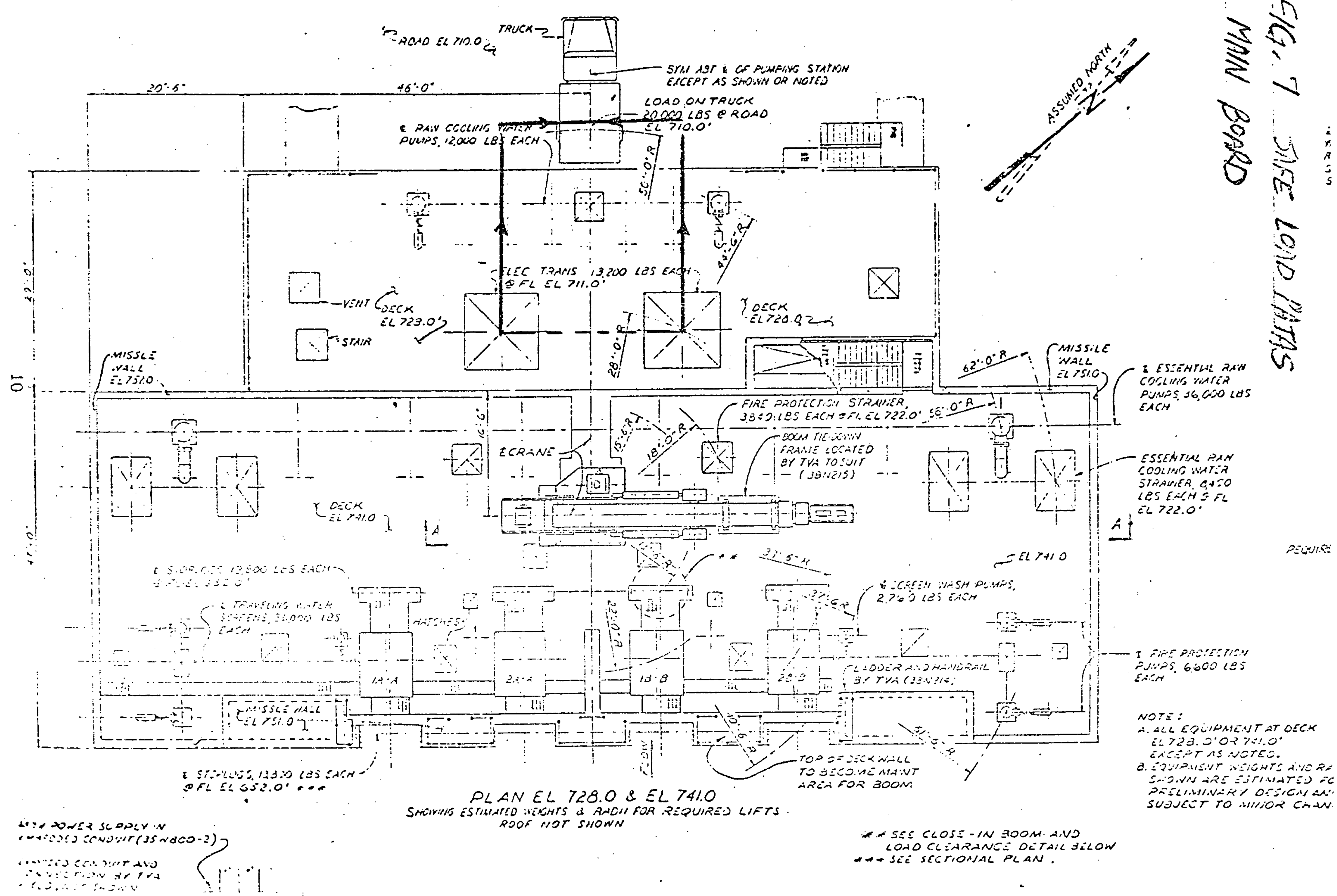
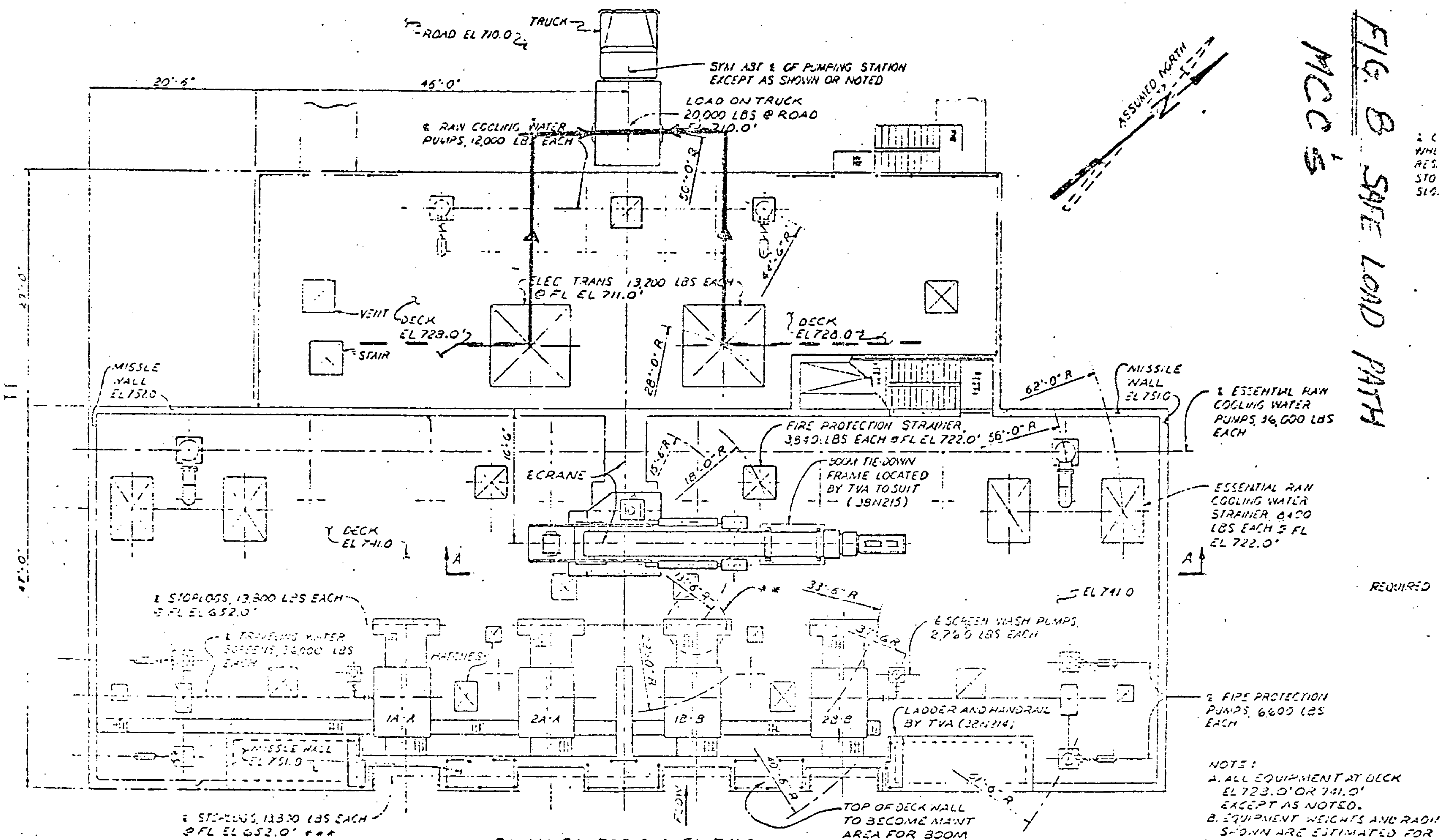


FIG. 7 SAFE LOAD PATHS MAIN BOARD



PLAN EL 728.0 & EL 741.0

SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS ROOF NOT SHOWN

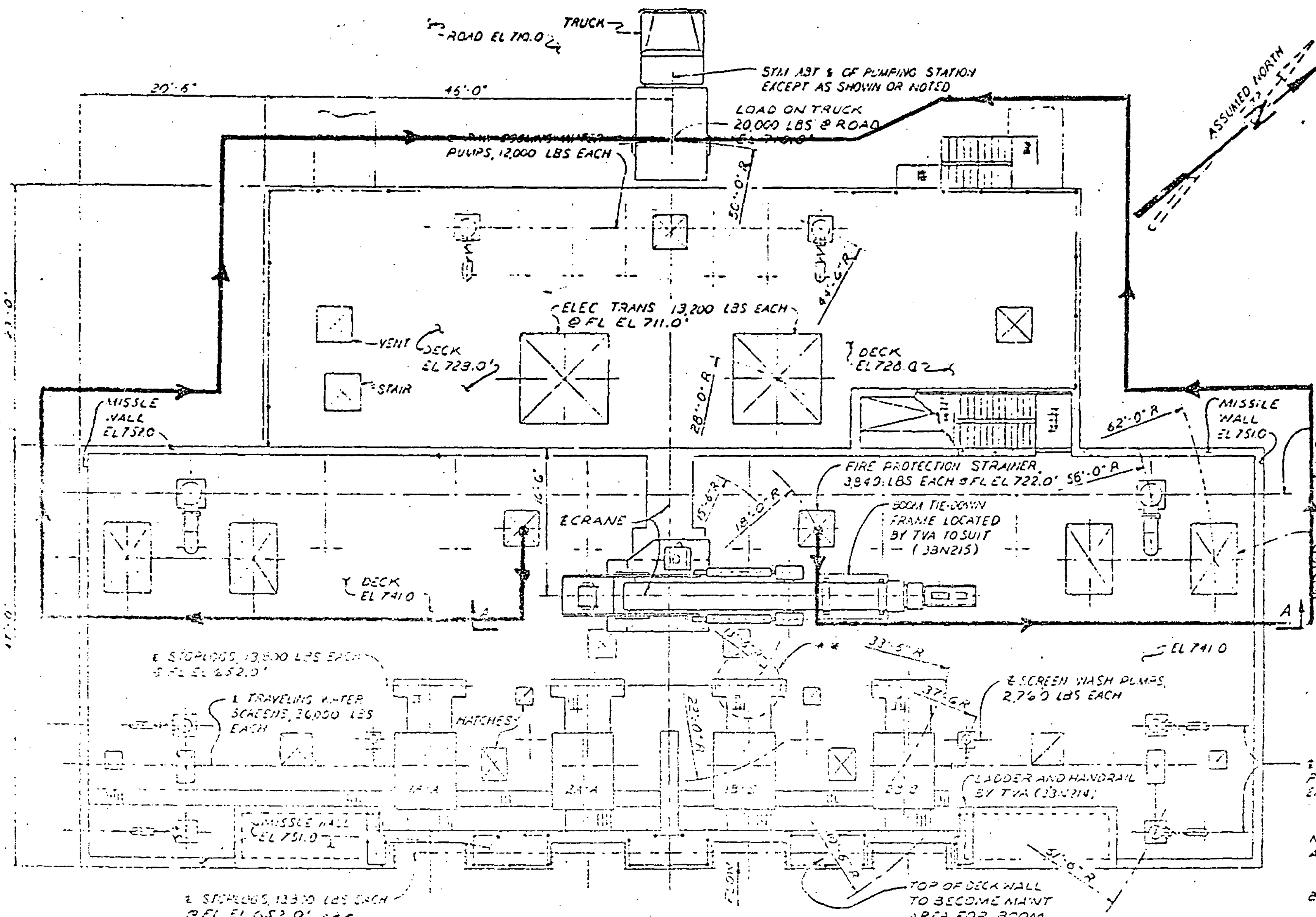
NOTE:

A. ALL EQUIPMENT AT DECK EL 728.0' OR 741.0' EXCEPT AS NOTED.
B. EQUIPMENT WEIGHTS AND RADII SHOWN ARE ESTIMATED FOR PRELIMINARY DESIGN AND SUBJECT TO MINOR CHANGE

** SEE CLOSE-IN BOOM AND LOAD CLEARANCE DETAIL BELOW

*** SEE SECTIONAL PLAN

FIG. 9 SAFE LOAD PATH
FIRE PROTECTION STRAINERS



PLAN EL 728.0 & EL 741.0
SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN

** SEE CLOSE-IN BOOM AND LOAD CLEARANCE DETAIL BELOW
*** SEE SECTIONAL PLAN.

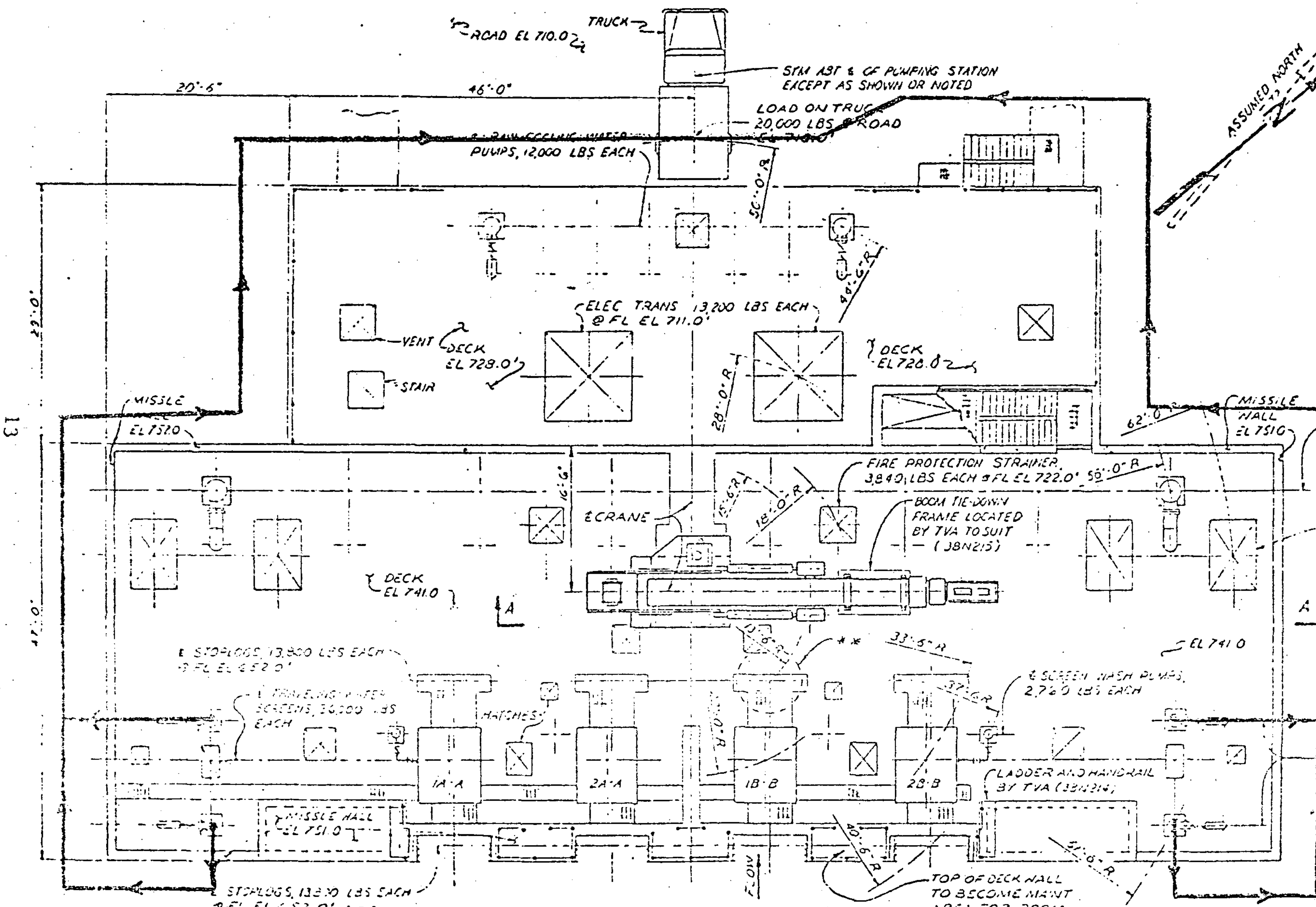
NOTE:
A. ALL EQUIPMENT AT DECK EL 728.0' OR 741.0' EXCEPT AS NOTED.
B. EQUIPMENT WEIGHTS AND R... SHOWN ARE ESTIMATED F... PRELIMINARY DESIGN AN... SUBJECT TO MINOR CHAN...

REQUIR...

... POWER SUPPLY IN EMBEDDED CONDUIT (35N800-2)

34N310 H 85

FIG. 10 SAFE LOAD PATH FIRE PROTECTION PUMPS



PLAN EL 728.0 & EL 741.0

SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN

REQUIRE.

NOTE:
A. ALL EQUIPMENT AT DECK EL 728.0' OR 741.0' EXCEPT AS NOTED.
B. EQUIPMENT WEIGHTS AND RAD SHOWN ARE ESTIMATED FO PRELIMINARY DESIGN AND SUBJECT TO MINOR CHANG

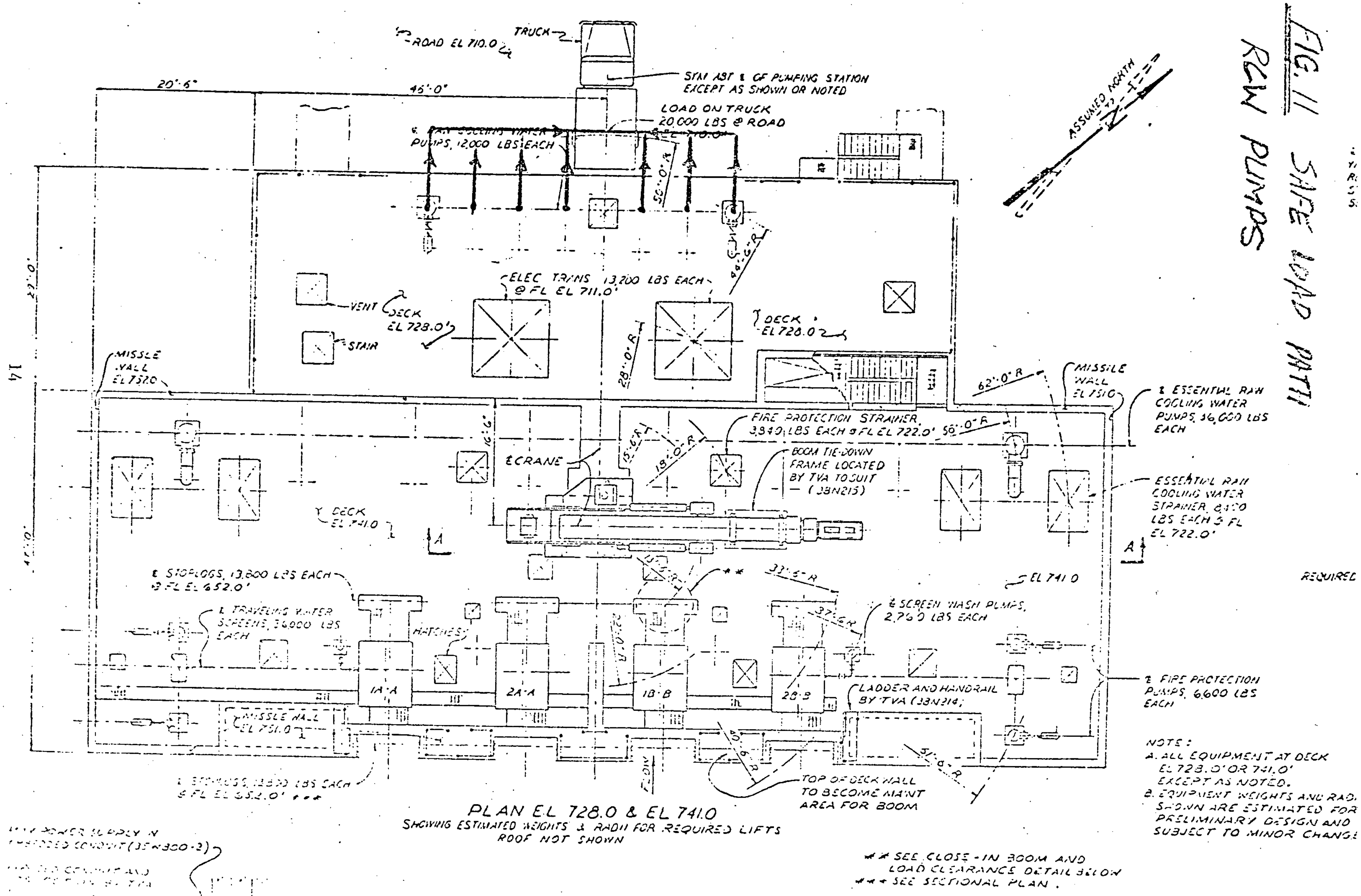
4KV POWER SUPPLY IN EMBEDDED CONDUIT (35N800-2)

EMBEDDED CONDUIT AND CONNECTION BY TVA

** SEE CLOSE-IN BOOM AND LOAD CLEARANCE DETAIL BELOW
*** SEE SECTIONAL PLAN

13

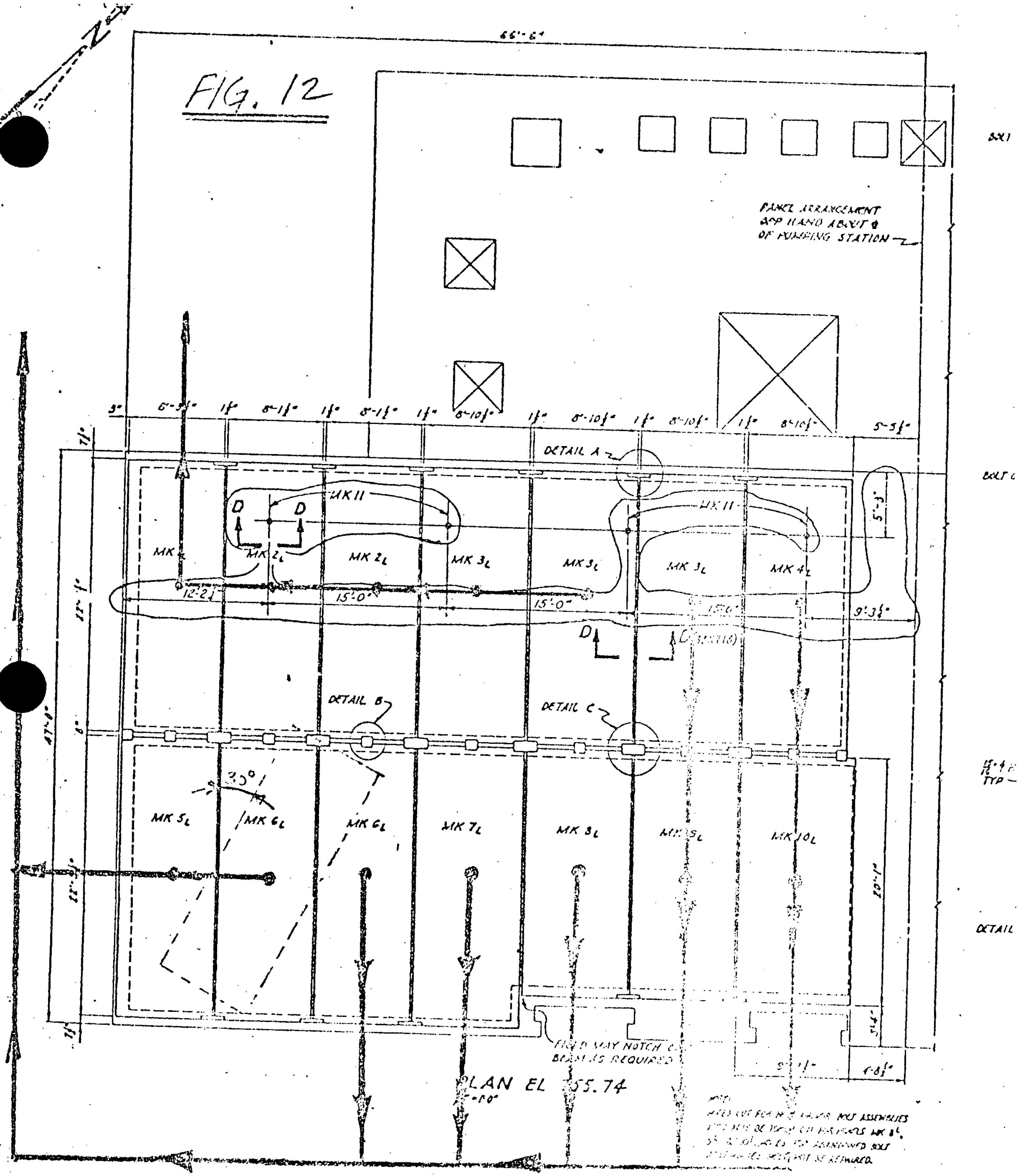
85 H 34N310



PLAN EL 728.0 & EL 741.0
SHOWING ESTIMATED WEIGHTS & RADII FOR REQUIRED LIFTS
ROOF NOT SHOWN

FIG. 11 SAFE LOAD PATH
RCW PUMPS

FIG. 12



SAFE LOAD PATHS FOR REMOVAL OF MISSILE SHIELD ROOF SECTIONS

APPENDIX D

Response to NUREG 0612 Question 2.1-3a

EN DES CALCULATIONS

TITLE WATTS BAR N.P. — REACTOR BUILDING OPERATING DECK	UNID SYSTEM(S) ———	PLANT/UNIT WATTS BAR / 1 & 2 SAR SECTION(S)

PREPARING ORGANIZATION: SWP CIVIL #1

APPLICABLE DESIGN DOCUMENTS: 41N735-1, 41W736-1 THRU 4

BRANCH/PROJECT IDENTIFIERS: WCG-1-43

KEY NOUNS: ———

REV	(FOR MEDS USE)	MEDS ACCESSION NUMBER
R0	790723A0013	SWP '790711 064
R1	801124A0103	SWP '801107 082
R2		WBP '83 0722 147
R3		

REV	R0	R1	R2	R3
DATE	7/16/79	11-8-80	7-22-83	
PREPARED		G H Boyd	R.H. Bandall	
CHECKED		James Adair	P.K. Laster	
SUBMITTED	ARY	Larry A. Katikon	B.W. Whittier	
APPROVED		A. Jonsson	A. Jonsson H	
ATTACHMENTS MICROFILMED:				
LIST ALL PAGES* ADDED BY THIS REV:			50a-50c	
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STATEMENT OF PROBLEM

ABSTRACT

Reinforced concrete design calculations for Reactor Building Operating Deck floor slab.

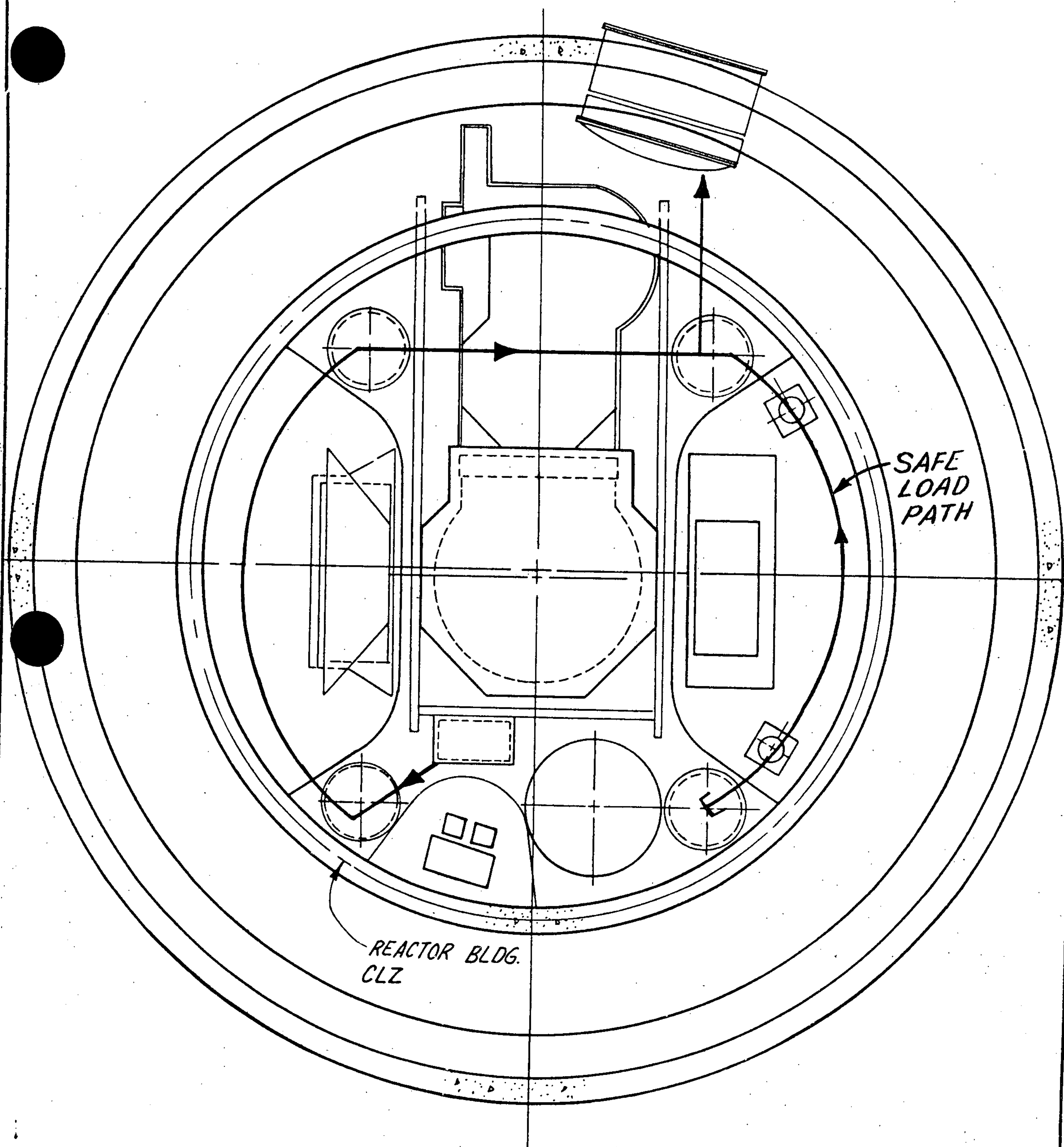
R1) FILM TO SHOW SIGNATURES
CALCULATIONS STORED IN TIC

R2) ADDED HEAVY LOAD DROP ANALYSIS FOR NUREG 0612.

TVA 10697 (ENDES-7-78) *Use revision log (form TVA 10534) if more room is required

R0069 F 1983

All heavy loads being moved horizontally should be kept as close to the operating deck, El 756.63, as possible. The maximum height should not exceed 8 feet above El 756.63 when moving the reactor vessel head, upper internals, reactor coolant pump plug, reactor coolant pump motor, and the reactor coolant pump.



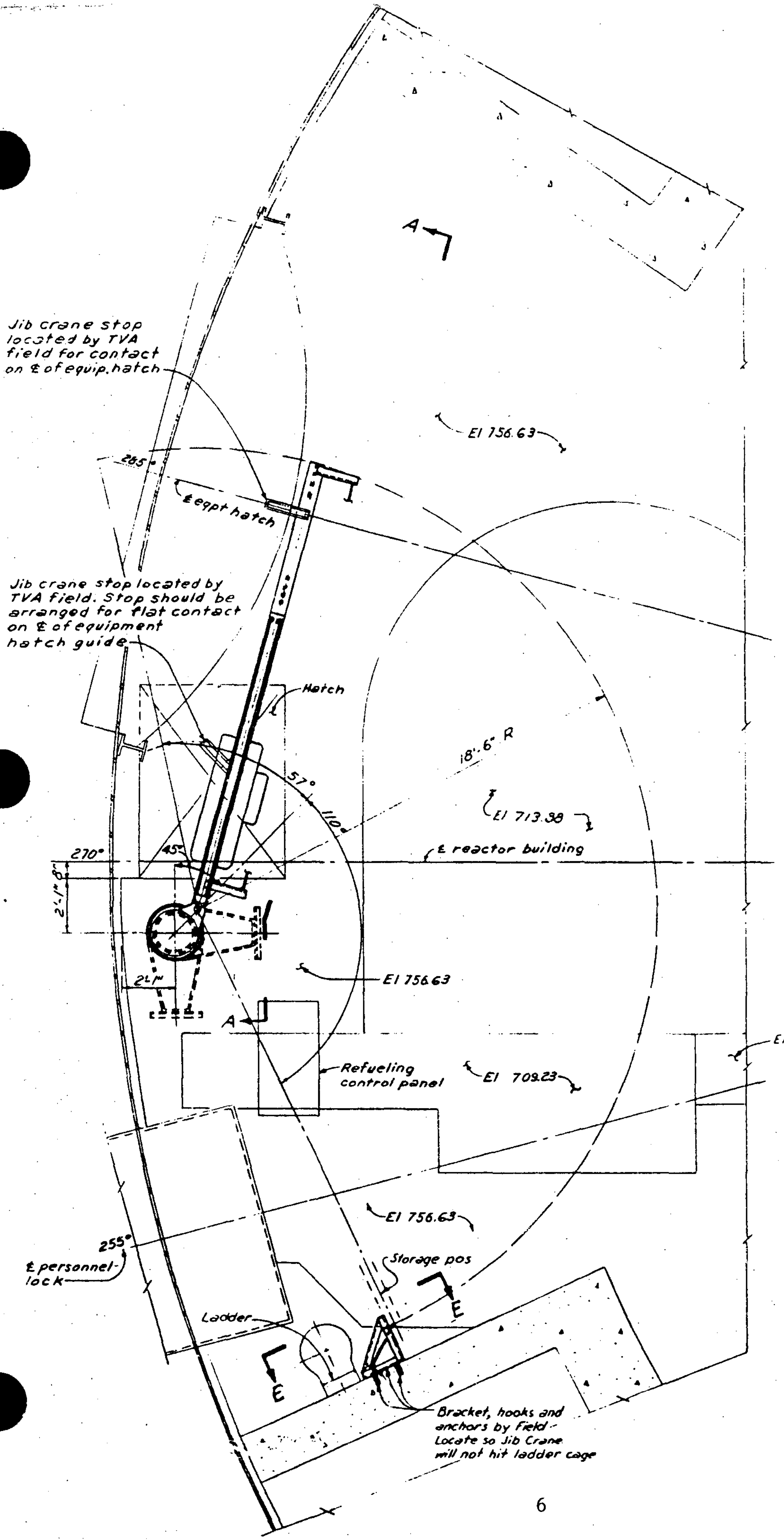
REACTOR BUILDING CRITICAL LIFT ZONE

NOTE 1: All miscellaneous lifts shall follow the paths indicated.
NOTE 2: All other lifts shall take the shortest safe path to the designated laydown area.

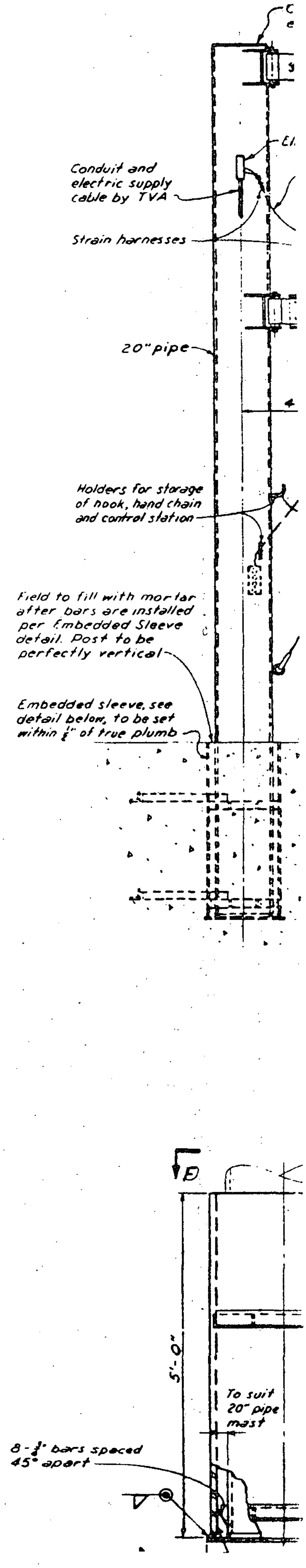
3-ton capacity JIB crane with 3-ton capacity wire cable electric hoist and chain driven trolley.

For handling path refer to 44N384 and 47W200-11.

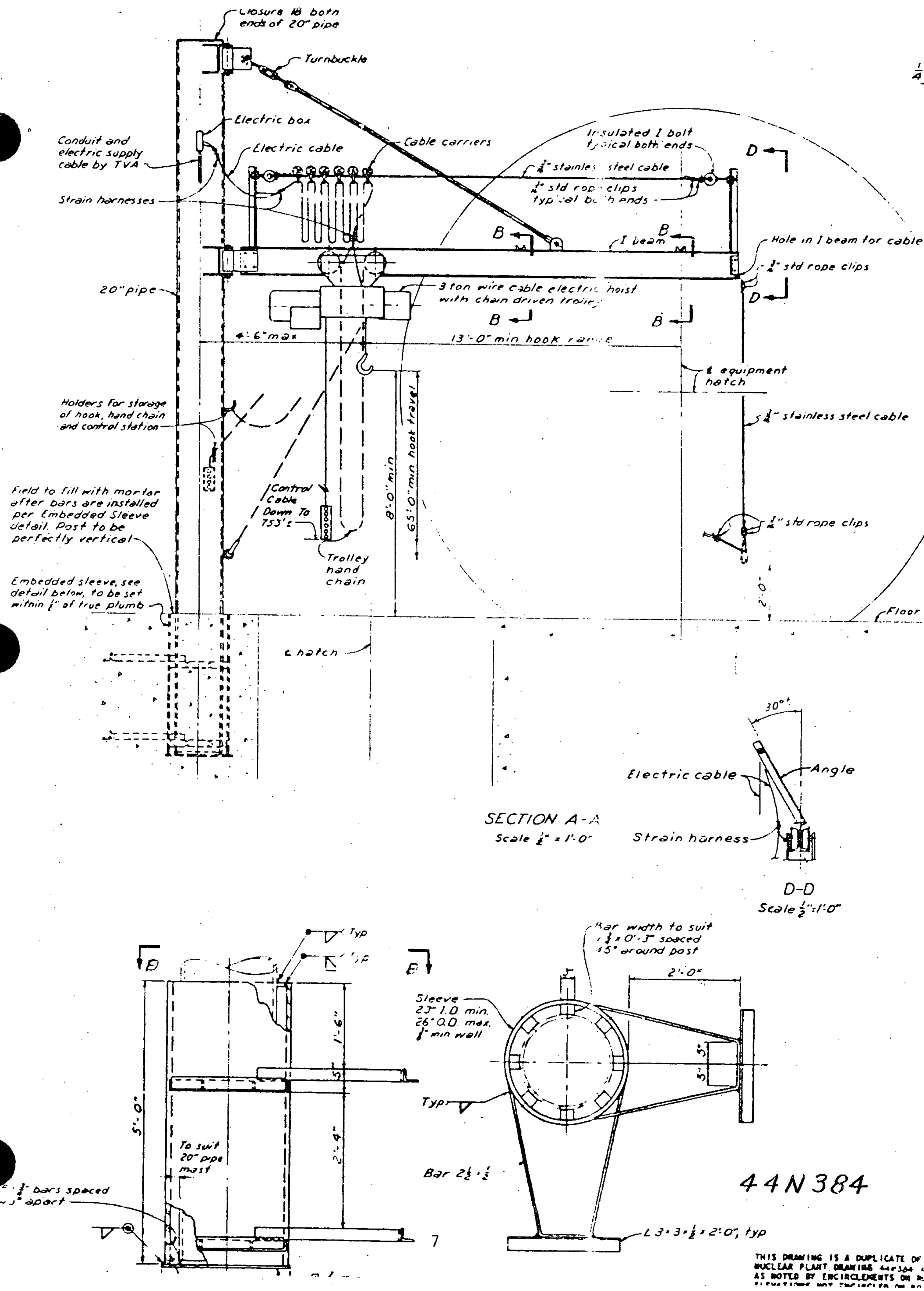
This crane is for general lifts, such as valves, tools, pipe, etc.



A
Jib crane stop located by TVA field for contact on ℄ of equip. hatch
El 756.63
285°
℄ eqpt hatch
Jib crane stop located by TVA field. Stop should be arranged for flat contact on ℄ of equipment hatch guide
Hatch
18'-6" R
57°
110°
El 713.38
270°
45°
℄ reactor building
2'-1" 8"
2'-1"
El 756.63
A
El 724.0
Refueling control panel
El 709.23
El 756.63
255°
℄ personnel-lock
Storage pos
E
Ladder
E
Bracket, hooks and anchors by Field - Locate so Jib Crane will not hit ladder cage



Conduit and electric supply cable by TVA
Strain harnesses
20" pipe
Holders for storage of hook, hand chain and control station
Field to fill with mortar after bars are installed per Embedded Sleeve detail. Post to be perfectly vertical
Embedded sleeve, see detail below, to be set within 1/8" of true plumb
E
5'-0"
To suit 20" pipe mast
8 - 3/4" bars spaced 45° apart



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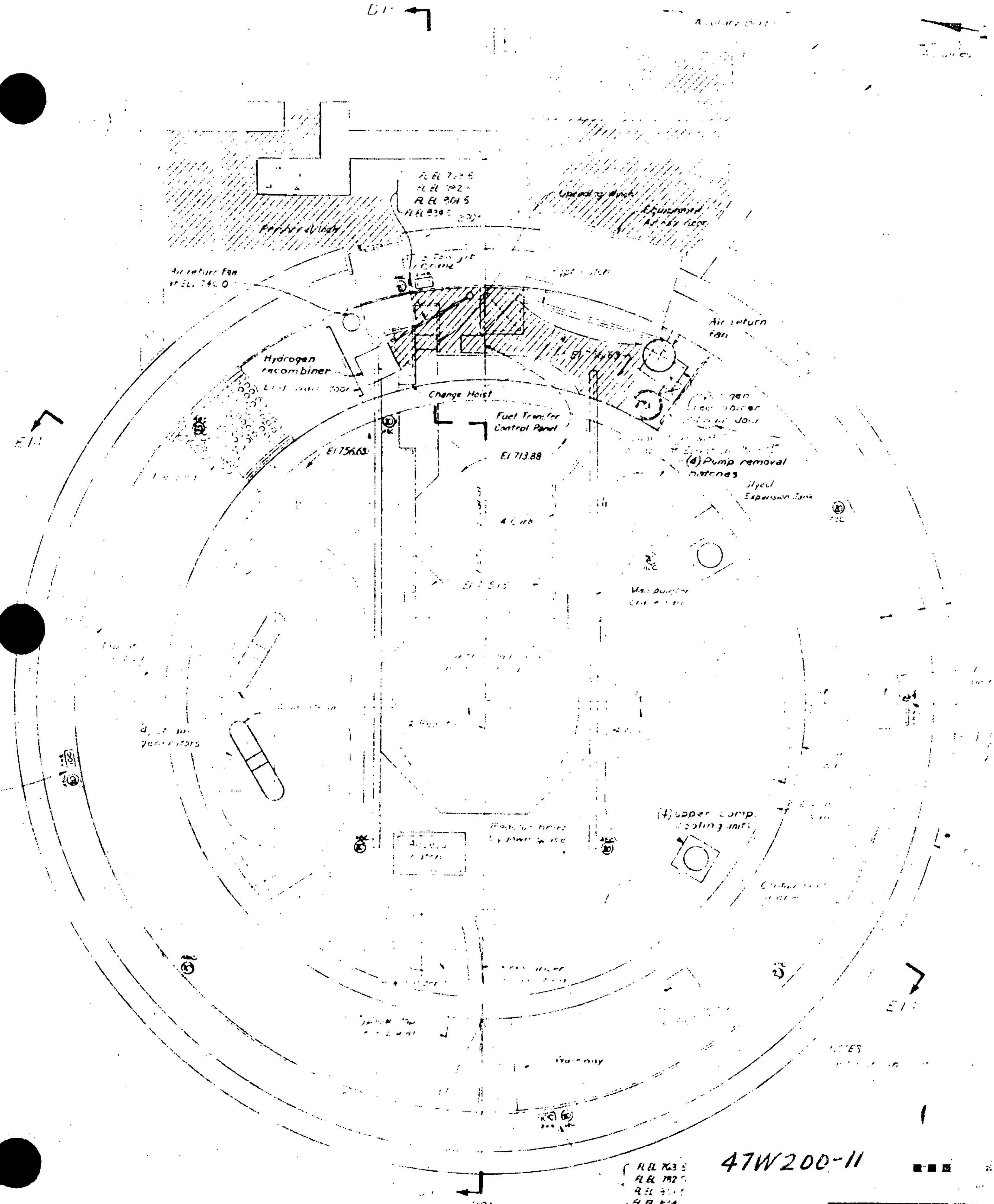
724 0

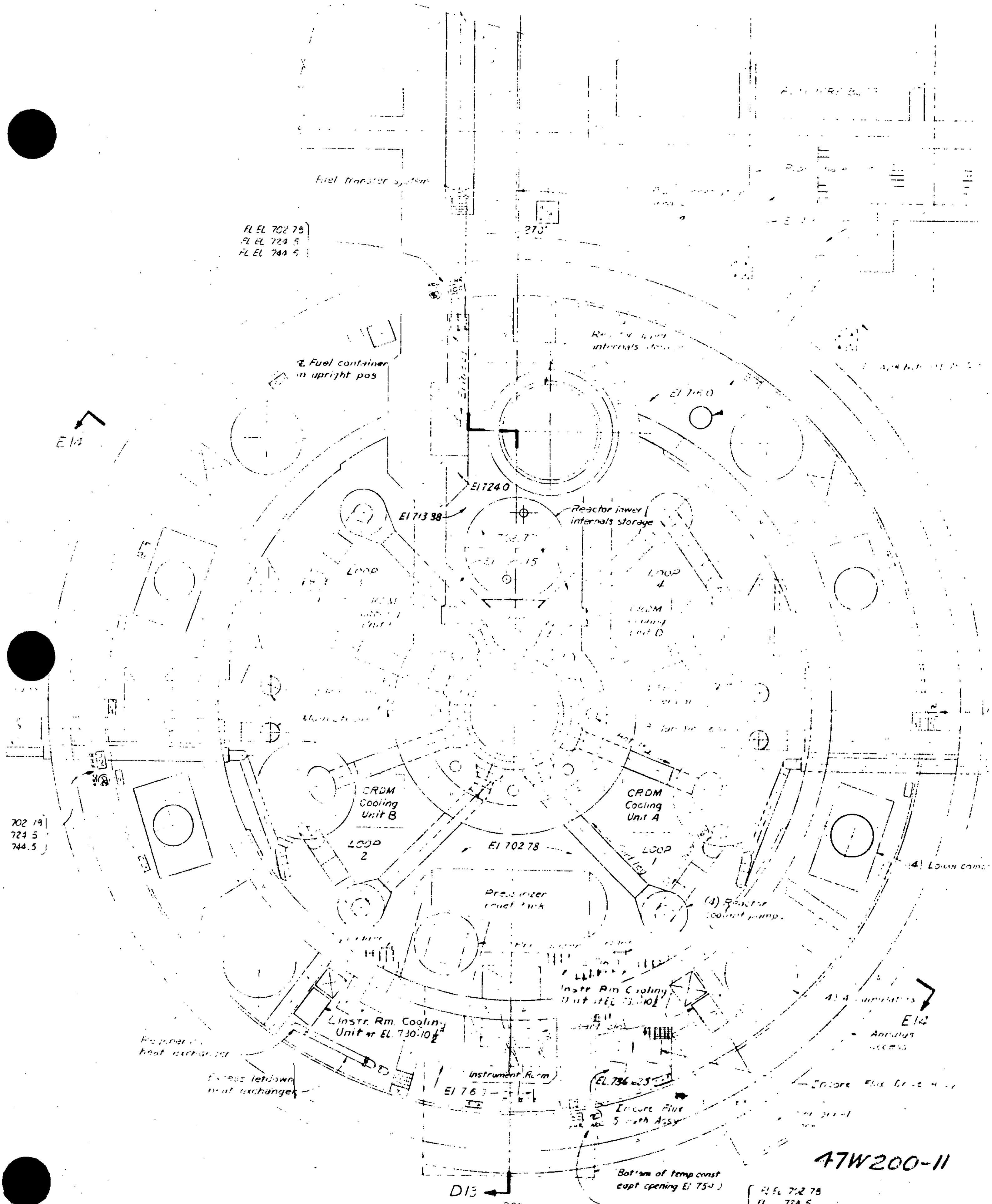
1/4

44N384

THIS DRAWING IS A DUPLICATE OF NUCLEAR PLANT DRAWING 44N384 AS NOTED BY ENCIRCLEMENTS ON ... ELEVATIONS NOT ENCIRCLED ON ...



UPPER COMPARTMENT



PLAN - LOWER COMPARTMENT

APPENDIX E

Response to NUREG 0612 Question 2.1-3a

EN DES CALCULATIONS

TITLE EL 757.0 FLOOR SLAB AUXILIARY BUILDING	UNID SYSTEM(S)	PLANT/UNIT Watts Bar 1 & 2 / SAR SECTION(S)

PREPARING ORGANIZATION	REV	(FOR MEDS USE)	MEDS ACCESSION NUMBER
SWP Civil #1	R0		
APPLICABLE DESIGN DOCUMENTS: 41N321-1 TO 41N322-5 / BRANCH/PROJECT IDENTIFIERS: KCG-1-80	R1		SWP '801107 052
	R2		WBP '83 0720 008
KEY NOUNS: Concrete	R3		

REV	R0	R1	R2	R3
DATE		11-8-80	7-20-83	
PREPARED		G.H. Boyd	R.H. Bendall	
CHECKED		James Adair	P.K. Foster	
SUBMITTED		[illegible]	B.W. Whitman	
APPROVED		A. Johnson	A. Johnson	
ATTACHMENTS MICROFILMED:				
LIST ALL PAGES* ADDED BY THIS REV:			276-296	
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STATEMENT OF PROBLEM

DESIGN CONCRETE FLOOR SLAB FOR THE AUXILIARY BUILDING 757.0' FLOOR

ABSTRACT

R1) FILM TO SHOW SIGNATURES
CALCULATIONS STORED IN TIC

R2) ADDED HEAVY LOAD DROP ANALYSIS SECTION
FOR NU REG 0612.

TVA 10697 (ENDES-7-78) *Use revision log (form TVA 10534) if more room is required

EN DES CALCULATIONS

TITLE SPENT FUEL PIT		UNID SYSTEM(S)	PLANT/UNIT WATTS BAR 1&2 SAR SECTION(S)

PREPARING ORGANIZATION		REV	(FOR MEDS USE)	MEDS ACCESSION NUMBER
SWP CIVIL #1		R0		
APPLICABLE DESIGN DOCUMENTS 41N355-1,-2 41N356-1,-2,-3	BRANCH/PROJECT IDENTIFIERS WCG-1-129	R1	801211E0012	SWP '801203 019
		R2		
KEY NOUNS CONCRETE		R3		

REV	R0	R1	R2	R3
DATE		12-1-80		
PREPARED		GH Boyd		
CHECKED		[signature]		
SUBMITTED		[signature]		
APPROVED		A. Jonasson		
ATTACHMENTS MICROFILMED:				
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LIST ALL PAGES* CHANGED BY THIS REV:		COVER SHT		

STATEMENT OF PROBLEM

DESIGN OF CONCRETE AND REINFORCEMENT FOR THE SPENT FUEL PIT IN THE AUXILIARY BLDG.

ABSTRACT

R1) FILM TO SHOW SIGNATURES AND CROSS REFERANCES
THESE CALS TO BE STORED AT TIC

TVA 10697 (ENDES-7-78) *Use revision log (form TVA 10534) if more room is required

The monorails Mk 306 (48N1276-3, 44N389 and 44N391), Mk 307 (48N1276-3 and 44N390), Mk 224 (48N1276-2 and 44N389) follow fixed paths. A field investigation will be made to determine the exact location of safety-related electrical equipment. A final report will be made prior to October 15, 1983. If it is determined that these monorails do not follow a safe load path, the necessary corrective action will be taken.

APPENDIX E

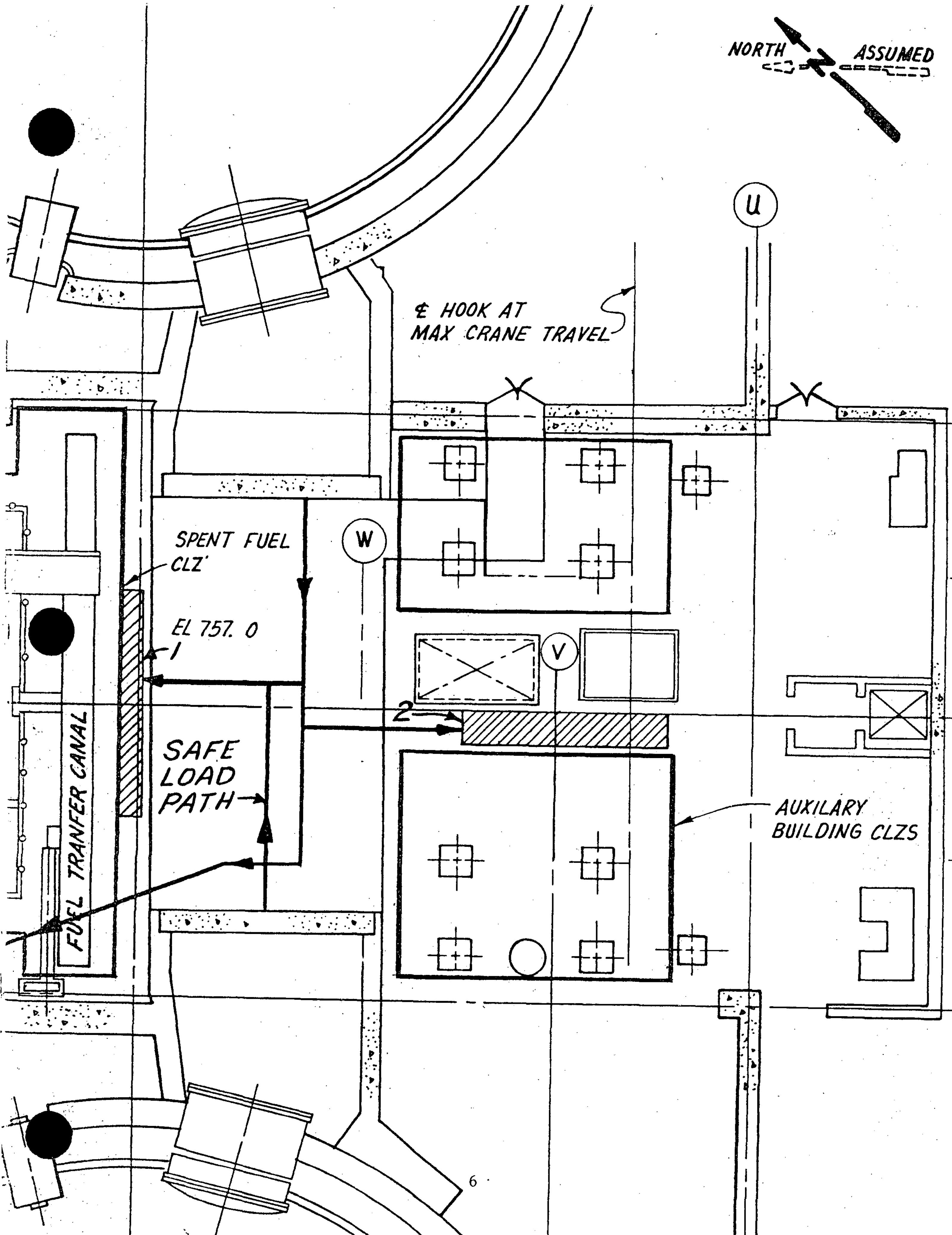
2.1-3a

Auxiliary Building

The restrictions on handling these equipment hatch shield plugs (50 tons) include lowering the plugs to less than 6 inches above the floor promptly before moving them horizontally. The height above the floor should be kept at a minimum, the minimum number of inches that will allow movement, while moving to the designated setdown area. This procedure would minimize the damage done should the load be dropped. Directly below El 757.0 between the two units are safety-related equipment in the path between the two equipment hatches. Therefore, written procedures should require that loads be lowered to just above floor El 757.0 before moving the load to the setdown area. The safety related equipment includes CCS Booster Pump and CCS piping, CCS SFPCS HXB supply 12-inch diameter, CCS SFPCS HXA return 12-inch diameter, numerous safety-related conduits, control boxes and other safety-related electrical equipment. Written handling procedures for the 50-ton shield plugs, 44N356, should require that they be moved to the nearest designated setdown area. That is, do not move these 50-ton shield plugs any further than is necessary. These setdown areas are shown on the sketches as 1, 2, and 3. One plug can be set down on position 1, two plugs on position 2, and three plugs on position 3. Positions 1 and 2 are better setdown areas for the plugs as position 3 requires more travel. See drawings 41N321-1, note 12, 41N321-2, note B2 and note C2, 41N321-3, note C3 for locations and information on setdown areas.

Restrictions on handling the spent fuel shipping cask:

The load drop toppling analysis for the 100-ton shipping casks shows that the slab could be damaged structurally from a load drop that toppled the cask. The restrictions on handling should include lowering the cask to less than 6 inches above the floor before moving it. While moving, the height should be kept at a minimum to prevent damage from dropping of the cask or to prevent the cask from rolling if dropped.



NORTH
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U
℄ HOOK AT
MAX CRANE TRAVEL
W
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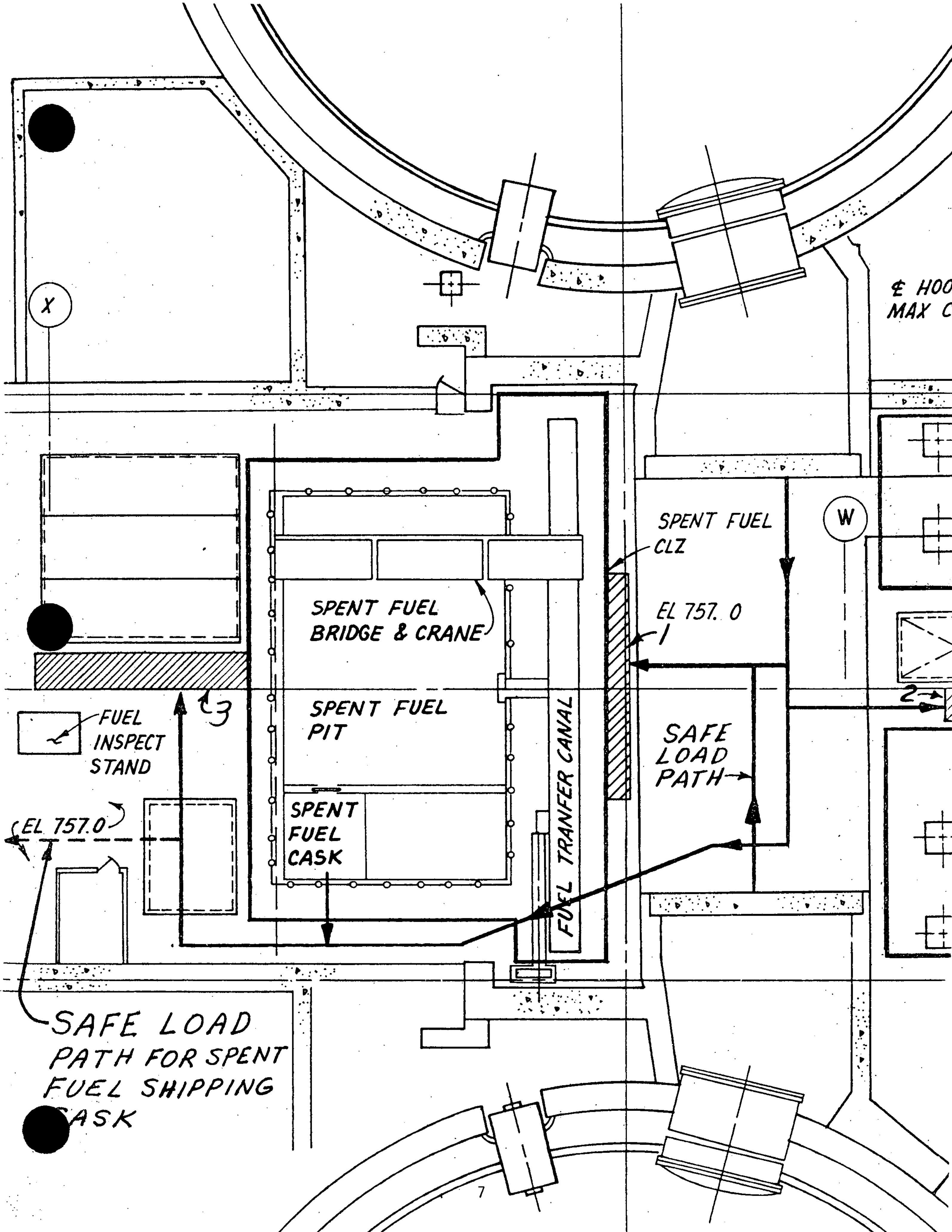
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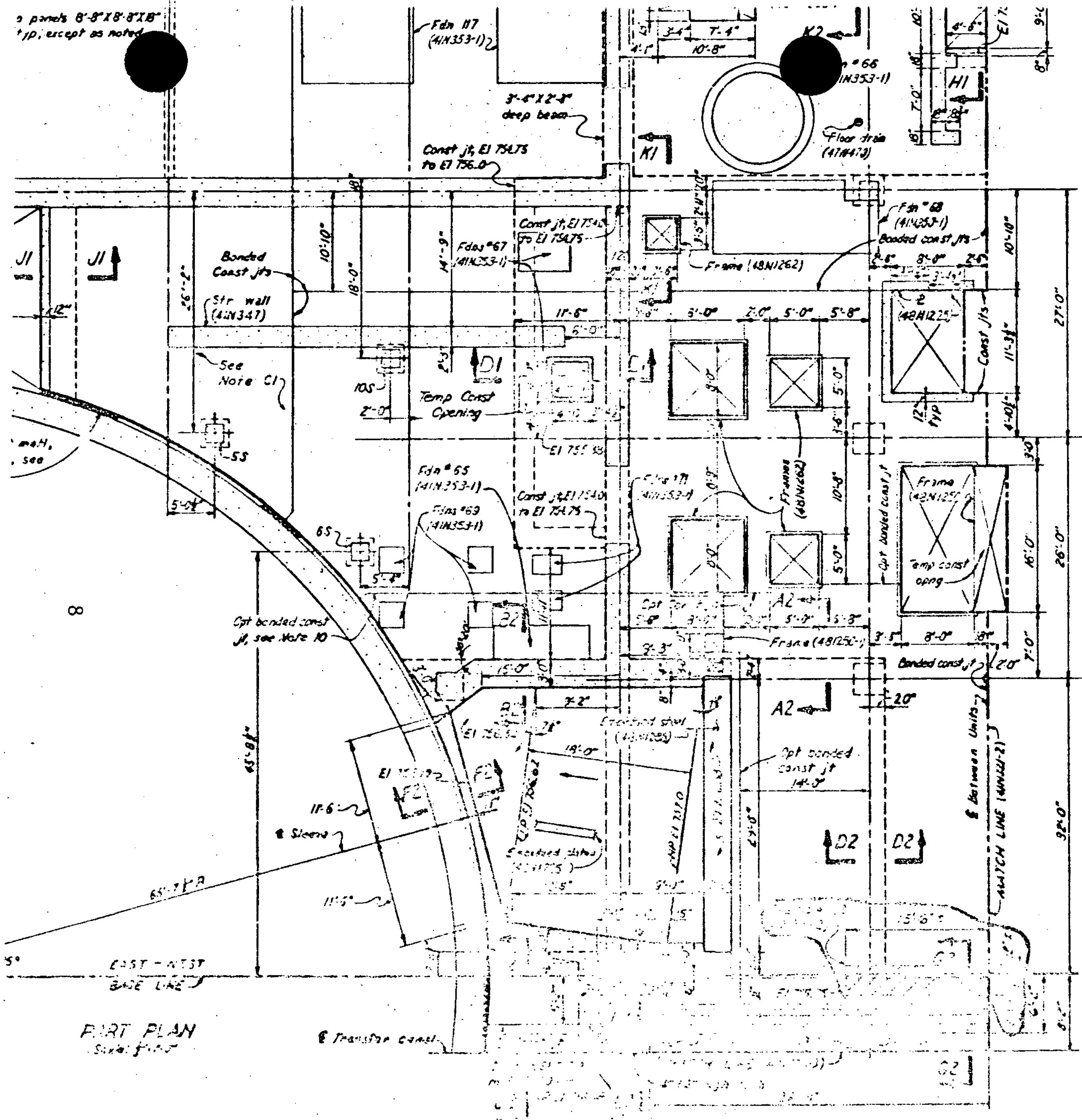
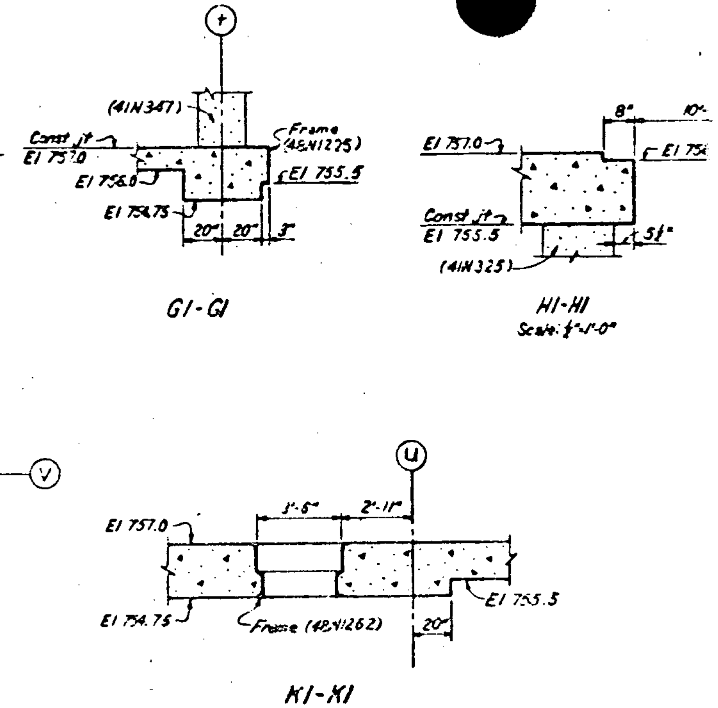
CASK





Notes cont'd:

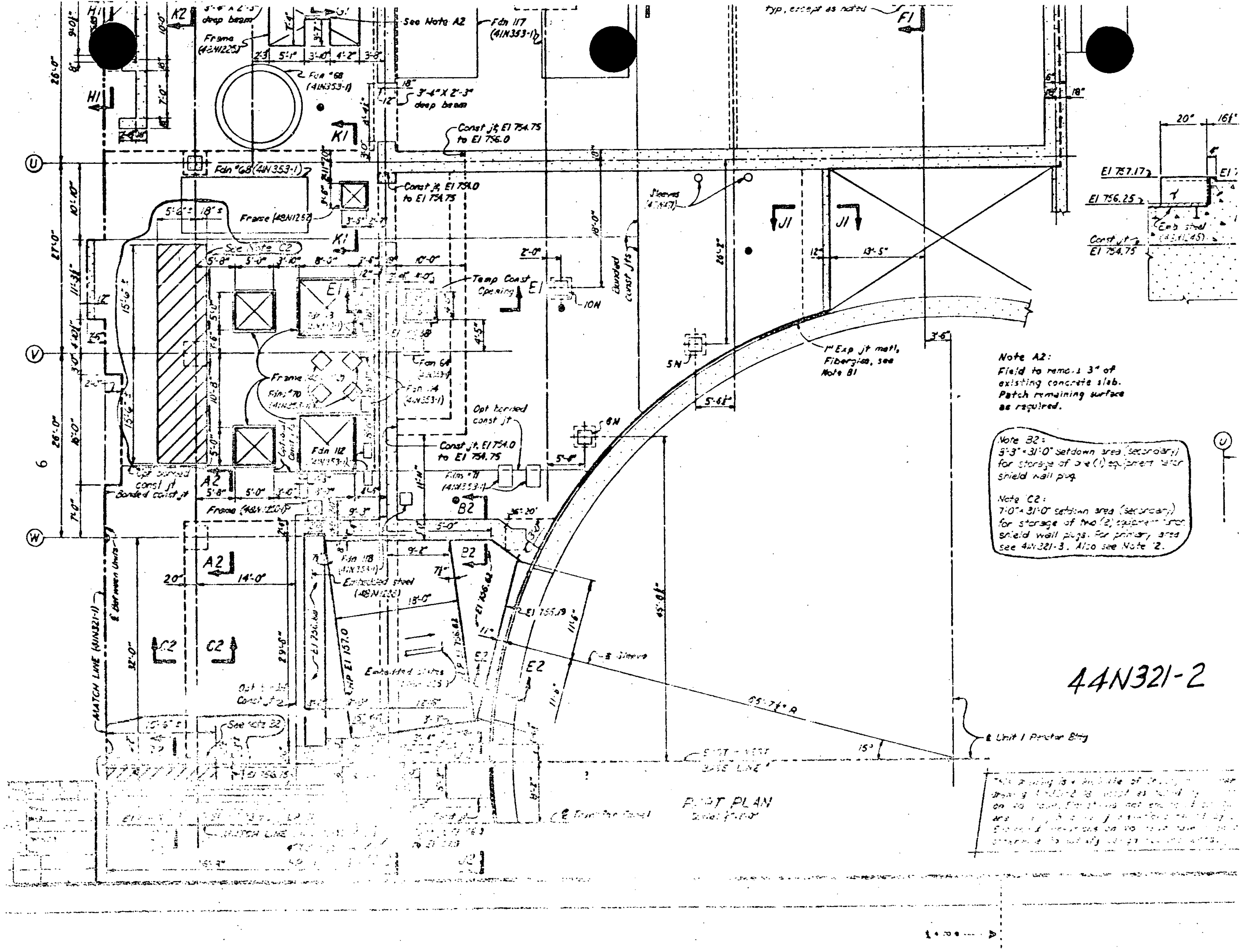
2. The areas designated ▨ are setdown areas for storage of equipment hatch shield wall plugs. Where plugs are set down on floor surfaces sloped for drainage, measures shall be taken by shimming, or any other method determined adequate by field, to ensure approximately uniform contact between plugs and slab surface.

REFERENCE DRAWING:
41BM321... BILL OF MATERIAL

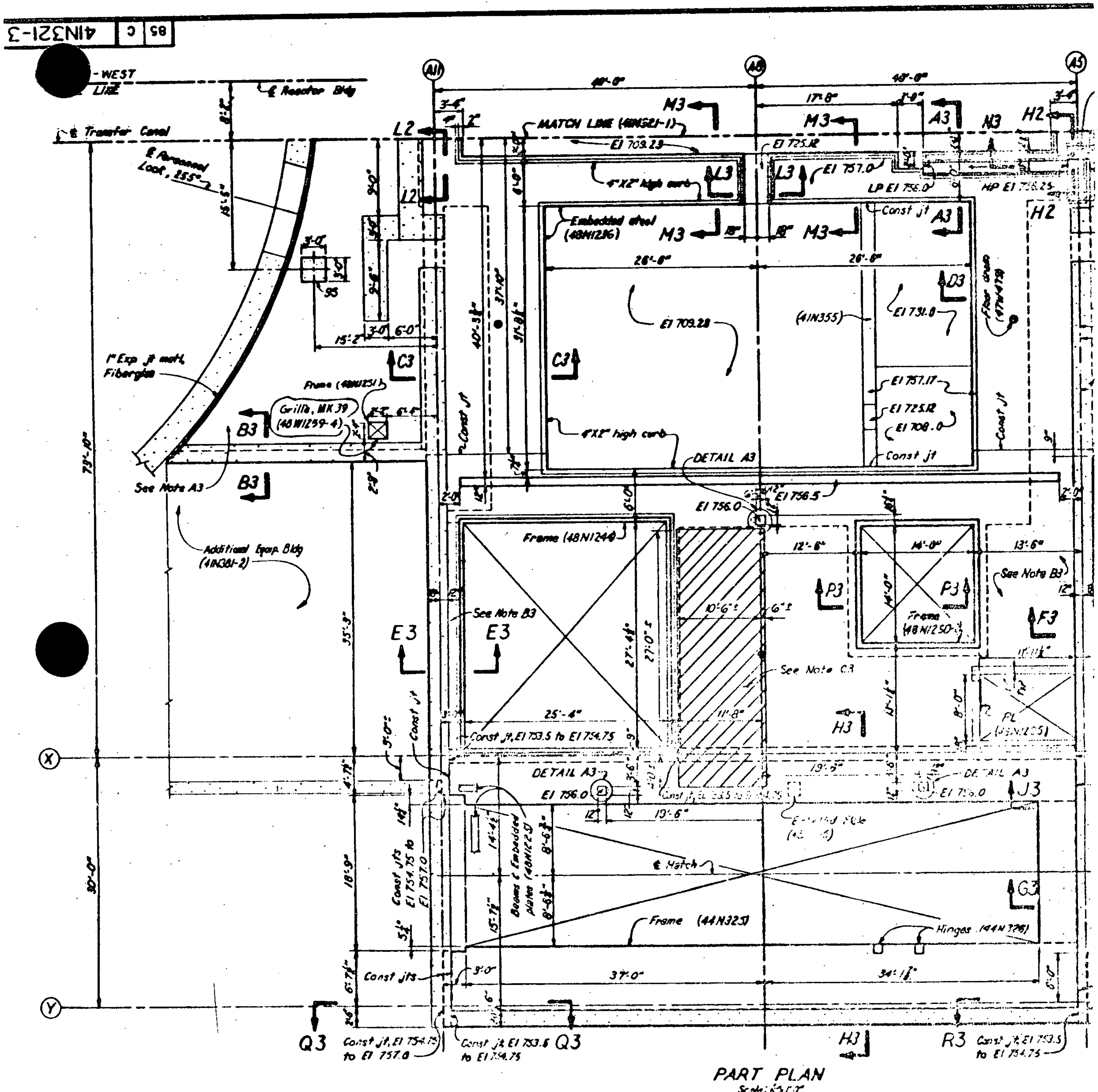
SCALE ¼"=1'-0"
EXCEPT AS NOTED

COMPANION DRAWINGS 41N321...

41N321-1



See Note A2
Fdn 117 (41N353-1)
Fdn #68 (41N353-1)
3'-4" X 2'-3" deep beam
Const jt, El 754.75 to El 756.0
Fdn #68 (41N353-1)
Const jt, El 754.0 to El 754.75
Frame (48N1257)
Sleeves
18'-0"
See Note C2
Temp Const Opening
Bonded const jts
1" Exp jt matl, Fiberglas, see Note B1
Note A2:
Field to remove 3" of existing concrete slab. Patch remaining surface as required.
Note B2:
3'-3" x 31'-0" setdown area (secondary) for storage of one (1) equipment hatch shield wall plug.
Note C2:
7'-0" x 31'-0" setdown area (secondary) for storage of two (2) equipment hatch shield wall plugs. For primary area see 44N321-3. Also see Note 12.
Opt bonded const jt
Const jt, El 754.0 to El 754.75
Fdn 112
Fdn 118
Embedded steel
Frame (48N1220)
Bonded const jt
MATCH LINE (44N321-1)
Embedded plates
65'-7 1/4" R
℄ Unit 1 Reactor Bldg
El 757.17
El 756.25
Const jt, El 754.75
44N321-2
PLAN



Note A3:
Shoring under slabs adjacent to 8" walls shown in Section B3-B3 must remain in place until 2'-3" walls are poured to El 779.75

Note C3:
11'-0" x 31'-0" set down area (primary) for storage of three (3) e, ipment hatch shie'd wall plugs. Also see Note 12 (4N321-1).

Note B3:
Shoring under slabs adjacent to 5 and A11 line walls from 36'-0" uth of the X line to the Y line must remain in place until the A5 and A11 line walls are poured to El 762.0

TVA Nuclear

TITLE INSPECTION, TESTING, MAINTENANCE, AND OPERATION OF NUCLEAR PLANT CRANES, HOISTS, AND RIGGING EQUIPMENT

PROCEDURE NO. N74M15

	DATE: 7/26/82	10/28/82		
PREPARED/REVISED: Supervisor, Stationary Equipment Group	ENM [illegible]	[illegible]		
SUBMITTED BY: Chief, Emergency Preparedness and Protection Branch	[illegible]	[illegible]		
CONCURRENCE: Chief, Quality Assurance & Compliance Branch	[illegible]	[illegible]		
PROGRAM MANAGER APPROVAL: Chief Mechanical Branch	[illegible]	[illegible]		

N74M15

TVA

DIVISION OF NUCLEAR POWER

DPM REVISION LOG

REVISION DATE	PAGES AFFECTED	DESCRIPTION OF CHANGE
6/25/81	All	To address all plant hoisting and rigging equipment and to comply with NRC and safety requirements.
10/9/81	Pages 1, 2, 25, 37, 51, and 52	Addition of section 3.8, "Scaffolds and Temporary Platforms" to provide requirements for their support from or on CSSC piping systems, thus resolving violations depicted by NRC in Sequoyah unit 2 OIE Inspection Report 50-328/81-03.
7/26/82	Page 2	To delete the requirement of a yearly QA audit.
10/28/82	Page 6	Revised to be consistent with Division of Medical Services Examiner's Guide.

TENNESSEE VALLEY AUTHORITY
Division of Nuclear Power
Division Procedures Manual

To: Power Plant Superintendents, All Nuclear Plants

From: Director of Nuclear Power

*Subject: INSPECTION, TESTING, MAINTENANCE, AND OPERATION OF NUCLEAR PLANT CRANES, HOISTS, AND RIGGING EQUIPMENT - DPM NO. N74M15

References:
1. Topical Report TVA-TR75-1A, Revision 4, Table 17.2-5
2. ANSI N45.2.2-1972
3. ANSI B30.2.0-1976, Overhead and Gantry Cranes
4. ANSI B30.5-1968, Crawler, Locomotive, and Truck Cranes
5. ANSI B30.7-1977, Base-Mounted Drum Hoists
6. ANSI B30.9-1971, Slings
7. ANSI B30.10-1975, Hooks
8. ANSI B30.11-1973, Monorail Systems and Underhung Cranes
9. ANSI B30.15-1973, Mobile Hydraulic Cranes
10. ANSI B30.16-1973, Overhead Hoists (Underhung)
11. ANSI N14.6-1978, American National Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds or More for Nuclear Materials

*12. ANSI A10.8-1977, Safety Requirements for Scaffolding

*13. DPM No. N78S2, Section IV, M16 - Scaffolds, Ladders, and Temporary Platforms

PURPOSE

*This procedure provides requirements for the inspection, testing, maintenance, and operation of nuclear plant cranes, hoists, and rigging equipment in accordance with Table 17.2-5, Paragraph H, Topical Report TVA-TR75-1A (Reg. Guide 1.38, Rev. 2, May 1977, "Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants").

SCOPE

*These requirements shall apply to all plant cranes, hoists, and rigging equipment, whether handling CSSC or non-CSSC equipment. The requirements for the support of scaffolds and temporary platforms shall apply to CSSC piping systems only.

*Revision

1.0 RESPONSIBILITIES

1.1 The plant superintendent shall designate a person(s) to implement and maintain the requirements of this procedure.

1.2 The designated person(s) shall establish an inspection/maintenance schedule for all equipment referenced in this procedure.

1.3 The NCO Management Services Staff shall provide a system to initiate inspection/maintenance requirements at the plant and to verify completion of these requirements.

**

1.4 The Mechanical Branch shall serve as a technical advisor in the interpretation of this procedure and in the writing of implementing documents (maintenance instructions, surveillance instructions, standard practices, etc.). The Mechanical Branch shall receive concurrence from the Emergency Preparedness and Protection Branch on these interpretations.

2.0 RECORDS

2.1 Periodic inspection/maintenance records shall be kept by the designated person for the entire service life of all plant hoisting equipment. A copy of each periodic inspection shall be forwarded to the Mechanical Branch for review.

2.2 When hoisting equipment is found to be defective or in need of unscheduled maintenance during either inspection or operation, a Maintenance/Trouble Report shall be initiated and processed through appropriate channels; if found during a periodic inspection, the Maintenance/Trouble Report shall be referenced on the inspection records. Defective equipment shall be tagged inoperative and all power sources shall be placed under the plant clearance control until the equipment is repaired and returned to service.

3.0 PROCEDURE

The following sections specify the particular requirements for specific equipment as derived from the applicable ANSI standards.

3.1 - Overhead and Gantry Cranes
3.2 - Monorail Systems, Underhung Cranes, and Overhead Hoists
3.3 - Fixed Boom Cranes (Truck, Crawler, etc.)
3.4 - Mobile Hydraulic Cranes
3.5 - Base-Mounted Drum Hoists
3.6 - Slings
3.7 - Hooks
3.8 - Scaffolds and Temporary Work Platforms

**Deletion

3.1 Overhead and Gantry Cranes

This section applies to top running overhead and gantry cranes including polar, semi-gantry, cantilever gantry, and wall cranes and others having the same fundamental characteristics. These cranes are grouped because they all have top-running trolleys and similar travel characteristics.

3.1.1 Inspection

3.1.1.1 Initial Inspection--Before initial use, all new, reinstalled, altered, modified, or extensively repaired cranes shall be inspected by a person designated by the plant superintendent. The designated person shall ensure that the crane meets the requirements of the original TVA purchase contract.

3.1.1.2 Frequent Inspection--A visual examination shall be performed by the operator or other designated employee once each month in accordance with Checklist 3.1-1, "Frequent Inspection of Overhead and Gantry Cranes"; certain items as shown on Checklist 3.1-1 shall be checked before use on each shift. No inspection records are required for frequent inspections.

3.1.1.3 Periodic Inspection--A visual inspection shall be performed annually by the Power Service Shops' crane inspection team in accordance with inspection schedules prepared by the plants and shall consist of at least all items on Checklist 3.1-2, "Periodic Inspection of Overhead and Gantry Cranes."

3.1.1.4 Cranes Not In Regular Use--Cranes which have been idle for a period of one month or more, but less than one year, shall receive the frequent inspection listed in 3.1.1.2 before use.

3.1.1.5 Inaccessible Cranes--Cranes that are inaccessible during the annual inspection period (i.e., a reactor building polar crane during an 18-month refueling cycle) shall receive a periodic inspection in accordance with paragraph 3.1.1.3 before using.

3.1.2 Testing

3.1.2.1 Operational Tests--Before use, all new, reinstalled, altered, extensively repaired, or modified cranes shall be tested to ensure proper operation as follows:

a. Check hoisting and lowering.
b. Check trolley travel.
c. Check bridge travel.
d. Check limit switches, locking, and safety devices.

PRECAUTION: Adjust the hoist device trip setting by traveling the empty hook in increasing speeds up to the maximum speed. Locate the actuating mechanism of the limit switch so that it will trip the device under all conditions in sufficient time to prevent contact of the hook or load block with any part of the trolley or crane.

3.1.2.2 Rated load test--Before initial use, all new, extensively repaired, or altered cranes shall be load tested to 125 percent of the rated load. The rated load test shall be performed in accordance with Checklist 3.1-3, "Rated Load Test for Cranes."

3.1.3 Maintenance

3.1.3.1 A preventive maintenance and lubrication program based on the crane manufacturer's recommendation shall be established by the responsible maintenance supervisor.

3.1.3.2 The precautions listed in Checklist 3.1-4, "Crane Maintenance Precautions," shall be followed as applicable before initiating maintenance activities.

3.1.3.3 The maintenance supervisor shall designate trained employees to work on cranes when adjustments and tests on energized equipment are required.

3.1.3.4 The crane shall not be restored to service until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

3.1.3.5 The responsible plant maintenance supervisor shall assure that corrective measures are initiated for all rejected conditions found during frequent and periodic crane inspections before the crane can resume normal operation.

3.1.3.6 When repairing load-sustaining crane members by welding, the materials shall be identified; and the appropriate welding procedure shall be used.

3.1.4 Wire Rope Inspection, Replacement, and Maintenance

3.1.4.1 Rope inspection

a. An inspection shall be performed on all wire rope at least annually in accordance with Checklist 3.1-5, "Crane Running Rope Inspection." Records of the inspection shall be kept on file as specified by the plant superintendent.

b. All wire rope on cranes which have been idle for a period of six months or more shall be given an inspection in accordance with Checklist 3.1-5 before it is placed in service. A dated report of the rope condition shall be filed.

3.1.4.2 Rope Replacement

a. If any of the items inspected on Checklist 3.1-5 are below standard, the plant superintendent shall be informed and a determination shall be made by qualified personnel before additional use.

b. All replacement rope shall be of proper size, grade, and construction as specified in the original procurement contract for the crane unless otherwise approved by the Division of Engineering Design (EN DES).

3.1.4.3 Maintenance

a. Unreeling or uncoiling of rope shall be performed as recommended by the rope manufacturer to prevent kinking or inducing twist.

b. Before cutting a rope, means shall be used to prevent unlaying of the strands.

c. Rope should be maintained in a well-lubricated condition. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and the rope manufacturer should be consulted. Lubricant applied shall be of the type which does not hinder visual inspection. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope.

d. After replacement, new wire rope should be cycled three times for the full vertical travel as a breaking procedure.

3.1.5 Qualification for Operators

3.1.5.1 Cab-, pulpit-, floor-, and remote-operated cranes shall only be operated by:

a. Persons designated by the plant superintendent.

b. Trainees under the direct supervision of designated persons.

c. Maintenance and test employees when it is necessary to perform their duties on the crane.

d. Inspectors.

e. No one, other than the employees listed in this paragraph, shall enter the crane cab or pulpit with the exception of oilers and supervisors whose duties require them to do so, and then only in the performance of their duties and with the knowledge of the operator.

3.1.5.2 Qualifications for Operators of Cab-, Pulpit-, and Remote-Operated Cranes

a. The responsible maintenance supervisor shall designate a crane qualification examiner who shall give an oral and practical operation examination to each operator. The examination shall be limited to a specific type of crane.

b. Operators shall complete a TVA medical examination form as evidence that the physical qualifications listed in Checklist 3.1-6, "Overhead and Gantry Crane Operator Physical Qualifications," have been successfully met.

*c. Each operator shall be requalified medically every five years up to the age of 40 and every two years thereafter.

d. An operator eligibility list for these cranes shall be maintained by the electrical maintenance supervisor.

3.1.5.3 Qualifications for Operators of Floor-Operated Cranes--The crane examiner, who shall have successfully completed the U.S. Crane course, shall give a practical operating examination to each operator covering the specific type of crane involved.

3.1.5.4 The crane examiner shall ensure that each crane operator has read the instructions for conduct of operators, moving of loads, and signals. These instructions are included on Checklist 3.1-7, "Overhead Gantry Crane Operations, Handling Loads, and Signals."

3.1.6 Handling the Load

3.1.6.1 The crane shall not be loaded beyond its rated load except for a rated load test or for special heavy lifts.

Special heavy lifts--Before lifts in excess of the rated load, the following requirements shall be met:

a. The maintenance history of the crane, including reports of any prior special lifts, shall be reviewed.

b. Structural, mechanical, and electrical components of the crane design shall be checked by EN DES.

ERM
*Revision

c. The crane-supporting structural design shall be checked for conformance to AISC or other applicable design standards by EN DES.

d. A complete inspection of the crane as described in 3.1.1.3 of this procedure shall be made just before making the lift. The crane support shall be inspected and any deterioration or damage shall be taken into consideration in EN DES calculations.

e. The lift shall be made under controlled conditions under the direction of a person designated by the responsible maintenance supervisor.

f. The operator shall test the crane during the special heavy lift by lifting the load a short distance and setting the brakes.

g. Complete records of the lift shall be placed on file with the plant Mechanical Maintenance Supervisor.

h. After the special heavy lift is concluded, a thorough inspection shall be made of all critical parts designated by EN DES.

CHECKLIST 3.1-1 - FREQUENT INSPECTION FOR OVERHEAD AND GANTRY CRANES

1. Inspect all functional operating mechanisms for misadjustment interfering with proper operation (before use).
2. Inspect all limit switches without a load on the hook. Inch into the limit switch or run in at slow speed (before use).
3. Inspect for leakage in lines, tanks, valves, pumps, and other parts of air or hydraulic systems (before use).
4. Inspect for deformed or cracked hooks by visual inspection, and for hooks with cracks or throat openings 15 percent in excess of normal or more than a 10-degree twist from the plane of the unbent hook. Hooks showing defects shall be taken out of service (before use).
5. Inspect hook latches if used (before use).
6. Inspect hoist ropes, including tightness of end clamps and rope clips (monthly only).
7. Inspect slings, including end connections, for wear, broken wires, stretch, kinking, or twisting in accordance with 3.6 of this procedure (before use).
8. Inspect rope reeving for noncompliance with the crane manufacturer's recommendation (monthly only).

CHECKLIST 3.1-2 - PERIODIC INSPECTION FOR OVERHEAD AND GANTRY CRANES

Accept Reject

1.0 Checklist 3.1-1, "Frequent Inspection for Overhead and Gantry Cranes," has been completed.

2.0 Inspect cranes for the following items. Any deficiencies shall be listed, examined, and a determination made by the responsible plant supervisor of the corrective action required.

2.1 Deformed, cracked, or corroded members.

2.2 Loose bolts or rivets.

2.3 Cracked or worn sheaves or drums.

2.4 Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, locking, and clamping devices.

2.5 Excessive wear on brake system parts, linings, pawls, and ratchets.

2.6 Load, wind, and other indicators over their full range for any significant inaccuracies.

2.7 Gasoline, diesel, electric, or other power plants for improper performance.

2.8 Excessive wear of chain drive sprockets and excessive chain stretch.

2.9 Electrical apparatus for signs of any deterioration of controllers, master switches, contacts, limit switches, and pushbutton stations, but not limited to these items.

2.10 Perform dye penetrant, magnetic particle, or other suitable crack-detecting inspection on all hooks.

COMMENTS:

CHECKLIST 3.1-3 - RATED LOAD TEST FOR CRANES

	Accept	Reject
1. The test load (____ Tons) shall be hoisted a distance to ensure that the load is supported by the crane and held by the hoist brakes.		
2. The test load shall be transported the full length of the bridge by means of the trolley.		
3. The test load shall be transported by means of the bridge for the full length of the runway in one direction with the trolley as close to the extreme right end of the crane as practical and in the other direction with the trolley as close to the extreme left end of the crane as possible.		
4. The test load shall be lowered, stopped, and held with the brake.		

NOTE: A modified version of the load test shall be performed to prevent the handling of "Heavy Loads" (as defined in NUREG-0612) over or near spent nuclear fuel assemblies or over safe shutdown equipment.

CHECKLIST 3.1-4 - CRANE MAINTENANCE PRECAUTIONS

1. The crane to be repaired shall be run to a location where it will cause the least interference with other cranes and operations in the area.

2. All controllers are in the "off" position.

3. Main power disconnect shall be deenergized and locked, tagged, or flagged in the deenergized position.

4. Warnings or "out of order" signs shall be placed on the crane.

CHECKLIST 3.1-5 - CRANE RUNNING ROPE INSPECTION

Accept Reject

1.0 Inspect running rope for reduction of rope diameter and determine if diameter reduction exceeds values shown in table below.

Nominal Diameter	Reduction Greater Than
Up to 5/16" incl.	1/64"
3/8" - 1/2"	1/32"
9/16" - 3/4"	3/64"
7/8" - 1-1/8"	1/16"
1-1/4" - 1-1/2"	3/32"

2.0 Inspect running rope for the following types of deterioration.

2.1 Wear of one-third the original diameter of outside individual wires.

2.2 Individual wires broken, 12 random in one rope lay or 4 broken in one strand in one rope lay.

2.3 Corroded or broken wires at end connections.

2.4 Corroded, cracked, bent, worn, or improperly applied end connections.

2.5 Kinking, crushing, cutting, unstranding, or any other damage resulting in distortion of the rope structure.

2.6 Exposure to temperature sufficient to discolor the wire or cause deterioration of any portion of the wire rope structure.

COMMENTS:

CHECKLIST 3.1-6 - OVERHEAD AND GANTRY CRANE OPERATOR PHYSICAL QUALIFICATIONS

1. Have vision of at least 20/30 Snellen in one eye and 20/50 in the other, with or without corrective lenses.

2. Be able to distinguish colors, regardless of position of colors, if color differential is required for operation.

3. Hearing, with or without hearing aid, must be adequate for a specific operation.

4. Have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of equipment operation.

5. Evidence of physical defects or emotional instability which could render the operator a hazard to himself or others which, in the opinion of the examiner, could interfere with the operator's safe performance may be sufficient cause for disqualification. In such cases, specialized clinical or medical judgements and tests may be required.

6. Evidence that an operator is subject to seizures or loss of physical control shall be sufficient reason for disqualification. Specialized medical tests may be required to determine these conditions.

7. Operators and operator trainees should have normal depth perception, field of vision, reaction time, manual dexterity, and coordination and no tendencies toward dizziness or similar undesirable characteristics.

____
(Certified by TVA Medical Unit)

General Revision

CHECKLIST 3.1-7 - OVERHEAD/GANTRY CRANE OPERATIONS, HANDLING LOADS, AND SIGNALS

1.0 OPERATOR CONDUCT

1.1 The operator shall not engage in any practice which will divert attention while actually operating the crane.

1.2 When physically or otherwise unfit, an operator shall not engage in the operation of the equipment.

1.3 The operator shall respond to signals from the person who is directing the lift or an appointed signal person. When a signal person or a crane follower is not required as part of the crane operation, the operator is then responsible for the lifts. However, the operator shall obey a stop signal at all times, no matter who gives it.

1.4 Each operator shall be responsible for those operations under the operator's direct control. Whenever there is any doubt as to safety, the operator shall consult with the supervisor before handling the loads.

1.5 If a warning device is furnished, it shall be activated each time before traveling and intermittently when approaching work persons.

1.6 Before leaving the crane unattended, the operator shall land any attached load, place controllers in the "off" position, and open the main-line device of the specific crane.

1.7 The operator shall not close the main-line disconnect device until certain that no worker is on or adjacent to the crane. If there is a warning sign or lock on the device, it shall not be energized until the sign or lock is removed by the person who placed it thereon.

1.8 Before closing the main-line device, the operator shall see to it that all controllers are in the "off" position.

1.9 If power goes off during operation, the operator shall immediately place all controllers in the "off" position. Before reuse of the crane, operating motions shall be checked for proper direction.

1.10 The operator shall be familiar with the equipment and its proper care. If adjustments or repairs are necessary or any defects are known, the operator shall report the same promptly to the appointed person who shall be responsible for the safe operation and maintenance repairs of the crane. The operator shall also notify the next operator of any remaining uncorrected defects upon changing shifts.

CHECKLIST 3.1-7 (Continued)

1.11 Contacts with runway stops or other cranes shall be made with extreme caution. The operator shall do so with particular care for the safety of persons on or below the crane and only after making certain that any persons on the other cranes are aware of what is being done.

1.12 Operators of outdoor cranes shall secure them when leaving.

1.13 When the wind-indicating alarm is given, the bridge or gantry on the outside cranes shall be anchored.

1.14 Before the operator performs any maintenance work on the crane, the operator shall lock, tag, or flag the main switch in the deenergized position.

1.15 All controls shall be tested by the operator before beginning a new shift. If any controls do not operate properly, they should be adjusted or repaired before operations are begun.

1.16 Persons boarding or leaving overhead cranes should do so only at authorized locations and designated boarding entrances.

2.0 HANDLING LOADS

2.1 Attaching the Load

2.1.1 The hoist chain or hoist rope shall be free from kinks or twists and shall not be wrapped around the load.

2.1.2 The load shall be attached to the load block hook by means of slings or other devices.

2.1.3 Care shall be taken to make certain that the sling clears all obstacles.

2.2 Moving the Load

2.2.1 The appointed person directing the lift shall see that the load is well secured and properly balanced and positioned in the sling and lifting device before it is lifted more than a few inches.

2.2.2 Before starting to lift, the following conditions should be noted.

2.2.2.1 Hoist rope shall not be kinked.

2.2.2.2 Multiple part lines shall not be twisted around each other.

2.2.2.3 The hook shall be brought over the load in such a manner as to eliminate swinging.

CHECKLIST 3.1-7 (Continued)

2.2.2.4 If there is a slack rope condition, it should be determined that the rope is properly seated on the drum and in the sheaves.

2.2.3 During lifting, care shall be taken that:

2.2.3.1 There is no sudden acceleration or deceleration of the moving load.

2.2.3.2 Load does not contact any obstructions.

2.2.4 Cranes shall not be used for side pulls except when specifically authorized by a qualified person who has determined that the stability of the crane is not thereby endangered and that various parts of the crane will not be overstressed.

2.2.5 The operator shall not lift, lower, or travel while anyone is on the hook or a load. Where no practical alternative means of transporting persons exists, the use of a work platform attached to the crane hook is permitted. A four-point lifting bridle must be used and the crane hook must have a safety latch or other means to prevent accidental release of the bridle. Each person in the work platform must wear a safety belt with the lanyard secured to the hook.

2.2.6 The operator should avoid carrying loads over people.

2.2.7 The operator shall check the hoist brakes at least once each shift if a load approaching the rated load is to be handled. This shall be done by raising the load a short distance and applying the brakes.

2.2.8 The load shall not be lowered below the point where less than two wraps of rope shall remain on each anchorage of the hoisting drum unless a lower limit device is provided, in which case no less than one wrap shall remain.

2.2.9 When two or more cranes are used to lift a load, one qualified person shall be in charge of the operation. This person shall analyze the operation and instruct all employees involved in the proper positioning, rigging of the load, and the movements to be made.

2.2.10 The operator shall not leave the position at the controls while the load is suspended.

2.3 Hoist Limit Device

2.3.1 At the beginning of the shift, the operator shall try out the upper limit device of each hoist under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the device does not operate properly, the operator shall immediately notify the appointed person.

CHECKLIST 3.1-7 (Continued)

2.3.2 The hoist limit device which controls the upper limit of travel of the load block shall not be used as an operating control in normal operation unless additional means are provided to prevent damage from over travel.

3.0 SIGNALS

3.1 Standard Signals--Signals to the operator should be in accordance with the standards prescribed herein, unless voice communication equipment (telephone, radio, or equivalent) is utilized. Signals should be discernible or audible at all times. Some special operations may require additions to, or modifications of, the basic signals standardized herein. For all such cases, these special signals should be agreed upon and thoroughly understood by both the signal person and the operator and should not be in conflict with the standard signals.

3.2 Hand Signals--Hand signals shall be posted conspicuously. (See figure 1.)

3.2.1 Multiple Trolley Cranes--Cranes that are equipped with two separately operated trolleys present a problem of establishing ground-person-to-crane-person operating signals when both trolleys are being operated to accomplish the work at hand.

3.2.2 Crane trolleys shall be numbered with numerals large enough so that they are legible from the floor. Hoist load blocks shall have numbers applied on both sides of the block. Trolleys shall be numbered as follows:

3.2.2.1 Trolley nearest the crane cab is designated No. 1.

3.2.2.2 Trolley away from the crane cab is designated No. 2.

3.2.2.3 Where cabs are located in the center of crane girders, the trolleys and load blocks shall be numbered. Each installation shall establish and post its required signals.

3.2.3 Connecting and Disconnecting Magnet Leads--When magnet leads are to be connected and disconnected or when magnet repairs are to be made, the crane operator shall open the magnet switch upon request of the person on the ground, who shall wait for a safe sign from the crane operator that the magnet switch is open. (A safe sign is indicated by the operator spreading both hands apart--palms up.) In addition, lights indicating the magnet controller's status may be desirable.

CHECKLIST 3.1-7 (Continued)

4.0 MISCELLANEOUS

4.1 Ladders

4.1.1 Hands shall be free from encumbrances while employees are using ladders.

4.1.2 Articles which are too large to be carried in pockets and tool belts shall be lifted and lowered by hand line.

4.2 Cabs

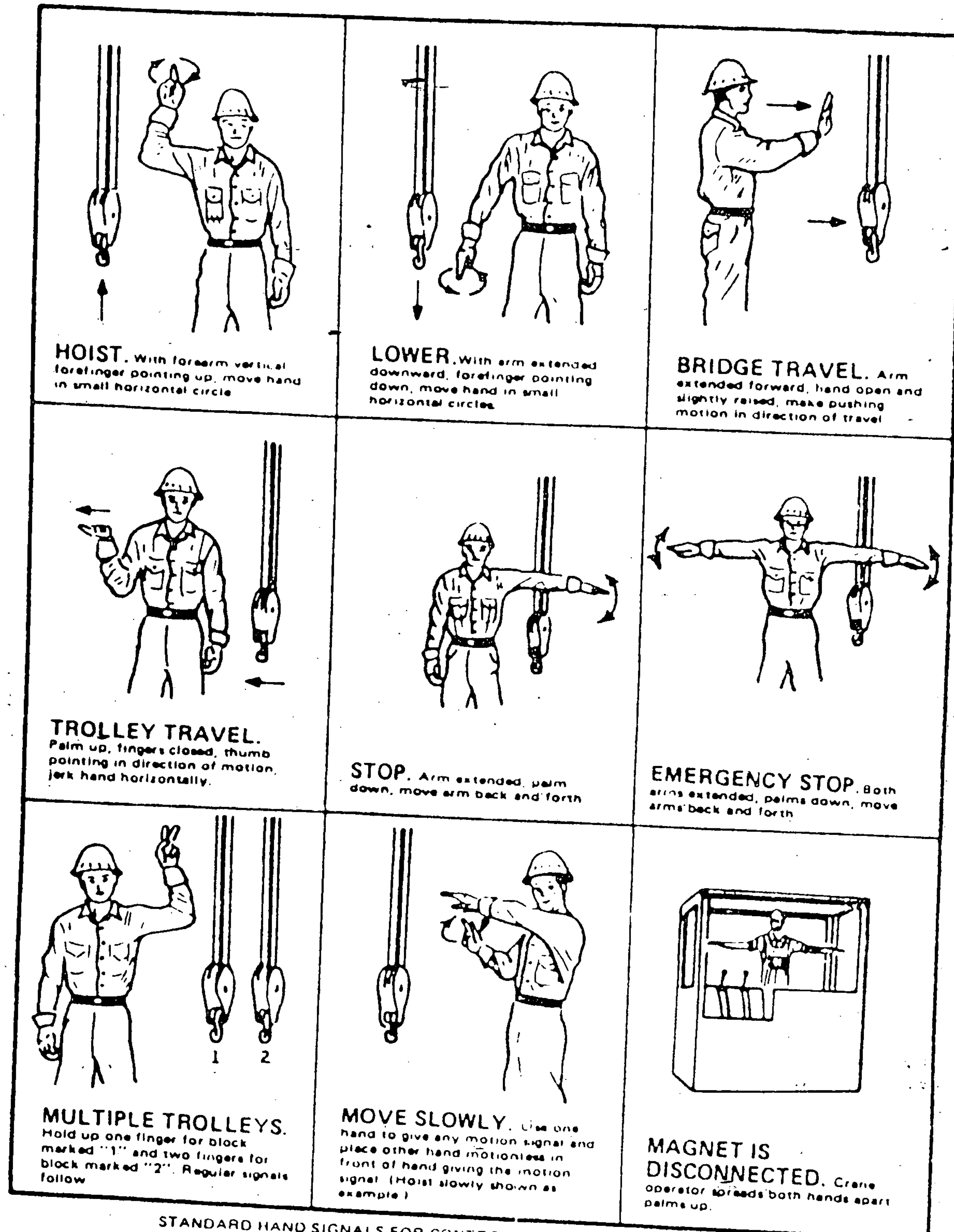
4.2.1 Necessary clothing and personal belongings shall be stored in such a manner as to not interfere with access or operation.

4.2.2 Tools, oil cans, water, extra fuses, and other necessary articles shall be stored in the tool box and shall not be permitted to lie loose in or about the cab.

4.3 Fire Extinguishers--Operators shall be familiar with the operation and care of fire extinguishers provided.

CHECKLIST 3.1-7 (Continued)

AMERICAN NATIONAL STANDARD
OVERHEAD AND GANTRY CRANES
(TOP RUNNING BRIDGE, MULTIPLE GIRDER)



STANDARD HAND SIGNALS FOR CONTROLLING OVERHEAD AND GANTRY CRANES

Figure 1

3.2 - Monorail Systems, Underhung Cranes, and Overhead Hoists

This section applies to underhung cranes operating on the bottom flange of a track section; to single-track monorail systems including all curves, switches, transfer devices, trolleys, and associated equipment; and all power-operated and manually-operated overhead hoists for lifting service. This equipment is grouped together because of common considerations which are peculiar to this type equipment.

3.2.1 Inspections

3.2.1.1 Initial Inspection--Before initial use after installation, all new, altered, or extensively repaired cranes, monorail systems, or overhead hoists shall be inspected to ensure compliance with this section.

3.2.1.2 Frequent Inspections--All equipment shall be given a frequent inspection before use in accordance with Checklist 3.2-1, "Frequent Inspection for Monorail Systems and Underhung Cranes," and either Checklist 3.2-1a, "Frequent Inspection for Hand Chain-Powered Overhead Hoists," or Checklist 3.2-1b, "Frequent Inspection for Electric- or Air-Powered Hoists," depending on the type of equipment.

3.2.1.3 Periodic Inspections--A periodic inspection shall be performed yearly on all regularly used equipment in accordance with Checklist 3.2-2, "Periodic Inspection for Monorail Systems and Underhung Cranes," and either Checklist 3.2-2a, "Periodic Inspection for Hand Chain-Powered Overhead Hoists," or Checklist 3.2-2b, "Periodic Inspection for Electric- or Air-Powered Hoists," as applicable.

3.2.1.4 Equipment Not in Regular Use

a. Equipment which has been idle for over six months shall be given a complete inspection conforming to the requirements of paragraph 3.2.1.3.

b. Equipment which is idle for a period greater than 12 months shall require a periodic inspection in conformance with paragraph 3.2.1.3 only before use (i.e., equipment on an 18-month refueling cycle).

3.2.2 Testing

3.2.2.1 Operational Tests

3.2.2.1.1 Before initial use, all new and altered equipment or equipment which has been idle in excess of 12 months shall be tested for proper operation including functions as follows:

a. Hoisting and lowering.

b. Trolley travel.

c. Bridge travel (if applicable).

d. Travel limiting device (if applicable).

e. Locking and safety devices for interlocking mechanism, track switches, drop sections, lift sections, etc.

3.2.2.1.2 Hand Chain-Powered Overhead Hoists--All altered or repaired hoists or hoists which have been idle in excess of 12 months shall be tested as follows:

a. All functions of the hoist including hoisting and lowering shall be checked with the hoist suspended in the unloaded state.

b. After testing in the unloaded state, a load of 50 pounds times the number of load supporting parts of the chain shall be applied to the hoist in order to check proper control.

3.2.2.1.3 Electric- or Air-Powered Overhead Hoists--All altered or repaired hoists or hoists which have been idle for 12 months or more shall be tested before use as follows:

a. Hoisting and lowering.

b. Operation of brakes.

c. Limit devices and locking and safety devices.

The trip setting of limit switches and limiting devices shall be determined by tests under "no-load" conditions.

3.2.2.2 Load Tests

3.2.2.2.1 Before initial use, all new, extensively repaired or altered equipment shall be tested and a written report furnished confirming the load rating of the system.

a. The load rating shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated load.

b. On hoists incorporating overload devices which prevent the lifting of 125-percent rated load, a 100-percent load test shall be performed, after which the function of the overload device shall be tested.

3.2.3 Maintenance

3.2.3.1 A preventive maintenance program based upon manufacturer's recommendation shall be established.

3.2.3.2 Maintenance Procedure

a. Before adjustments and repairs, precautions as stated in section 3.1, Checklist 3-1.4, shall be taken.

b. After adjustments and repairs have been made, the equipment shall not be operated until all guards have been reinstalled, safety devices reactivated, and tools and maintenance equipment removed.

3.2.3.3 Adjustments or Repairs

a. Any unsafe conditions described in the frequent or periodic inspection requirements shall be corrected before the equipment is returned to service.

b. Repair, replacements, or adjustments shall be made for correct performance of all equipment.

3.2.3.4 Lubrication--All moving parts of the equipment for which lubrication is specified by the manufacturer shall be regularly lubricated.

3.2.4 Load Chain and Wire Rope Inspection, Replacement, and Maintenance

3.2.4.1 Load Chain

3.2.4.1.1 Welded Link Chain

a. Inspection

(1) Test the hoist under load in hoisting and lowering directions and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.

(2) If the chain binds, jumps, or is noisy, first see that it is clean and properly lubricated. If trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.

(3) Examine visually for gouges, nicks, weld splatter, corrosion, and distorted links. Slacken the chain and move adjacent links to one side to inspect for wear at contact points. If wear is observed or if stretching is suspected, the chain should be measured as follows:

(a) Select an unworn, unstretched length of chain from slack end.

(b) Suspend the chain vertically under tension and, using a calpiper-type gauge, measure the outside length of any convenient number of links approximately 12 to 24 inches overall.

(c) Measure the same number of links in the used sections and calculate the percentage increase in length.

b. <u>Replacement</u>

(1) If the used chain is 2-1/2 percent longer than the unused chain, replace the chain.

(2) Gouges, nicks, corrosion, weld splatter, or distorted links are sufficient reason to consider replacement of load chain.

(3) Replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer, unless otherwise recommended by the hoist manufacturer.

(4) Load chain links which pass over the hoist load sprocket on edge should be installed with the welds away from the center of the sprocket.

(5) The chain shall be installed without any twist between the hoist and an anchored end on either the loaded side or the slack side.

(6) When the chain is replaced, disassemble the hoist and inspect the mating parts for wear and replace if necessary.

c. <u>Maintenance</u>

(1) Load chain and hand chain should be kept clean and free from rust and from any coating deposit that will build up and change its dimensions or reduce flexibility.

(2) Load chain should be lubricated as specified by the hoist manufacturer. In absence of recommendation use, an EP-type lubricant may be applied sparingly but frequently as it dissipates during use.

3.2.4.2 Wire Rope

a. Inspection

(1) All running ropes in periodic use throughout the shift shall be visually inspected once every shift by the operator. A thorough inspection of all ropes shall be made once each month in accordance with Checklist 3.1-5 for equipment in regular use. A dated and signed report of the rope condition shall be kept on file where readily available to appointed employees.

(2) All rope which has been idle for a period of one month or more shall be given a thorough inspection in accordance with Checklist 3.1-5, and a dated and signed report of the rope condition shall be kept on file.

b. Replacement

(1) If any of the items inspected on Checklist 3.1-5 are below standard, the plant superintendent shall be informed; and a determination shall be made by qualified employees of the NCO Stationary Equipment Group before additional use.

(2) No less than two wraps shall remain on the drum with the loaded hook at its extreme lower position, unless a lower limit device is provided, in which case no less than one wrap shall remain.

c. Maintenance

(1) Rope shall be stored to prevent damage or deterioration.

(2) Unreeling and uncoiling of rope shall be done as recommended by the rope manufacturer and with extreme care to avoid kinking or inducing a twist.

(3) Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands.

3.2.5 Operation

3.2.5.1 Hand Chain-Powered Hoists

a. Operating Practices

(1) The operator shall not engage in any practice which will divert his attentithe hoist.

(2) Any "holds" on the hoist shall be removed by a responsible person before use of the hoist.

(3) Before using the hoist, the operator shall verify that all employees are clear of the area.

(4) The operator shall familiarize himself with the equipment and its proper care.

(5) The operator shall have safe access to the hand chain.

(6) Hoists shall never be operated by other than hand power.

b. Handling the Load

(1) Size of Load--The rated load shall not be exceeded except for properly authorized tests.

*(2) Support Structure--The limitations assigned to the use of support structure for portable hoists shall be based on the determinations of an engineer designated by the plant superintendent who is competent in this field; such determinations shall be documented and recorded appropriately. The use of piping systems as temporary supports shall adhere to the restrictions of section 3.8.2.

(3) Attaching the Load

(a) The hoist chain shall not be wrapped around the load.

(b) The load shall be attached to the hook by means of slings or other approved devices.

(c) The slings or other approved devices shall be seated properly in the saddle of the hook before operations.

(4) Moving the Load

(a) Before starting to lift, the chain shall be properly seated in the sprockets.

(b) The load shall not be moved or lifted more than a few inches until it is well balanced in the sling or lifting device.

(c) Hoists shall not be operated until centered over the load to be lifted.

(d) The operator shall avoid carrying loads over people.

*Revision

(e) The operator shall test braking mechanisms each time a load approaching rated capacity is handled.

(f) The operator shall not leave the load suspended unless specific precautions have been taken to provide protection and the operator chain secured.

3.2.5.2 <u>Electric- or Air-Powered Hoists</u>

a. Qualifications for and Conduct of Operators

(1) <u>Operators</u>--Hoists shall be operated only by the following employees:

(a) Appointed operators.

(b) Maintenance and test employees to perform their duties on the hoist.

(c) Inspectors.

(2) <u>Qualifications</u>--Operators shall operate the crane in the presence of an experienced operator for an operating examination. Qualifications shall be limited to the specific type of equipment for which examined.

(3) <u>Operating Practices</u>--These practices are the same as described in paragraph 3.2.5.1 with the following additional requirements:

All controls shall be tested by the operator before beginning a shift.

b. <u>Handling the Load</u>--These requirements are the same as listed in paragraph 3.2.5.1b.

CHECKLIST 3.2-1 - FREQUENT INSPECTION FOR MONORAIL SYSTEMS AND UNDERHUNG CRANES

1. Inspect all functional operating mechanisms for maladjustment interfering with proper operation.

2. Inspect all functional operating mechanisms for excessive wear of components.

3. Inspect all safety devices for malfunction.

4. Inspect all hoist and travel limit switches before use. These switches should be checked without a load on the device. Each motion should be inched into its limit switch with extreme care.

5. Inspect for deterioration or leakage in lines, tanks, valves, drain pumps, or other parts of air or hydraulic systems.

6. Inspect rope reeving (where applicable) for noncompliance with manufacturer's recommendations.

7. Inspect braking mechanism for evidence of slippage under load.

CHECKLIST 3.2-1a - FREQUENT INSPECTION FOR HAND CHAIN-POWERED OVERHEAD HOISTS

1.0 Inspect overhead hoists for the following items:

1.1 Braking mechanism for evidence of slippage under load.

1.2 Load chain for wear, twists, broken, cracked, or otherwise damaged links. Check chain also for deposits of foreign material which may be carried into hoist mechanism.

1.3 Hooks damaged from chemicals, deformations, or cracks or having more than 15 percent in excess of normal throat opening or more than a 10-degree twist from the plane of the unbent hook.

CHECKLIST 3.2-1a - FREQUENT INSPECTION FOR HAND CHAIN-POWERED OVERHEAD HOISTS

1.0 Inspect overhead hoists for the following items:

1.1 Braking mechanism for evidence of slippage under load.

1.2 Load chain for wear, twists, broken, cracked, or otherwise damaged links. Check chain also for deposits of foreign material which may be carried into hoist mechanism.

1.3 Hooks damaged from chemicals, deformations, or cracks or having more than 15 percent in excess of normal throat opening or more than a 10-degree twist from the plane of the unbent hook.

CHECKLIST 3.2-1b - FREQUENT INSPECTION FOR ELECTRIC- AND AIR-POWERED HOISTS

1.0 Inspect hoists for the following items:

1.1 All controls and operating mechanisms for improper operation.

1.2 All safety devices for malfunction.

1.3 Deterioration or leakage in air systems.

1.4 Hooks damaged from chemicals, deformation, or cracks or having more than 15 percent in excess of normal throat opening or more than a 10-degree twist from the plane of the unbent hook.

1.5 Load-carrying ropes or chains. Visual inspection for wear, twist, distortion, or improper dead-ending to the hoisting drum and other attachments. Check chain also for deposits of foreign material which may be carried into the hoist mechanism.

CHECKLIST 3.2-2 - PERIODIC INSPECTION FOR MONORAIL SYSTEMS AND UNDERHUNG CRANES

Accept Reject MR/TR

1.0 Checklist 3.2-1, Frequent Inspection for Monorail Systems and Underhung Cranes, has been completed.

2.0 Inspect for the following items:

2.1 Loose bolts and rivets.

2.2 Deformed, cracked, or corroded structural members.

2.3 Cracked or worn sheaves.

2.4 Worn, cracked, or distorted parts such as pins, bearings, wheels, shafts, gears, rollers, clamping devices, bumpers, switch baffles, interlock bolts, and trolley stops.

2.5 Wear on brake system parts, linings, pawls, and ratches.

2.6 Wear of geared trolley chain sprockets and hand chain.

2.7 Electrical apparatus for signs of pitting or deterioration of control contactors, limit switches, and pushbuttom stations.

2.8 Wear on lower load-carrying flange of all track sections in the system, both straight and curved.

CHECKLIST 3.2-2a - PERIODIC INSPECTION FOR HAND CHAIN-POWERED OVERHEAD HOISTS

Accept Reject

1.0 Checklist 3.2-1a, Frequent Inspection for Hand Chain-Powered Overhead Hoists, has been completed.

2.0 Inspect for the following items:

2.1 Excessive wear of chain, load sprockets, idler sprockets, or chain stretch.

2.2 Hooks--Dye penetrant, magnetic particle, or other suitable crack-detecting inspection should be performed at least once per year.

2.3 Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining member should be inspected.

2.4 Does brake mechanism have: worn, glazed, or oil contaminated friction discs; worn pawls, cams, or ratchet; or corroded, stretched, or broken pawl springs.

2.5 Worn, cracked, or distorted parts such as hood blocks, suspension housing, outriggers, hand-chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, and bearings.

2.6 Loose bolts, nuts, or rivets.

2.7 Supporting structure and trolley, if used, shall be inspected for continued ability to support the imposed loads.

CHECKLIST 3.2-2b - PERIODIC INSPECTION FOR ELECTRIC- AND AIR-POWERED HOISTS

	Accept	Reject	MR/TR
1.0 Checklist 3.2-1b, Frequent Inspection for Electric- and Air-Powered Hoists, has been completed.			
2.0 Inspect for the following items:			
2.1 Loose bolts or rivets.			
2.2 Cracked or worn drums or sheaves.			
2.3 Worn, corroded, cracked, or distorted parts, such as pins, bearings, shafts, gears, rollers, or locking and clamping devices.			
2.4 Excessive wear on motor or load brake.			
2.5 Excessive wear of chain, rope, load sprockets, drums, sheaves, and chain stretch.			
2.6 Hooks--Dye penetrants, magnetic particle, or other suitable crack- detecting inspection shall be performed at least once per year.			
2.7 Electrical apparatus for signs of pitting or any deterioration of controlled contactors, limit switches, and pushbutton stations.			
2.8 Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining member shall be inspected.			
2.9 Supporting structure and trolley, if used, shall be inspected for continued ability to support the imposed loads.			

3.3 Fixed Boom Cranes (Truck, Crawler, etc.)

This section will be added at a later date. In the interim, requirements for this type of equipment may be found in ANSI B30.5-1968, "Crawler, Locomotive, and Truck Cranes" (Reference 4).

3.4 Mobile Hydraulic Cranes

This section will be added at a later date. In the interim, requirements for this type of equipment may be found in ANSI B30.15-1973, "Mobile Hydraulic Cranes" (Reference 9).

3.5 Base-Mounted Drum Hoists

This section will be added at a later date. In the interim, requirements for this type of equipment may be found in ANSI B30.7-1977, "Base-Mounted Drum Hoists" (Reference 5).

3.6 Slings

This section applies to slings made from alloy chain, synthetic webbing, wire rope, metal mesh, and natural or synthetic fiber rope used in conjunction with equipment described in this procedure.

3.6.1 Inspection Intervals and Operating Practices

3.6.1.1 All slings shall be given a periodic inspection annually or before use if not used for over one year. The inspection shall be performed in accordance with the applicable type of sling as defined in this section.

3.6.1.2 All slings shall be visually inspected before each use for obvious deficiencies.

3.6.1.3 Safe Operating Practices--All employees using rigging equipment shall be instructed in the following safe operating practices:

a. Approximate weight of load shall be determined.

b. Sling shall have suitable characteristics and rated capacity for the load and environment.

c. Sling shall be long enough to provide the maximum practical angle between the sling leg and the horizontal (minimum practical angle at the crane hook if vertical angles are used).

d. Slings shall not be shortened with knots, bolts, or other unapproved methods.

e. Damaged slings shall not be used and shall be tagged with form TVA 18004, "Defective Equipment Tag".

f. Sling shall be hitched securely to the load.

g. Sharp corners shall be padded with material of sufficient strength to withstand the load.

h. Hands and fingers shall be kept from between the sling and the load.

i. Employees shall stand clear of the suspended load.

j. Shock loading shall be avoided, particularly when working at temperatures below 40°F.

k. Slings shall not be pulled from under a load when the load is resting on the sling.

l. Slings shall be stored in an area where they will not be subject to mechanical damage or corrosive action.

m. Twisting and kinking the legs shall be avoided.

n. Load should be centered in the base (bowl) of the hook to prevent point loading on the hook.

o. The load shall be free to move before lifting and shall be kept clear of all obstructions.

p. In a basket hitch, the load shall be balanced to prevent slippage.

q. Ensure that the sling's legs contain or support the load from the sides above the center of gravity when using a basket hitch.

r. Guide loads with a tag line when practical.

s. Do not inspect slings with bare hands.

t. Keep slings well lubricated.

*u. Limitations assigned to the use of temporary support structures for rigging purposes shall be based on the determination of an engineer designated by the plant superintendent who is competent in this field; such determinations shall be documented and recorded appropriately. The use of piping systems as temporary supports shall adhere to the restrictions listed in section 3.8.2.

3.6.2 Alloy Steel Chain

3.6.2.1 Chain Properties

a. All chains shall be manufactured and tested by the chain manufacturer in accordance with ASTM Specification for Alloy Steel Chain, A391-65 (ANSI G61.1-1968).

b. Minimum proof loads for alloy steel shall be equal to twice the working load limit values for single slings.

c. The chain manufacturer shall furnish a certificate of proof test to the purchaser or his representative.

3.6.2.2 Properties of Alloy Steel Chain Slings

a. Rated capacity (working load limit) for alloy steel chain slings shall conform to the values shown in Table 3.6-1.

b. Alloy steel chain slings shall not be used at loads in excess of those shown in Table 3.6-1.

*Revision

3.6.2.3 Sling Identification

Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and sling manufacturer.

3.6.2.4 Effects of Temperature

a. Alloy steel chain and chain slings shall not be heated above $1000^{o}F$ after being received from the manufacturer.

b. When exposed to service temperatures in excess of $600^{o}F$, working load limits shall be reduced in accordance with the chain manufacturer's recommendations.

3.6.2.5 Attachments

a. Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links, or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used.

b. All welded components in the sling assembly shall be proof tested.

c. Homemade links, makeshift fasteners formed from bolts, rods, etc., or other such attachments shall not be used.

d. Where used, handles shall be welded to the master link or hook before heat treating.

3.6.2.6 Repair and Reconditioning Alloy Steel Chain Slings

a. All assemblies reconditioned by the sling manufacturer shall be proof tested under a load equal to that used for a new assembly of the specific type in question.

b. Alloy steel mechanical coupling links shall be used only in accordance with the manufacturer's recommendation.

c. Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.

3.6.2.7 Sling Chain Inspection

a. Effects of Overloading

1. If the chain is stretched beyond its original length by more than 2.5 percent, the sling shall be removed from service.

2. Inspection shall also be made on an individual link basis. If any link does not hinge freely with the adjoining link, the sling shall be removed from service.

b. If wear at any point of any chain link exceeds that shown in Table 3.6-2, the assembly shall be removed from service.

c. Nicks and Gouges--If the depth of a nick or gouge exceeds the values shown in Table 3.6-2, the assembly shall be removed from service.

d. Deformed hooks or attachments shall only be reconditioned by the manufacturer.

e. Assemblies with cracked hooks or other end attachments shall be removed from service.

3.6.3 Wire Rope Slings

3.6.3.1 Grades of Wire Rope for Slings--The wire rope slings covered by this section shall be as specified in Tables 3.6-3 through 3.6-14. Other grades, types, sizes, and constructions may be used. When such slings are used, the sling manufacturer shall be consulted for specific data. All wire rope slings to be purchased shall conform to TVA Standard Procurement Specification 21.008.

3.6.3.2 Wire Rope Sling Properties

a. Factor of safety--The factor of safety for rope slings of all grades shall be a minimum of five (5). Features which affect the rated capacity of the sling and which shall be considered in calculating the factor of safety are:

1. Nominal wire rope breaking strength.

2. Splicing or end attachment efficiency.

3. Number of parts of rope in sling.

4. Type of hitch, e.g., straight pull, choker hitch, or basket hitch.

5. Angle of loading.

6. Diameter of curvature around which the sling is bent.

b. Rated capacities--Rated capacities for rope slings shall be as shown in Tables 3.6-3 through 3.6-14.

3.6.3.3 Sling Identification--All wire rope slings shall have a permanent (identification) tag attached which indicates identification, storage location, type of material, size, and rated capacity (vertical).

3.6.3.4 Proof Load

a. Slings of all grades terminated by mechanical splices, sockets, and pressed or swagged terminals shall be proof loaded by either the sling manufacturer when specified by purchaser or responsible plant personnel as determined by plant maintenance supervision with documentation verifying the proof load testing.

b. The proof load for single leg slings and endless slings shall be two (2) times the vertical rated capacity.

c. The proof load for multiple leg bridle slings shall be applied to the individual legs and shall be two (2) times the vertical rated capacity of a single-leg sling of the same size, grade, and construction of rope.

3.6.3.5 Effects of Temperature

Fiber core wire rope slings of all grades shall not be exposed to temperatures in excess of 200°F.

3.6.3.6 Minimum Sling Lengths

a. 6 x 19, 6 x 37, and cable-laid slings shall have a minimum clear length of rope ten (10) times the rope diameter between splices, sleeves, or end fittings.

b. Braided slings shall have a minimum clear length of rope forty (40) times the component rope diameter between the loops or end fittings.

c. Grommets and endless slings shall have a minimum circumferential length of ninety-six (96) times the body diameter of the grommet or endless sling.

3.6.3.7 End Attachments

a. All components welded before assembly in the sling shall be proof loaded.

b. Welding of handles or any other accessories to end attachments shall be performed before the assembly of the sling.

c. An eye splice made in any wire rope shall not have less than three full tucks.

3.6.3.8 Sling Inspection and Replacement

a. Periodic inspections shall be performed by a person(s) designated by the plant superintendent. Any deterioration which could result in applicable loss of original strength shall be carefully noted and determination made before further use.

b. Replacement--Slings shall be removed from use if any of the following conditions exist.

1. Six randomly distributed broken wires in one rope lay, or three broken wires in one strand.

2. Wear or scraping of one-third the original diameter of outside individual wires.

3. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.

4. Evidence of heat damage.

5. End attachments that are cracked, deformed, or worn.

6. Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point; or twisted more than 10 degrees from the plane of the unbent hook.

7. Extensive corrosion of the rope or end attachments.

3.6.4 Synthetic Webbing (Nylon, Polyester, and Polypropylene)

3.6.4.1 Safety Factor--The factor of safety for synthetic web slings shall be a minimum of five.

3.6.4.2 Marking--Each sling shall be marked or coded to show:

a. Name or trademark of manufacturer.

b. Rated capacities for type of hitch.

c. Type of material.

3.6.4.3 Rated Capacity--Rated capacities of these slings shall be provided by the sling manufacturer.

3.6.4.4 Safe Operating Practices

a. Slings shall be stored in an area that will prevent mechanical or chemical damage.

b. Nylon slings shall not be used where acid conditions exist.

c. Polyester and polypropylene slings shall not be used where caustic conditions exist.

d. Polyester and nylon slings shall not be used where temperatures exceed 180°F. Polypropylene slings shall not be used where temperatures exceed 200°F.

e. Aluminum fittings shall not be used where caustic conditions exist.

3.6.4.5 Inspection Requirements

3.6.4.5.1 Type of Inspection

a. Initial Inspection--Before using any new or repaired sling it shall be inspected to ensure that it meets the requirements of this section.

b. Frequent Inspection--This inspection shall be made by the person handling the sling each time the sling is used.

c. Periodic Inspection--This inspection shall be performed annually by personnel appointed by the responsible maintenance supervisor with written inspection records maintained.

3.6.4.5.2 Inspection Criteria--A sling shall be removed from service if any defects such as the following are visible:

a. Acid or caustic burns.

b. Melting or charring of any part of the surface.

c. Snags, punctures, tears or cuts.

d. Broken or worn stitches.

e. Wear or elongation exceeding the amount recommended by the manufacturer.

f. Distortion of fittings.

g. Other apparent defects which could cause doubt concerning the strength of the sling should be referred to the manufacturer for determination.

3.6.4.5.3 Repairs--Slings shall be repaired only by a sling manufacturer.

3.6.5 Metal Mesh; Rope: Natural and Synthetic Fiber

3.6.5.1 Because of the infrequent use of these types of slings in the Division of Nuclear Power, inspection and testing requirements of these slings will not be listed in this procedure, but may be obtained in ANSI B30.9-1971, "Slings" (Reference 6).

Table 3.6-1

RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS*
RATED CAPACITY (WORKING LOAD LIMIT), POUNDS

Chain Size, Inches	Single Branch Sling – 90 degree Loading	Double Sling, Vertical Angle (1): 30 degree / Horizontal Angle (2): 60 degree	Double Sling, Vertical Angle (1): 45 degree / Horizontal Angle (2): 45 degree	Double Sling, Vertical Angle (1): 60 degree / Horizontal Angle (2): 30 degree	Triple and Quadruple Sling (3), Vertical Angle (1): 30 degree / Horizontal Angle (2): 60 degree	Triple and Quadruple Sling (3), Vertical Angle (1): 45 degree / Horizontal Angle (2): 45 degree	Triple and Quadruple Sling (3), Vertical Angle (1): 60 degree / Horizontal Angle (2): 30 degree
1/4	3,250	5,650	4,550	3,250	8,400	6,800	4,900
3/8	6,600	11,400	9,300	6,600	17,000	14,000	9,900
1/2	11,250	19,500	15,900	11,250	29,000	24,000	17,000
5/8	16,500	28,500	23,300	16,500	43,000	35,000	24,800
3/4	23,000	39,800	3[illegible],500	23,000	59,500	48,500	34,500
7/8	28,750	49,800	40,600	28,750	74,500	61,000	43,000
1	38,750	67,100	54,800	38,750	101,000	82,000	58,000
1-1/8	44,500	77,000	63,000	44,500	115,500	94,500	66,500
1-1/4	57,500	99,500	81,000	57,500	149,000	121,500	86,000
1-3/8	67,000	116,000	94,000	67,000	174,000	141,000	100,500
1-1/2	80,000	138,000	112,500	80,000	207,000	169,000	119,500
1-3/4	100,000	172,000	140,000	100,000	258,000	210,000	150,000

(1) Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure 5.

(2) Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure 5.

(3) Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

* Other grades of proof tested steel chain include Proof Coil, BBB Coil and Hi-Test Chain. These grades are not recommended for overhead lifting and therefore are not covered by this code.

Table 3.6-2

MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK

Chain Size, Inches	Maximum Allowable Wear, Inch
1/4	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1-1/8	7/32
1-1/4	1/4
1-3/8	9/32
1-1/2	5/16
1-3/4	11/32

Table 3.6-3

RATED CAPACITIES FOR SINGLE LEG SLINGS
6 × 19 AND 6 × 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket* HT	Vertical Basket* MS	Vertical Basket* S
1/4	6 × 19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6 × 19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6 × 19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6 × 19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6 × 19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6 × 19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6 × 19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6 × 19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6 × 19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6 × 19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1-1/8	6 × 19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1-1/4	6 × 37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1-3/8	6 × 37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1-1/2	6 × 37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1-5/8	6 × 37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1-3/4	6 × 37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6 × 37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

HT = Hand Tucked Splice and Hidden Tuck Splice
For hidden tuck splice (IWRC) use values in HT columns.
MS = Mechanical Splice
S = Swaged or Zinc Poured Socket
*These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of rope.

Table 3.6-4

RATED CAPACITIES FOR SINGLE LEG SLINGS
6 × 19 AND 6 × 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket* HT	Vertical Basket* MS	Vertical Basket* S
1/4	6 × 19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6 × 19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6 × 19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6 × 19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6 × 19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6 × 19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6 × 19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6 × 19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6 × 19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6 × 19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1-1/8	6 × 19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1-1/4	6 × 37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1-3/8	6 × 37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1-1/2	6 × 37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1-5/8	6 × 37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1-3/4	6 × 37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6 × 37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

HT = Hand Tucked Splice
For hidden tuck splice (IWRC) use Table I values in HT column.
MS = Mechanical Splice.
S = Swaged or Zinc Poured Socket.
*These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S Slings is 20 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of rope.

Table 3.6-5

RATED CAPACITIES FOR SINGLE LEG SLINGS
CABLE LAID ROPE – MECHANICAL SPLICE ONLY
7 x 7 x 7 & 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope		Rated Capacities, Tons (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7 x 7 x 7	0.50	0.38	1.0
3/8	7 x 7 x 7	1.1	0.81	2.0
1/2	7 x 7 x 7	1.8	1.4	3.7
5/8	7 x 7 x 7	2.8	2.1	5.5
3/4	7 x 7 x 7	3.8	2.9	7.6
5/8	7 x 7 x 19	2.9	2.2	5.8
3/4	7 x 7 x 19	4.1	3.0	8.1
7/8	7 x 7 x 19	5.4	4.0	11.0
1	7 x 7 x 19	6.9	5.1	14.0
1-1/8	7 x 7 x 19	8.2	6.2	16.0
1-1/4	7 x 7 x 19	9.9	7.4	20.0
3/4	7 x 6 x 19 IWRC	3.8	2.8	7.6
7/8	7 x 6 x 19 IWRC	5.0	3.8	10.0
1	7 x 6 x 19 IWRC	6.4	4.8	[illegible]
1-1/8	7 x 6 x 19 IWRC	7.7	5.8	15.0
1-1/4	7 x 6 x 19 IWRC	9.2	6.9	18.0
1-5/16	7 x 6 x 19 IWRC	10.0	7.5	20.0
1-3/8	7 x 6 x 19 IWRC	11.0	8.2	22.0
1-1/2	7 x 6 x 19 IWRC	13.0	9.6	26.0

*These values only apply when the D/d ratio is 10 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of rope.

Table 3.6-6

RATED CAPACITIES FOR SINGLE LEG SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 x 7 AND 6 x 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Ropes		Rated Capacities, Tons (2,000 lb)					
Diameter (Inches)	Constr	Vertical		Choker		Basket Vertical to 30 degrees*	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6 x 7	0.76	0.57	0.57	0.42	1.3	0.98
3/16	6 x 7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7 x 7	0.51	0.39	0.38	0.29	0.89	0.67
1/8	7 x 7	0.95	0.71	0.71	0.53	1.6	1.2
3/16	7 x 7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6 x 19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6 x 19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6 x 19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6 x 19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6 x 19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6 x 19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6 x 19	15.0	11.0	11.0	8.5	26.0	20.0
5/8	6 x 19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6 x 19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6 x 19	36.0	27.0	27.0	20.0	62.0	47.0
1	6 x 19	47.0	35.0	35.0	26.0	81.0	61.0

*These values only apply when the D/d ratio is 20 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of component rope.

Table 3.6-7

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Slings						3-Leg Bridle Slings					
Dia (Inches)	Constr	Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6 x 19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6 x 19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6 x 19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6 x 19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6 x 19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6 x 19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6 x 19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6 x 19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6 x 19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1-1/8	6 x 19	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1-1/4	6 x 37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	18.0	17.0
1-3/8	6 x 37	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	25.0	28.0	18.0	20.0
1-1/2	6 x 37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1-5/8	6 x 37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1-3/4	6 x 37	33.0	37.0	27.0	30.0	19.0	11.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6 x 37	43.0	48.0	35.0	38.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand Tucked Splice.
MS = Mechanical Splice

Table 3.6-8

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 and 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Sling						3-Leg Bridle Sling					
Dia (Inches)	Constr	Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6 x 19	1.4	1.5	1.1	1.2	0.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6 x 19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6 x 19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
1/2	6 x 19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6 x 19	4.3	4.8	3.5	3.9	2.5	2.7	6.1	7.1	5.2	5.8	3.7	4.1
5/8	6 x 19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
3/4	6 x 19	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6 x 19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	6 x 19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1-1/8	6 x 19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1-1/4	6 x 37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0
1-3/8	6 x 37	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1-1/2	6 x 37	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0
1-5/8	6 x 37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1-3/4	6 x 37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	6 x 37	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

HT = Hand Tucked Splice
MS = Mechanical Splice

Table 3.6-9

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
CABLE LAID ROPE – MECHANICAL SPLICE ONLY
7 × 7 × 7 AND 7 × 7 × 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 × 6 × 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope		Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling			3-Leg Bridle Sling		
Dia (Inches)	Constr	Vert 30 deg Horz 60 deg	45 degree Angle	Vert 60 deg Horz 30 deg	Vert 30 deg Horz 60 deg	45 degree Angle	Vert 60 deg Horz 30 deg
1/4	7 × 7 × 7	0.87	0.71	0.50	1.3	1.1	0.75
3/8	7 × 7 × 7	1.9	1.5	1.1	2.8	2.3	1.6
1/2	7 × 7 × 7	3.2	2.6	1.8	4.8	3.9	2.8
5/8	7 × 7 × 7	4.8	3.9	2.8	7.2	5.9	4.2
3/4	7 × 7 × 7	6.6	5.4	3.8	9.9	8.1	5.7
5/8	7 × 7 × 19	5.0	4.1	2.9	7.5	6.1	4.3
3/4	7 × 7 × 19	7.0	5.7	4.1	10.0	8.6	6.1
7/8	7 × 7 × 19	9.3	7.6	5.4	14.0	11.0	8.1
1	7 × 7 × 19	12.0	9.7	6.9	18.0	14.0	10.0
1-1/8	7 × 7 × 19	14.0	12.0	8.2	21.0	17.0	12.0
1-1/4	7 × 7 × 19	17.0	14.0	9.9	26.0	21.0	15.0
3/4	7×6×19 IWRC	6.6	5.4	3.8	9.9	8.0	5.7
7/8	7×6×19 IWRC	8.7	7.1	5.0	13.0	11.0	7.5
1	7×6×19 IWRC	11.0	9.0	6.4	17.0	13.0	9.6
1-1/8	7×6×19 IWRC	13.0	11.0	7.7	20.0	16.0	11.0
1-1/4	7×6×19 IWRC	16.0	13.0	9.2	24.0	20.0	14.0
1-5/16	7×6×19 IWRC	17.0	14.0	10.0	26.0	21.0	15.0
1-3/8	7×6×19 IWRC	19.0	15.0	11.0	28.0	23.0	16.0
1-1/2	7×6×19 IWRC	22.0	18.0	13.0	33.0	27.0	19.0

Table 3.6-10

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 × 7 AND 6 × 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 × 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Slings						3-Leg Bridle Slings					
		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
Dia (Inches)	Constr	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6 × 7	0.74	0.55	0.60	0.45	0.42	0.32	1.1	0.83	0.90	0.68	0.64	0.48
1/8	6 × 7	1.3	0.98	1.1	0.80	0.76	0.57	2.0	1.5	1.6	1.2	1.1	0.85
3/16	6 × 7	2.9	2.2	2.4	1.8	1.7	1.3	4.4	3.3	3.6	2.7	2.5	1.9
3/32	7 × 7	0.89	0.67	0.72	0.55	0.51	0.39	1.3	1.0	1.1	0.82	0.77	0.58
1/8	7 × 7	1.6	1.2	1.3	1.0	0.95	0.71	2.5	1.8	2.0	1.5	1.4	1.1
3/16	7 × 7	3.6	2.7	2.9	2.2	2.1	1.5	5.4	4.0	4.4	3.3	3.1	2.3
3/16	6 × 19	3.0	2.2	2.4	1.8	1.7	1.3	4.5	3.4	3.7	2.8	2.6	1.9
1/4	6 × 19	5.3	4.0	4.3	3.2	3.1	2.3	8.0	6.0	6.5	4.9	4.6	3.4
5/16	6 × 19	8.3	6.2	6.7	5.0	4.8	3.6	12.0	9.3	10.0	7.6	7.1	5.4
3/8	6 × 19	12.0	8.9	9.7	7.2	6.8	5.1	18.0	13.0	14.0	11.0	10.0	7.7
7/16	6 × 19	16.0	12.0	13.0	9.8	9.3	6.9	24.0	18.0	20.0	15.0	14.0	10.0
1/2	6 × 19	21.0	15.0	17.0	13.0	12.0	9.0	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6 × 19	26.0	20.0	21.0	16.0	15.0	[illegible]	39.0	29.0	32.0	24.0	23.0	17.0
5/8	6 × 19	32.0	24.0	26.0	20.0	19.0	14.0	48.0	36.0	40.0	30.0	28.0	21.0
3/4	6 × 19	46.0	35.0	38.0	28.0	27.0	20.0	69.0	52.0	56.0	42.0	40.0	30.0
7/8	6 × 19	62.0	47.0	51.0	38.0	36.0	27.0	94.0	70.0	76.0	57.0	54.0	40.0
1	6 × 19	81.0	61.0	66.0	50.0	47.0	35.0	[illegible]	91.0	99.0	74.0	70.0	53.0

Table 3.6-11

RATED CAPACITIES FOR STRAND LAID GROMMET – HAND TUCKED IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7 × 19	0.85	0.64	1.7
5/16	7 × 19	1.3	1.0	2.6
3/8	7 × 19	1.9	1.4	3.8
7/16	7 × 19	2.6	1.9	5.2
1/2	7 × 19	3.3	2.5	6.7
9/16	7 × 19	4.2	3.1	8.4
5/8	7 × 19	5.2	3.9	10.0
3/4	7 × 19	7.4	5.6	15.0
7/8	7 × 19	10.0	7.5	20.0
1	7 × 19	13.0	9.7	26.0
1-1/8	7 × 19	16.0	12.0	32.0
1-1/4	7 × 37	18.0	14.0	37.0
1-3/8	7 × 37	22.0	16.0	44.0
1-1/2	7 × 37	26.0	19.0	52.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which rope is bent.
d = Diameter of rope body.

Table 3.6-12

RATED CAPACITIES FOR CABLE LAID GROMMET – HAND TUCKED 7 × 6 × 7 AND 7 × 6 × 19 CONSTRUCTIONS IMPROVED PLOW STEEL GRADE ROPE 7 × 7 × 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
3/8	7 × 6 × 7	1.3	0.95	2.5
9/16	7 × 6 × 7	2.8	2.1	5.6
5/8	7 × 6 × 7	3.8	2.8	7.6
3/8	7 × 7 × 7	1.6	1.2	3.2
9/16	7 × 7 × 7	3.5	2.6	6.9
5/8	7 × 7 × 7	4.5	3.4	9.0
5/8	7 × 6 × 19	3.9	3.0	7.9
3/4	7 × 6 × 19	5.1	3.8	10.0
15/16	7 × 6 × 19	7.9	5.9	16.0
1-1/8	7 × 6 × 19	11.0	8.4	22.0
1-5/16	7 × 6 × 19	15.0	11.0	30.0
1-1/2	7 × 6 × 19	19.0	14.0	39.0
1-11/16	7 × 6 × 19	24.0	18.0	49.0
1-7/8	7 × 6 × 19	30.0	22.0	60.0
2-1/4	7 × 6 × 19	42.0	31.0	84.0
2-5/8	7 × 6 × 19	56.0	42.0	112.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which cable body is bent.
d = Diameter of cable body.

Table 3.6-13

RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS-MECHANICAL JOINT IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	6 × 19 IWRC	0.92	0.69	1.8
3/8	6 × 19 IWRC	2.0	1.5	4.1
1/2	6 × 19 IWRC	3.6	2.7	7.2
5/8	6 × 19 IWRC	5.6	4.2	11.0
3/4	6 × 19 IWRC	8.0	6.0	16.0
7/8	6 × 19 IWRC	11.0	8.1	21.0
1	6 × 19 IWRC	14.0	10.0	28.0
1-1/8	6 × 19 IWRC	18.0	13.0	35.0
1-1/4	6 × 37 IWRC	21.0	16.0	41.0
1-3/8	6 × 37 IWRC	25.0	19.0	50.0
1-1/2	6 × 37 IWRC	29.0	22.0	59.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which rope is bent.
d = Diameter of rope body.

Table 3.6-14

RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS-MECHANICAL JOINT 7 × 7 × 7 AND 7 × 7 × 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7 × 6 × 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7 × 7 × 7	0.83	0.62	1.6
3/8	7 × 7 × 7	1.8	1.3	3.5
1/2	7 × 7 × 7	3.0	2.3	6.1
5/8	7 × 7 × 7	4.5	3.4	9.1
3/4	7 × 7 × 7	6.3	4.7	12.0
5/8	7 × 7 × 19	4.7	3.5	9.5
3/4	7 × 7 × 19	6.7	5.0	13.0
7/8	7 × 7 × 19	8.9	6.6	18.0
1	7 × 7 × 19	11.0	8.5	22.0
1-1/8	7 × 7 × 19	14.0	10.0	28.0
1-1/4	7 × 7 × 19	17.0	12.0	33.0
3/4	7 × 6 × 19 IWRC	6.2	4.7	12.0
7/8	7 × 6 × 19 IWRC	8.3	6.2	16.0
1	7 × 6 × 19 IWRC	10.0	7.9	21.0
1-1/8	7 × 6 × 19 IWRC	13.0	9.7	26.0
1-1/4	7 × 6 × 19 IWRC	16.0	12.0	31.0
1-3/8	7 × 6 × 19 IWRC	18.0	14.0	37.0
1-1/2	7 × 6 × 19 IWRC	22.0	16.0	43.0

* These values only apply when the D/d value is 5 or greater where:
D = Diameter of curvature around which cable body is bent.
d = Diameter of cable body.

Table 3.6-13

RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS-MECHANICAL JOINT IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	6 × 19 IWRC	0.92	0.69	1.8
3/8	6 × 19 IWRC	2.0	1.5	4.1
1/2	6 × 19 IWRC	3.6	2.7	7.2
5/8	6 × 19 IWRC	5.6	4.2	11.0
3/4	6 × 19 IWRC	8.0	6.0	16.0
7/8	6 × 19 IWRC	11.0	8.1	21.0
1	6 × 19 IWRC	14.0	10.0	28.0
1-1/8	6 × 19 IWRC	18.0	13.0	35.0
1-1/4	6 × 37 IWRC	21.0	15.0	41.0
1-3/8	6 × 37 IWRC	25.0	19.0	50.0
1-1/2	6 × 37 IWRC	29.0	22.0	59.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which rope is bent.
d = Diameter of rope body.

Table 3.6-14

RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS-MECHANICAL JOINT 7 × 7 × 7 AND 7 × 7 × 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7 × 6 × 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7 × 7 × 7	0.83	0.62	1.6
3/8	7 × 7 × 7	1.8	1.3	3.5
1/2	7 × 7 × 7	3.0	2.3	6.1
5/8	7 × 7 × 7	4.5	3.4	9.1
3/4	7 × 7 × 7	6.3	4.7	12.0
5/8	7 × 7 × 19	4.7	3.5	9.5
3/4	7 × 7 × 19	6.7	5.0	13.0
7/8	7 × 7 × 19	8.9	6.6	18.0
1	7 × 7 × 19	11.0	8.5	22.0
1-1/8	7 × 7 × 19	14.0	10.0	28.0
1-1/4	7 × 7 × 19	17.0	12.0	33.0
3/4	7 × 6 × 19 IWRC	6.2	4.7	12.0
7/8	7 × 6 × 19 IWRC	8.3	6.2	16.0
1	7 × 6 × 19 IWRC	10.0	7.9	21.0
1-1/8	7 × 6 × 19 IWRC	13.0	9.7	26.0
1-1/4	7 × 6 × 19 IWRC	16.0	12.0	31.0
1-3/8	7 × 6 × 19 IWRC	18.0	14.0	37.0
1-1/2	7 × 6 × 19 IWRC	22.0	16.0	43.0

* These values only apply when the D/d value is 5 or greater where:
D = Diameter of curvature around which cable body is bent.
d = Diameter of cable body.

3.7 Hooks

This section of the procedure will be added at a later date. In the interim, requirements for hooks may be found in ANSI B30.10-1975, "Hooks" (Reference 7).

*3.8 Scaffolds and Temporary Platforms

This section establishes requirements for the support of scaffolding on or from CSSC equipment, piping, or ductwork. Requirements for the fabrication and use of scaffolds are contained in DPM No. N78S2, Section IV, M16.

3.8.1 Responsibilities

3.8.1.1 Maintenance Supervisor or Outage Director--Prior to issuing permits for scaffolds or temporary platforms per Attachment 1 of DPM No. N78S2, Section IV, M16, the responsible supervisor shall ensure that scaffolds or temporary platforms will not be supported from CSSC ductwork or cable trays and, when supported from CSSC piping, they conform to the restrictions of Section 3.8.2.

3.8.2 Restrictions

3.8.2.1 Scaffolding or temporary platforms may be placed on CSSC piping systems provided the following restrictions are adhered to:

a. Scaffolding or temporary platforms supported on piping systems will be limited to pipe that is three inches or larger only.

b. Loading of personnel and equipment on either side shall not exceed a total weight for the piping size as shown:

3-inch pipe -	375 lbs.
4-inch pipe -	675 lbs.
6-inch pipe -	1,500 lbs.
8-inch pipe -	1,600 lbs.
10-inch pipe -	2,500 lbs.
12-inch pipe -	2,500 lbs.
16-inch pipe -	2,500 lbs.
24-inch pipe -	3,100 lbs.

c. No scaffolding or temporary platforms shall be placed on insulated piping systems regardless of piping size.

*Addendum

d. Metal scaffolding on stainless-steel piping shall have a soft pad or wood bearing point to prevent scratches that would be difficult to clean relative to chlorides.

TFZ:CRF:ENM:SAM
cc: ~~R. S. Zettle~~, 127 PSC-M
W. E. [illegible]

WATTS BAR NUCLEAR PLANT

ADMINISTRATIVE INSTRUCTION

AI-6.4

CRANES, HOISTS, AND RIGGING EQUIPMENT

CURRENT REVISION LEVEL 0

Prepared By R. L. Bruce

Revised By

Submitted By R L Bruce
Supervisor

PORC Review Date 1-3-83

Approved By Robert [illegible]
Superintendent

Date Approved 1-3-83

Last page of this instruction: 40

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
1C	Plant Superintendent
1C	Asst. Plant Supt. (Operations)
1C	Asst. Plant Supt. (Maintenance)
	Adm. Svs. Supervisor
	Asst. Mechanical Maint. Sup.
1C	Chemical Laboratory
1C	Chemical Unit Supervisor
1C	Chief, Nuclear Training Branch
1C	Compliance Unit
1C	DPSO-WBN
1C	Document Control Supervisor
3C	Electrical Maint. Supervisor
1C	Electrical Shop
1C	Engineering Supervisor
1C	Field Services Supervisor
1C	Health Physicist
	Health Physics Laboratory
1C	Instrument Engineer
1C	Instrument Maint. Supervisor
1C	Instrument Shop
1C	Janitor & Labor Supervisor
1C	Management Svs. Supervisor
3C	Mechanical Maint. Supervisor
1C	Mechanical Unit Supervisor
1C	Operations Supervisor
1C	OPQA - Plant Coordinator
1C	Plant Services Supervisor
1C	Plant Training Officer
1C	Plant Training Shift Engineer
1C	Power Stores Unit Supervisor
1C	Preop Test Supervisor
1C	Public Safety
2U	QA Manager, QA and Audit Staff
3C	Quality Assurance Supervisor
1C	Reactor Unit Supervisor
1C	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
0	1-3-83	All	

PUNCHLIST

1. DPM N74M15, step 3.1.5.3, requires the crane examiner for floor-operated overhead cranes must have successfully completed the U. S. Crane course. The reference document for section 3.1 of the DPM, ANSI B30.2.0-1976, "Overhead and Gantry Cranes", does not make this a requirement. The program outlined in section 5.9 meets the ANSI requirements. A memorandum will be sent to the NCO asking for a DPM change.

2. Step 5.2.5.1.b places responsibility for determining when a wire rope should be replaced on the Mechanical Maintenance Secton supervisor or the Field Services Group supervisor. DPM N75M15 step 3.2.4.2.6.1 assigns this responsibility to the NCO. A memorandum will be sent to the NCO asking for a DPM change.

[illegible signature]
Signature

[illegible]
Date

4.4 Should questions arise in the interpretation of the requirements of DPM N74M15 (or it's referenced requirements), the NCO Mechanical Branch shall be utilized as the technical advisor for those interpretations.

4.5 The sections/groups assigned responsibilities in section 5.0 of this instruction shall prepare and implement the programs and instructions required to meet those assigned responsibilities. For those steps that indicate the record of the activity is a QA record, the instructions prepared to implement the requirements must be PORC-revised.

4.6 When deficiencies are found on cranes, hoists, or rigging equipment, the supervisor of the section/group assigned the responsibility for maintenance of the deficient equipment shall be responsible for evaluating the deficiency and taking the appropriate corrective action.

5.0 SPECIFIC REQUIREMENTS

This section provides the specific requirements and assignment of responsibilities for all plant cranes, hoists, and lifting equipment and is subdivided as follows:

5.1 Large Overhead Cranes

5.2 Other cranes and hoists

5.3 Fixed Boom Cranes (Truck, Crawler, etc.)

5.4 Mobile Hydraulic Cranes

5.5 Base-Mounted Drum Hoists

5.6 Slings

5.7 Hooks

5.8 Heavy Loads Program

5.9 Operator Qualification

5.10 Rigger Qualification

5.1 Large Overhead Cranes

This subsection applies to the following listed cranes:

Auxiliary Building Crane (0-CRN-271-A1)
Polar Crane - Unit 1 (1-CRN-271-R1)
Polar Crane - Unit 2 (2-CRN-271-R1)
Turbine Building Crane - Unit 1 (1-CRN-270-T1)
Turbine Building Crane - Unit 2 (2-CRN-270-T1)

5.1.1 Inspections

5.1.1.1 Initial Inspection

Before initial use, these cranes shall be inspected by the Preoperational Test Group to ensure the crane meets the requirements of the original TVA purchase contract. Should a crane be reinstalled, altered, modified, or extensively repaired, an inspection shall be performed to ensure the crane meets the requirements of the original TVA purchase contract. This inspection shall be conducted in accordance with an instruction and the records generated by this inspection are considered QA records. The Mechanical Maintenance Section is responsible for preparing the instruction and inspecting the Auxiliary Building and Turbine Building cranes. The Field Services Group is responsible for preparing the instruction and inspecting the Polar cranes.

5.1.1.2 Frequent Crane Inspection

A visual and operational check of the crane shall be conducted by the operator prior to the use of the crane each shift. An instruction for performing this activity for each of the cranes shall be prepared and maintained by the Electrical Maintenance Section. After instruction completion, the data sheet shall be reviewed by the supervisor of the operator. Records generated by this inspection are considered maintenance history but are not QA records, except that the records associated with the Heavy Loads Program, subsection 5.8, are QA records. This check shall, as a minimum, consist of the following:

a. Visually inspect the bridge, trolley, hoists, control cabinets, and controls for obvious defects that could interfere with operation.

b. Check the operation of the crane including hoisting, lowering, trolley travel, and bridge travel.

c. Check the limit switches, locking, and safety devices. As a precaution, the limit switches shall be checked at slow speed or by "inching" into the limit.

5.1.1.3 Frequent Rigging Inspections

A visual inspection of the crane hooks and slings shall be conducted by the rigger(s) prior to their use each shift. For lifts covered by subsection 5.8 (Heavy Loads Program) additional requirements for rigging are imposed and the records generated by those requirements are QA records. The check shall, a minimum, consist of the following:

a. Inspect for deformed or cracked hooks by visual inspection. Hooks showing defects shall be taken out of service.

b. Inspect hook latches if used.

c. Inspect slings (including end connections) for wear, broken wires, stretch, kinking, or twisting in accordance with subsection 5.6 of this procedure.

5.1.1.4 Monthly Inspection

An inspection shall be performed monthly by the Mechanical Maintenance Section on the auxiliary building crane and the turbine building cranes. During periods of use, an inspection will be performed monthly by the Field Services Group on the Polar Cranes. These responsible section group shall prepare instructions for these inspections. Records generated by these inspections are considered maintenance history records but are not QA records. The inspection shall consist of the following items:

a. Inspect hoist ropes for visual defects, including tightness of end clamps and rope clips.

b. Inspect rope reeving for compliance with the crane manufacturer's recommendation.

5.1.1.5 Periodic Inspection

A visual inspection shall be performed an ually on the Turbine and Auxiliary Building cra.es by the Power Service Shops' crane inspector. The Mechanical Maintenance Section shall be responsible for preparing the instruction for this inspection, scheduling the crane inspector, supporting the inspector, and correcting deficiencies found. The records generated by this inspection are QA records. The inspection shall consist of at least the following items:

a. A Frequent Crane Inspection (section 5.1.1.2).
b. A Monthly Inspection (section 5.1.1.4).
c. Deformed, cracked, or corroded members.
d. Loose bolts or rivets.
e. Cracked or worn sheaves or drums.
f. Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, locking, and clamping devices.
g. Excessive wear on brake system parts, linings, pawls, and ratchets.
h. Load, wind, and other indicators over their full range for any significant inaccuracies.
i. Excessive wear of chain drive sprockets and excessive chain stretch.
j. Electrical apparatus for signs of any deterioration of controllers, master switches, contacts, limit switches, and pushbutton stations, etc.
k. Electric motors, MG sets, drive units, control cabinets, etc.
l. Perform dye penetrant, magnetic particle, or other suitable crack-detecting inspection on all hooks. Inspect hooks for throat openings 15 percent in excess of normal or more that a 10 degree twist fromthe plane of the unbent hook.
m. Perform a wire rope inspection in accordance with step 5.1.4.

5.1.1.6 Polar Cranes--Due to the inaccessibility of these cranes during plant operation, these cranes shall receive a periodic inspection in accordance with step 5.1.1.5 before their use. Until made inaccessible due to plant operation, these cranes shall receive an annual inspection in accordance with Step 5.1.1.5. The Field Services Group shall be responsible for preparing the instruction for this inspection, scheduling the crane inspector, supporting the inspector, and correcting the deficiencies found. The records generated by this inspection are QA records.

5.1.2 Testing

5.1.2.1 Rated Load Test--Before initial use, all new, cranes shall be load tested to 125 percent of the rated load. This test shall be performed by the Preoperational Test Section. For extensively repaired or altered cranes, the load test shall be performed in accordance with instructions. The records generated by these tests are QA records. Mechanical Maintenance shall prepare the instruction and perform the test for the Auxiliary Building or Turbine Building Cranes and the Field Services Group shall prepare the instruction and perform the test for the Polar Cranes. The rated load test shall be performed in accordance with the following steps:

a. The test load shall be hoisted a distance to ensure that the load is supported by the crane and held by the hoist brakes.

b. The test load shall be transported the full length of the bridge by means of the trolley.

c. The test load shall be transported by means of the bridge for the full length of the runway in one direction with the trolley as close to the extreme right end of the crane as practical and in the other direction with the trolley as close to the extreme left end of the crane as possible.

d. The test load shall be lowered, stopped, and held with the brake.

EXCEPTION: The load test shall be modified as necessar to prevent the handling of "Heavy Loads" (see subsectio 5.8) over or near spent nuclear fuel assemblies or over safe shutdown equipment.

5.1.3 Maintenance

5.1.3.1 A preventive maintenance and lubrication program (including wire prelubrication per step 5.1.4.2.c) based on the crane manufacturer's recommendations shall be established by the Mechanical Maintenance Section for the Auxiliary Building and Turbine Building Cranes and by the Field Services Group for the Polar Cranes.

5.1.3.2 The following precautions shall be observed as applicable before initiating maintenance activities.

a. The crane to be repaired shall be run to a location where it will cause the least interference with operations in the area.

b. All controllers are in the "off" position.

c. Main power disconnect shall be deenergized and locked, tagged, or flagged in the deenergized position.

d. Warnings or "out-of-order" signs shall be placed on the crane.

5.1.3.3 The crane shall not be restored to service until all guards have been reinstalled, safety devices reactivated, and maintenance equipment removed.

5.1.3.4 The responsible supervisor shall assure that corrective measures are initiated for all rejected conditions found during frequent and periodic crane inspections before the crane can resume normal operation.

5.1.3.5 When repairing load-sustaining crane members by welding, the materials shall be identified, and the appropriate welding procedure shall be used.

5.1.4 <u>Wire Rope Inspection, Replacement, and Maintenance</u>

5.1.4.1 <u>Rope Inspection and Replacement</u>

a. <u>Rope Inspection</u>

An inspection shall be performed on the wire rope of all cranes in conjunction with the periodic inspection of steps 5.1.1.5 or 5.1.1.6 by the responsible section/group. This inspection shall be conducted in accordance with approved instructions. The records generated by this inspection are considered QA records. The inspection shall, as a minimum, include the following listed items:

1. Inspect running rope for reduction of rope diameter and determine if diameter reduction exceeds values shown below.

Nominal Diameter	Reduction Greater Than
Up to 5/16" incl.	1/64"
3/8" - 1/2"	1/32"
9/16" - 3/4"	3/64"
7/8" - 1-1/8"	1/16"
1-1/4" - 1-1/2"	3/32"

2. Wear of one-third the original diameter of outside individual wires.

3. Individual wires broken, 12 random in one rope lay or 4 broken in one strand in one rope lay.

4. Corroded or broken wires at end connections.

5. Corroded, cracked, bent, worn, or improperly applied end connections.

6. Kinking, crushing, cutting, unstranding, or any other damage resulting in distortion of the rope structure.

7. Exposure to temperature sufficient to discolor the wire or cause deterioration of any portion of the wire rope structure.

b. Rope Replacement

1. If any of the items inspected by the procedures generated by step 5.1.4.1 are below standard, the plant superintendent shall be informed and a determination of acceptability shall be made by the Mechanical Maintenance supervisor or Field Services Group supervisor as appropriate before the crane can be returned to service.

2. All replacement rope shall be of proper size, grade, and construction as specified in the original procurement contract for the crane unless otherwise approved by the Division of Engineering Design (EN DES).

5.1.4.2 Rope Maintenance

This step is provided as information and guidance for maintenance of wire ropes on large overhead cranes. It should be used as a guidelines by the section/group responsible for the ropes.

a. Unreeling or uncoiling of rope shall be performed as recommended by the rope manufacturer to prevent kinking or inducing twist.

b. Before cutting a rope, means shall be used to prevent unlaying of the strands.

c. Rope should be maintained in a well-lubricated condition. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and the rope manufacturer should be consulted. Lubricant applied shall be of the type which does not hinder visual inspection. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedure require special attention when lubricating rope.

d. After replacement, new wire rope should be cycled three times for the full vertical travel as a breaking-in procedure.

5.1.5 Large Overhead Crane Operators

5.1.5.1 These cranes shall only be operated by:

a. Persons qualified by a training program as specified in subsection 5.9.

b. Trainees under the direct supervision of qualified persons.

c. Maintenance and test employees when it is necessary to perform their duties on the crane.

d. Inspectors.

5.1.5.2 No one, other than the employees listed in step 5.1.5.1, shall enter the crane cab with the exception of supervisors whose duties require them to do so, and then only only in the performance of their duties and with the knowledge of the operator.

5.1.5.3 Qualified Operator List

The Electrical Maintenance supervisor and the Field Services supervisor shall maintain and publish to the appropriate plant sections/groups a listing of those employees qualified to operate the large overhead cranes.

5.1.6 Special Heavy Lifts

The crane shall not be loaded beyond its rated load except for a rated load test or for special heavy lifts.

Lifts in excess of the rated load shall be conducted in accordance with instructions approved by the plant superintendent. The Mechanical Maintenance supervisor shall prepare the instructions and provide direction for special heavy lifts on the Auxiliary Building or Turbine Building Cranes. The Field Services supervisor shall prepare the instructions and provide direction for special heavy lifts for the Polar cranes. The records generated by this activity are QA records. The instructions shall include at least the following requirements:

a. The maintenance history of the crane, including reports of any prior special lifts, shall be reviewed.

b. Structural, mechanical, and electrical components of the crane design shall be checked by EN DES.

c. The crane-supporting structural design shall be checked for conformance to AISC or other applicable design standards by EN DES.

d. A periodic inspection of the crane as described in step 5.1.1.5 of this procedure shall be made just before making the lift. The crane support shall be inspected and any deterioration or damage shall be taken into consideration in EN DES calculations.

e. The lift shall be made under controlled conditions under the direction of a person designated by the responsible supervisor.

f. The operator shall test the crane during the special heavy lift by lifting the load a short distance and setting the brakes.

g. After the special heavy lift is concluded, a thorough inspection shall be made of all critical parts designated by EN DES.

5.2 Other Cranes and Hoists

This subsection applies to the cranes and hoists listed in Attachment B, to all portable power-operated hoists, and all permanently installed or portable manually-operated hoists (including come-alongs). This equipment is grouped together because of common consideraton which are peculiar to these types of equipment.

The assignments of responsibility for the preparation of instructions for the inspection and maintenance of these cranes and hoists are as follows:

Mechanical Maintenance Section--(1) all cranes and hoists in the Service Bay and Turbine Building; (2) all cranes and hoists in the Auxiliary Building except as those assigned Field Services as noted below; and (3) all portable hoists purchased for and used by plant sections.

Field Services Group--(1) all cranes and hoists in the Reactor Buildings; (2) the following cranes and hoists located in the Auxiliary Building: Spent Fuel Pit Crane, Equipment Access Hoists, and the New Fuel Elevator; and (3) all portable hoists purchased and used by the Field Services Group.

Operations Section--All fuel handling instructions and checkout of fuel handling equipment.

5.2.1 Inspections

5.2.1.1 Initial Inspection--Before initial use after installation, alterations or extensive repairs, cranes, monorail systems, and overhead hoists shall be inspected to ensure compliance with this subsection.

5.2.1.2 Frequent Inspections--All cranes and hoists covered by this subsection shall be given an inspection and check before use by the operator. This inspection requires no documentation but shall include the following items as applicable:

a. Other Cranes and Hoists (as listed in Attachment B)

1. Inspect all functional operating mechanisms for maladjustment interfering with proper operation.

2. Inspect all functional operating mechanisms for excessive wear of components.

3. Inspect all safety devices for malfunction.

4. Inspect all hoist and travel limit switches before use. These switches should be checked without a load on the device. Each motion should be inched into its limit switch with extreme care.

5. Inspect for deterioration or leakage in lines, tanks, valves, drain pumps, or other parts of air or hydraulic systems.

6. Inspect rope and reeving for visual damage or deficiencies.

7. Inspect braking mechanism for evidence of slippage under load.

8. Inspect hooks damaged from chemical, deformations, or cracks.

9. Check proper operation of the equipment including the following functions:

   a. Hoisting and lowering
   b. Trolley travel
   c. Bridge travel (if applicable)
   d. Travel limiting devices (stops)
   e. Locking and safety devices for interlocking mechanism, track switches, drop sections, lift sectons, etc. (if applicable).

b. Handchain-Powered Overhead Hoists (Permanent or Portable)

1. Inspect and check braking mechanism for evidence of slip-page under load.

2. Inspect load chain for wear, twists, broken, cracked, or otherwise damaged links. Check chain also for deposits of foreign material which may be carried into hoist mechanism.

3. Inspect hooks damaged from chemicals, deformations, or cracks.

4. Check the hoisting and lowering functions.

c. Electric, Air-Powered or Hand-Operated Portable Hoists

1. Inspect and check all controls and operating mechanisms for improper operation including hoisting, lowering, and braking.

2. Inspect all safety devices and limit switches for malfunction.

3. Inspect for deterioration or leakage in air systems.

4. Inspect hooks damaged from chemicals deformation, or cracks. Inspect hook latches where applicable.

5. Inspect load-carrying ropes or chains. Visual inspection for wear, twist, distortion, or improper dead-ending to the hoisting drum and other attachments. Check chain also for deposits of foreign material which may be carried into the hoist mechanism.

5.2.1.3 Monthly Inspection

An inspection shall be performed monthly by the responsible section/group on the wire ropes of all accessible cranes and hoists and all normally inaccessible cranes and hoists or fuel handling equipment that are in use. The responsible section/group shall prepare instructions for these inspections.

Records generated by these inspections are maintenance history records but not QA records. The inspection shall consist of the following items:

a. Inspect hoist ropes for visual defects, including tightness of and clamps and rope clips.

b. Inspect rope reeving for compliance with the crane or hoist manufacturer's recommendation.

5.2.1.4 <u>Periodic Inspections</u>

An inspection shall be performed annually on all cranes and hoists except as noted in step 5.2.1.5. or 5.2.1.6. These inspections shall be accomplished in accordance with written instructions. The records generated as a result of these inspections for all cranes and hoists located in the auxiliary and reactor building are QA records. The records of the inspections of all other cranes and hoists covered by this subsection are to be retained as maintenance history records. The inspections shall consist of at least the following items as applicable to the type of crane and hoist:

a. <u>Monorail, Underhung Cranes, Pendant-Operated Overhead Cranes</u>

1. Frequent inspection per step 5.2.1.2.a.

2. Loose bolts and rivets.

3. Deformed, cracked, or corroded structural members.

4. Cracked or worn sheaves,

5. Worn, cracked, or distorted parts such as pins, bearings, wheels, shafts, gears, rollers, clamping devices, bumpers, switch baffles, interlock bolts, and trolley stops.

6. Wear on brake system parts, linings, pawls, and ratches.

7. Wear of geared trolley chain sprockets and hand chain.

8. Electrical apparatus for signs of pitting or deterioration of control contactors, limit switches, and push-button stations.

9. Wear on lower load-carrying flange of all track sections in the system, both straight and curved.

10. Hooks - Dye penetrant, magnetic particle, or other suitable crack-detecting inspection. Inspect hooks for throat openings 15 percent in excess of normal or more than a 10 degree twist from the plane of the unbent hook.

11. Check and set limit switches and other safety devices (under no-load conditions).

12. Inspect wire rope in accordance with step 5.2.5.

b. Handchain-Powered Overhead Hoists

1. Frequent Inspection per step 5.2.1.2.b.

2. Excessive wear of chain, load sprockets, idler sprockets, or chain stretch.

3. Hooks--Dye penetrant, magnetic particle, or other suitable crack-detecting inspection Inspect the hook for throat openings 15 percent in excess of normal or more than a 10 percent twist from the plane of the unbent hook.

4. Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining member should be inspected.

5. Does brake mechanism have: worn, glazed, or oil contaminated friction discs; worn pawls, cams, or ratchet; or corroded, stretched, or broken pawl springs.

6. Worn, cracked, or distorted parts such as hood blocks, suspension housing, outriggers, handchain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears, and bearings.

7. Loose bolts, nuts, or rivets.

8. Supporting structure and trolley, if used, shall be inspected for continued ability to support the imposed loads.

9. Check and set limit switches and other safety devices (under no-load conditions).

10. Inspect the load chain in accordance with step 5.2.4.

c. Electric Air-Powered or Hand-Operated Portable Hoists

1. Frequent Inspection per step 5.2.1.2.c.

2. Loose bolts or rivets.

3. Cracked or worn drums or sheaves.

4. Worn, corroded, cracked, or distorted parts, such as pins, bearings, shafts, gears, rollers, or locking and clamping devices.

5. Excessive wear on motor or load brake.

6. Excessive wear of chain, rope, load sprockets, drums, sheaves, and chain stretch.

7. Hooks--Dye penetrants, magnetic particle, or or other suitable crack detecting inspection. Inspect the hook for throat openings 15 percent in excess of normal or more than a 10 percent twist from the plant of the unbent hooks.

8. Electrical apparatus for signs of pitting or any deterioration of controlled contactors, limit switches, and pushbutton stations.

9. Hook-retaining nuts or collars and pins, welds, or riveting used to secure the retaining member shall be inspected.

10. Supporting structure and trolley (if used) shall be inspected for continued ability to support the imposed loads.

11. Check and get limit switches on other safety devices under no-load.

12. Inspect wire rope in accordance with step 5.2.5 or the load chain in accordance with step 5.2.4.

5.2.1.5 Standby Equipment

Standby cranes and hoists are those not in regular service but which are used occasionally or intermittently. Attachment B, Table 2 contains the listing of all equipment meeting this requirement. For those items, step 5.2.1.3 is not aplicable, but step 5.2.1.4.a, b, or c shall be performed every six months.

5.2.1.6 Inaccessible or Fuel Handling Equipment

Cranes and hoists that are inaccessible during plant operation, or are used for fuel handling operations (Attachment B, Table C) shall receive a periodic inspection in accordance with steps 5.2.1.4.a, b, or c before their use. Until made inaccessible due to plant operation, these cranes shall receive an annual inspection in accordance with steps 5.2.1.4.a, b, or c.

This inspection need not be repeated while the equipment is used during a refueling outage, however, step 5.2.1.3 will apply for outage periods exceeding one month.

5.2.2 Load Tests

Before initial use, all new, extensively repaired or altered cranes and hoists shall be load tested. This load test will be performed in accordance with preprepared instructions and the records generated by this test for all cranes and hoists in the auxiliary and reactor buildings are QA records. The records generated for all other cranes and hoists covered by this subsection are to be retained as maintenance history records.

a. The load rating shall not be more than 80 percent of the maximum load sustained during the test. Test loads shall not be more than 125 percent of the rated load.

b. On hoists incorporating overload devices which prevent the lifting of 125-percent rated load, a 100-percent load test shall be performed, after which the function of the overload device shall be tested.

5.2.3 Maintenance

5.2.3.1 A preventive maintenance program based upon manufacturer's recommendations for the equipment shall be established by the appropriate section/group.

5.2.3.2 <u>Maintenance Procedure</u>

a. Before adjustments and repairs, applicable precautions as stated in step 5.1.3.2 shall be taken.

b. After adjustments and repairs have been made, the equipment shall not be operated until all guards have been reinstalled, safety devices reactivated, and tools and maintenance equipment removed.

5.2.3.3 <u>Adjustments or Repairs</u>

a. Any unsafe conditions encountered during the frequent or periodic inspections shall be corrected before the equipment is returned to service.

b. Repair, replacements, or adjustments shall be made as necessary to provide correct performance of all equipment.

5.2.3.4 <u>Lubrication</u>--All moving parts of the equipment for which lubrication is specified by the manufacturer shall be regularly lubricated.

5.2.4 <u>Load Chain Inspection, Replacement, and Maintenance</u>

An inspection shall be performed on the load chains of the hoist covered by this subsection in conjunction with the periodic inspection of steps 5.2.1.4.b or 5.2.1.5 by the responsible section/group.

5.2.4.1 a. <u>Inspection</u>

1. Test the hoist under minimum load in hoisting and lowering directions and observe the operation of the chain and sprockets. The chain should feed smoothly into and away from the sprockets.

2. If the chain binds, jumps, or is noisy, ensure that it is clean and properly lubricated. If trouble persists, inspect the chain and mating parts for wear, distortion, or other damage.

3. Examine visually for gouges, nicks, weld splatter, corrosion, and distorted links. Slacken the chain and move adjacent links to one side to inspect for wear at contact points. If wear is observed or if

stretching is suspected, the chain should be measured as follows:

(a) Select an unworn, unstretched length of chain from slack end.

(b) Suspend the chain vertically under tension and, using a calpiper-type gauge, measure the outside length of any convenient number of links approximately 12 to 24 inches overall.

(c) Measure the same number of links in the used sections and calculate the percentage increase in length.

b. Replacement

1. If the used chain is 2-1/2 percent longer than the unused chain, replace the chain.

2. Gouges, nicks, corrosion, weld splatter, or distorted links are sufficient reason to consider replacement of load chain.

3. Replacement chain shall be the same size, grade, and construction as the original chain furnished by the hoist manufacturer, unless otherwise recommended by the hoist manufacturer.

4. Load chain links which pass over the hoist load sprocket on edge should be installed with the welds away from the center of the sprocket.

5. The chain shall be installed without any twist between the hoist and an anchored end on either the loaded side or the slack side.

6. When the chain is replaced, disassemble the hoist and inspect the mating parts for wear and replace if necessary.

5.2.4.2 Maintenance

1. Load chain and handchain should be kept clean and free from rust and from any coating deposit that will build up and change its dimensions or reduce flexibility.

2. Load chain should be lubricated as specified by the hoist manufacturer. In absence of a recommendation, an EP-type lubricant may be applied sparingly but frequently as it dissipates during use.

5.2.5 Wire Rope Inspection, Replacement, and Maintenance

5.2.5.1 Inspection and Replacement

a. Inspection

An inspection shall be performed on the wire ropes of cranes and hoists covered by this subsection in conjunction with the periodic inspections of steps 5.2.1.4.a, 5.2.1.4.b, or 5.2.1.5 by the responsible section/group. The criteria provided in step 5.?.4.1 shall be applied for this inspection. In addition to these steps, the following item shall be verified:

> No less than two wraps shall remain on the drum with the loaded hook at its extreme lower position, unless a lower limit device is provided, in which case no less than one wrap shall remain.

b. Replacement

1. If any of the items inspected as noted in step 5.2.5.1 are below standard, the plant superintendent shall be informed; and a determination shall be made by the Mechanical Maintenance supervisor or the Field Services supervisor as appropriate before the crane or hoist can be returned to services.

2. All replacement rope shall be of proper size, grade, and construction as specified in the original procurement contract for the crane unless otherwise approved by the Division of Engineering Design (EN DES).

5.2.5.2 Maintenance

a. Rope shall be stored to prevent damage or deterioration.

b. Unreeling and uncoiling of rope shall be done as recommended by the rope manufacturer and with extreme care to avoid kinking or inducing a twist.

c. Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands.

5.2.6 Qualification for Operators

5.2.6.1 Operators for Cranes and Hoists (Except Handchain Powered)

These cranes and hoists shall be operated only by:

a. Persons qualified by a training program specified in subsection 5.9.

b. Trainees under the direct supervision of qualified persons.

c. Maintenance and test employees to perform their duties on the hoist.

d. Inspectors.

5.2.5.2 Qualified Operator List

Each section/group that uses any of the cranes and hoists covered by this subsection shall maintain and publish a listing of their personnel who are qualified to operate these cranes and hoists.

5.2.5.3 Personnel may operate handchain-powered hoists or hand-operated in the performance of their duties without special qualifications. No listing of these personnel are required.

5.3 Fixed Boom Cranes (Trucks, Crawler, etc.)

DPM N74M15 presently does not contain the requirements for this type of equipment. In the interim, the requirements of ANSI B30.5-1968 shall be observed.

The Mechanical Maintenance Section shall be responsible for maintenance of this type equipment. Each section/group utilizing the equipment shall be responsible for qualifying operators to use the equipment in accordance with subsection 5.9 and maintaining and publishing a listing of their personnel who are qualified to use these cranes.

5.4 Mobile Hydraulic Cranes and IPS Crane

DPM N74M15 presently does not contain the requirements for this type of equipment. In the interim, the requirements of ANSI B30.15-1973 shall be observed.

The Mechanical Maintenance Section shall be responsible for maintenance of this equipment. Each section/group utilizing the equipment shall be responsible for qualifying operators to use the equipment in accordance with subsection 5.9 and maintaining and publishing a listing of their personnel who are qualified to use these cranes.

5.5 Base-Mounted Drum Hoists

DPM N74M15 presently does not contain the requirements for this type equipment. In the interim, the requirements of ANSI B30.7-1977 shall be observed. This subsection is applicable to the following listed hoists:

Auxiliary Bldg Hatch A	0-HST-271-HA
Auxiliary Bldg Hatch B	0-HST-271-HB
Auxiliary Bldg Hatch C	0-HST-271-HC
Auxiliary Bldg Hatch D	0-HST-271-HD
Auxiliary Bldg Hatch E	0-HST-271-HE
Auxiliary Bldg Hatch F	0-HST-271-HF

The Mechanical Maintenance Section is responsible for these hoists.

This subsection also applies to any portable base mounted drum hoist used. The Mechanical Maintenance Section is responsible for all these hoists used by the plant sections and the Field Services Group is responsible for these hoists they use.

Each section/group utilizing these hoists shall be responsible for qualifing operators to use the equipment in accordance with subsection 5.9 and maintaining and publishing a listing of their personnel qualified to use these hoists.

5.6 Slings

This subsection applies to slings made from alloy chain, synthetic webbing, wire rope, metal mesh, and natural or synthetic fiber rope.

The Field Services Group shall be responsible for the purchase, inspection, and maintenance of slings for their use. The Mechanical Maintenance Section shall be responsible for the purchase, inspection, and maintenance of slings for use by plant sections. All slings shall be visually inspected by the user before each use for obvious deficiencies.

5.6.1 Alloy Steel Chain

5.6.1.1 Purchase Requirements

The purchaser of alloy steel chain slings shall ensure the requirements of DPM N75M14, section 3.6.2.1 appear on the purchase request and are met by the slings when received.

5.6.1.2 Sling Identification

Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity (provided in Table 3.6-1 of DPM N78M15), and sling manufacturer.

5.6.1.3 Effects of Temperature

a. Alloy steel chain and chain slings shall not be heated above 1000°F after being received from the manufacturer.

b. When exposed to service temperatures in excess of 600°F, working load limits shall be reduced in accordance with the chain manufacturer's recommendations.

5.6.1.4 Attachments

a. Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links, or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used.

b. All welded components in the sling assembly shall be proof tested.

c. Homemade links, makeshift fasteners formed from bolts, rods, etc., or other such attachments shall not be used.

d. Where used, handles shall be welded to the master link or hook before heat treating.

5.6.1.5 Repair and Reconditioning Alloy Steel Chain Slings

a. All assemblies reconditioned by the sling manufacturer shall be proof tested under a load equal to that used for a new assembly of the specific type in question.

b. Alloy steel mechanical coupling links shall be used only in accordance with the manufacturer's recommendation.

c. Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.

5.6.1.6 Periodic Sling Inspection

All slings shall be given an inspection annually and when received new or after repairs. The inspection shall include the following items:

a. If the chain is stretched beyond its original length by more than 2.5 percent, the sling shall be removed from service.

b. Inspection shall also be made on an individual link basis. If any link does not hinge freely with the adjoining link, the sling shall be removed from service.

c. If wear at any point of any chain link exceeds that shown in Table 5.6-1, the assembly shall be removed from service.

Table 5.6-1

MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK

CHAIN SIZE INCHES	MAXIMUM ALLOWABLE WEAR, INCHES
1/4	3/64
3/8	?
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1-1/8	7/32
1-1/4	1/4
1-3/8	9/32
1-1/2	5/16
1-3/4	11/32

d. Nicks and Gouges--If the depth of a nick or gouge exceeds the values shown in Table 5.6-1, the assembly shall be removed from service.

e. Deformed hooks or attachments shall only be reconditioned by the manufacturer.

f. Assemblies with cracked hooks or other end attachments shall be removed from service.

5.6.2 Wire Rope Slings

5.6.2.1 Purchase Requirements

All wire rope slings to be purchased shall conform to TVA Standard Procurement Specification 21.008 and tables 3.6-1 through 3.6-12 of DPM N75M14.

5.6.2.2 Wire Rope Sling Properties

a. Factor of Safety--The factor of safety for rope slings of all grades shall be a minimum of five (5).

5.6.2.3 Sling Identification--All wire rope slings shall have permanent affixed durable identification stating type of material, size, and rated capacity (vertical).

5.6.2.4 Proof Load

a. Slings of all grades terminated by mechanical splices, sockets, and pressed or swagged terminals shall be proof loaded by either the sling manufacturer when specified by purchaser or responsible plant personnel as determined by plant maintenance supervision with documentation verifying the proof load testing.

b. The proof load for single leg slings and endless slings shall be two (2) times the vertical rated capacity.

c. The proof load of multiple leg bridle slings shall be applied to the individual legs and shall be two (2) times the vertical rated capacity of a single-leg sling of the same size, grade, and construction or rope.

5.6.2.5 Effects of Temperature

Fiber core wire rope slings of all grades shall not be exposed to temperatures in excess of 200°F.

5.6.2.6 Minimum Sling Lengths

a. 6 x 19, 6 x 37, and cable-laid slings shall have a minimum clear length of rope ten (10) times the rope diameter between splices, sleeves, or end fittings.

b. Braided slings shall have a minimum clear length of rope forty (40) times the component rope diameter between the loops or end fittings.

c. Grommets and endless slings shall have a minimum circumferential length of ninety-six (96) times the body diameter of the grommet or endless sling.

5.6.2.7 End Attachments

a. All components welded before assembly in the sling shall be proof loaded.

b. Welding of handles or any other accessories to end attachments shall be performed before the assembly of the sling.

c. An eye splice made in any wire rope shall not have less than three full tucks.

5.6.2.8 Periodic Sling Inspection

All slings shall be given an inspection annually when received new, or after repairs. Any deterioration which could result in applicable loss of original strength shall be carefully noted and determination made before further use.

The inspection shall include the following items and a sling shall be removed from use if any of the following conditions exist:

a. Six randomly distributed broken wires in one rope lay, or three broken wires in one strand.

b. Wear or scraping of one-third the original diameter of outside individual wires.

c. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.

d. Evidence of heat damage.

e. End attachments that are cracked, deformed, or worn.

f. Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point; or twisted more than 10 degrees from the plane of the unbent hook.

g. Extensive corrosion of the rope or end attachments.

5.6.3 Synthetic Webbing (Nylon, Polyester, and Polypropylene)

5.6.3.1 Safety Factor--The factor of safety for synthetic web sling shall be a minimum of five.

5.6.3.2 Marking--Each sling shall be marked or coded to show:

a. Name or trademark of manufacturer.

b. Rated capacities for type of hitch.

c. Type of material.

5.6.3.3 Periodic Sling Inspection

All slings shall be given an inspection annually, when received new, or after repairs. The inspection shall include the following items and a sling shall be removed from service if any defects such as the following exists.

a. Acid or caustic burns.

b. Melting or charring of any part of the surface.

c. Snags, punctures, tears, or cuts.

d. Broken or worn stitches.

e. Wear or elongation exceeding the amount recommended by the manufacturer.

f. Distortion of fittings.

g. Other apparent defects which could cause doubt concerning the strength of the sling should be referred to the manufacturer for determination.

5.6.3.4 Repairs--Slings shall be repaired only by a sling manufacturer.

5.6.4 Metal Mesh; Rope (Natural and Synthetic Fiber)

DPM N74M15 does not contain the requirements for these type slings due to infrequent use by Nuclear Power. Inspection and testing requirements for these slings are available in ANSI B30.9-1971 if needed.

5.7 Hooks

DPM N74M15 presently does not contain the requirements for hooks. In the interim, the requirements of ANSI B30.10-1975 shall be observed.

The Field Services Group shall be responsible for the hooks on the cranes and hoists assigned their responsibility and the Mechanical Maintenance Section shall be responsible for the hooks on the cranes and hoists assigned their responsibility.

5.8 Heavy Loads Program (NUREG 0612)

This subsection provides the requirements for the control of lifts greater than 2,000 pounds (1 ton) made in the auxiliary building (elevation 575), and in the upper compartments of units 1 and 2 reactor buildings within the areas designated as the critical lifting zones (CLZ). The CLZs are defined as follows and shown in Attachment A, "Heavy Loads Program," pages 1, 2, and 3:

1. The region, defined as the Reactor Building CLZ, inside the polar crane wall of the upper compartment when fuel is in the vessel and at least one of the horizontal reactor well missile shields has been removed. (Attachment A, Page 1.)

2. The region, defined as the Spent Fuel Pit CLZ, within 15 feet of the spent fuel pit when spent fuel is in the pit. (Attachment A, page 2.)

3. The region, defined as the Auxiliary Building CLZ, within 15 feet of the RHR and containment spray heat exchanger hatches when the hatch plugs have been removed and the heat exchangers are in service. (Attachment A, page 3.)

This program does not apply to the lifting of new or spent fuel assemblies using the manipulator crane or spent fuel bridge. The following steps (5.8.1 and 5.8.2) provide requirements which shall be incorporated into the Frequent Crane Inspection (step 5.1.1.2) instruction for the Auxiliary Building Crane and the Unit 1 and Unit 2 polar cranes. Attachment A provides the drawings showing the CLZs, the list of approved lifts, and a sample of the documentation required for compliance with the heavy load program.

5.8.1 Precautions

5.8.1.1 Maintain a minimum clearance between the load and the floor or object over which the load must pass.

5.8.1.2 Clearance over the steam generators from the #1 and #2 RCP area will not be sufficient in some control lifts. These lifts can only be performed over an open reactor head when shield head blocks are in place.

5.8.2 Lift Documentation

5.8.2.1 Only approved lifts shall be made. Verify that the lift to be made is an approved lift (see Attachment A, pages 4, 5, or 6). Note the referenced procedures and safe load path.

5.8.2.2 Complete the prelift requirements on a data sheet, similar to Attachment A, page 7.

5.8.2.3 Raise and transfer the load to its destination, following the safe path given. A "standard" safe load path is the most direct path into and out of the critical zone which minimizes time and proximity to the open vessel or fuel in racks.

5.8.2.4 Indicate satisfactory completion of the lift on the data sheet.

5.8.2.5 Submit the data package at the end of each shift to the appropriate supervisor for review. This data package shall be submitted to the Master File as a QA record.

NOTE: Several unrelated lifts may be documented on a single data sheet.

5.9 Operator Qualification

5.9.1 Large Overhead Cranes (Subsection 5.1)

The Electrical Maintenance supervisor and the Field Services supervisor shall establish training programs to qualify personnel to operate the plant's large overhead cranes. The programs shall, as a minimum, meet the following listed requirements.

5.9.1.1 Medical Requirements

a. A TVA medical exam shall be performed on each operator to ensure the following physical requirements are met:

1. Have vision of at least 20/30 Snellen in one eye and 20/50 in the other, with or without corrective lenses.

2. Be able to distinguish colors, regardless of position of colors, if color differential is required for operation.

3. Hearing, with or without hearing aid, must be adequate for a specific operation.

4. Have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of equipment operation.

5. Evidence of physical defects or emotional instability which could render the operator a hazard to himself or others which, in the opinion of the examiner, could interfere with the operator's safe performance may be sufficient cause for disqualification. In such cases, specialized clinical or medical judgements and tests may be required.

6. Evidence that an operator is subject to seizures or loss of physical control shall be sufficient reason for disqualification. Specialized medical tests may be required to determine these conditions.

7. Operators and operator trainees should have normal depth perception, field vision, reaction time, manual dexterity, and coordination and no tendencies toward dizziness or similar undesirable characteristics.

b. Each operator shall be requalified medically every five years up to the age of 40 and every two years thereafter.

5.9.1.2 <u>Operational Requirements</u>

The Electrical Maintenance supervisor and the Field Services Group supervisor shall designate crane qualification examiners who shall give an oral and practical operational examination to each operator. The operator must successfully demonstrate knowledge of the following items:

a. Proper conduct, movement of loads, and signals from HCI-M7 "Cranes and Hoists"

b. Knowledge of the requirements of Heavy Loads Program (subsection 5.8)

c. Familiarity with the frequent inspection of the cranes

d. Knowledge of the differences between the large overhead cranes.

e. Familiarity wth the controls and equipment of each of the large overhead cranes.

f. Demonstrate the ability to safely operate a large overhead crane.

5.9.1.3 Documentation

The Electrical Maintenance supervisor or the Field Services Group supervisor shall maintain records that each operator qualified under their program meets the qualification requirements of steps 5.9.1.1 and 5.9.1.2.

5.9.2 Other Cranes and Hoists (subsection 5.2), Fixed Boom Cranes (subsection 5.3), Mobile Hydraulic Cranes and IPS Crane (subsection 5.4), and Base-Mounted Drum Hoists (subsection 5.5)

Each section/group supervisor whose personnel will use any of these types of cranes and hoists shall establish a training program that meets the following requirements:

5.9.2.1 Separate training shall be provided for each type of crane with at least the following divisions:

a. Radio-controlled cranes and hoists.

b. Overhead pendant controlled cranes with both bridge and trolley.

c. Overhead pendant controlled mon rail mounted cranes and hoists.

d. Fixed boom cranes.

e. Mobile hydraulic cranes and IPS crane.

f. Base-mounted drum hoists.

5.9.2.2 The supervisor shall designate a crane examiner who shall give a practical operating examination for the specific type of crane involved and ensure the operator has familiarity with the following items:

a. Proper conduct movement of loads, and signals from HCI-M7, "Cranes and Hoists."

b. Knowledge of the frequent inspection of the cranes and hoists.

c. Familiarity with the controls and equipment of the crane.

d. Demonstrate the ability to safely operate the crane.

5.9.2.3 Documentation

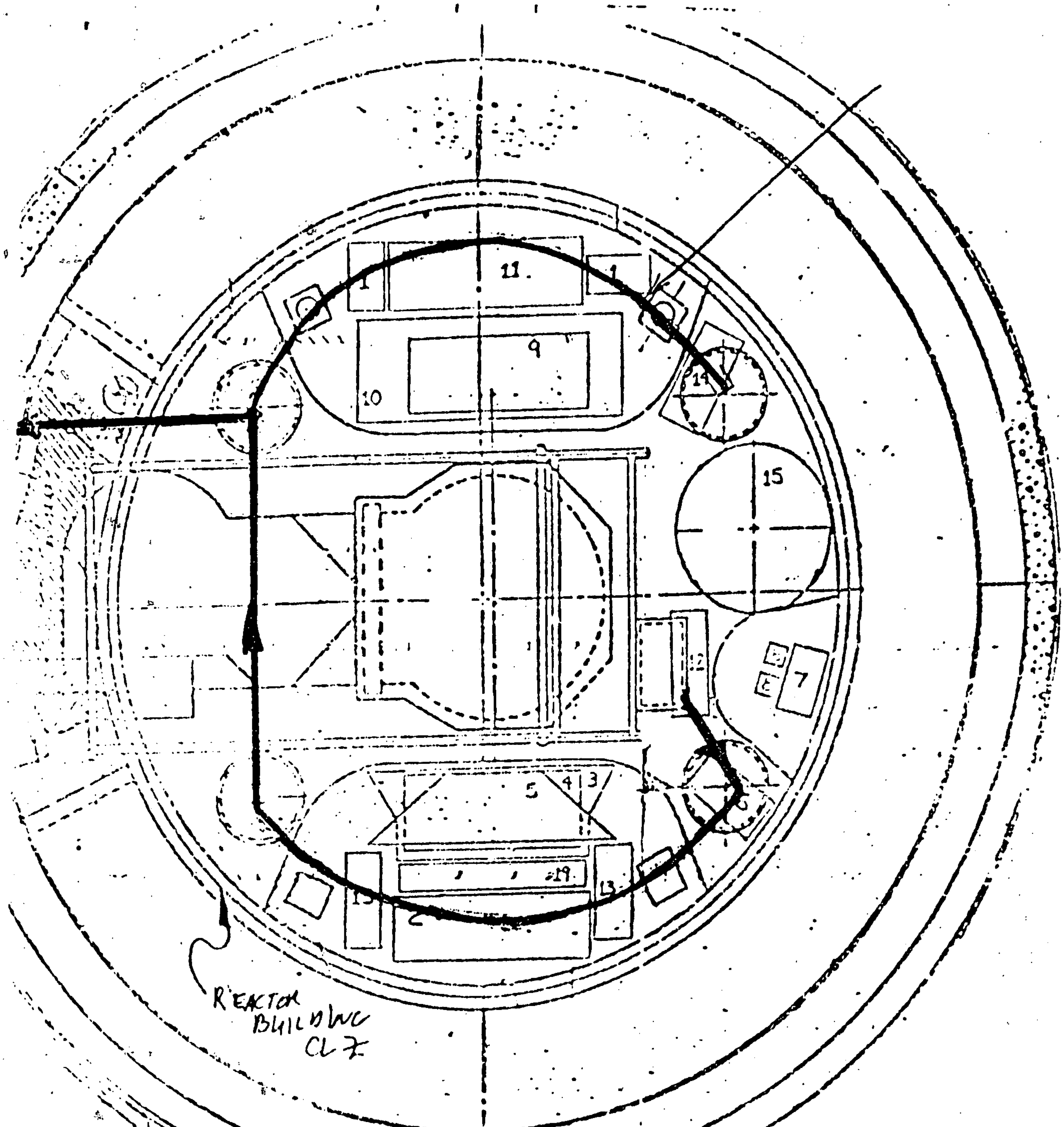
Each section/group supervisors shall maintain records that each operator qualified under this program meets the requirements of step 5.9.2.2.

5.10 Rigger Qualification

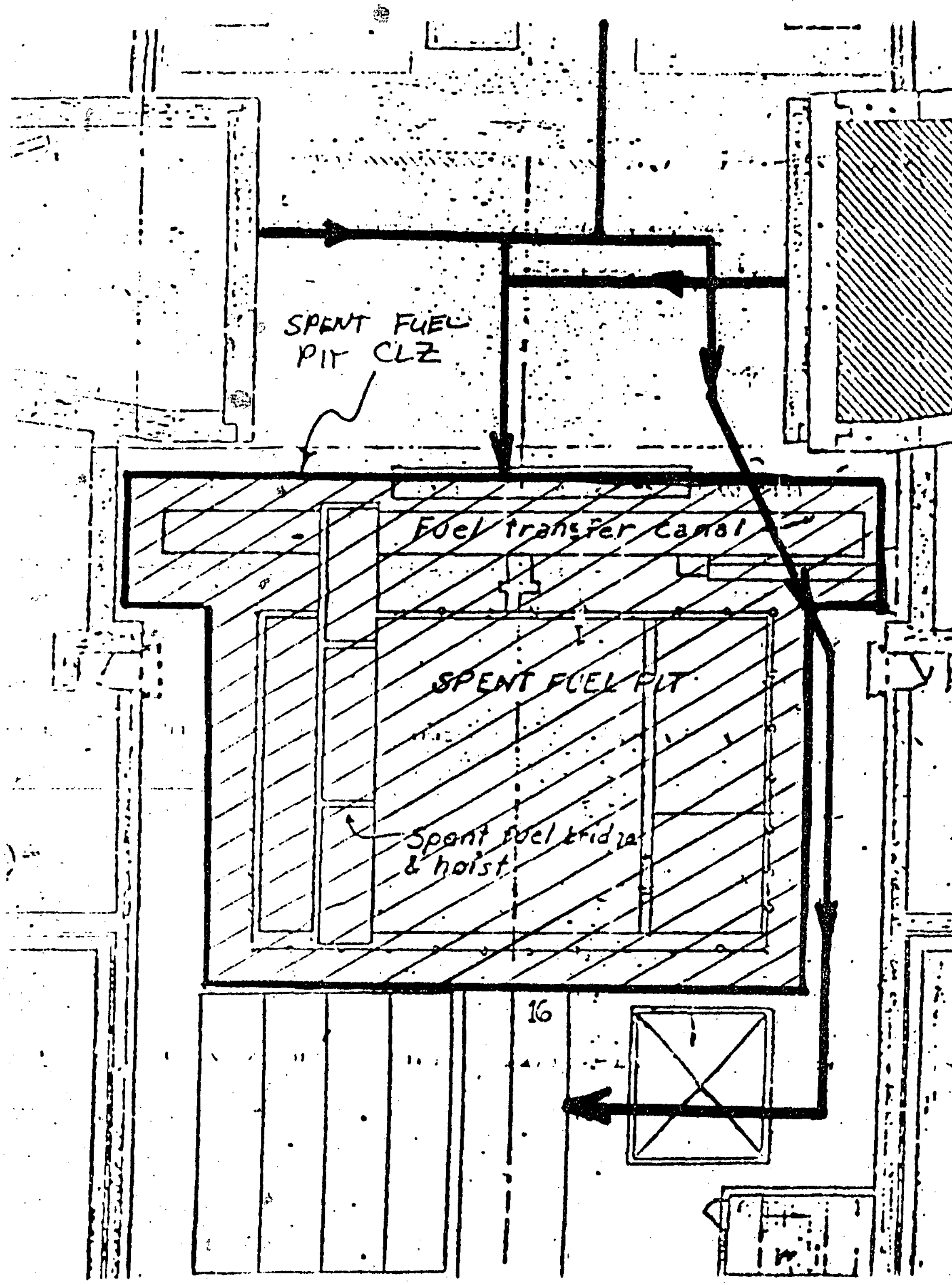
Each section/group supervisor whose personnel will rig loads for any crane or hoist shall establish a program to train personnel. The training shall be sufficient to allow the rigger to safely place loads on a crane. The program will cover the frequent inspection requirements for slings (subsection 5.6). The section/group supervisor will maintain a list of trained personnel and only those personnel will rig loads for any crane.

REACTOR BUILDING CRITICAL LIFT ZONE

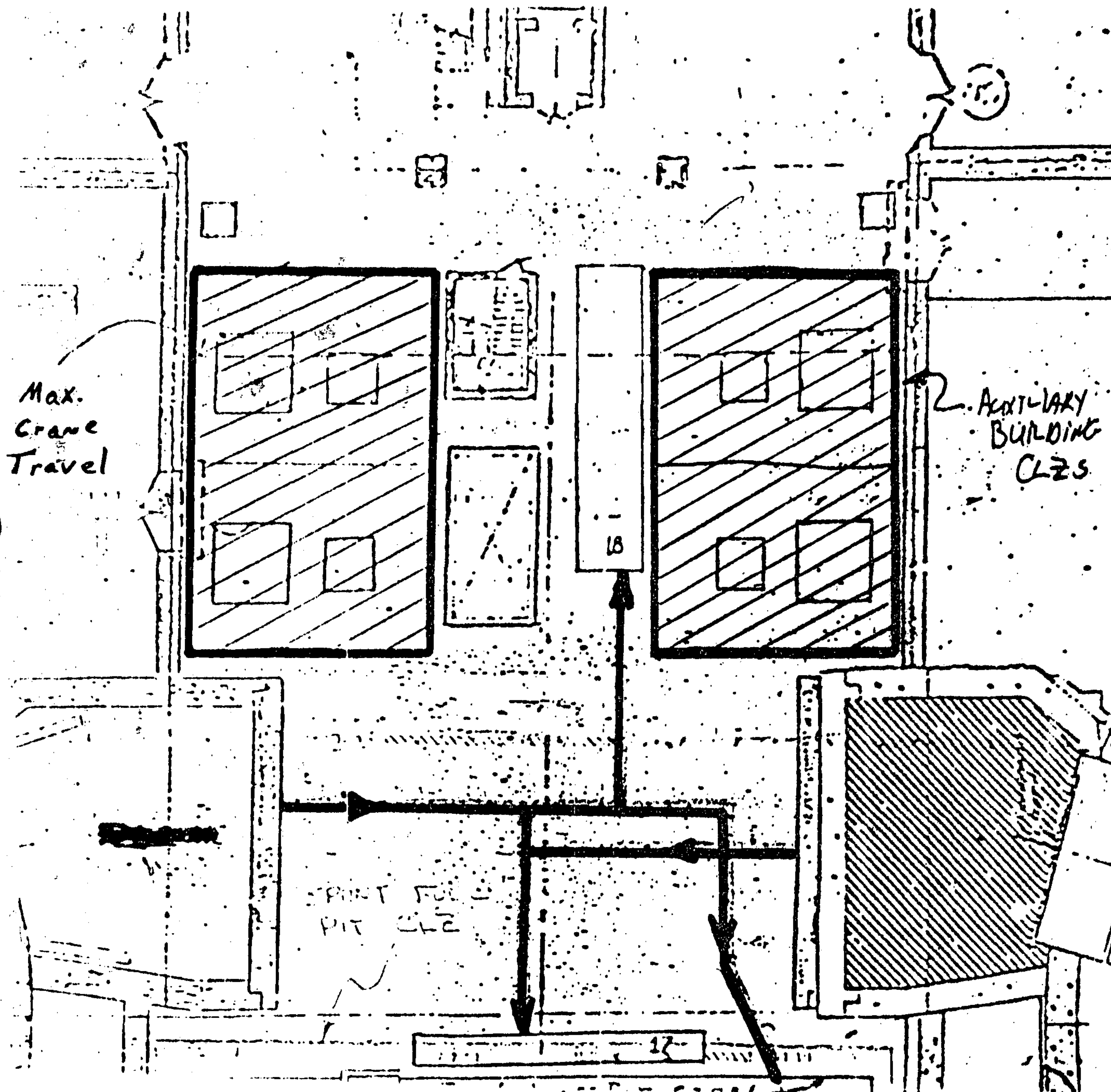
NOTE 1: All miscellaneous lifts shall follow the paths indicated.
NOTE 2: All other lifts shall take the shortest safe path to the designated laydown area.



SPENT FUEL PIT CRITICAL LIFT ZONE



AUXILIARY BUILDING CRITICAL LIFT ZONE



REACTOR BUILDING CLZ LIFTS

LIFT NO.	R. B. POLAR HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
RB-1	Main	2 Slings MK	Missile Shields PC-1 PC-2				Attachment A, Page 1
RB-2	Main and Aux.	2 Slings MK and 1 Sling MK	Canal Gates PC-3 PC-4 PC-5				"
RB-3	Main	2 Slings MK	Canal Gates PC-3 PC-4 PC-5 Missile Shield PC-6				"
RB-4	Main	Closure Head Lifting Rig	RV Head				"
RB-5	Main	Internals Lifting Rig	Upper Internals				"
RB-6	Aux.	4 Part Sling MK	Reactor Coolant Pump Plug				"
RB-7	Aux.	4 Part Sling MK	Hatch Plug				"
RB-8	Main	Lifting Assembly MK	R.C. Pump Motor				"
RB-9	Main		R.C. Pump				"
RB-10	Main	Approved Slings or Rigging	Miscellaneous Equip in R. B. (not otherwise listed)				"

SPENT FUEL PIT CLZ LIFTS

LIFT NO.	AUX BLDG HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
SF-1	Main	Lifting Beam MK Slings MK per Ref. Dwg.	R.B. Equipment Hatch Plugs A B C				Attachment A, Page 2
SF-2			Pool Divider Gates				"
SF-3			Fuel Transfer Canal Door				"
SF-4			Irradiated Speciman Shipping Cask				"
SF-5			Spent Resin, Filter or other ... mat'l shipping				"

AUXILIARY BUILDING CLZ LIFTS

LIFT NO.	AUX BLDG HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
AX-1			Containment Spray Shield Blocks				Attachment A, Page 3
AX-2			RHR Shield Blocks				"

CRITICAL ZONE LIFT CHECKLIST

APPROVED LIFT NUMBER	DATE	TIME	PRE-LIFT CHECKS COMPLETED THIS SHIFT (INITIAL)	HANDLING DEVICE, RIGGING CORRECT PER ATTACHMENT A, PAGES 4,5,OR 6 (CHECK)	SLING** CAPACITY RATED FOR LOAD ( )OR N/A	LIFT COMPLETED SATISFACTORY (INITIAL)	REMARKS

**N/A for lifts using special lifting devices designed for the lift.

ATTACHMENT B

LISTING OF OTHER CRANES AND HOIST FOR SUBSECTION 5.2

TABLE 1

ACCESSIBLE NORMAL USE CRANES AND HOISTS

6 Ton Underhung Crane (Aux Bldg Railroad Bay)	0-CRN-271-RR6
Auxiliary Crane 1 (TB Unit 1)	1-CRN-270-T3
Auxiliary Crane 2 (TB Unit 2)	2-CRN-270-T3
10 Ton Turbine Bldg Underhung Crane	1-CRN-270-T6
Machine Shop Crane	0-CRN-270-51
Radwaste Packaging Crane	0-CRN-77-1
Dock to Power Stores Monorail Hoist	0-HST-270-51
Power Stores Monorail Hoist	0-HST-270-52
Waste Baler Monorail Hoist	0-HST-270-53
Paint Storage Monorail Hoist	0-HST-270-54
Insul Shop - Storage Monorail Hoist	0-HST-270-55
Sht Mtl Storage Monorail Hoist	0-HST-270-56
Carp Shop Monorail Hoist	0-HST-270-57
Elec Shop Monorail Hoist	0-HST-270-58

TABLE 2

STANDBY CRANES AND HOISTS

FDWTR Pump Turbine Monorail Crane (Unit 1)	1-CRN-270-T5
FDWTR Pump Turbine Monorail Crane (Unit 2)	2-CRN-270-T5
Hotwell Pump Crane (Unit 1)	1-CRN-270-T7
Hotwell Pump Crane (Unit 2)	2-CRN-270-T7
Aux Bldg Misc Hoist (A12U/737)	0-HST-271-AB1
Aux Bldg Misc Hoist (A5T/737)	0-HST-271-AB10
Aux Bldg Misc Hoist (A4U/772)	0-HST-271-AB11
Aux Bldg Misc Hoist (A11T/737)	0-HST-271-AB12
Aux Bldg Misc Hoist (A9W/737)	0-HST-271-AB13
Aux Bldg Misc Hoist (A12V/772)	0-HST-271-AB14
Aux Bldg Misc Hoist (A4X4/786)	0-HST-271-AB15
Aux Bldg Misc Hoist (A5V/692)	0-HST-271-AB16
5 Ton Hoist-Aux Bldg (A5U/737)	0-HST-271-AB18
Aux Bldg Misc Hoist (A14Q/713)	0-HST-271-AB19
Aux Bldg Misc Hoist (A14R/692)	0-HST-271-AB20
Aux Bldg Misc Hoist (A10R/692)	0-HST-271-AB21
Aux Bldg Misc Hoist (A10R/737)	0-HST-271-AB3
5 Ton Hoist-Aux Bldg (A10Q/737)	0-HST-271-AB45
Aux Bldg Misc Hoist (A4U/737)	0-HST-271-AB5
Aux Bldg Misc Hoist (A5U/757)	0-HST-271-AB6
Aux Bldg Misc Hoist (A35/772)	0-HST-271-AB7
Aux Bldg Misc Hoist (A11U/757)	0-HST-271-AB8
Aux Bldg Misc Hoist (A13S/772)	0-HST-271-AB9

ATTACHMENT B

LISTING OF OTHER CRANES AND HOIST FOR SUBSECTION 5.2

TABLE 2 (continued)

STANDBY CRANES AND HOISTS

Portable Cond Tube Handling Hoist 1A	0-HST-270-1A
Portable Cond Tube Handling Hoist 1B	0-HST-270-1B
Portable Cond Tube Handling Hoist 2A	0-HST-270-2A
Portable Cond Tube Handling Hoist 2B	0-HST-270-2B

All portable equipment not in continuous use.

TABLE 3

UNACCESSIBLE OR FUEL HANDLING CRANES AND HOISTS

Ice Condenser Bridge Crane (Unit 1)	1-CRN-61-1
Ice Condenser Bridge Crane (Unit 2)	2-CRN-61-1
Manipulator Crane (Unit 1)	1-CRN-78-M1
Manipulator Crane (Unit 2)	2-CRN-78-M1
Spent Fuel Pit Crane	0-CRN-78-1
New Fuel Elevator	0-ELEV-78-1
Equipment Access Hoist (Unit 1)	1-CRN-78-1EH
Equipment Access Hoist (Unit 2)	2-CRN-78-1EH
RCC Crane (Unit 1)	1-CRN-78-1RCC
RCC Crane (Unit 2)	2-CRN-78-1RCC
RB1 3 Ton JB Crane	1-CRN-78-15
RB1 3 Ton JB Crane	2-CRN-78-15
Stud Tensioner Hoist	1-HST-78-ST1
Stud Tensioner Hoist	1-HST-78-ST2
Stud Tensioner Hoist	1-HST-78-ST3
Upending Winch (Rt Side)	1-HST-78-W1
Upending Winch (Reactor Side)	1-HST-78-W2
Stud Tensioner Hoist	2-HST-78-ST1
Stud Tensioner Hoist	2-HST-78-ST2
Stud Tensioner Hoist	2-HST-78-ST3
Upending Winch (Rt Side)	2-HST-78-W1
Upending Winch (Reactor Side)	2-HST-78-W2

WATTS BAR NUCLEAR PLANT

MI-271.4

REACTOR BUILDING POLAR CRANE ANNUAL INSPECTION

Units 1 and 2

CURRENT REVISION LEVEL 0

Prepared By Vernon P. Law

Revised By N/A

Submitted By [signature] Supervisor

PORC Review Date 11/9/82

Approved By [signature] Superintendent

Date Approved 11/9/82

Last page of this instruction: 10

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
	Plant Superintendent
	Asst Plant Supt (Operations)
	Asst Plant Supt (Maintenance)
	Adm Services Supervisor
	Asst Mechanical Maint Supv
	Chemical Laboratory
	Chemical Unit Supervisor
	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Services Group Supervisor
1C	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Services Supervisor
1C	Mechanical Maint Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	OPQA - Plant Coordinator
1U/1C	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
1C	Quality Assurance Supervisor
	Reactor Unit Supervisor
	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room
1C	Mechanical Maintenance Shop Office

OS/6

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
0	11/9/82	All	

REACTOR BUILDING POLAR CRANE ANNUAL INSPECTION

1.0 PURPOSE

The purpose of this instruction is to describe the periodic inspection procedure for the Reactor Building polar cranes. This instruction shall be performed, while in modes 1 through 6, for either of the following reasons:

1. As an annual inspection unless the crane is inaccessible, then as a preoutage general inspection, or
2. Prior to being placed in service when the crane has been idle for more than six months, section 6.2.5.7 must be performed.

NOTE: During outages, preventive maintenance measures shall be performed according to the PM folder maintained by the Field Services Group (see FSGL-A26).

2.0 REFERENCES

2.1 Standard Practice WB7.4.3

2.2 175 Ton/35 Ton Reactor Building Polar Crane, Operations and Maintenance Manual, contract No. 75K38-86129

2.3 DPM N74M15

3.0 PREREQUISITES

3.1 Obtain approval of the shift engineer or his designee to perform this instruction.

3.2 Obtain necessary clearances for the performance of this procedure, e.g., the feeder breaker on 480V shutdown board B2B, compartment 3B.

3.3 Contact Health Physics personnel, as required, to determine applicable Health Physics requirements.

3.4 This inspection should be performed by a crane inspector from the Power Service Shop supported by a qualified crane operator and the assistance of Field Services Group personnel. Inspection results shall be recorded on form TVA 7885 or equal.

3.5 MRs shall be written and issued in order to correct any deficiencies found. Wire lifts will be recorded on a temporary condition log, e.g., attachment C of MAI-5.

4.0 PRECAUTIONS

4.1 Caution should be exercised when working on energized equipment.

4.2 Caution should be taken not to drop articles from the crane.

4.3 This MI shall not be performed while the reactor vessel head is removed (see WB 7.1.12).

5.0 PREPARATION FOR WORK

5.1 Obtain the following tools and instruments for use in this instruction. Record the unique ID numbers and calibration due dates, where applicable.

5.1.1 500-volt megger, 0-100 MΩ, ± 1/16" from reading

5.1.2 DC clamp-on ammeter, 0-1000A, ± 10 percent

5.1.3 V-O-M, ± 3.6 percent FS AC volts and current, ± 10 percent ohms

5.1.4 Air filters, 9 - 10" x 10" x 1", 4 - 16" x 20" x 1"

5.1.5 Clean lint-free rags

5.1.6 Vacuum cleaner

5.1.7 Shimpo hand digital tachometer, ± 20 counts, or General Radio Company electric strobotac, ± 1.2 percent of full scale, or equal.

5.1.8 Several cans of spray contact cleaner approved in accordance with TI-35

5.1.9 G.E. 44 or equal bulbs

5.1.10 G.E. D6A2C5 grease

5.1.11 Brush seater and commutator cleaner (1 hard and 1 soft)

6.0 PERFORMANCE OF WORK

6.1 With crane power off, perform the following:

6.1.1 Clean the various control cabinets, bridge, trolley, main and auxiliary hoists, with a vacuum to remove dust and dirt from the cabinets. Use contact cleaner to clean relays, contactors, etc.

6.0 PERFORMANCE OF WORK (continued)

6.1 With crane power off, perform the following: (continued)

6.1.2 While cleaning the cabinets, visually inspect the electrical connections on the various components for signs of loose connections, arcing, heating, or pitting. Any adverse conditions found should be noted in the comments section of the data sheet supplied by the inspector. Make certain to identify the exact component found unsatisfactory.

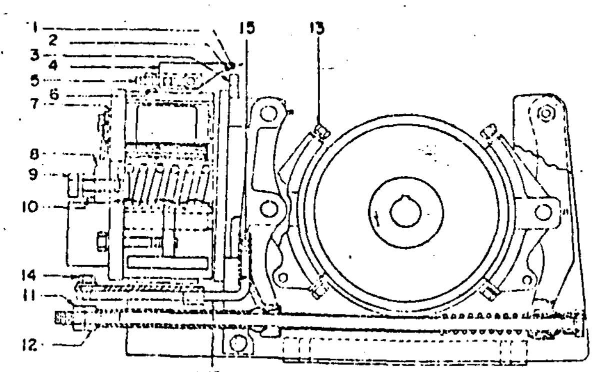
Also, check any critical mechanical bolted connections for tightness, i.e., flanged couplings, motor leveling bolts, etc. Note any unacceptable results in the comments section.

6.1.3 Replace all air filters in the cabinets.

6.1.4 Visually inspect the festoon system for damage to wire, towing harness, and physical connection to junction boxes.

6.1.5 Inspect the main and auxiliary hoist magnetic brakes according to the following criteria.

6.1.5.1 Check the brake spring for the proper torque setting, 550 ft-lbs. The proper torque value can be checked using the gauge accompanying the brake. To set the torque, loosen lock nut 10, turn the adjusting screw 9 (Figure 1) in or out until the head of the screw is the same as the 550 ft-lbs indicator on the gauge. Tighten lock nut 10 after adjustment which should be 1-3/32 ± 1/8 inches from the head of the screw to the block (8). This measurement is obtained from the table in the operations manual.



1. Indicating point
2. Indicating point
3. Armature indicator
4. Gap indicator
5. Manual release bolt
6. Nut
7. Torque gage
8. Spring block
9. Torque adjusting screw
10. Locknut
11. Locknut
12. Magnet-gap adjustor
13. Lining bolts
14. Shoe-clearance clamping bolt
15. Pivot in yoke
16. Adjustable pivot arm

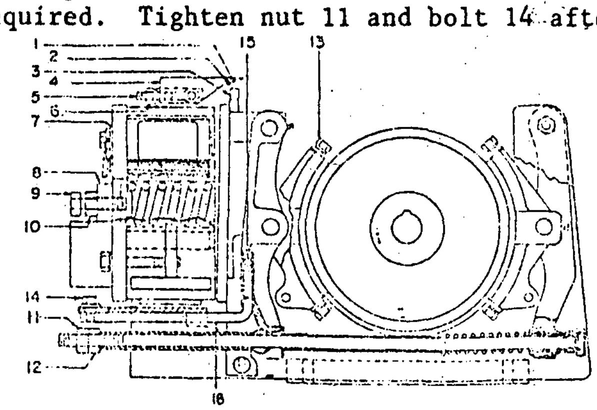
Figure 1

6.0 PERFORMANCE OF WORK (continued)

6.1 With crane power off, perform the following: (continued)

6.1.5.2 If a torque adjustment is made, the brake shoe clearance must be equalized on both sides of the brake wheel. If the shoe clearances are not equal, the adjustable pivot arm 16 in Figure 2 may be repositioned to accomplish this.

6.1.5.3 Verify that magnetic gap is correct. The gap is correct when the inner face of the armature lug 3 lines up with the outer face of notch 2 as shown in Figure 2. If it is necessary to adjust the magnetic gap, loosen the shoe clearance clamping bolt 14 and nut 11. Turn the adjustor 12 clockwise or counter-clockwise as required. Tighten nut 11 and bolt 14 after adjustment.



1. Indicating point
2. Indicating point
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6. Nut
7. Torque gage
8. Spring block
9. Torque adjusting screw
10. Locknut
11. Locknut
12. Magnet-gap adjustor
13. Lining bolts
14. Shoe-clearance clamping bolt
15. Pivot in yoke
16. Adjustable pivot arm

Figure 2

6.1.6 Inspect the main and auxiliary hoist motors according to the following criteria:

6.1.6.1 Remove the brush cover of the motor.

6.1.6.2 Inspect the brushes for wear, cracks, and chips. If they are worn or cracked, replace them.

6.1.6.2.1 Inspect brush holders to ensure that the brushes move freely making firm even contact with the commutator.

6.0 PERFORMANCE OF WORK (continued)

6.1.6 Inspect the main and auxiliary hoist motors according to the following criteria: (continued)

6.1.6.3 Lift the brushes from the commutator.

6.1.6.4 Inspect the brush pigtails for a tight clean connection. Remove any copper lodged in the face of the brush.

6.1.6.5 Clean the commutator with a lint-free cloth to remove carbon dust. Do not use any oils or lubricants. Note signs of arcing and unusual conditions. If minor pitting is noted, the commutator may be polished with a commutator cleaner to remove the flaws

6.1.6.6 If necessary, clean the motor of carbon dust with a vacuum cleaner.

6.1.6.7 With the brushes still removed, megger the motor field winding with a 500-volt megger. Minimum acceptable reading shall be 1 megohm.

6.1.6.8 Megger the armature windings with 500-volt megger. Minimum acceptable reading shall be 1 megohm.

6.1.6.9 Replace the brushes in their holders onto the commutator.

6.1.6.10 At this time close the cab breaker, start the hoist motors, and operate. Verify motor speed does not exceed 2,340 rpm by using the tachometer or the strobe light. Optimum setting is 1,800 to 1,900 rpm. Inspect commutator and brush action. Commutation should be smooth with little sparking. Jumping brushes give advance warning of commutator surface deterioration.

6.1.6.11 Notify the Engineering Section to conduct vibration tests in accordance with TI 31.2. Note any unusual noise and vibration in operation of the hoists. Test results should be included as part of this MI.

6.1.7 Inspect trolley and bridge motors. Collector rings, brushes, brush holders, and brush studs should be examined for wear and dust accumulation. Verify motor speed is below 2,340 rpm by using the tachometer or the strobe light. Optimum setting is 1,800 to 1,900 rpm.

6.1.7.1 Open the cab breaker and megger trolley motor and bridge motors. Minimum acceptable reading shall be 1 megohm.

6.0 PERFORMANCE OF WORK (continued)

6.1 With crane power off, perform the following: (continued)

6.1.8 Inspect operation of solenoid brakes on trolley and bridge drive motor. Each bridge drive motor will have one brake and each trolley motor two brakes. These are parking brakes and are not intended to stop the crane bridge or trolley.

6.1.8.1 Refer to Figure 3. As the lining wears, the travel of the core (2) increases until it fails to pull down and release the brake or until level (3) strikes the underside of the crosspiece (8) or stop (21). It is then necessary to take up on nut (7) to bring the travel of the core (2) down to the minimum necessary to release the shoes. This also brings the spring (12) back to its original value. Adjust screw (5) to equalize the shoes and nut (14) to adjust braking intensity. This is found from the motor torque. The motor torque is found by multiplying the hp by 5,250, then dividing by the full load speed. Using this value, the table in the operations manual shows the spring on the bridge brakes should be 1-29/32 ± 1/8 inches and on the trolley, spring length should be 2-1/8 ± 1/8 inches. The solenoid gap should be 1/2 ± 1/8 inch for both trolley and bridge. Solenoid gap is defined as the distance the plunger travels from deenergized to the energized position.

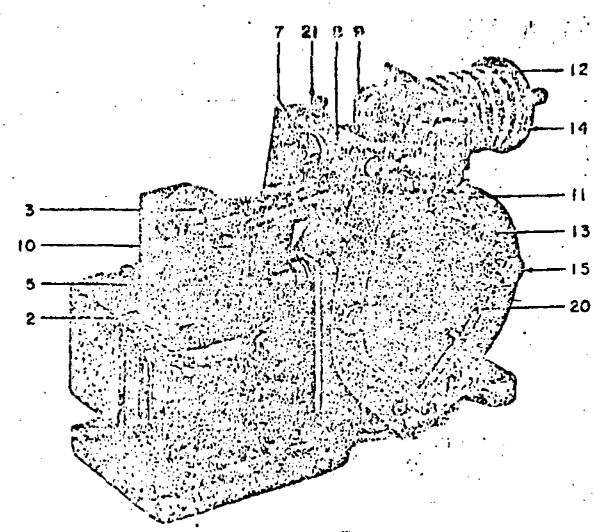


Figure 3

6.0 PERFORMANCE OF WORK (continued)

6.2 With crane power on, perform the following:

6.2.1 Verify that all space heaters are working either physically or electrically. The heaters will not be on while the hoists are running.

6.2.2 Check all crane running lights for operability. (Exercise extreme caution in rebulbing. Do not drop bulbs in reactor pit, spent fuel cavity, etc.)

6.2.3 Open all hoist limit switches (on the trolley), check the physical condition of each switch, operate the switch manually and verify the mechanical operability.

6.2.4 Check the digital scoreboard for operability by placing the scoreboard switch in the test position. All segments should light. Replace bulbs as necessary (Sylvania 44).

6.2.5 In accordance with Standard Practice WB7.4.3, certain safety checks must be made annually. These can and should be done at the regular annual maintenance intervals. The following will enable the user of this MI to accomplish these.

NOTE: Record all wire lifts on a temporary condition log.

6.2.5.1 Verify the phase reversal/phase loss relay is operating to allow the dc machines to generate or run correctly. Check of this may be done by removing one of the main disconnect phases for any hoist of the crane. Removal will simulate a phase loss. Phase reversal can be accomplished by actually reversing any two phases at these same points. With crane power off at the main disconnect, reverse L1 and L2 at the main hoist cabinet. Reverse L1 and L2 in auxiliary hoist cabinet. Turn the main disconnect on and try to operate the main hoist. Try to operate auxiliary hoist. Turn off main disconnect. Restore main hoist phase rotation, i.e., L1 to L1 and L2 to L2. Return auxiliary hoist phase rotation to normal by replacing L1 to L1 and L2 to L2.

6.2.5.2 Check overspeed operation by manually operating the centrifugal overspeed switch while the hoist is operating at slow speed.

6.2.5.3 Open the cab disconnect and remove the instantaneous overcurrent relays for the main and auxiliary hoist by lifting 3DP3 and 3DP4 for the main hoist and 4DP3 and 4DP4 for the auxiliary hoist. Have the IORs calibrated by the Field Services Group, using a dc Multi-Amp test set or dc arc welder, to set the pick-up at 425 ± 2

6.0 PERFORMANCE OF WORK (continued)

6.2 With crane power on, perform the following: (continued)

6.2.5.3 (continued)

percent amps. A calibration sticker should be placed on the relays. Replace the relays and their leads.

6.2.5.4 Remove the field loss relays on the main and auxiliary hoist by lifting 3G12 and 3G13 for the main hoist and 4G12 and 4G13 for the auxiliary hoist. Have the FLRs calibrated by PSO to set the pick up at 3.0 ± 2 percent amps and drop out at 85 percent of the minimum field. A calibration sticker should be attached to the relays. Replace the relays and their leads.

6.2.5.5 Close the cab disconnect and verify electrical operation of all main and auxiliary hoist limit switches.

6.2.5.6 Dynamic braking can be checked by lifting a load approximately 12 inches off the floor, shutting the hoist down, and then manually releasing the brakes. The total weight need not be great, possibly 10-percent rated. The crane must lift the weight, positioning itself away from major equipment, fuel pit, and other features. The crane must then be turned off. Two people must then manually release the hoist brakes. The deceleration of the load indicates that the braking is working properly.

6.2.5.7 Inspect hoisting wire ropes including those portions normally hidden from view. Take measurements as necessary to establish the amount of wear on the wire ropes. These measurements can be checked against baseline data for acceptance. Wire rope is acceptable for use if none of the following conditions are found.

Nominal Diameter	Reduction Greater Than	Nominal Diameter	Reduction Greater Than
Up to 5/16" incl.	1/64"	7/8" - 1-1/8"	1/16"
3/8" - 1/2"	1/32"	1-1/4" - 1-1/2"	3/32"
9/16" - 3/4"	3/64"		

b. Wear of one-third the original diameter of outside individual wires.

c. Individual wires broken, 13 random in one rope or 4 broken in one strand in one rope lay.

6.0 PERFORMANCE OF WORK (continued)

6.2 With crane power on, perform the following: (continued)

d. Corroded or broken wires at end connection.

e. Corroded, cracked, bent, worn, or improperly applied end connections.

f. Kinking, crushing, cutting, unstranding, or any other damage resulting in distortion of the rope structure.

g. Exposure to temperature sufficient to discolor the wire or cause deterioration of any portion of the wire rope structure.

6.2.5.8 A 100-percent load test shall be performed after a wire rope replacement on the affected hook. The rope must be broken in before the 100-percent load lift. See manufacturers data and/or Attachment A of DPM N74M15.

6.2.5.9 Respective crane hooks will be inspected for defects by the crane inspector. Results will be documented and made a part of this Maintenance Instruction.

6.2.5.10 Visually inspect all structural members for obvious defects such as deformation, cracks, corrosion and loose fasteners.

6.2.5.11 Inspect rails for alignment, flat spots, and looseness.

6.2.5.12 Check lubrication levels in gear boxes and hydraulic brakes and check if greasing is required.

6.2.5.13 Check sheaves and drums for wear using groove wear indication gauges.

6.2.5.14 Check mechanical parts for defects such as drums and sheaves, worn or cracked parts such as pins, bearings, shafts, gears, rollers, linings, and locking and clamping devices.

6.3 Clean the crane and remove all work materials.

6.4 Notify the shift engineer or his designated representative upon completion of this instruction.

7.0 DOCUMENTATION

Completion of this MI shall be documented by use of a form TVA 7885, "Crane Inspection" or a similar form for that purpose.

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-271.5

PERIODIC INSPECTION OF THE STANDBY HOIST LOCATED IN THE AUXILIARY BUILDING

UNITS 0, 1, 2

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
	Plant Superintendent
	Asst. Plant Supt. (Operations)
	Asst. Plant Supt. (Maintenance)
	Adm. Svs. Supervisor
	Asst. Mechanical Maint. Sup.
	Chemical Laboratory
	Chemical Unit Supervisor
2C	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint. Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Services Supervisor
1C	Field Quality Engineering Supv.
1C	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint. Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Svs. Supervisor
1C	Mechanical Maint. Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	Plant Program Section Supv.
2C, 1U	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
	Reactor Unit Supervisor
	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room
1C	Mech. Maint. Shop Office

CURRENT REVISION LEVEL 0

Prepared By Martin G. Galyon

Revised By N/A

Submitted By J. L. Collins
Supervisor

PORC Review Date 9/28/83

Approved By H. B. Brush
Superintendent

Date Approved 9/28/83

Last page of this instruction: 29

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
0	9/28/83	All	New Instruction

1.0 PURPOSE AND APPLICABILITY

The purpose of this instruction is to describe the procedure for the periodic inspection of the standby hoist in the Auxiliary Building. (a list of these hoists is given in Appendix A.) These hoists shall be inspected per this instruction every six months. This instruction can be performed with the reactor in any mode.

2.0 REFERENCES

2.1 AI-6.4

2.2 DPM N74M15

2.3 DPM N80E3

2.4 ANSI 30.16

2.5 HCI-M7

2.6 Yale Instruction Manual

2.7 TVA drawings 44N387, 44N388, and 44N389.

3.0 PREREQUISITES

3.1 QC will be needed for hook inspection.

3.2 Coordinate the performance of this instruction with the shift engineer. Obtain SE's signature on initiating MR.

3.3 Contact Health Physics' personnel to determine the applicable health physics requirements. ALARA shall be used.

3.4 Inspection shall be made by personnel who are familiar with the operation of these cranes.

4.0 PRECAUTIONS

4.1 The responsible foreman shall review the task to be performed to ensure that ALARA requirements (AI-2.7) have been considered.

4.2 Before performance of this instruction, all personnel involved shall be familiar with HCI-M7.

4.3 Before working on hoist, the following steps shall be taken:

4.3.1 Main power breaker to hoist shall be tagged out (AI-2.12).

4.3.2 If maintenance personnel can not be clearly seen from controller, an "Out of Order" sign shall be placed on the control pendant.

4.4 After maintenance work on hoist, all guards and safety devices shall be reinstalled prior to operation of hoist.

5.0 PREPARATION OF WORK

5.1 A qualified hoist operator is needed (MSL-36).

5.2 A QC inspector is needed for magnetic particle test of hook.

5.3 All hoist inspected shall have a separate checklist.

5.4 Complete checklist as work is performed.

5.5 M.T. test on hook shall be documented on TVA form No. 7440A and attached to checklist.

6.0 PERFORMANCE OF WORK

6.1 Perform frequent inspection on hoist. This inspection shall be performed by a qualified hoist operator (MSL-36, per AI-6.4).

6.2 Inspect hoist, trolley and monorail for loose bolts, rivets, cracks, or any other structural damage.

6.3 Inspect all sheaves for cracks or excessive wear.

6.4 Inspect all moving parts (wheels, shafts, gears, etc.) for excessive wear, cracks, or distortion.

6.5 Inspect brakes (linings, pawls, ratches, etc) for wear. See Appendix B.

6.6 Inspect electrical apparatus for signs of pitting or deterioration of control contractors, limit switches, etc.

6.7 Check and set limit switches (under no load conditons) per Appendix C.

6.8 Inspect for excessive wear of lower flange on monrail.

6.9 Inspect drum for wear (use circumference gage).

6.10 Inspect hook for more than 10° twist or throat opening of 15%. See Appendix D.

6.11 QC inspector to perform magnetic particle or dye penetrant test on hook. This inspection shall be performed in accordance with DPM N80E3 (N-MT-1 or N-PT-1). Record of inspection will be attached to this MI data sheets for that hoist.

6.12 Qualified rigger (MSL-18) shall inspect the wire rope as follows:

6.12.1 Rope diameter for reduction per Appendix E.

6.12.2 Wear of one-third the original diameter of the outside individual wire.

6.12.3 Individual broken wires per Appendix E.

6.12.4 Corroded or broken wires at end connections.

6.12.5 Corroded, cracked, bent, worn, or improperly applied end connections.

6.12.6 Kinking, crushing, birdcaging, or other damage to rope.

6.12.7 Any discoloration due to temperature.

6.13 Lubricate hoist per Appendix F (include wire rope). If oil inside gear case is dirty, replace all oil. QC to verify proper oil.

APPENDIX A

LIST OF STANDBY HOISTS IN AUXILIARY BUILDING

ID No.	Location	Type
0-HST-271-AB1	A12U/737	3 ton, Yale, M/N LC3F23S20
0-HST-271-AB10	A5T/737	5 ton, Yale, M/N LD5H25S20
mk 1 0-HST-271-AB11 U-1	A4U/772	5 ton, Yale, M/N LD5H44S20
0-HST-271-AB12	A11T/737	5 ton, Yale, M/N LD5H25S20
mk 8 0-HST-271-AB13	A9W/737	5 ton, Yale, M/N LD5H25S20
mk 1 0-HST-271-AB14 U-2	A12V/772	5 ton, Yale, M/N LD5H44S20
0-HST-271-AB15	A4X4/786	5 ton, Yale, M/N FEW5-80ST 315/12D2
0-HST-271-AB16	A5V/692	5 ton, Yale, M/N LD5H25S20
0-HST-271-AB18	A9W/676	5 ton, Yale, M/N LD5H16520
0-HST-271-AB19	A14Q/713	5 ton, Yale, M/N LD5H25S20
0-HST-271-AB20	A14R/692	5 ton, Yale, M/N LD5H25S20
0-HST-271-AB21	A10R/692	5 ton, Yale, M/N LD5H44S20/7
0-HST-271-AB3	A10R/737	5 ton, Yale, M/N LD5H25S20
0-HST-271-AB45	A10Q/737	5 ton, Yale, M/N LD5H25S20
0-HST-271-AB5	A4U/737	3 ton, Yale, M/N LC3F23S20
0-HST-271-AB6	A5U/757	3 ton, Yale, sidewinder trolley
0-HST-271-AB7	A3S/772	6 ton, Yale, M/N LE6F31E24
0-HST-271-AB8	A11U/757	3 ton, Yale, Sidewinder trolley
0-HST-271-AB9	A13S/772	6 ton, Yale, M/N LE6F31E24

APPENDIX B

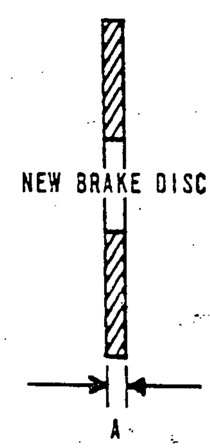
Hook Dimensions

CE AND CA SERIES (Cable King)
ELECTRIC AND AIR HOIST
WIPE ROPE

CAPACITY	CHASSIS (Where Used)	NORMAL	MAXIMUM
1/2	PD & LB	1 1/32	1 7/32
1	PB, LB & PC	1 5/32	1 27/64
1	LC	1 5/16	1 37/64
2	LC	1 5/16	1 37/64
2	PC & PD	1 17/32	1 51/64
3	PD & LD	1 31/32	2 1/4
5, 6 & 7 1/2	D & E	1 31/32	2 11/32
15	E	3 1/2	4 9/64

Load Brake Disc Wear Chart For Electric And Air Hoists

MODEL	A DIMENSION	MAXIMUM WEAR ALLOWED
CE AND CA SERIES (Cable King)	3/16	1/16



APPENDIX C

LIMIT SWITCHES

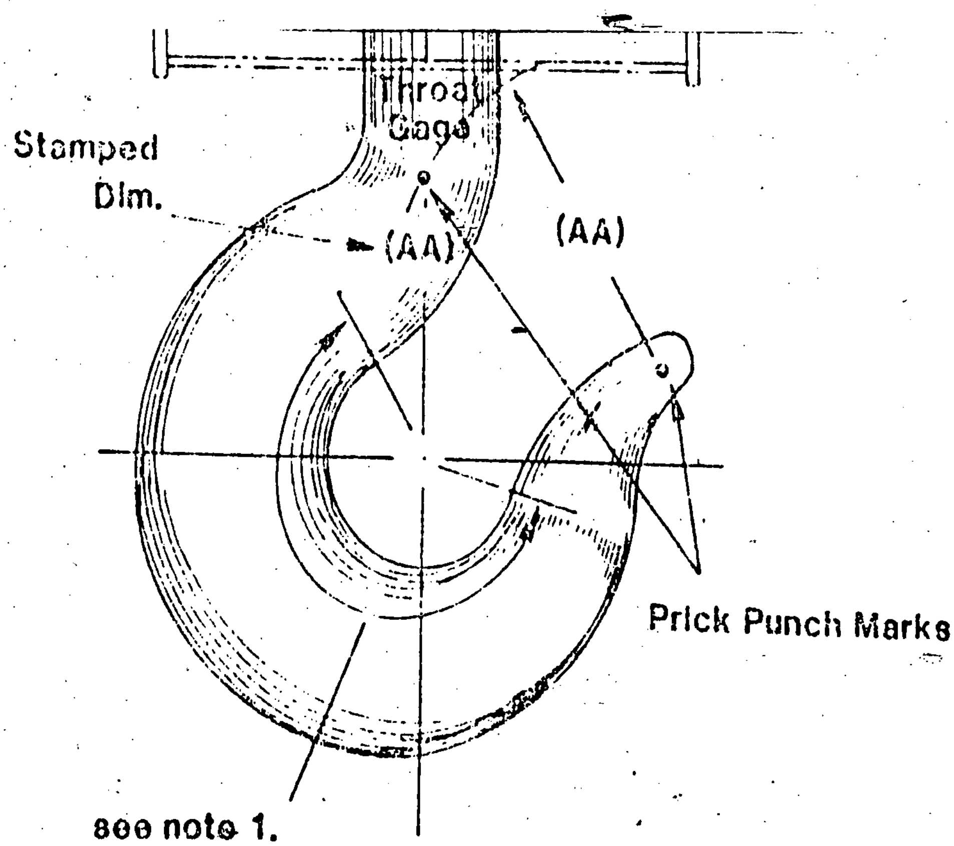
1. PADDLE OR WEIGHT TYPE UPPER LIMIT SWITCH

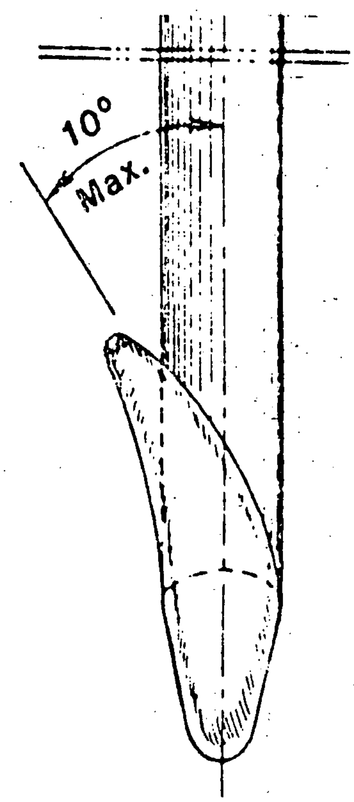
After the hoist is determined to be running in the proper direction, lower the hook to approximately eight feet (8') below the hoist. Check the limit switch by running the hook upward and lifting the paddle or weight by hand. When the paddle or weight is lifted from one-half inch (½") to two inches (2") the hoist should cut off. Any further lifting of the paddle or weight should close the lowering circuit and cause the hook to lower.

2. TRAVELING NUT UPPER AND LOWER LIMIT SWITCH

Check the adjustment of the upper and lower traveling nut limit switches by inching the bottom block to the upper and lower positions. The extreme upper limit is at a point just before the upper plugging limit switch is tripped and the extreme lower limit is in a position where there is no less than 1½ laps of rope remaining on the drum. The upper and lower limits can be set at any point between these two extremes. To adjust these switches, or set them at other desired levels, remove the cover of the switch. Run the unit down noticing the switch toward which the nut travels. Stop the bottom block at the desired lower limit and remove the flat plate under the nuts. Move the nut nearest the switch until it bears against the switch operating lever. Now move the nut gradually until the switch is heard to trip. Replace the flat plate. Repeat the above to set the upper limit.

APPENDIX D





Twisted Hook

FIG 4 Inspection of Crane Hooks

1. No visible transverse cracks permitted in the area shown or in the hook shank.

2. Measure (AA) between prick punch marks. Replace the hook if (AA) measures more than 15% original throat gage stamped on hook.

3. If hook is twisted more than 10°, hook shall be replaced.

APPENDIX E

WIRE ROPE INSPECTION

All wire rope is to be inspected and a dated inspection report maintained. Wire rope should be replaced if any of the following conditions are noted.

1. Six randomly distributed broken wires in one rope lay, or three broken wires in one strand in one rope lay.

2. Wear of (1/3) one third of the original diameter or outside individual wires.

3. Kinking, crushing, birdcaging or any distortion of the wire rope.

4. Evidence of heat damage.

5. Reductions from nominal diameter of more than:

NEW ROPE DIAMETER	MAXIMUM REDUCTION
5/16" and under	1/64"
3/8" thru 1/2"	1/32"
9/16" thru 3/4"	3/64"
7/8" thru 1/8"	1/16"
1¼" thru 1½"	3/32"

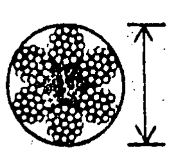
6. Rope sockets should be inspected for broken wires. If broken wires are noted, the rope should be replaced.

CAUTION REPLACEMENT WIRE ROPE SHOULD BE THE SAME SIZE, GRADE AND CONSTRUCTION AS THE ORIGINAL WIRE ROPE. AFTER WIRE ROPE REPLACEMENT CHECK FOR PROPER LIMIT SWITCH OPERATION.

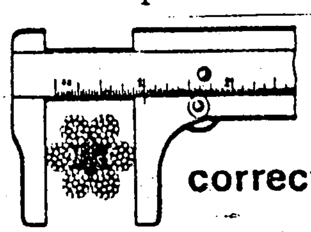
CAUTION ROPE PILE UP ON THE HOISTING DRUM WILL SEVERELY DAMAGE THE HOISTING ROPE. IF THIS CONDITION IS NOTED THE HOISTING ROPE SHOULD BE INSPECTED ACCORDING TO THE PARAGRAPH ON WIRE ROPE INSPECTION. IF DAMAGED ROPE IS FOUND, CHECK DRUM AND FRAME MEMBERS FOR DAMAGE.

HOW TO MEASURE WIRE ROPE

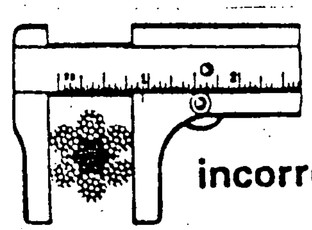
The correct diameter of a wire rope is the diameter of a circumscribed circle which will enclose all the strands. If is the largest cross-sectional measurement as illustrated below. The measurement should be made carefully with calipers. The illustrations below show the correct and incorrect method of measuring the diameter of wire rope.



true diameter



correct



incorrect

APPENDIX F

LUBRICATION DATA

Gear Case (Hoist); ATF-FS; Fill to top plug hole.

Wire Rope; FGC-2; Light coat.

MTR Linkage; STO-1; Light coat.

Wheel gear and pinion; FGC-2; Light coat.

Gear Case (Trolley); TL-140; Level with fill hole - side.

All grease fittings; GP-1, 2 pumps.

DATA PACKAGE COVER SHEET

Reference MR No. ______________________

Performed by: ____________ / ____________ / ________
Title Date

Crack inspection of hook by ____________ / ________
QC Inspector Date

Results reviewed by: ____________ / ________
M. M. System Engineer Date

Results reviewed and approved ____________ / ________
M. M. Supervisor Date

Electrical review ____________ / ________
E. M. Supervisor Date

FQE review ____________ / ________
FQE Supervisor Date

Return to M.M.

REMARKS: ______________________

HOIST INSPECTED: ______________________

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB1

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB10

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB11

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB12

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB13

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB14

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB15

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB16

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB18

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST
IN THE AUXILIARY BUILDING
CHECKLIST

Hoist ID No. 0-HST-271-AB19

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB20

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB21

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB3

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection	______	______	______	______
6.2 (Loose bolts, cracks) structure	______	______	______	______
6.3 Sheaves	______	______	______	______
6.4 Moving parts	______	______	______	______
6.5 Brakes	______	______	______	______
6.6 Electrical	______	______	______	______
6.7 Limit switches	______	______	______	______
6.8 Monorail lower flange	______	______	______	______
6.9 Drum	______	______	______	______
6.10 Hook________ in throat opening	______	______	______	______
6.11 Hook TVA form 7440A attached	______	______	______	______
6.12 Wire Rope________ in diameter	______	______	______	______
6.13 Lubrication	______	______	______	______

COMMENTS:

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PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB45

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB5

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB6

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope ________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB7

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB8

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

PERIODIC INSPECTION OF STANDBY HOIST IN THE AUXILIARY BUILDING CHECKLIST

Hoist ID No. 0-HST-271-AB9

	OK	Needs Attn.	Initial	Date
6.1 Frequency inspection				
6.2 (Loose bolts, cracks) structure				
6.3 Sheaves				
6.4 Moving parts				
6.5 Brakes				
6.6 Electrical				
6.7 Limit switches				
6.8 Monorail lower flange				
6.9 Drum				
6.10 Hook ________ in throat opening				
6.11 Hook TVA form 7440A attached				
6.12 Wire Rope________ in diameter				
6.13 Lubrication				

COMMENTS:

WATTS BAR NUCLEAR PLANT

Maintenance Instruction

MI-271.1

ANNUAL INSPECTION OF
LARGE OVERHEAD CRANES

UNITS 0, 1, 2

CURRENT REVISION LEVEL 4

Prepared By L. N. Calahan

Revised By M. G. Galyon

Submitted By
Supervisor

PORC Review Date 6-14-83

Approved By
Superintendent

Date Approved 6-14-83

Last page of this instruction: 3

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
	Plant Superintendent
	Asst. Plant Supt. (Operations)
	Asst. Plant Supt. (Maintenance)
	Adm. Svs. Supervisor
	Asst. Mechanical Maint. Sup.
	Chemical Laboratory
	Chemical Unit Supervisor
2C	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint. Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Services Supervisor
1C	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint. Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Svs. Supervisor
1C	Mechanical Maint. Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	OPQA - Plant Coordinator
2C&1U	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
1C	Quality Assurance Supervisor
	Reactor Unit Supervisor
1U	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room
1C	Mech. Maint. Shop Office

CTI

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
0	6/2/78		New Instruction.
1	9/7/79	All	
2	7/22/80	Pp 1 thru 14 pg 24	
3	12/22/81	All	
4	6-14-83	All	General Revision. To comply with AI-6.4.

1.0 PURPOSE AND APPLICABILITY

The purpose of this instruction is to describe the procedure for performing the annual inspection of the following (large overhead crane): 1-CRN-270-T1, 2-CRN-270-T1, 0-CRN-271-A1.
125

2.0 REFERENCES

2.1 DPM N74M15 rev. 10/28/82

2.2 ANSI 30.2 - 2.1.3 and 30.2-2.4.1

2.3 AI-6.4 Rev. 0 (1/3/83)

3.0 PREREQUISITES

3.1 Contact the Power Service Shop's Crane Inspector.

4.0 PRECAUTIONS

4.1 Care should be taken to insure that crane will not be operated with people on crane.

4.2 Gloves should be worn when handling wire rope.

4.3 Care should be taken so as not to create a fall hazard.

5.0 PREPARATIONS FOR WORK

5.1 Power Service Shop's Crane Inspector shall perform this inspection.

6.0 PERFORMANCE OF WORK

6.1 The Power Service Shop's Crane Inspector shall be contacted and scheduled to perform the annual inspection.

6.2 The Crane Inspector shall document his inspection on Form TVA 7885 (DF&H-6-81), "Crane Inspection."

6.3 The annual crane inspection shall include the following items:

6.3.1 A frequency inspection

6.3.2 A monthly inspection

6.3.3 All structural components (bolts, rivets, weld, etc.) for cracks, corrosion, looseness, etc.

6.3.4 All sheaves and drums for excessive wear or cracks.

6.3.5 All bearings, shafts, gears, rollers, pins, locking and clamping devices for wear, cracks or distortion

6.3.6 All brakes and braking systems for excessive wear

6.3.7 All wire rope shall be inspected for the following:

6.3.7.1 Reduction of rope diameter

6.3.7.2 Broken wires

6.3.7.3 Worn outside wires

6.3.7.4 Corroded or broken wires at end connections

6.3.7.5 Corroded cracked, bent, worn, or improperly applied end connections

6.3.7.6 Kinking, crushing, cutting, unstranding, or any other damage resulting in distortion of the rope structure.

6.3.7.7 Exposure to temperature sufficient to discolor the wire rope or cause deterioration of any portion of the rope

6.3.7.8 Proper amount of lubricate on rope.

6.3.8 Dye penetrant on magnetic particle. Test shall be performed on all hooks.

6.3.9 Hook inspection for throat opening at 15% or less and twist of 10 degrees or less.

6.3.10 Load indicators over their full range for any significant inaccuracies.

6.3.11 Electrical apparatus for signs of any deterioration of controllers, master switches, contacts, limit switches, and pushbuttons.

6.3.12 Electrical motors, MG sets, drive units, control cabinets, etc., for proper performance.

6.4 Data Cover Sheet

6.4.1 There shall be one cover sheet per crane inspected.

DATA COVER SHEET

ANNUAL INSPECTION OF LARGE OVERHEAD CRANES

Crane ID ____________________ Reference MR No. ____________

Performed by ______________________ / ______________ / __________
Crane Inspector Title Date

Inspector's Checklist Attached (TVA Form 7885) ______________ / __________
Initial Date

Mechanical Review ______________________ / __________
M. M. System Engr. Date

Electrical Review ______________________ / __________
E. M. System Engr. Date

QE Review ______________________ / __________
QE Supervisor Date

Return to Mechanical Maintenance Section

Remarks: ____

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-68.1

REMOVAL AND REPLACEMENT OF REACTOR VESSEL HEAD AND ATTACHMENTS

UNIT 1 OR 2

CURRENT REVISION LEVEL 5

Prepared By S. M. Anthony/R. H. Mills

Revised By L. E. Ottinger

Submitted By J. T. Kirkpatrick
Supervisor

PORC Review Date 9/28/83

Approved By [signature]
Superintendent

Date Approved 9/28/83

Last page of this instruction: 158

1C	Document Control Unit, 1520 CST2-C
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	Asst Mechanical Maint Supv
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	Chemical Unit Supervisor
2C	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Quality Engineering Supv
1C	Field Services Group Supervisor
1C	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Services Supervisor
~~1C~~	Mechanical Maint Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	Plant Program Section Supv
1U/2C	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
	Reactor Unit Supervisor
	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room
~~1C~~	Mech Maint Shop Office

OS/6 - FSG

E14

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
3	83/01/11	Punchlist; pp 3, 4, 15, 17, 18, 23, 66, 82, 83, 84, 132, and 145	Revised to improve instruction and delete some punchlist items
4	83/08/23	4, 41	Changed references on Prevention of Foreign objects from Falling into Reactor Cavity to AI-2.6.
5	9/28/83	All	General revision

PUNCHLIST

1. Obtain two "full-down" measurements for the upper internals from bench marks on the refueling machine. The two points on the upper internal are shown on figure 16. Record the acceptable measurement on Data Sheet E in appendix A.

2. Obtain base line dimensions for the CRDM seismic tie rods. Record on Data Sheet D in appendix A.

3. ASME Code, Section XI, has various requirements for periodic inspection of welds, bolting materials, piping, etc. A determination should be made as to who will track the inspection requirements and how the inspections will be coordinated with the performance of this MI.

J.T. Kirkpatrick
Signature

9/28/83
Date

CONTENTS

1.0 PURPOSE AND APPLICABILITY

This instruction defines the methods and procedures to be utilized in preparing the reactor vessel, reactor cavity, and refueling cavities for normal refueling activities. Also covered are reassembly of all components for normal operation following refueling. This instruction can be performed when the reactor is in modes 5 or 6.

The scope of maintenance tasks required prior to normal refueling is briefly outlined below (not necessarily in sequence).

1. Removal of CRDM missile shields (3 top blocks & 3 gate blocks)
2. Lowering CRDM cable support, removal of turnbuckles (4), and disconnecting cables (3 trays on swing booms)
3. Removal of CRDM seismic platform turnbuckles (6)
4. Removal of UHI restraints (4) and restraint beams (2)
5. Removal of UHI snubbers and brackets (24)
6. Removal of UHI mirror insulation (4 pipes)
7. Removal of UHI spring hangers (3)
8. Removal of UHI valves (4)
9. Disconnecting instrumentation and removal of instrument port conoseals
10. Removal of head flange mirror insulation
11. Installing cavity seal ring
12. Changing gasket on nozzle inspection covers (8)
13. Installing plugs and gaskets on refueling cavity drains (2)
14. Removal of fuel transfer tube blind flange
15. Cleaning (hydrolazing) of reactor cavity and refueling cavity (walls and floors)
16. Detensioning closure head studs and removing studs (54)
17. Installing guide stud sleeves (3) and stud hole plugs (51)
18. Installing guide studs (3)
19. Removal of reactor closure head and changing O-rings

1.0 PURPOSE AND APPLICABILITY (continued)

20. Removal of upper internals

21. Installation of reactor vessel flange protection ring.

Recovery from refueling and reassembly for normal operation involves restoring the equipment above to the initial conditions.

2.0 REFERENCES

2.1 Instruction Manual (4/8/76) 173" I.D. Reactor Pressure Vessel, Westinghouse Electric Corp.

2.2 Operating and Maintenance Manual (7/5/74), Tensioner Model No. 2-5009-1, 7-inch 8N-2A Thread, Biach Industries, Inc.

2.3 SI-4.14

2.4 SI-4.4

2.5 SOI-62.3D

2.6 MAI-16

2.7 AI-2.7

2.8 TI-27, Part III

2.9 FHI-6

2.10 FHI-8

2.11 FHI-10

2.12 TVA Drawings:

47W435-17	Upper Head Injection Piping
47W915-3	Mech. HVAC - CRDM Cooling Ducts
48N1706-1 & 2	UHI Protective Devices
44N265	Plug, Gate, and Missile Shield Handling
44N266	Plug, Gate, and Missile Shield Handling
44N267	Plug, Gate, and Missile Shield Handling
44N268	Nozzle Shield Plug Handling
48N940	Reactor Well Handrail and Missile Shield Anchor Bolts
48W1706-1 thru 13	Structural Steel In Reactor Cavity (Protection Devices)
48N935-2, 3, 4, 5, 17	Misc. Steel Reactor Well Stainless Steel Liners
48N945	Misc. Steel Nozzle Shield Plug
44N293	Seals and Gaskets

2.0 REFERENCES (continued)

2.13 Westinghouse Drawings (contract 71C62-54114-1)

Drawing No.	Title
685J561	Instrument Port Column Seal
1098E58	Reactor Closure Head Lifting Rig
1141E17	Internals Lifting Rig
583F861	CRDM Seismic Support Tie Rod Assembly
1102E71	CRDM Air Cooling Baffle (Lower Chamber)
1102E28	CRDM Air Cooling Baffle (Upper Chamber)

2.14 Diamond Power Drawings (Contract 72C62-92756)

Drawing No.	Title
590009-021CA	Insulation Arrangement
590009-026RB	Insulation Arrangement

2.15 EDS Nuclear Drawings (Contract 74C38-83015)

1-87-XXX (Hanger No. at end)

2.16 MI-270.03

2.17 AI-2.6

2.18 AI-6.4

3.0 PREREQUISITES

Specific prerequisites for each work operation are given in the body of the procedure. General prerequisites are listed below:

3.1 Health Physics shall issue RWPs for all work performed in this procedure. New RWPs shall be obtained prior to commencing work not specifically addressed by the RWP in effect.

3.2 Reactor shall be in the shutdown condition (mode 5) and Reactor Coolant Water temperature shall be below 200°F.

3.3 A spare set of reactor vessel O-rings is in place under the head storage stand. Carrying O-rings into the reactor building and placing them at the stand after the missile shields have been removed is more difficult and should therefore be done while the shields are in place if at all possible.

3.4 Standard and special slings to be used in the performance of this procedure must meet the requirements of AI-6.4.

3.5 Contact Safety Engineer for evaluating transient fire loads.

3.0 PREREQUISITES (continued)

3.6 Verify top of steam generator enclosures are cleared for storage of missile shields and equipment.

4.0 PRECAUTIONS

Specific precautions for each work operation are given in the body of the procedure. General precautions are listed below:

4.1 Reactor Closure Head, Closure Head Studs, and UHI piping will initially be hot and can cause severe burns on contact. Use caution in working near hot surfaces and drape insulating cloth over surfaces if required.

4.2 Do not move loads over the open reactor or above fuel assemblies. Move loads over the upper internals only if absolutely necessary. Move loads over the closure head/CRDM assemby only as required for disassembly and reassembly of head attachments. Refer to AI-6.4 for specific requirements.

4.3 Safety belts and safety lines or lanyards and/or other fall protection safety devices and safeguards shall be used for work activities where there is a potential for falls of over 4 feet.

4.4 Work in the Reactor Cavity and Refueling Cavity shall be covered by a confined space entry permit as addressed by Hazard Control Instruction (HCI-G8) latest revision.

5.0 PREPARATION FOR WORK

5.1 The responsible foreman shall review the task to be performed to ensure that the requirements of AI-2.7 have been met.

5.2 In preparation for performing the refueling procedures, review the special and standard tool lists, locate each tool, and determine if each tool is functional. This may require special testing in some cases, as for the stud tensioners and fast stud spinout tools. All tools required for a specific operation should be brought to the auxiliary building storage area and readied for use prior to commencement of that operation in the Reactor Building.

5.3 Prior to performing a specific operation, the personnel involved should be familarized with the specific prerequisites and precautions for that operation and should study the pertinent reference drawings (see section 2.0) and other reference material. Complex tasks may require training on mock-ups, such as the conoseal disassembly/assembly and tensioning/detensioning operations.

5.0 PREPARATION FOR WORK (continued)

5.4 The following special tools and equipment will be required at some time during the performance of this instruction. These items should be available at the start of vessel disassembly.

NOTE: 1. For tools with mark nos. refer to reactor pressure vessel manual.

2. Calibration required for equipment denoted by @.

3. All tools and equipment which may come in contact with reactor coolant or related components must be approved per TI-35.

Item	Part No.	Quantity	Use
@Depth dial indicator	MK-73 Starret No. 664P or equivalent	1	Obtain initial & final dial readings of stud elongation
Nut Wrench for 7-inch nut	MK-70	1	Rotate closure nut
Plug tool	MK-61	1	Install & remove stud hole plugs
Sleeve tool	MK-61 thru 67	1	Install & remove stud hole sleeves
Guide stud	MK-55	3	Install & remove closure head and internals
Guide stud sleeve with gasket (Parker 2-440)	MK-59/MK-60	3	Install guide stud into stud hole
Lifting eye, guide stud	MK-58	3	Lift & handle guide studs
Lifting eye, closure stud	MK-46	54	Lift & handle closure studs
Elongation rod	MK-68	54	Measure stud elongation (inserted in studs)
Hydraulic tensioners (2,350,000 lbs)	Biach Ind. Model No. 2-5069-1	3	Tension & detension closure studs
@Hydraulic pumping unit with air & hydraulic gages		1	Tension & detension closure studs

5.0 PREPARATION FOR WORK (continued)

Item	Part No.	Quantity	Use
Hydraulic pneumatic & return hoses		1 set	For use during tensioning/detensioning
Stud hole plug with gasket or expanding seal plug		51	Maintain stud hole cleanliness
@Hydraulic pressure gauge 0-10,000 psi with the assembly		1	Measurement of press. for conoseal assembly
Conoseal loading device assembly	882D292GRI	1	Installing/removing conoseals
Conoseal lower gasket removal tool	674C941GRI	1	Removal of gasket from male flange
Conoseal upper gasket removal tool		1	Removal of gasket from instrument column
Fast-stud spinout tool		3	Removal of vessel studs
Portable reactor cavity cleanup system, including pump, filter assembly, and hoses		1	Removal of impurities from reactor cavity water for clarity.
Crane scale, 1,000 lb-2,000 lb range		1	Setting load compensation for fast stud spinout tools
Stud, nut, & washer carriers		9	Store & carry head studs, nuts, & washers (6 each per carrier)
Nozzle shield plugs		8	Nozzle shielding to reduce radiation exposure during refueling operations
Sling MK-44N358-5 for nozzle shield plugs		1	Handling of nozzle shield plugs
Stud support		54	Temporarily supporting studs during stud removal
7-inch diameter wire brush with 3-foot extension rod		2	Cleaning stud holes

5.0 PREPARATION FOR WORK (continued)

Item	Part No.	Quantity	Use
Set of tools in locked box marked "Instrument Port Conoseal" -- consisting of the tools listed in section 5.5 for instrument port conoseal assembly		1	Assembly & disassembly of instrument port conoseals
UHI valve spool piece lifting jig		4	Lifting spool pieces from cavity
Instrument column protective sleeve with locking clip		5	Protection & sealing of instrument columns during refueling
Templates for inspection covers		8	Cutting gaskets & drilling
Closure head stud protective covers 8" DIA x 12" long		6	Protecting top portion of studs during operations which could cause thread damage
Missile shield sling	MK44N267-1	2	Handling of missile shields
Missile shield sling	MK44N267-2	2	Handling of missile shields
Missile shield sling	MK44N267-3	2	Handling of missile shields
Refueling cavity drain plugs		2	Sealing & shielding of RF cavity drains during refueling
Hydrolazer (8,000 psi minimum)		1	Decontamination of cavity
Safety barrier post for reactor and refueling cavities		18	Temporary barriers at edge of cavaties

5.0 PREPARATION FOR WORK (continued)

5.4 (continued)

Item	Part No.	Quantity	Use
Pre-cut angles		1 set	For blocking UHI spring hangers
Air eductor system		1	Venting head
Cavity drain shield plugs		2	
Gray loc blanks		4	Blanking off UHI lines
100 ft. steel tape & plumb bob		1	Taking measurements on internals installation
Snubber & hanger storage boxes		3	Storing UHI snubbers, hangers, & brackets
Portable HEPA filter		2	

5.5 The following standard tools and equipment will be required at some time during the performance of this instruction. This equipment should be ordered and stocked in preparation for refueling to minimize lost time.

NOTE: All tools, equipment and materials which may come in contact with reactor coolant or related components must be approved per TI-35.

Assortment of brass bars, 3/8" diameter to 1" diameter (Approx. 6" long)

2 cases approved silicone grease

5 bundles approved, white, lint-free coths

12 cans approved Nickel Never-Seez lubricant

5 pints approved Graphite/Isopropanol

Five gallons of approved alcohol

Assortment of wire brushes (stainless steel and carbon steel)

Flashlights

Hammers, ballpeen and soft face

Approved plastic bags (clear plastic not allowed)

Approved plastic sheet (clear plastic not allowed)

5.0 PREPARATION FOR WORK (continued)

5.5 (continued)

Assortment of nylon slings

Assortment of wire rope chokers

Assortment of shackles

CSSC torque wrenches (click type): Approximate ranges: 50 ft-lb, 250 ft-lb, 600 ft-lb, 200 in-lb

CSSC temperature measurement device: Approximate range 200°F

Metal or wooden boxes for storage of gaskets, UHI mirror insulation, etc.

Metal boxes for storage of small parts

Approved heat-resistant paint and carbo-zinc 11 paint

Nylon ropes (2 spools of 1/4" nylon rope and 1 spool of 3/4" nylon rope).

Six cases approved white silicone rubber (RTV). NOTE: CLEAR SILICONE rubber is prohibited. Approved per TI-35

One roll of 1/8" thick red rubber gasket material

Wood blocks covered with herculite, as follows:
12 - 2" x 4" x 36"
4 - 2" x 6" x 67"

1/2 ton and 1 ton chain hoists - one each

Hydraulic pumping unit for Instrument Port Conoseal assembly (see Appendix G for approved types)

Two 4-1/4" - 1-1/2" drive sockets for missile shield anchor bolt removal

Two 1-1/2" impact wrenches

Three 2-1/4" open end wrenches for cavity seal ring nuts

Three 2-1/4" - 3/4" drive deep socket for cavity seal ring nuts

One 1-5/8" socket

One 1 1/8" x 8 UNC tap set

5.0 PREPARATION FOR WORK (continued)

5.5 (continued)

One 1/8" x 8 UNC die nut

20 rolls herculite (approved per TI-35)

1 case of approved duct tape

40 rolls of blotter paper

1 can gasket glue B.F. Goodrich # A-1372-B

3 small levels (to check head levelness)

One strap wrench (7" diameter)

Tools for Instrument Port Conoseal assembly (to be kept in a locked box on the refuel floor as follows:

One-6 inch, 1/2 inch drive extension

Two-1/2 inch drive universals

One-2 inch, 1/2 inch drive extension

One-1/2 inch drive, 1-1/4" socket

One-1/2 inch drive, 1-1/8" socket

One-1-1/4 inch combination wrench

One-1-1/8 inch combination wrench

One-6 inch, 1/4 inch drive extension for torque wrench

One-5/16 allen insert socket 1/4 inch drive

One-3/8" to 1/4" socket adapter

One bottle of Graphite/Isopropanol and brushes

One 16 inch adjustable wrench

One-1/2" drive socket wrench

One-3/8" drive socket wrench

Fine sandpaper, scotchbrite #7447, and honing stones

5.0 PREPARATION FOR WORK (continued)

5.5 (continued)

One roll stainless steel wire for lockwiring, 0.030" to 0.035" diameter

Lockwire pliers or equivalent

5.6 The following is a list of spare parts that will be needed to perform this procedure and should be checked for availability prior to starting work. An item not in stock should be ordered on a emergengy basis for receipt prior to the operation requiring the parts. Parts that are replaced must have its part number and "575" or "4421" number recorded on the data sheet in Appendix A.

Item and use	Number Required	Part Number	Comments
Lower conoseal gaskets for instr. ports	5	Aeroquip MGC-67802	
Upper conoseal gaskets for instr. ports	5	Aeroquip 50887-200-S	
Closure head O-rings	One set of 2	30738-1553-29 & 30738-1553-30	
Fuel transfer tube blind flange gaskets	One set of 2	Dwg. 22406-3 P/N 5003, 5006	
Instr. column protective sleeve O-rings	5	1140E34H165	
Underwater light bulbs	10		
Guide stud sleeve O-rings	3	Parker 2-440	
Nozzle inspection cover gaskets - refueling type	8	44N293 MK43 & MK47	Gaskets must be cut per individual cover templates, glued, & drilled (5/8" holes)
Refueling cavity drain plug gasket	2	44N293 MK47	

5.0 PREPARATION FOR WORK (continued)

5.7 The following items may not necessarily require replacement at each refueling. However, they should be checked for availability at the beginning of refueling in case the original parts become defective and cannot be reused. Any part that is replaced must have its part number and material procurement number recorded on the data sheet in Appendix A.

Item and use	Number Used	Part Number	Comments
Nozzle inspection cover gaskets - operational type	8	44N293 MK45 & MK46	Gaskets must be cut per individual templates & glued.
Bolts for nozzle inspection plates	80	1/2" UNC x 1-1/2" long	Commercial stainless steel 18-8
Missile shield gaskets	6		
Head O-ring hold down screws	32	30738-1928-37	
Head O-ring hold down clips	32	30738-1928-36	
Snubber & restraint cotter pins	Assorted		
Transfer Tube Blind Flange bolts	20	1-1/8"-8UN-2A x 3-3/8" long	SA193B7 Chrome plated
Grayloc seal rings for 8" UHI clamps	8	Gray tool P/N 73277	
Stud for 8" Grayloc clamp	32	Gray tool P/N 71627	SA 453 grade 660
Nut for 8" Grayloc clamp	32	Gray Tool P/N 71616	SA 453 Grade 660
Spring clip for instrument column	6	675C077H01	

6.0 PERFORMANCE OF WORK

GENERAL - The following steps are to be performed in conjunction with the Control Instructions in Data Sheet G of Appendix A. The Control Instructions are to be considered the master document for controlling work under this MI. This will ensure proper work verification, inspection, and

6.0 PERFORMANCE OF WORK (continued)

coordination. It is not essential that the performance of any individual step be completed prior to the commencement of subsequent steps provided the completion of each activity is not impaired by the alteration in work sequence, that no prerequisite requirements are violated, and that such work does not interfere with required inspections and verifications. This determination shall be made by the refuel floor coordinator on shift.

6.1 Removal of Missile Shields and Head Attachments

NOTE: Unit 2 locations in parentheses.

PREREQUISITES:

1. A hold order clearance is in effect on all power connections to the closure head assembly as detailed in appendix B.

2. Standard slings to be used in this operation and special slings MK44N267-1, 2, and 3 illustrated in TVA drawing 44N267 have been inspected and are ready for use inside containment.

3. Copies of drawings 44N265, 44N266, 44N267, and 48N940 have been obtained and personnel have been familiarized with these drawings and with applicable figures in appendix D on missile shields and head attachments.

4. The Polar Crane has been inspected per MI 271.1 and is ready for use, with a trained operator stationed in the cab.

5. The prerequisites listed in section 3.0 are satisfied.

PRECAUTIONS:

1. Reactor closure head flange mirror insulation will not hold a man's weight. Do not attempt to stand, walk, or place heavy tools on the insulation.

2. Do not use hard faced hammers to drive out pinned connections. Use only soft faced mallets or brass bars to keep from damaging pins beyond repair.

3. Do not crib under any missle shields, this could result in warpage.

6.0 PERFORMANCE OF WORK (continued)

6.1.1 Remove center missile shield as follows:

1. Remove anchor bolts and hillside washer from center missile shield PC-1 and store hardware (4-1/4" socket required). Store matched bolts and washers together.

2. Remove center missile shield PC-1 using main hook and two slings MK44N267-2. Store as shown on drawing 44N265, clearing as much space as possible on ladder side of south (north) steam generator compartment.

NOTE: Health Physics to monitor all missile shields prior to storage.

3. Remove slings from main hook and leave connected to missile shield, making sure wood is placed under slings to protect paint and the lifting rings are lowered to the horizontal position.

6.1.2 Lower CRDM cable support as follows:

1. Unbolt CRDM cable swing booms from CRDM cable support unit and move booms until they just clear the latch.

2. Unbolt cable support pads from outer two missile shields and store hardware.

3. Fully extend bolts on the bottom of the four legs of the CRDM cable support unit.

4. Support the CRDM cable support unit using jacks or chainfalls to allow all cable support turnbuckle supports to be unpinned from the cable support without adjustment of the turnbuckles. Lower all cable support turnbuckles until they rest against the cavity walls. Replace all pin hardware in brackets.

5. Lower CRDM cable support unit to CRDM platform. Extended bolts on end of legs must sit in holes provided in locating plates.

6.1.3 Remove snubber hanger 87-73 as follows:

1. Install temporary pickboards as required for removal of snubber 87-73.

6.0 PERFORMANCE OF WORK (continued)

6.1.3 (continued)

2. Using approved procedures in MAI-16 as a general guideline, unbolt and remove snubber/bracket/clamp from cavity wall and store all hardware in a preassigned box 87-73. Enter required information in appendix A on Data Sheet C of this instruction.

6.1.4 Disconnect CRDM, RPI, thermocouple instrumentation, tensioner hoist, and loose parts monitoring cables as follows:

NOTE: Refer to figure 7 for cable locations.

1. Notify shift engineer that the electrical connections to the head equipment are to be disconnected and verify hold order on all related systems.

2. Verify cables are properly tagged or marked with the numbers on the cable panels.

CAUTION: The tensioner hoist power input connector is a male plug. Check for voltage on pins any time this plug is disconnected, whether hold order is in effect or not. Install protective cap over pins as a routine procedure.

3. Remove temporary pickboards as necessary to allow 180° cable boom to be swung to cavity wall.

4. Disconnect all electrical connections at the panels on top of the head (see figure 7). It will be necessary to remove wires from loose parts monitoring junction box since no connector is supplied for this system. (Refer to 45N1632-15)

5. Swing cable booms to the cavity wall and tie in place. Place connectors on bottom of blow out cavities so they will not hang over into the reactor cavity.

6.1.5 Remove attachments from underneath outer two missile shields as follows:

NOTE: This section includes removal of all attachments underneath the outer two missile shields except restraints 06-2 and 06-4.

6.0 PERFORMANCE OF WORK (continued)

6.1.5 (continued)

PRECAUTION: To keep track of all hardware used for snubbers and spring hangers, reassemble with hardware prior to storing in pre-assigned boxes. Use temporary nuts on bracket bolts which do not have permanent nuts. Check to ensure that all pins, spacers, nuts, etc. are accounted for prior to closing box.

1. Install scaffolding and pickboards as required for removal of the remainder of the UHI equipment above the CRDM seismic platform.

2. Verify proper marking (steel stencil or otherwise) and color coding of hanger components (per figures 4, 5, and 6).

3. Unclip and remove mirror insulation sections from the four UHI lines between the check valves and elbows.

4. Unbolt and remove UHI restraints 06-1 and 06-3 from underneath restraint beams. Tag and store hardware and restraints.

5. Attach nylon slings to restraint beams, pull slight tension using auxiliary hook and unbolt beams from missile shields. Lower beams to cable support tube steel using wood blocks to support weight of beams.

6. Block under springs of spring hanger cans using pre-cut metal angles to maintain cold position settings.

7. Using approved procedures in MAI-16 as a general guideline, unbolt and remove snubber/bracket 87-33 from under missile shield, snubber/bracket 87-58 from under missile shield, snubber/bracket 87-74 from under missile shield and snubber 87-57 from cavity wall. (Leave 87-57 bracket attached to wall). Enter required information in Appendix A on Data Sheet C of this instruction.

8. Unbolt and remove spring hangers/brackets 87-34, 87-72 and 87-76 from underneath outer two missile shields. Store in preassigned boxes. Enter required information in Appendix A on Data Sheet C.

9. Verify that all attachments have been removed from underneath missile shields except restraints 06-2 and 06-4.

6.0 PERFORMANCE OF WORK (continued)

6.1.6 Remove missile shield over canal gates as follows:

1. Remove and store the anchor bolts from missile shield PC-2 and PC-6.

   NOTE: Health physics to monitor all missile shields prior to storage.

2. Using main hook, hook up to two slings MK44N267-2 located on center missile shield at top of south (north) steam generator compartment and unhook from shield lifting rings, leaving rings in the horizontal (stored) position so they will not interfere with subsequent shields to be stacked on top.

3. Raise PC-2 missile shield using main hook and MK44N267-2 slings until restraint 06-4 will clear missile shield PC-6.

4. Move missile shield PC-2 over missile shield PC-6 until restraint 06-4 is in the center of PC-6.

5. Place plywood under restraint, lower until restraint is just above plywood and unbolt restraint from missile shield.

6. Store PC-2 as shown on drawing 44N265, clearing as much space as possible on ladder side of north (south) steam generator compartment.

7. Unhook slings MK44N267-2 from missile shield PC-2 and store behind shield, laying slings on plywood. Verify that shield lifting rings are in the horizontal (stored) position.

6.1.7 Remove snubbers and brackets from canal gates as follows:

1. Install scaffolding as required for removal of the equipment covered in this section, laying herculite under scaffolding at cavity floor.

2. Using approved procedures in MAI-16 as a general guideline, unbolt and remove snubbers, brackets, plates, and hardware associated with hangers 87-24, 87-25, 87-32, 87-36, and 87-150 and store in preassigned boxes.

6.0 PERFORMANCE OF WORK (continued)

6.1.7 (continued)

3. Verify all hardware has been removed from the canal gates and all scaffolding is clear of the gates. No attachments can be past flush since the blocks must be stacked on top of the steam generator compartments.

6.1.8 Remove canal gates and last missile shield as follows:

NOTE: Health physics to monitor missile shields and canal gates prior to storage.

1. Attach one MK44N267-2 sling to auxiliary hook. (Slings should be located behind missile shield PC-2 on north (south) steam generator compartment.)

2. Attach two MK44N267-1 slings to main hook so that the hooks face in the same direction.

3. Using MK-1 slings and main hook, hook up to top canal gate PC-3 with hooks facing toward equipment hatch. Lift gate upward until clear.

4. Move trolley and bridge until PC-3 is above missile shield PC-6, then lower auxiliary hook and hook MK-2 slings to bottom lifting rings on vertical face of canal gate with hooks facing away from gate.

5. Rotate canal gate to horizontal position using the auxiliary hook, verifying that the hooks are facing as shown on drawing 44N266 during this operation.

6. Place PC-3 on top of PC-6.

7. Repeat steps 3 through 6 for canal gates PC-4 and PC-5 placing them on PC-6 as shown on drawing 44N266 and verifying that lifting rings are left in the horizontal (stored) position.

8. Store slings MK44N267-1 and 2 on north (south) steam generator compartment behind missile shield PC-2, laying slings on plywood to protect paint.

6.0 PERFORMANCE OF WORK (continued)

6.1.8 (continued)

9. Using two slings MK44N267-3 and main hook, store canal block PC-5 on top of missile shield PC-2 on north (south) steam generator compartment and canal blocks PC-3 and PC-4 on missile shield PC-1 on south (north) steam generator compartments (see drawing 44N265).

10. Using two slings MK44N267-3 and main hook, raise missile shield PC-6 until restraint 06-2 will clear floor elevation.

11. Move missile shield PC-6 over floor at end of reactor cavity so that restraint 06-2 is accessible.

12. Place plywood under restraint, lower until missile shield 06-2 is just above plywood and unbolt restraint from missile shield.

13. Store PC-6 as shown on drawing 44N265 on north (south) steam generator compartment (PC-6 may be rotated 180° from plan view to allow more space on ladder side of compartment).

14. Remove slings MK44N267-3 from main hook and leave hooked to missile shield, making sure plywood is placed under slings to protect paint and the lifting rings are lowered to the horizontal position.

15. Install safety barrier posts in bolt holes indicated by black dots on drawing 48N940. String chain or 3/4" rope through eyes in posts. Cover anchor bolt holes with herculite or duct tape if not used for safety posts.

6.1.9 Prepare for work in cavity as follows:

1. Install cavity ladder cage extension.

2. Install temporary safety barrier across end of reactor cavity at gate block slots.

3. Cover floor of cavity with approved herculite, making sure to cover reactor annulus opening so that no foreign material can enter.

6.1.10 Remove restraint beams from cable support and store.

6.0 PERFORMANCE OF WORK (continued)

6.1.11 Begin draining and venting operations as follows. List Hold Order No. in Appendix A, Data Sheet G.

1. Remove UHI vent blanks (8) and RPV vent blank.

2. Coordinate with health physics and operations to vent and drain the vessel beginning at the UHI vent valves on the vessel side of the check valves.

3. When the RPV vent line is above the vessel water level, vent and allow standing water to drain into the vessel, then install air eductor on vent flange and begin operation of eductor system. Eductor is to remain in operation through subsequent disassembly procedures.

4. Coordinate with health physics and operations to vent and drain the UHI lines on the accumulator side of the check valve, leaving vent valves open to atmosphere.

6.1.12 Remove UHI check valve spoolpieces as follows:

1. Notify health physics and the shift engineer that the UHI valves are to be removed and verify that draining operations on both sides of the valve are sufficiently complete to allow removal. Verify hold order on reactor coolant boundary.

2. Install scaffolding as required for removal of the check valves.

Perform the following steps for each of the four check valve spoolpieces.

3. Install the special lifting jig on the check valve cover plate using the tapped holes in the plate and rig with slings to the polar crane until a slight tension is achieved.

CAUTION: The grayloc clamps may be under tension due to springing of the UHI piping. In the following steps, relieve tension with come-alongs as required.

6.0 PERFORMANCE OF WORK (continued)

6.1.12 (continued)

4. Place herculite under grayloc hubs to protect the head from borated water which may drip out when the clamps are removed. Also verify that temporary covers are on hand to close UHI lines (rubber gasket material and tape will be adequate for the vessel side and blank Gray Loc hubs for the accumulator side.)

5. Disassemble the grayloc clamps, label hardware by valve number, and store hardware in boxes after protecting studs with cushioning material.

6. Using come-alongs, deflect the piping as necessary to remove the seal ring easily. Then remove the spoolpiece from the cavity and install the temporary covers at the ends of the UHI piping on the vessel side. Install the Gray Loc blanks on the accumulator side.

NOTE: Maintain system cleanliness until UHI piping is covered.

6.1.13 Remove the CRDM platform seismic ties as follows:

CAUTION: Do not use hard faced hammers to drive pins out of brackets. Use only soft mallets or brass bars.

1. Verify that all ties are properly marked or color coded (see figure 7).

2. Remove scaffolding and pickboards as required to raise or remove seismic ties.

3. For the four short tie rods, drive pins from seismic platform tie brackets and raise ties to the cavity wall. Tie with ropes in the raised position using adjacent brackets as tie points. Reinsert pin and cotter pins in seismic platform brackets.

4. Remove long seismic ties (270° north and south) driving pins from brackets on each end of tie and removing ties from cavity for storage.

6.0 PERFORMANCE OF WORK (continued)

6.1.13 (continued)

5. Reinsert pins and cotter pins in brackets on cavity wall and seismic platform.

6. Remove all scaffolding and pickboards at seismic platform.

6.1.14 Remove all CRDM cooling ducts as follows:

PRECAUTION: Use nylon slings when rigging to lower duct sections. Do not use wire rope tied around duct.

NOTE: Health physics to monitor ducts for contamination.

Refer to figures 2 and 3 for location of ducts. Perform the following steps for each of the two duct assemblies.

1. Mark each duct section north or south prior to disassembly.

2. Install scaffolding as required for disconnecting duct joints.

3. Using the polar crane and the installed lifting angles, rig to the top duct section (square piece) as close to the hook as possible.

4. Disconnect joints from the cavity wall and from the "Y" section on the bottom by loosening wing nuts and rotating swing bolts 90°.

5. Raise and store the square duct section on top of the steam generator compartment on the same side of the reactor building as the duct, taping rubber gaskets to duct joints.

6. Rig to the "Y" duct section and disconnect joints from the branch section at the top and from the shroud at the bottom.

7. Store "Y" section on the steam generator compartment with the square section, taping rubber gaskets to duct joints.

6.0 PERFORMANCE OF WORK (continued)

6.1.14 (continued)

8. Rig to the branch duct section, disconnect joint at shroud and store with other sections. Tape rubber gaskets to duct joints as below.

9. Cover all open ends with herculite and seal with duct tape to prevent the spread of contamination.

6.1.15 Remove all remaining UHI snubbers as follows:

1. Install scaffolding as required for access to equipment removed in this section and for removal of the instrument support conoseals in Section 6.1.16.

2. Using approved procedures in MAI-16 as a general guideline, remove snubbers 87-21, 87-22, 87-23, 87-37, 87-59, 87-60, 87-61, 87-62, 87-63, 87-64, 87-79, and 87-180 and all associated hardware except brackets mounted to cavity wall. Store in preassigned boxes. Enter required information in Appendix A, data sheet C of this instruction.

3. Touch up paint on all wall mounted brackets which will be underwater during refueling using carbo-zinc 11 paint.

6.1.16 Disconnect thermocouple leads and open instrument port columns as follows:

PREREQUISITES:

1. Ensure that personnel have been trained properly on conoseal disassembly by reviewing drawings and by training with an instrument port mock-up assembly.

2. Ensure that the tools listed in Section 5.5 for conoseal work are available and ready for use and that boxes are available for storage of removed parts (Torque wrenches and related parts are not required).

3. RPV head must be vented and free of contaminated gases.

6.0 PERFORMANCE OF WORK (continued)

6.1.16 (continued)

PRECAUTIONS:

1. Handle all parts with particular care to prevent damage which would affect seal integrity. Maintain utmost cleanliness during this operation.

2. During disassembly all parts will have high quantities of loose surface contamination which should be treated accordingly.

3. Inspect for evidence of boric acid crystals. If present, document on which component for future reference.

4. Place all parts removed from each conoseal in a metal box for storage after properly identifying by instrument port number and protecting from damage. (See figure 11 for port numbers.)

INSTRUCTIONS: Perform the following steps for each of the five instrument ports.

1. Notify health physics and the shift engineer that the instrument port conoseals are to be removed. The area should be monitored for increases in airborne activity during this operation and the water level must be maintained well below the conoseal elevation.

2. Install scaffolding as required for the removal of the instrument port conoseals.

3. For one instrument column, tag each side of each instrumentation connection so that correct reconnection is ensured.

4. Disconnect instrumentation connectors above instrument port and tie loose ends out of the way.

6.0 PERFORMANCE OF WORK (continued)

6.1.16 (continued)

INSTRUCTIONS: (continued)

5. Cut safety wire on the conoseal jack screws and dispose of properly in an approved plastic bag.

6. Loosen tightening screws until split ring can be removed. (Two adjacent screws will have to be completely removed and reinserted.)

7. Remove split ring and jack screw plate, identify properly, and place into the metal box with all parts protected against damage.

   NOTE: Verify that each metal box is properly marked to identify that parts for particular columns are stored therein.

8. Disassemble the marmon clamp, identify properly, and store in the metal box with studs and nuts protected against damage.

9. Carefully remove male flange. Conoseals should stay on female flange and the thermocouple support column. Cover the female flange and thermocouple support column. Seal surfaces with a protective cover of soft rags approximately 1/4" thick and apporved duct tape.

10. Store the male flange in the metal box. The sealing surfaces of the male flange must be protected against nicks and scratches by covering with rubber gasket material or other suitable material.

11. Ensure that all parts removed have been properly protected and stored in a properly identified metal box.

6.0 PERFORMANCE OF WORK (continued)

6.1.16 (continued)

INSTRUCTIONS: (continued)

12. Remove temporary protective cover from thermocouple support column sealing surface and install thermocouple protective sleeve, O-ring, and locking clip.

13. Ensure that the protective sleeve is secured by the locking clips at the lower end. Improper installation could result in damage to the instrument column when the reactor head is removed.

14. Repeat steps 2-13 for the remaining instrument ports until all instrument ports have been disassembled and parts stored and protected properly.

15. Remove all scaffolding and equipment from the cavity.

6.1.17 Remove and store reactor vessel head insulation as follows:

NOTE: Health physics to monitor head insulation prior to storage.

PRECAUTIONS:

1. Do not lift insulation with wire rope--use nylon slings or nylon rope.

2. Vessel temperature could be high enough to melt rubber gloves if held in contact. Do not lean against the head.

3. Do not stack insulation in any way which could deform the section. Stack only on end.

INSTRUCTIONS:

1. Unclip and remove all top insulation sections ("S" pieces) beginning at piece 14 (at approximately 0° azimuth). Remove from cavity and store.

6.0 PERFORMANCE OF WORK (continued)

6.1.17 (continued)

INSTRUCTIONS: (continued)

2. Unclip and remove, in reverse order, all side insulation sections ("R" and "Q" pieces) beginning with highest numbered piece. (approximately 0° azimuth). Remove from cavity.

6.2 Preparations for Cavity Flood Up

6.2.1 Install Cavity Seal as follows:

NOTE: When moving the seal by hand or by slings, avoid severe bending or kinking of the seal. Reference TVA drawing 44N293-3.

1. Nylon slings may be used to lift the seals and lower them into position.

2. Locate the valve assembly in the seal retainer first.

3. The valve assembly is equipped with wrench flats that must be used when installing the seal. The wrench flats will prevent damage to the valve assembly when making this air connection.

4. Connect the air supply to the 1/8-27 NPT fitting on the valve stem.

5. Inflate the seal to 30 ±5 PSI operating pressure. (Make sure the seal is properly installed).

6.2.2 Install nozzle shield plugs and inspection plate refueling gaskets as follows:

NOTE: The nozzle shield plugs may be left out at the discretion of the Cognizant Engineer based on radiation field strength and the work to be done.

Refer to figure 8 for location of inspection ports.

1. Notify health physics that inspection plates are to be removed. Arrange for monitoring the area when first plate is removed to determine potential exposure.

6.0 PERFORMANCE OF WORK (continued)

6.2.2 Install nozzle shield plugs and inspection plate refueling gaskets as follows: (continued)

2. Notify shift engineer that inspection plates are to be removed. Request that refuel floor coordinator be informed of any change in vessel water level which may cause increased exposure.

3. Contact instrument section to remove excore instrumentation if necessary.

Perform steps 3 through 8 below for each of the 8 nozzle inspection ports.

3. Lift inspection plate to limit of chains, remove plate gaskets for storage.

4. Remove pins from chain brackets and carefully lower chain into hole using ropes. Tie ropes to chain brackets and reinsert pins with cotter pins in brackets.

5. Lift inspection plate from port and set on blocks (to keep carbon steel brackets from touching the floor).

6. Using sling 44N358 MK5 and polar crane, install nozzle shield plug for the applicable inspection port.

7. Clean gasket sealing surfaces and install refueling gaskets (coated with a thick layer of silicone grease), then set inspection plate back into position over new gasket, making sure that holes in gasket are aligned with holes in plate and that gasket joints are glued properly.

8. Repeat until all eight nozzle shield plugs and inspection plate refueling gaskets are installed.

9. Install all bolts in inspection plates using a light coat of nickel Never-Seez thread lubricant.

10. Tighten all bolts evenly until gasket is compressed.

11. Perform a final check on all plates to ensure that all bolts are tight, and that gaskets are evenly compressed.

6.0 PERFORMANCE OF WORK (continued)

6.2.3 Install refueling cavity drain plugs as follows:

1. Unbolt and remove drain top hat assemblies from cavity drains.

2. Clean cover sealing surfaces and install new gaskets (coated with a thick layer of silicone grease).

3. Install refueling cavity drain plugs.

4. Lubricate bolts with nickel Never-Seez thread lubricant and install.

5. Tighten all bolts evenly until gaskets are compressed.

6. Perform final check to ensure gasket compression and bolt tightness.

6.2.4 Remove fuel transfer tube blind flange as follows:

PREREQUISITES:

1. Obtain SRO permission to remove the fuel transfer tube blind flange.

2. The refueling cavity drain plugs are installed.

3. Fuel transfer tube gate valve closed and hold order in effect on valve.

4. Gate between spent fuel pit and transfer canal installed and transfer canal dewatered.

PRECAUTION: Take extreme care not to damage threads on chromium plated bolts used on transfer tube blind flange.

INSTRUCTIONS:

1. Verify all prerequisites are satisfied for removing the fuel transfer tube blind flange.

2. Using a socket wrench with 1-5/8" socket installed, remove the 1-1/8" bolts and store in a box for reuse.

6.0 PERFORMANCE OF WORK (continued)

6.2.4 (continued)

INSTRUCTIONS: (continued)

3. Lubricate threads on davit stem below stem nut with a light coat of approved nickel Never-Seez.

4. Turn stem nut until blind flange will clear transfer cart tracks.

5. Rotate the davit arm until the blind flange is well clear of the tracks and upender.

6. Remove the two blind flange flexitallic gaskets and discard gaskets.

7. Clean all blind flange and transfer tube external surfaces and check internal portions of transfer tube for foreign objects, blockages, or anything which may interfere with transfer cart travel. Clean as required.

8. As time permits, chase threads on any bolts which had evidence of thread damage using a 1-1/8" - 8 UN-2 die nut.

6.3 Detensioning of Reactor Closure Head

PREREQUISITES: 1. Water temperature 140°F maximum.

2. Inspection plates, ex-core detector covers, cavity seal ring, and refueling cavity drain plugs are installed properly. This is required as a safeguard against flooding of the lower compartment if the vessel water level is inadvertently raised after the studs are detensioned.

3. Tensioners and pump assembly inspected, lubricated, and operability verified (preferably by use of a mockup).

4. Vessel water level no higher than 4 inches below sealing surface.

6.0 PERFORMANCE OF WORK (continued)

6.3 Detensioning of Reactor Closure Head (continued)

5. Closure head, head flange, and closure studs 70°F minimum (See step 6.3.11).

NOTE: This minimum bolt up temperature remains constant throughout vessel life due to relatively low irradiation of the upper vessel.

6. Boron concentration within the limiting condition defined in the Technical Specifications for refueling operations.

7. The reactor closure head has been tensioned for normal full power. If the vessel has been tensioned for hydrostatic testing, refer to the Reactor Vessel Manual for detensioning sequences and pressures.

PRECAUTIONS:

1. Exercise care at all times to avoid damage to threaded parts. When lowering a tensioner onto a stud, protect threads of adjacent studs with protective covers.

2. After studs are detensioned, leakage past vessel O-rings may occur if the water level rises above flange. If this occurs evacuate cavity in an orderly fashion until water level is reestablished below flange.

3. Use only the two lifting eyes provided in the top plate of tensioners for lifting and shifting of each tensioner.

6.3.1 Verify all prerequisites are satisfied and all personnel have been informed of precautions to be taken in the performance of the following work.

6.3.2 Connect tensioner hoist power cable at the 180° cable tray and release hold order for this circuit. Check tensioner hoists for proper operation and limit cut-outs.

6.3.3 Provide work platforms or stands as required for subsequent steps.

6.0 PERFORMANCE OF WORK (continued)

6.3.4 Clean top of flange of all dirt, grease, loose articles, etc.

6.3.5 Remove top inserts from studs and clean all accessible portions of the studs, nuts, and washers until all foreign matter has been removed, especially in the root area of the threads. Store top inserts for later use, protecting threads with cushioning material. Tape hole at top of stud.

6.3.6 Apply a light coat of graphite/isopropanol to the stud threads above the nut.

6.3.7 Using the polar crane rig to the two lifting eyes and carefully lower each tensioner onto a stud as listed below (the colors refer to the painted markings on the stud tensioner hoists).

Red	5
Yellow	23
Blue	41

6.3.8 Install the hydraulic pump assembly in the cavity in the vicinity of the gate guide slots.

6.3.9 Install the hydraulic, pneumatic, and return hoses between the tensioners and pump assembly.

6.3.10 Connect the air supply hose to the pump assembly. Supply pressure should be 100 psi for most efficient operation.

6.3.11 Using a calibrated instrument, measure the temperature of the head flange, head and studs at 3 azimuths around the head. (See figure 1 for measurement points).

6.3.12 Record the minimum of the 3 azimuth temperature readings for each of the measurement locations on data sheet F in Appendix A. These are the initial temperature readings and must be equal to or greater than 70°F. Spot check the temperatures of the required points at approximately one hour intervals during detensioning and immediately stop the detensioning process if any point drops below 70°F.

6.0 PERFORMANCE OF WORK (continued)

6.3.13 Verify that the tensioner pump hydraulic gauge is in calibration. Record required information on Data Sheet F.

NOTE: Prior to lowering stud tensioners over studs in the subsequent steps, check exposed portion of studs for thread damage and repair as necessary.

6.3.14 Beginning with the three studs listed under sequence No. 1 in Appendix A, Table A-1 lower the tensioners down over the stud and nut until the housing rests on the flange. Guide the tensioners as they are being lowered with the two knobs located at the bottom of the tensioner.

NOTE: The drive sleeve for the nut will be riding on top of the nut, and the puller bar will be supported by its spring support mechanism when the tensioner is in the proper position.

6.3.15 Turn the drive gear clockwise until the driving teeth of the drive sleeve matches the slots in the nut and drops into place.

CAUTION: Always turn the drive gear clockwise when engaging the drive sleeve with the nut.

6.3.16 Grasp the handwheel at the top of the puller bar and carefully feel for the thread to engage between the puller bar socket and stud.

6.3.17 Screw on the puller bar until the holding nut bottoms on the spherical washer. Then back off 1-1/2 turns.

6.3.18 Open the release valve on the gauge panel and start the pump by pushing the air valve. After the pump is operating satisfactorily, close the release valve.

6.3.19 Operate the pump until the nuts loosen or to 8,000 psi maximum. Close the air valve and shut down the pump.

6.3.20 Back off the nuts by turning the handle counterclockwise six full turns. Ensure that the nuts have been backed off properly.

6.3.21 Crank open the release valve and slowly decrease the pump pressure to the intermediate pressures given in Table A-1 (or Reactor Vessel Manual - see note below).

6.0 PERFORMANCE OF WORK (continued)

6.3.21 (continued)

NOTE: For detensioning after studs have been tensioned for hydrostatic test, the intermediate values will be as given in Table A (5-1) of the Reactor Vessel Manual (validated copy required). Line through values in Table A-1 and record these values on MI working copy prior to proceeding.

6.3.22 Close the release valve and turn the drive gear handle clockwise to seat the nut. The nut can be seated by backing off crank handle 45° and seating the nut with a sharp rap (approximately 30 ft-lbs) of the crank handle.

6.3.23 Open the release valve and allow the pressure to go to zero.

6.3.24 Remove the tensioners and continue to the next sequence.

6.3.25 Repeat steps 6.3.14 through 6.3.24 in sequence indicated in Table A1 of Appendix A until all studs are unloaded.

6.3.26 Record final minimum temperature of stud, head flange, and head as described in step 6.3.12.

6.3.27 Remove the stud tensioners from the stud and from the cavity for storage after disconnecting all hoses.

6.3.28 Remove pump assembly and all other tensioning equipment from the cavity for storage.

6.3.29 Health physics to monitor all items as they leave the cavity area.

6.4 Removal and Cleaning of Closure Head Studs

PREREQUISITES: The fast stud spinout tools have been tested and lubricated and the air regulator assembly oil reservoir has been filled to the operating level.

PRECAUTIONS: 1. Exercise extreme caution to avoid damage to threaded parts. If damage is sustained to any part of the closure stud nut or washer assembly, note the serial number of the damaged component for subsequent repair.

6.0 PERFORMANCE OF WORK (continued)

6.4 Removal and Cleaning of Closure Head Studs (continued)

PRECAUTIONS: (continued)

2. Turn the stud out of the vessel only when the stud weight is properly counterbalanced by the smoothie.

6.4.1 Lower the 3 fast stud spinout tools, smoothies, air regulator assemblies, and associated hoses into the cavity.

6.4.2 Connect service air to the air supply boxes and connect air lines from the supply boxes to the smoothies and turning devices.

6.4.3 Apply approved graphite/isopropanol to threads of eye bolt (MK 46) and install eye bolts into top of studs. Handtighten.

6.4.4 Hook smoothies to tensioner hoists.

6.4.5 Attach smoothie and turning device to studs 12, 28, and 44. For each smoothie, adjust air regulator until stud spins easily by hand. At this pressure the smoothie is adjusted to counterbalance properly the stud weight. Note this pressure and maintain throughout the stud spinout procedure.

6.4.6 Lower fast-stud spinout equipment over studs beginning with studs 12, 28, and 44 and spin each stud out of hole, keeping smoothie cylinder near mid stroke while spinning stud.

6.4.7 Raise stud out of hole, install stud support, and remove spinout tool.

NOTE: When studs 12, 28, and 44 have been spun out, installation of guide studs (starting with step 6.4.14) can be done in parallel with spinning out of other studs.

6.4.8 Repeat for the remaining studs until all are raised and resting on stud supports.

6.4.9 Remove the fast stud spinout equipment from the cavity for storage.

6.0 PERFORMANCE OF WORK (continued)

6.4.10 Lower the stud carriers into the cavity.

6.4.11 Using the polar crane, or stud tensioner hoists, lift stud, nut, and washers (remove 12, 28, and 44 first) and store in stud carriers (do not remove nuts).

CAUTION: Washers will have to be tied to stud to keep them from dropping off when studs are raised.

6.4.12 Immediately, upon removing studs, install either the guide stud sleeve (MK 55 and O-ring MK 60, applicable to studs 12, 28, and 44) or the stud hole plug and O-ring (applicable to all other studs) as follows:

1. Inspect and clean threads and O-ring grooves in sleeves or plugs.

2. Lubricate male thread on each sleeve or plug and lubricate threads in stud hole wth graphite/isopropanol approximately 9 inches into hole.

3. Install O-ring and lubricate lightly with approved silicone grease.

4. Gently lower the sleeve or plug through the closure head until it rests on the vessel flange.

5. Using the plug and sleeve tool, rotate the plug until hand tight; sleeve should travel down approximately 8-5/8 inches (245mm).

6. Inspect the plug or sleeve to ensure that the O-ring is seated properly.

NOTE: If inflatable stud hole plugs are used, plugs should be inflated only when installed in stud hole, and the inflation pressure should be 70 ±5 psig.

6.4.13 Repeat steps 6.4.12 and 6.4.13 for the remainig studs until all are removed and stored in the racks.

6.4.14 Remove stud carriers from the cavity floor. Transfer out of containment and clean studs as follows:

NOTE: Health physics to monitor each nut, washer and stud prior to cleaning.

1. Remove nut and washer from stud, then remove stud from rack and remove eyebolt from stud.

6.0 PERFORMANCE OF WORK (continued)

6.4.14 (continued)

2. Use a stainless steel or carbon steel wire brush to remove all dirt and foreign matter from both ends of the stud and from the hole in the stud.

3. Repeat for the internal threads and external surfaces of the nut.

4. Using lint free cloths, thoroughly bathe and clean the threads on the studs and nuts with approved alcohol.

5. Thoroughly dry all threads and check for cleanliness. Repeat process until no foreign material is visible.

6. Clean eyebolt and apply graphite/isopropanol to threads.

7. Clean the washer with approved alcohol and lint free cloths.

8. Apply graphite/isopropanol to stud threads, reinstall eyebolt, and place in storage rack.

9. Apply approved graphite/isopropanol to the nut threads and assemble the washer and nut onto the stud, verifying that the stud, nut and washer serial numbers are the same.

   NOTE: Verify that they are placed back together in the same rack. This will ensure that the studs for a particular portion of the vessel are together and will minimize polar crane travel time.

10. Lift the studs as necessary to cover the entire stud, nut, washer, and eyebolt with approved herculite or plastic, taping the top so that no moisture can enter.

11. Mark the plastic with the stud number for later reference.

6.0 PERFORMANCE OF WORK (continued)

6.4.15 Install the three guide studs in holes 12, 28, and 44 as follows:

1. Install a one ton chainfall on the polar crane auxiliary hook for use in handling and lowering the guide studs.

2. Lubricate threads of guide stud eyebolts with approved graphite/isopropanol and install into top of guide studs, verifying that shoulder on eyebolt seats properly.

NOTE: The guide studs are marked either 12, 28, or 44 on the top of each stud for their respective location.

3. Using the chainfall hooked to the eyebolt, lift guide stud, insert through the head flange, and align key with L slot in guide sleeve.

4. With the chainfall, carefully lower guide stud until it is seated in sleeve with weight of guide stud still on chainfall.

5. Temporarily mark guide stud so that rotated position can be determined in subsequent steps.

6. Using a short metal tube or strap wrench, rotate guide stud clockwise approximately 38° until key contacts side of L slot.

7. Disconnect chain fall from guide stud, and remove eyebolt from guide stud.

6.4.16 Verify closure head studs have been removed, and stud holes plugged or guide studs installed.

6.4.17 Obtain hold order clearance for the tensioner hoist power circuit and disconnect cable from 180° cable tray. Check for voltage on pins and install temporary plug covers.

6.5 Final Preparations for Closure Head Removal

PREREQUISITES: All work items in the cavity complete to this point as documented in the Procedure Control Sheets. Continuing work items to be performed entirely outside the cavity do not have to be complete.

6.0 PERFORMANCE OF WORK (continued)

6.5.1 Install cavity lights.

6.5.2 Install portable reactor cavity cleanup system including all discharge and suction piping.

6.5.3 Clean reactor and refueling cavity walls and floor by washing down using broom and hose, wiping as required.

6.5.4 Clean fuel transfer equipment and RCC change fixture.

6.5.5 Clean, check, and lubricate the internals lifting rig as follows:

1. Verify that all bolted connections are tight and all components and welds show no evidence of cracking, deformation, or damage.

2. Verify that the alignment pin guides are in the extended position (lowered).

3. Check protective coating on internals lifting rig and touch up with approved carbo-zinc 11 paint as required where carbon steel surfaces are exposed. Seal all cavities and gaps as required (where painting is not feasible) with approved white silicone rubber.

4. Clean all surfaces on lifting rig as required to remove dust and foreign matter. Clean the pin, bore, and pull rod threads on the rig sling block and lubricate with approved graphite/isopropanol.

5. Check the flange protection ring and internals roto-lock tools for damage. Repair as necessary. Clean thoroughly with approved alcohol and apply approved graphite/isopropanol to threads. Verify that the springs are properly adjusted to counterbalance the weight of the tools.

6.5.6 Perform visual check of the upper internals and lower internals storage stands and verify that all surfaces are clean and bolted connections are secure.

6.0 PERFORMANCE OF WORK (continued)

6.5.7 Perform visual check of the head lifting lugs and vertical legs, verifying that all parts are tight and show no evidence of having been disturbed, deformed, or damaged.

6.5.8 Verify all tape and foreign material has been removed from the cavity walls, blow out openings, vent openings at top of cavity, refueling machine and polar crane.

6.5.9 If unable to seal the cavity with gaskets, seal the edges of the nozzle inspection plates, cavity seal ring, and refueling cavity drain plugs by applying approved white silicone rubber to the gap around the ring or plate to form a bead 1/2" thick (minimum).

6.5.10 Remove the eductor system attached to the head vent and remove all eductor equipment and hoses from the cavity for storage. Tape over the vent flange hole.

6.5.11 Remove temporary covers and tape from the conoseal female flange openings.

6.5.12 Mark guide studs using approved graphite/isopropanol with a one inch band 128 inches above top of head flange.

6.5.13 Remove all portable ladders, tools, equipment and other articles from the cavity which are not permanent fixtures required for refueling operation.

6.5.14 Perform final cleaning of the head flange and CRDM platform to remove loose material and dust which might be dislodged during head removal.

6.5.15 Remove all loose tools, equipment, and other items from the reactor building which will not be required during head removal.

6.5.16 Remove temporary covers from manipulator crane tracks and clean track area.

6.5.17 Perform final cleaning of floor area around cavity.

6.5.18 Perform visual check of head lifting rig, verifying that all welds, structural members and leg adjustment nuts show no evidence of having been disturbed, deformed, or damaged.

6.0 PERFORMANCE OF WORK (continued)

6.5.19 Attach head lifting rig to polar crane by turning sling block pin fully into main hook adapter. Verify pin extends through hole in adapter past flush.

6.5.20 Health physics to monitor all items leaving cavity area.

6.5.21 Raise head lifting rig from stored position and move to head, aligning polar crane bridge rails so that they are parallel with steam generator compartment walls.

6.5.22 Attach head lifting rig to lifting clevices on head by means of the supplied pins, verifying that the rig is in the proper orientation by matching color coded markings on leg and clevis, and verifying that the clevis adjustment has not been disturbed.

6.5.23 Install two new O-rings at the head stand if this has not already been done.

6.5.24 Install at least two levels (approximately 90° apart) on head flange, verify they indicate level, and secure them with silicone rubber.

6.5.25 Perform final QC cleanliness inspection of the reactor and refueling cavities, the reactor head, the manipulator and polar crane, and all upper compartment floor areas, gratings, etc., for loose articles or debris which could become dislodged and fall into the cavity during or after head removal.

6.5.26 Establish control of the reactor building upper compartment in accordance with AI-2.6 to prevent foreign objects from falling into the reactor vessel.

6.6 Removal of Reactor Closure Head and Replacement of O-Rings.

PREREQUISITES:

1. All work in the cavity completed as documented in the Procedure Control Sheets.

2. Functional demonstrations of the fuel transfer system, refueling machine and RCC change fixture completed per (FHI-6).

6.0 PERFORMANCE OF WORK (continued)

6.6 Removal of Reactor Closure Head and Replacement of O-Rings (continued)

PREREQUISITES: (continued)

3. The upper internals storage stand has been inspected and is ready for use, with the flange protection ring in position on the stand.

4. New closure head O-rings are in position at the head stand.

5. The head lifting rig has been inspected and is attached properly to the closure head.

6. Reactor head and reactor coolant degasification is complete (ref. SOI-62.3D).

7. The internals lifting rig has been inspected and is ready for use.

8. Health physics personnel are present, are equipped to monitor radiation levels during head removal, and have issued RWPs for work to be performed.

9. Operations has the necessary personnel assigned and communications established to verify and adjust water level during initial head lifting and thereafter and to check for leakage.

10. The fuel transfer tube blind flange has been removed, the fuel transfer tube gate valve is closed and the fuel transfer canal in the auxiliary building is at the normal level with the transfer canal gate removed.

11. A functional crane scale or load cell is available for monitoring load during head removal.

12. If work is to be performed in the steam generators, all required nozzle covers have been installed properly and checked for leakage.

6.0 PERFORMANCE OF WORK (continued)

6.6 Removal of Reactor Closure Head and Replacement of O-Rings (continued)

PREREQUISITES: (continued)

13. The in-core instrumentation has been retracted and refueling seals installed properly.

14. The plant has established procedures in accordance with AI-2.6 to prevent entry of foreign objects into primary system through an open head.

15. A floatation device is present at the cavity with a minimum of 75 ft. of rope attached.

16. Reactor coolant system integrity has been restored following any system maintenance.

17. Verify equipment access hatch is closed.

PRECAUTIONS:

1. After head removal, tools and equipment should be removed from the reactor vessel area immediately after they are used.

2. Tools and other objects withdrawn from the refueling water may be highly contaminated. Wrap in plastic before storage and store in a specified area. Health physics to survey and attach radiation material tag prior to storage.

3. Avoid undue personnel exposure to the underside of the reactor closure head and verify that all personnel exposed are covered by an appropriate RWP.

4. Refueling water cannot be allowed to touch the head at any time.

5. Rotate the head on the polar crane using only ropes attached to the hook itself or to the lifting rig. Do not apply excessive torque through the lifting rig.

6. Verify all personnel in upper containment are wearing respiratory equipment comparable to that required on head removal RWP until HP surveys determine that the respiratory equipment is not needed.

6.0 PERFORMANCE OF WORK (continued)

6.6.1 Verify that all prerequisites have been completed and personnel have been informed of precautions to be taken in the performance of the following work.

6.6.2 Verify that the shift engineer is ready for the closure head to be removed. Evacuate all unnecessary personnel from the reactor building.

6.6.3 Coordinate with operations to raise the vessel water level to between 4 and 12 inches below the vessel flange.

CAUTION: Monitor the crane scale or load cell during all head lifting operations. If the indication is erroneous at any time, suspend lifting operations until the cause can be determined. Weight of vessel head is approximately 280,000 pounds.

6.6.4 Take a strain on the head lifting rig and verify that it does not ride or bind against any component or part of the closure head.

6.6.5 Raise head approximately one inch and check for levelness by verifying that the guide studs do not bind in the stud holes. If binding occurs, set head back on vessel, determine cause of problem and take necessary action to correct (adjustment of lifting rig, etc.).

CAUTION: Health physics must monitor area during the following operations to ensure safe radiation limits. Operations must monitor source range instrumentation to a head height of 128 inches above the vessel flange. Inspection shall be done under an RWP which covers working under the exposed head.

6.6.6 Slowly raise the closure head approximately 24 inches, checking for levelness as it is being lifted and verifying that guide studs do not bind.

6.6.7 Verify that source range instrumentation indicates that no control rods have been lifted with the head.

CAUTION: Alert health physics and person performing step 6.6.8 of extreme radiation.

6.0 PERFORMANCE OF WORK (continued)

6.6.8 Slowly raise the closure head to a height of approximately 128 inches above the vessel flange (to marks on guide studs); verifying by source range instrumentation and visual inspection with a flashlight that the drive shafts are free in the mechanism housings and were not raised with the closure head.

6.6.9 Evacuate all unnecessary personnel from the refueling cavity.

CAUTION: In the following steps do not allow water to contact head.

6.6.10 Raise the water level in the cavity to just above the flange and verify that the nozzle inspection plates, cavity seal ring, and refueling cavity drain plugs do not leak.

6.6.11 Raise the water level in the cavity to approximately five feet above the vessel flange, verifying that the upper internal guide tubes are submerged under several inches of water.

6.6.12 Complete a HP survey of the refueling elevation to verify that the water level is sufficient for shielding of the upper internals such that negligible background radiation is attributable to this assembly.

6.6.12.1 Install portable radiation monitor in cavity to ensure that fluctuations in water level does not significantly affect dose rates.

CAUTION: In the following step use a herculite covered wood board to block between the head flange and crane wall when positioning the head over the stand. This will ensure that the wall is not damaged by swinging of the head assembly. Personnel shall not get between the head and the wall.

6.6.13 Raise the head assembly clear of the cavity and all obstructions, then move the head to the storage stand, rotating the head assembly on the hook as necessary so that the cable support on top of the head clears the crane wall.

6.0 PERFORMANCE OF WORK (continued)

6.6.14 Coordinate raising of the water level in the cavity to approximately 10 feet above the vessel flange for control rod drive shaft unlatching, and turn on cavity lights.

6.6.15 Lower the head assembly into place on the storage stand, using the 3 floor mounted guides for final positioning. Monitor the load cell indicator or crane scale while lowering the head and stop the operation if a load change is noted before the head seats on the stand.

6.6.16 Reduce the load on the polar crane until the indicated weight equals no load (weight of hook and load cell).

6.6.17 Turn the pin out of the crane hook adapter fully, then raise the hook to the stored position.

6.6.18 Cover and protect instrument port openings with rubber gasket material or equivalent.

6.6.19 Drape the head in herculite or plastic to cut down on the release of airborne particulates if determined necessary by HP.

6.7 Replacement of Closure Head O-Rings

NOTE: Replacement of closure head O-rings below should be performed in parallel with fuel movement as practical, or alternately just prior to head replacement. In any event due concern should be given to O-ring protection after installation and final O-ring inspection must be performed just prior to head replacement.

6.7.1 Verify that a RWP has been issued for replacement of head O-rings.

6.7.2 Remove the O-rings from the head by removing all captured screws and wire clips (see figure 14). Account for all hardware and store in small boxes for reuse. Procure new parts as required if old hardware is damaged. Used O-rings to be scrapped as radioactive material.

6.7.3 Cut O-rings in half and remove from storage stand area. Cut into pieces small enough to fit into a 55 gallon drum and arrange for disposal.

6.0 PERFORMANCE OF WORK (continued)

6.7.4 Clean O-ring sealing grooves as required with clean, lintfree cloths and approved alcohol until all foreign material is removed.

6.7.5 If silver residue is present on the O-ring groove sealing surfaces, remove with scotchbrite or flat Arkansas stones or equivalent fine stones by lightly rubbing over surface. A minimum 1/2" by 1/2" flat stone surface must be in contact with sealing surface at all times.

CAUTION: Take extreme care not to scratch sealing surface.

6.7.6 Remove burrs on the vertical sides of the O-ring sealing grooves using scotchbrite or hard stones per above.

6.7.7 QC Hold Point: Inspect O-ring sealing grooves. The sealing surfaces must be free from nicks, burrs, and scratches which would impair sealing of the closure gaskets. Record inspection results on Data Sheet B.

CAUTION: Use rubber c-zone gloves or soft white lint-free cotton gloves when handling O-rings below. Do not damage soft silver coating on O-rings.

6.7.8 QC Hold Point: Remove wrapper from new inner O-ring and inspect for defects on all surfaces. The O-rings must be free from nicks, burrs, and scratches which would impair sealing. Record O-ring serial numbers in Appendix A, Data Sheet B.

6.7.9 Install inner O-ring in sealing groove using wire clips and screw. Coat screws with graphite/isopropanol prior to insertion.

6.7.10 Remove wrapper from outer O-ring gasket and inspect for defects as above. Record serial number on Data Sheet B in Appendix A.

6.7.11 Install outer O-ring as above.

6.7.12 Check all screws for tightness, exercising care not to overtighten screws to prevent shearing of screw shaft.

NOTE: The following step must be performed just prior to installation of the closure head.

6.0 PERFORMANCE OF WORK (continued)

Hold Point: QC Inspector

6.7.13 Perform final inspection of O-ring installation. Verify O-rings have not sustained damage and all screws and wire clips have been installed properly. Verify that screws do not protrude below the head seating surface by signing in Appendix A, Data Sheet B.

6.8 Removal of Upper Internals

PREREQUISITES

1. All control rod drive shafts have been unlatched and verified per (FHI-10).

2. The reactor cavity water level is being maintained in a stable condition.

3. The upper internals lifting rig has been inspected, cleaned, and lubricated per section 6.5.5 and is ready for use.

4. A functional crane scale or load cell is available for monitoring load during upper internals removal.

PRECAUTIONS:

1. Do not submerge the polar crane load cell at anytime. If it is accidentally submerged, it should be dried, reinspected, and rezeroed.

2. Exercise care when turning the engagement tools into the upper internals and protection ring assemblies. Turn slowly to prevent galling. If drag occurs, work tube back and forth until drag dissipates.

3. Avoid any contact with the CRD shafts when moving the lifting rig or upper internals package.

4. Monitor crane scale or load cell when performing lifting or lowering operations and suspend operation if sudden load changes occur.

5. While transporting the internals, observe clearance between guide studs, cavity walls, and internals package. Stop crane movements if there is any doubt package will clear.

6.0 PERFORMANCE OF WORK (continued)

6.8 Removal of Upper Internals (continued)

PRECAUTIONS: (continued)

6. Any equipment taken from the vessel and moved above water level shall be cleaned, kept covered, or kept wet to prevent the release of airborne activity.

6.8.1 Verify all prerequisites are satisfied and personnel have been informed of precautions to be taken in the performance of the following work.

6.8.2 Move refueling machine adjacent to internals lifting rig, then transfer two men to the internals lifting rig platform.

6.8.3 Attach upper internals lifting rig to polar crane by turning pin fully into load cell adapter. Verify that pin extends through hole in adapter past flush. Tighten rod locknut.

6.8.4 Attach ropes to main hook or lifting rig for rotating lifting rig assembly in subsequent steps.

6.8.5 Install the 3 top handles on the flange protection ring engagement tools and remove locking pins.

6.8.6 Push down the flange protection ring engagement tools, turn counterclockwise into the L slot in the engagement tool sleeve and then install the locking pins to hold tools in engaged position.

6.8.7 Remove tools and evacuate personnel from platform.

CAUTION: In the following step verify the tensioner hoists on the closure head do not interfere with the upper refueling machine beam.

6.8.8 Move refueling machine to far end of reactor cavity so that mast is in recessed slot of cavity wall.

6.8.9 Raise lifting rig with flange protection ring installed until it clears guide studs on storage stand.

6.0 PERFORMANCE OF WORK (continued)

6.8.10 Continue raising lifting rig and moving it towards the reactor vessel until the rig is positioned over the reactor vessel guide studs.

6.8.11 Using handlines align lifting rig guide brackets with vessel guide studs and lower rig until it is seated on the upper internals package and all weight (including rig weight) has been removed from the polar crane.

6.8.12 Station two men on internals lifting rig platform. Disconnect load cell adapter from lifting rig and raise hook clear of rig.

6.8.13 Disengage flange protection ring engagement tools by removing locking pins and releasing engagement tool from L slot in sleeve. The engagement tools should spring up to the released position.

6.8.14 Remove the top handles from the flange protection ring engagement tools and install them on the internals engagement tools.

6.8.15 Push down the internals engagement tools and turn the key into the L slot in the engagement tool sleeve, then install the locking pins to hold tools in engaged position.

6.8.16 Lower load cell adapter onto lifting eye and connect to lifting rig. Remove all tools and evacuate personnel from platform.

6.8.17 Notify the shift engineer and health physics that the upper internals package is ready to be lifted. Verify that source range instrumentation is being monitored in the control room and the shift engineer is ready for the upper internals to be removed. Coordinate raising of water level to normal refueling level during removal operation.

CAUTION: Monitor the load cell and suspend lifting operations if the indication is erroneous at any time. Weight of the upper internals is approximately 180,000 pounds.

NOTE: Health physics to monitor area during movement of internals for increase in radiation levels.

6.0 PERFORMANCE OF WORK (continued)

6.8.18 Begin raising water level and lifting upper internals from reactor vessel while monitoring source range instrumentation. Suspend lifting operation if abnormal indication occurs. Maintain sufficient water level to keep upper internals guide tubes submerged.

6.8.19 When the upper internals package clears vessel flange, verify that no control rods are attached to the package. Suspend lifting operation and notify the shift engineer immediately if a rod is still attached.

6.8.20 Continue raising the upper internals package until it will clear cavity seal ring and lifting rig guide brackets are above reactor vessel guide studs.

6.8.21 Move the upper internals over the upper internals storage stand and align the guide brackets with the stand guide studs.

6.8.22 Lower the upper internals onto the stand until it fully seats and all weight has been removed from polar crane.

6.8.23 Move refueling machine to internals lifting rig to allow personnel to climb onto platform for disconnecting polar crane.

6.8.24 Disconnect lifting rig from polar crane by turning pin out of crane hook adapter fully, then raise main hook to stored position.

6.8.25 Notify the shift engineer that the upper internals have been removed and stored and the flange protection ring is in position on the reactor vessel flange.

6.8.26 Remove all tools and equipment from around the reactor and refueling cavites in preparation for fuel movement.

6.9 Installation of Upper Internals

PREREQUISITES: 1. The lower internals package is installed in the reactor vessel and all fuel movement is complete.

6.0 PERFORMANCE OF WORK (continued)

6.9 Installation of Upper Internals (continued)

PREREQUISITES: (continued)

2. The internals lifting rig is engaged into the upper internals package on the upper internals storage stand.

3. Cavity water level is at the normal refueling level (749' 1-1/2").

4. The fuel transfer tube gate valve is closed.

PRECAUTIONS: See Precautions in Section 6.8

6.9.1 Notify shift engineer and health physics that the upper internals are to be replaced and verify that all Operations Prerequisites and Maintenance Prerequisites are satisfied for this task.

NOTE: Health physics to monitor area during movement of internals for increase of radiation levels.

6.9.2 Move refueling machine to internals lifting rig to allow personnel to climb onto platform for attachment of lifting rig to polar crane.

6.9.3 Attach upper internals rig to polar crane by turning pin fully into main hook adapter. Verify that pin extends through hole in adapter past flush.

6.9.4 Attach ropes to main hook for rotating lifting rig assembly in subsequent steps.

6.9.5 Evacuate personnel and remove tools from lifting rig platform.

6.9.6 Move refueling machine to end of reactor cavity so that mast is in recessed slot of cavity wall (approximate 90° azimuth).

CAUTION: In the following step, suspend lifting operations if the indicated weight is erroneous. Weight of upper internals is approximately 180,000 pounds.

6.9.7 Raise upper internals package from storage stand until guide tubes on package are within one foot of water level. The CRD shafts will protrude from the water.

6.0 PERFORMANCE OF WORK (continued)

6.9.8 Move upper internals over reactor vessel, verifying that the package clears the cavity seal ring and the lifting rig guide brackets clear reactor vessel guide studs.

6.9.9 Using handlines attached to crane hook, align lifting rig guide brackets with vessel guide studs and lower internals package into reactor vessel until it seats, monitoring load cell or crane scale during this operation to verify that no binding occurs.

6.9.10 Station two men on platform for disconnecting internals lifting rig in the following steps.

6.9.11 Disengage rotor-lock tools by removing locking pins and releasing engagement tool from L-slot in sleeve. The engagement tools should spring up to released position.

6.9.12 Transfer the top handles to the flange protection ring engagement tools, then engage and lock the flange protection ring as in step 6.8.6.

6.9.13 Verify internals engagement tools are properly disengaged and flange protection ring engagement tools are properly engaged.

6.9.14 Remove tools and evacuate personnel from internals lifting rig platform.

CAUTION: Discontinue lifting operation in the following step if the indicated weight is erroneous.

6.9.15 Raise lifting rig with flange protection ring installed until the lifting rig guide brackets clear guide studs.

6.9.16 Move lifting rig over upper internals storage stand and align guide brackets with stand guide studs.

6.9.17 Lower lifting rig onto stand until it seats and all weight has been removed, monitoring load cell or crane scale during this operation to verify that no binding occurs.

6.9.18 Move manipulator crane adjacent to internals lifting rig, then transfer two men to the internals lifting rig platform.

6.0 PERFORMANCE OF WORK (continued)

6.9.19 Disconnect lifting rig from polar crane by turning pin out of ~~crane~~ hook adapter fully, then raise main hook to stored position.

6.9.20 Using a steel tape and plumb bob, measure the distance from the manipulator crane upper handrail to the top of the upper internals and record results on Data Sheet E. (See Figure 16 for measurement locations).

6.9.21 Notify the shift engineer that the upper internals package has been reinstalled.

6.10 Installation of Reactor Closure Head

PREREQUISITES:

1. The upper and lower internals have been installed properly and full length CRD shafts have been latched.

2. The fuel transfer gate valve is closed.

3. Decontamination equipment for reactor and refueling cavities is present and operational and spray equipment ready for wetting cavity walls.

4. Shift engineer notified that vessel head is ready to be replaced and communications established with control room for head replacement operation and adjustment of cavity water level. Shift engineer to verify mode 5 requirements satisfied.

5. Health physics personnel are present, are equipped to monitor radiation levels during head replacement, and have issued RWPs for work to be performed.

6. Closure head O-rings have been installed and are ready for final inspection.

7. A functional crane scale or load cell is available for monitoring load during head installation.

PRECAUTIONS:

1. Do not allow closure head to ride or bind on the guide studs, since this could result in damage to the guide studs and stud holes in the vessel and head.

6.0 PERFORMANCE OF WORK (continued)

6.10 Installation of Reactor Closure Head (continued)

PRECAUTIONS: (continued)

2. Avoid undue personnel exposure to the underside of the reactor closure head and verify that all personnel exposed are covered by an appropriate RWP.

3. Refueling water cannot be allowed to touch the head at any time.

4. Cavity lights must be turned off before they are uncovered during draining operations.

6.10.1 Verify that all prerequisites are satisfied and personnel have been informed of precautions to be taken in the performance of the following work.

6.10.2 Clean all external surfaces of the head assembly as required to remove all loose dust and foreign matter which could be dislodged during head replacement.

6.10.3 Clean the stud holes in the head flange as required to remove all oil residue, dust, and foreign matter.

6.10.4 Attach head lifting rig to polar crane by turning pin fully into main hook adapter. Verify pin extends through hole in adapter past flush.

6.10.5 Position tensioner hoists at equal spaces around head.

6.10.6 Attach ropes for rotating head in subsequent steps.

6.10.7 Perform final inspection of the closure head O-ring installation per step 6.7.13.

6.10.8 Remove protecting covers from instrument ports.

6.10.9 Verify levels are still positioned at two level points on top of head flange approximately 90° apart and final preparations for installing the closure head are complete.

CAUTION: In the following step, suspend lifting operations if the indicated weight is erroneous. Weight of vessel head is approximately 280,000 pounds.

6.10.10 Raise head until it just clears storage stand and verify that the head is still level.

6.0 PERFORMANCE OF WORK (continued)

6.10.11 Coordinate draining of cavity to approximately 5 feet above the vessel flange with the RCC guide tubes just submerged. Wet cavity walls to keep airborne contamination down.

6.10.12 Raise head clear of storage stand and all obstructions and move head to reactor cavity. Align head directly over reactor vessel with polar crane bridge rails parallel with steam generator compartment walls.

6.10.13 Rotate head as required and lower until stud holes 12, 28, and 44 are directly over their respective guide studs.

CAUTION: In the following steps do not allow water to contact head.

6.10.14 Lower head over guide studs slowly, monitoring crane scale or load cell to verify that no binding occurs. Stop lowering when the head is approximately 128 inches above vessel flange (the marks on guide studs should be visible above head flange).

6.10.15 Continue lowering water level to approximately 4 inches below vessel flange.

6.10.16 Verify health physics is prepared to monitor flange area in the following steps and has issued RWP for work to be performed.

6.10.17 Verify with a flashlight that all CRD shafts and instrument columns align properly with their guides while lowering head to approximately one foot above vessel flange.

6.10.18 Clean the vessel flange of water and foreign materials with clean, white, lint-free cloths, and isopropanol alcohol, or D.I. water as required.

HOLD POINT: QC Inspector

6.10.19 Inspect the reactor vessel mating surface. The sealing surfaces must be free from nicks, burrs and scratches which would impair sealing of the closure gaskets. Minor burrs and scratches can be removed with scotchbrite or flat Arkansas stones, or equivalent fine stones, by lightly rubbing over surface. A minimum 1/2" by 1/2"

6.0 PERFORMANCE OF WORK (continued)

6.10.19 (continued)

flat stone surface must be in contact with sealing surface at all times. QC inspector to record inspection data on data sheet B in Appendix A.

6.10.20 Continue lowering head until it seats on reactor vessel.

6.10.21 Remove weight of head assembly from polar crane but leave weight of lifting rig. The clevis pins should be loose in the clevises. (Head lifting rig weighs 8,000 lbs.)

6.10.22 Remove clevis pins, raise lifting rig from head and reinstall pins in rig eyes.

6.10.23 Move lifting rig to head stand area and set on blocks to store.

6.10.24 With the lifting rig weight off the polar crane, disconnect rig by turning pin out of main hook adapter fully, then raise main hook to stored position.

6.10.25 Place protective covers over instrument port female-flange and tape.

6.11 Cavity Decontamination and Preparation for Maintenance

PREREQUISITES:

1. Head in place on reactor vessel and lifting rig disconnected.

2. Water spray system in operation to keep cavity walls wet until decontamination is complete.

3. An 8,000 psi minimum hydrolazer system ready and hooked up, a two-man skip box on hand, and trained personnel present for operating the hydrolazer equipment.

PRECAUTIONS:

1. Hydrolazer guns produce a reaction force when turned on which can cause the operator to lose balance. Always verify that safety belts are attached and operator is properly braced before operating gun.

6.0 PERFORMANCE OF WORK (continued)

6.11 Cavity Decontamination and Preparation for Maintenance (continued)

PRECAUTIONS: (continued)

2. Hydrolazer spray jets are extremely dangerous. They will cut through clothes, shoes, and flesh. Treat hydrolazer equipment with due respect and point guns only in the direction of equipment to be cleaned.

3. A person must be present at the hydrolazer pump whose sole job is to turn the pump on and off. He shall not be allowed to leave the pump while it is on.

6.11.1 Protect the head and CRDM assembly from water spray by wrapping herculite blankets around the entire circumference from seismic platform to vessel flange.

6.11.2 Maintain water level at just below reactor cavity floor (approximately 724 feet).

6.11.3 Begin hydrolazing of cavity walls beginning at top of reactor cavity and proceeding to floor of reactor cavity around head (include all wall area above cavity floor 725 elevation). Hose wall off prior to hydrolazing to remove gross activity which will reduce airborne radioactivity during hydrolazing.

6.11.4 Hydrolaze refueling cavity walls down to water level while commencing draining of refueling cavity.

6.11.5 Continue hydrolazing walls while reducing water level in cavity until cavity floor is exposed and can be hydrolazed.

6.11.6 Maintain water spray on cavity walls and floor area which cannot be sufficiently hydrolazed from polar crane due to inadequate crane travel. Continue decontaminating these areas in parallel with subsequent procedures using hose and broom from rope-falls until water spray can be removed without causing excessive airborne contamination levels.

6.11.7 Install temporary barrier at end of reactor cavity between gate block slots.

6.11.8 Decontaminate and remove portable reactor cavity cleanup system suction and discharge hoses, and store for future use.

6.0 PERFORMANCE OF WORK (continued)

6.11.9 If necessary, thoroughly dry reactor cavity floor and line floor with herculite.

NOTE: If necessary, the equipment hatch door may be opened at this time (using approved instruction 270.03).

6.12 Installation of Closure Studs

PREREQUISITES:

1. Vessel water level no higher than four inches below flange.
2. Decontamination of reactor cavity walls and floor complete.
3. All studs, nuts, and washers have been cleaned, lubricated and wrapped in plastic, and in the correct stud racks with nut and washer assembled on stud.

PRECAUTIONS:

1. If vessel water level rises above vessel flange, water may leak past O-rings. If this occurs, evacuate cavity in an orderly fashion until level is reestablished below flange.
2. Exercise extreme caution to avoid damage to threaded parts.
3. Turn studs into vessel only when stud weight is properly counterbalanced by the smoothie.

6.12.1 Verify all prerequisites are satisfied and all personnel have been informed of precautions to be taken in the performance of the following work.

6.12.2 Connect tensioner hoist power cable at the 180° cable tray and release hold order for this circuit. Have power turned on and check tensioner hoists for proper operation and limit cutouts.

6.12.3 Provide work platforms or stands as required for the following work.

6.12.4 Remove stud hole plugs using the stud hole plug handling tool and store for later use.

NOTE: Removal of guide studs can be done in parallel with subsequent steps (see step 6.12.24).

6.0 PERFORMANCE OF WORK (continued)

6.12.5 Using a 7" tube brush or equivalent, dry and clean stud holes until all foreign matter has been removed. Check holes and chase threads per instruction in Appendix H if required.

6.12.6 Lubricate stud holes with approved graphite/isopropanol.

6.12.7 After each hole has been cleaned and lubricated cover vessel flange hole with herculite.

6.12.8 Lower stud carriers into cavity positioning carriers by stud numbers.

6.12.9 Using the polar crane, or stud tensioner hoist, lift each stud from the carriers, remove plastic, and place in correct vessel hole sitting on stud support (except for guide stud holes).

6.12.10 Remove stud carriers from cavity floor.

6.12.11 Lower the three fast stud spinout tools, smoothies, air regulator assemblies, and associated hoses into cavity.

6.12.12 Connect service air to air supply boxes, and connect air lines from supply boxes to smoothies and turning devices.

6.12.13 Hook smoothies to tensioner hoists and hook onto lifting eyes of random studs.

6.12.14 Attach each smoothie and turning device to a stud and raise stud out of hold. For each smoothie, adjust air regulator until stud is suspended from smoothie with cylinder at midstroke. At this pressure the smoothie is adjusted to counter-balance properly the stud weight. Note this pressure and maintain throughout the stud spinout procedure.

6.12.15 Remove stud support.

6.12.16 Make final check of stud hole cleanliness and lubrication. Verify hole is dry. If hole is wet or shows evidence of rust or foreign matter, it must be recleaned and relubricated prior to installing the associated stud.

6.0 PERFORMANCE OF WORK (continued)

6.12.17 With smoothie cylinder near midstroke, lower each stud into hole slowly until stud contacts top of hole threads.

6.12.18 Begin threading stud into hole by hand and verify stud has started straight (at least three full threads).

6.12.19 Spin stud into hole using turning device while maintaining smoothie cylinder at near midstroke (approximately 85 turns total).

6.12.20 Seat stud in vessel flange, verifying clearance between nut and washer.

6.12.21 Back off stud 1/4 inch from seat by turning back (counterclockwise) 720 degrees or two full turns of stud.

6.12.22 Immediately mark the top surface of stud so that any movement from the back-off position can be detected.

6.12.23 Remove eyebolt from top of stud and tape over hole.

6.12.24 Remove each of the guide studs and sleeves in holes 12, 28, and 44 as follows:

1. Lubricate threads of guide stud eyebolts with approved graphite/isopropanol and install into top of guide studs, verifying that shoulder on eyebolt seats properly.

2. Install a one-ton chain fall on the polar crane auxiliary hook for use in removing guide studs.

3. Temporarily mark guide stud so that backed-off position can be determined in subsequent steps.

4. Hook the chainfall to the eyebolt, and with the chainfall apply an upward force to the guide stud while rotating stud counterclockwise approximately 38 degrees to center key in L slot of sleeve. (Use a short metal tube or strap wrench to rotate).

5. Using the chainfall, raise guide stud until the bottom of the stud is within head flange.

6.0 PERFORMANCE OF WORK (continued)

6.12.24 (continued)

6. Using polar crane, remove guide stud from head flange.

7. Remove guide stud sleeve using sleeve tool.

8. Clean and lubricate stud hole and install stud as previously instructed.

6.12.25 Remove fast stud spinout equipment and all stud carriers from containment for storage.

6.12.26 Health physics to check contamination levels of all equipment used in cavity area.

6.13 Tensioning of Reactor Closure Head

CAUTION: Vessel closure head is to be tensioned for normal full power, not hydrostatic testing. Refer to Reactor Vessel Manual for tensioning pressures and sequences for hydrostatic testing.

PREREQUISITES

1. All studs, nuts, and washers installed.

2. The tensioner pump assembly and the three tensioners checked, lubricated, and operability verified by use of a mockup or by recent use in detensioning.

3. Verify with operations, vessel water level no higher than four inches below sealing surface and stable.

4. Vessel water temperature between 80°F and 120°F and stable.

5. Closure head, flange, and closure studs 70°F minimum. See figure 11 for temperature measuring locations.

NOTE: This minimum boltup temperature remains constant throughout vessel life due to relatively low irradiation of the upper vessel.

6.0 PERFORMANCE OF WORK (continued)

6.13 Tensioning of Reactor Closure Head (continued)

PRECAUTIONS:

1. Exercise care at all times to avoid damage to threaded parts. When lowering a tensioner onto a stud, protect threads of adjacent studs with protective covers.

2. Use only the two lifting eyes provided in the top plate of tensioners for lifting and shifting of each tensioner.

3. Keep holes at top of studs covered at all times to keep foreign matter from entering.

4. Use only the supplied Biach tensioners when performing this procedure. The use of any other type or quantity of tensioners invalidates the sequences and pressures defined herein.

6.13.1 Verify that all prerequisites have been satisfied and all personnel have been informed of precautions to be taken in the performance of the following work.

6.13.2 Check the exposed portion of stud threads for damage. Repair as necessary.

6.13.3 Lower box containing elongation rods into cavity.

6.13.4 Check each hole in stud for cleanliness and install a clean elongation rod into each, taking care not to drop rods into holes.

6.13.5 Replace tape over hole.

CAUTION: In the following step, take extreme care when handling the gauge extension rods. If bent at all they will not be usable.

6.13.6 Using the polar crane and stud tensioner hoists carefully lower each tensioner onto a stud so that when finished each of the three tensioners is on one of the studs listed below (the colors refer to painted markings on tensioner hoists).

Red - 5 Yellow - 23 Blue - 41

6.13.7 Install the hydraulic pump assembly in cavity on gate block side. Record hydraulic gauge information on Data Sheet F in Appendix A.

6.0 PERFORMANCE OF WORK (continued)

6.13.8 Install hydraulic and relief return hoses between tensioners and pump assembly.

6.13.9 Connect air supply hose to pump assembly. Supply pressure should be 100 psi for most efficient operation.

6.13.10 Verify that all studs, nuts, and washers have been installed a minimum of six hours and all elongation rods have been installed a minimum of two hours.

6.13.11 Using a calibrated instrument, measure temperature of head flange, head, and studs at three azimuth locations around the head (see figure 11 for measurement points).

6.13.12 Record on data sheet F in Appendix A the minimum of the three azimuth temperature readings for each of the measurement locations. These are the initial temperature readings and must be equal to or greater than 70°F. Spot check the temperatures at the same locations at approximately one-hour intervals during tensioning and immediately stop the tensioning process if any point drops below 70°F. Also, stop the tensioning process if an appreciable rise in temperature is noted.

6.13.13 Notify the shift engineer tensioning is ready to begin. Verify vessel water temperature is between 80°F and 120°F, and request notification if temperature leaves this range.

NOTE: In the following steps discontinue tensioning if the water temperature drops below 80°F or exceeds 120°F. The cognizant engineer will then determine if tensioning can continue, based on temperature stability and time gradient. Tensioning can be performed at a water temperature between 70°F and 180°F if stability is sufficient and metal temperatures are within specification.

6.13.14 Obtain initial (no Load) elongation readings of each stud as follows:

1. Remove tape and clean top of stud of tape residue and other foreign water. Remove nicks or burrs from stud surface as required.

6.0 PERFORMANCE OF WORK (continued)

6.13.14 (continued)

2. Using the hand held CSSC dial indicator (MK-73), place indicator on stud so that stem touches approximate center of elongation rod and dial is tangent to vessel. Record CSSC information on data sheet F in Appendix A.

3. Keeping dial face tangent to vessel, move indicator around center position (no more than 1/8 inch in any direction) to obtain minimum dial reading.

4. Record this reading in Appendix A, table A3. The cognizant engineer and QC inspector must initial this data in the appropriate columns of table A3.

6.13.15 Each sequence of tensioning specified in table A2 shall be performed in turn, starting with sequence A, (seating pass), as follows.

6.13.16 Lower tensioners in place. Exercise care when lowering the tensioners to avoid damage to the threads of the studs and drawbar. While lowering the tensioners, ensure that the ring gear is seated on the nut and the crank handle is free to rotate (first-pass only). Also, ensure that the ring gear is properly seated in the nut castles.

6.13.17 Engage the drawbar and thread down until it bottoms out, then back off 1/2 turn on the handwheel.

NOTE: When nearing the bottom, care should be taken to prevent jamming drawbar on stud.

6.13.18 Pressurize the tensioners to the pressure specified in column 4 to tension the stud. Hold this pressure for a minimum of 10 seconds.

6.13.19 Fasten the nuts by turning the crank handle clockwise until the nuts are seated. Seat nuts with a sharp rap (approximately 30 ft-lbs.).

6.13.20 Reduce the pump pressure to zero.

6.13.21 Proceed with tensioning as shown in table A2. Perform each of the tensioning sequences A, B, and 1-40 in accordance with steps 6.13.15 through 6.13.20.

6.0 PERFORMANCE OF WORK (continued)

6.13.21 (continued)

NOTE: In the course of tensioning, it may be necessary to apply additional neolube to the stud threads.

6.13.22 After the last tensioning has been completed, obtain the elongation gauge reading of each of the 54 studs using the dial indicator (MK 73) on the stud reference surface (see step 6.13.14). Record final gauge readings in column 4 of table A3. Calculate elongation by subtracting initial gauge reading (column 3) from final guage reading (column 4) and record in column 5 of table A3.

NOTE: The target elongation for normal full power is 0.047 (+0.004/-0.002) inch.

6.13.23 If the stud elongation (column 5 of table A3) for any stud exceeds or is less than the target elongation, this stud must be adjusted using either of the two methods below:

METHOD A

1. Attach the stud tensioners to the sequence of three studs and pump the tensioners to 8,000 psi or until the nut-turning transmission crank handle can be turned (not to exceed 9000 psi).

2. Loosen the nut on the stud out of tolerance (or studs) by turning the crank handle counterclockwise 180 degrees.

3. Reduce the pump pressure to 6,100 psi and seat the nut with a sharp clockwise rap of the crank handle.

4. Reduce the pump pressure to zero and proceed to the next stud which requires corrections.

METHOD B

1. Pump all three tensioners until the crank handle can be turned (9000 psi maximum).

2. On the stud or studs which were out of tolerance, adjust the nut for proper positioning by turning 1/8 turns on crank handle for each .002" change required. (Elongation will decrease with a counterclockwise turn of the handle).

6.0 PERFORMANCE OF WORK (continued)

6.13.23 (continued)

METHOD B (continued)

3. Reduce the pump pressure to zero, and proceed to the next stud which requires corrections.

6.13.24 After all corrections have been completed, obtain the corrected elongation gauge reading of each of the 54 studs using the CSSC dial indicator (MK 73) as before.

Record the readings in column 6 of table A3. Calculate the elongation of each stud by subtracting the noload gauge reading (column 3) from the corrected pass gauge reading (column 6) and record in column 7 of table A3. If all corrected elongation are not within the target elongation tolerance, repeat step 6.13.23.

6.13.25 When all studs are withing the target elongation tolerance, record final inspection readings in column 8 of table A3 (see step 6.13.14 for measurement procedure). The cognizant engineer and QC inspector must initial this data in the appropriate columns of table A3.

6.13.26 Record final temperatures of stud, head flange, and head as described in step 6.13.12, and notify the shift engineer tensioning is complete.

6.13.27 Disconnect all tensioning hoses.

6.13.28 Using the polar crane, remove tensioners from studs and from cavity for storage.

6.13.29 Remove elongation rods from studs and store in special storage box.

6.13.30 Remove pump assembly, elongation rods, and all other tensioning equipment from cavity for storage.

6.13.31 Apply approved graphite/isopropanol to threads of stud inserts (MK 35) and install an insert into the top of each stud. Seat the insert and snug down (approximately 25 ft-lb).

6.13.32 Obtain hold order clearance for tensioner hoist power circuit and disconnect cable from 180° cable tray. Check for voltage on pins and install temporary plug cover.

6.0 PERFORMANCE OF WORK (continued)

6.13.33 Health physics to check contamination levels of all equipment used inside cavity area.

6.14 Preparation of Cavity for Normal Operation

6.14.1 Replace fuel transfer tube blind flange as follows:

PREREQUISITES:

1. Fuel transfer tube gate valve closed and hold order in effect on valve.
2. All operational prerequisites complete for installing fuel transfer tube blind flange as verified by the shift engineer.

PRECAUTIONS: Take extreme care not to damage threads on bolts used on transfer tube blind flange.

INSTRUCTIONS: Refer to Figure 8 for flange illustration.

1. Verify that all prerequisites are complete for installing the fuel transfer tube blind flange.
2. Verify that all chrome plated bolts have been checked for damage and threads chased with a 1-1/8" - 8 UN-2 die nut.
3. Verify that all holes in transfer tube flange have been prepared by running a 1 1/8"-8 UN-2 bottom tap through each and have been properly cleaned.
4. Clean sealing surfaces of blind flange and transfer tube flange, removing all foreign material and smoothing burrs, nicks, and scratches as required.

QC Hold Point:

5. Inspect cleanliness and sealing surface integrity of blind flange and transfer tube flange. Surfaces must be free from nicks, burrs, and scratches which would impair sealing of gaskets. Record results on data sheet E, in Appendix A.

6.0 PERFORMANCE OF WORK (continued)

6.14.1 (continued)

INSTRUCTIONS: (continued)

6. Rotate blind flange on davit arm until flange is directly above fuel transfer tube.

7. Lubricate treads on davit stem above stem nut with approved Nickel Never Seez.

8. Turn stem nut until blind flange lines up with transfer tube flange.

9. Install new flexitallic gaskets in gasket grooves and install bolts lubricated with approved Nickel Never Seez in flanges.

QC Hold Point:

10. Snug all bolts, then torque bolts using a crossing pattern until all bolts are at 350 ft-lbs. Final torque is verified by making one complete pass at this torque value with no movement of bolts detected. Record torque inspection results on data sheet E, in appendix A.

11. Refer to applicable testing instructions for leak test of blind flange if required (SI-6.31). If testing is not to be performed, verify plug is tight in test port at top of blind flange.

6.14.2 Remove two refueling cavity drain plugs and install top hat assemblies as follows:

NOTE: Tensioning should be complete and the fuel transfer tube blind flange installed or the fuel transfer gate valve closed and tagged prior to performing this operation.

1. Unbolt and remove drain plugs from cavity for storage.

6.0 PERFORMANCE OF WORK (continued)

6.14.2 (continued)

2. Remove and dispose of gasket and silicone rubber sealing material.

3. Clean bolts and lubricate threads with approved Nickel Never Seez.

4. Install and bolt down top hat assemblies.

5. Verify all bolts are tight.

6.14.3 Remove nozzle shield plugs (if installed) and install inspection plate operational gaskets as follows (refer to figure 8 for location of inspection ports).

NOTE: Tensioning should be complete prior to performing this operation.

1. Notify health physics that inspection plates are to be removed. Arrange for monitoring area when first plate removed to determine exposure.

2. Notify shift engineer that inpection plates are to be removed. Request that refuel floor coordinator be informed of any change in vessel water level which may cause increased exposure.

3. Remove all silicone rubber material around edges of all plate covers at floor of cavity and place in a yellow plastic bag for disposal.

4. Remove bolts from inspection plates and store for later use, taking care to protect bolt threads from damage.

5. Lift inspection plate using the polar crane. Remove refueling gasket and place in a plastic bag for disposal.

6. Remove inspection plate from port and set aside on blocks (to keep carbon steel brackets from touching floor).

6.0 PERFORMANCE OF WORK (continued)

6.14.3 (continued)

7. Using sling 44N358 and polar crane, remove nozzle shield plug for storage.

8. Move inspection plate over port to allow connection of chains.

9. Untie ropes from chain brackets and pull chains up with ropes until pins can be removed from end of chains.

10. Connect chains to plate brackets using pins and cotter pins. Remove temporary boards, if installed.

11. Install operational gaskets (previously removed in section 6.2.2) at nozzle inspection port flange and lower plate into place on gasket. Verify gasket seals properly between plate and port flange.

6.14.4 Remove inflatable cavity seal as follows:

CAUTION: Do not use wire rope slinge for handling inflatable seal. Use caution when removing seal from Rx head.

1. Deflate seal and disconnect air supply.

2. Remove seal from Rx annulus. Use nylon slings or equal.

3. Temporarily cover Rx annulus opening with herculite to keep foreign objects from falling through opening.

NOTE: This must be removed prior to installating center missile shield

6.15 Installation of Missile Shields and Head Attachments

PREREQUISITES: 1. Tensioning and preparation of reactor cavity complete for normal operation.

2. All excore detector maintenance and inspection complete.

6.0 PERFORMANCE OF WORK (continued)

6.15.1 Install reactor head insulation as follows:

PRECAUTIONS:

1. Do not lift insulation with wire ropes--use nylon slings or ropes.

2. When installed, the top horizontal insulation sections will not hold a man's weight. Do not stand or place heavy tools on these pieces.

3. Do not stack insulation in any way which could deform the section. Stack only on end.

4. Do not stand on rest loads on cavity seal ring.

INSTRUCTIONS:

1. Lower all side insulation sections (marked "R" or "Q") into cavity. Clean as required.

2. Assemble "R" section on "Q" section beginning with lowest numbered pieces at approximate 0° azimuth.

3. Clip next higher numbered sections to assembled pieces until all side pieces are installed.

4. Lower all top insulation sections (marked "S") into cavity. Clean as required.

5. Place lowest numbered section on like numbered side pieces. Attach next higher numbered sections to assembled pieces until all top pieces are installed.

6.15.2 Close instrument port columns and reconnect thermocouple leads as follows:

PREREQUISITES: Verify that personnel have been trained properly on conoseal reassembly by reviewing drawings and by training with an instrument port mock-up assembly.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

PRECAUTIONS:

1. Cleanliness is of the utmost importance in a conoseal joint. Assemble joint using clean, white, lint-free gloves or rubber C-zone gloves.

2. Take all precautions to avoid nicks and scratches to all sealing surfaces and edges. Leave old conoseals in place until just before reassembly as further protection against damage.

Tools and Equipment

The following tools and equipment will be required for assembly of the Instrument Port Conoseal.

Standard tools listed in Section 5.5 for this operation and kept in a locked box marked "Instrument Port Conoseal" on the refuel floor.

Hydraulic pumping unit approved in appendix F, table F3 with cylinder and spacer to give collapsed height of approximately 6.5".

Conoseal loading device assembly 882D292GRI. (Verify that all internal and external parts are clean prior to use).

Conoseal removal tool 674C941GRI. (Lower gasket)

Conoseal removal tool for upper gasket.

Click type torque wrench, 1/2" drive, approximate range 250 ft-lbs.

Click type torque wrench, 1/4" drive or 3/8" drive, approximate range 200 in-lbs.

1/2 ton chain hoist.

Five sets of conoseal gaskets as follows:

a. Aeroquip P/N 50887-200-S
b. Aeroquip P/N MGC-67802 (W P/N 674C440-1)

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

Parts removed from each instrument port and stored in metal boxes.

INSTRUCTIONS: Perform the following steps for each of the five instrument ports. (Refer to figures 11 and 12).

1. Notify the shift engineer and health physics that the instrument port conoseals are to be replaced. The containment should be monitored for increases in airborne activity during this operation and the water level must be maintained well below the conoseal elevation.

2. Install scaffolding as required for closing of the five instrument port conoseals. If possible, assemble scaffolding so that it can also be used for installing the lower UHI snubbers.

3. Verify that all new gaskets are free from defects. Place gaskets back in packages and mark package accordingly.

4. Using a nylon strap attached to cable support above seismic platform, hang a 1/2 ton chain hoist as directly as possible over the instrument port to be assembled.

5. Remove cooling shroud section over instrument port. (The hydraulic ram will not fit through cooling shroud hole.) Temporarily store plate and hardware.

6. Clean conoseal parts which were previously removed. Use only clean, white, lint-free cloths and approved alcohol or acetone.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

INSTRUCTIONS: (continued)

6. (continued)

Remove minor burrs on sealing surfaces of male flange with scotchbrite or rub lightly with honing stone or extremely fine sandpaper.

7. Apply approved graphite/isopropanol to all male and female threads and to clamp contact surfaces.

8. Remove locking clip, protective sleeve cover and O-ring from instrument column in that order and store for later use.

9. Clean instrument column above male flange with approved alcohol or DI water.

10. Remove temporary covering from instrument port female flange.

11. Clean female flange with approved alcohol or DI water.

12. Using the applicable special tool, remove upper and lower gaskets as applicable from instrument port and check sealing surfaces for defects. Remove minor burrs as before and perform final cleaning of sealing surfaces. Remove gaskets from packages and clean.

QC Hold Point:

13. Inspect cleanliness and sealing integrity of conoseal gaskets, instrument port and male flange. The sealing surfaces of all components must be free from nicks, burrs, and scratches which would impair sealing.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

INSTRUCTIONS: (continued)

14. Install upper and lower conoseal gaskets on instrument port.

    NOTE: The apex of the cone points up for the lower conoseal gasket and down for the upper conoseal gasket, (see figure 12).

15. Install weld ring on instrument port female flange.

16. Place male flange on female flange until male flange rests on lower conoseal gasket.

17. Verify that axial loading ram assembly is clean, both externally and internally, then suspend the device over the instrment port to be assembled using the 1/2 ton chain hoist.

18. Slowly lower loading device over instrument column until loading ram rests on male flange (item 1, figure 12). Keeping hands from device, continue lowering loading device until it can be engaged in female flange of instrument port.

19. Engage locking flange in female flange by rotating approximately 15 degrees such that keys are just inside notches of female flange.

20. Inspect threads of clamp bolts for damage and inspect bolts and clamp contact surfaces for proper lubrication. (graphite/isopropanol or Nickel Never-Seez).

21. Assemble clamp around male-female flange joint and hand tighten clamp bolts so that gaps between clamp sections are even.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

INSTRUCTIONS: (continued)

22. Check number on hydraulic cylinder used and determine required hydraulic pressure from chart in Appendix G. Record CSSC information on hydraulic gauge in Data Sheet B, in Appendix A.

CAUTION: Prior to the next step, verify hydraulic pump and cylinder are functioal and hydraulic connections are tight. Otherwise the cylinder will not receive the pump pressure and may fall out of loading ram.

23. Install hydraulic cylinder at top of ram, using a metal spacer block if required for cylinder used (the collapsed height of cylinder plus spacer should be approximately 6.5"). Pump cylinder sufficiently to seat plunger against ram plate. Tie cylinder hose to the ram or chain hoist as a final safety precaution.

24. Slowly increase hydraulic pressure to value determined in step 22, and hold this pressure throughout clamp torquing procedure below.

25. Locate clamp so that bolts can be easily tightened and so that loading device can be removed.

QC Hold Point:

26. Tighten bolts uniformly, starting at 45 ft-lbs and proceeding in increments of 20 ft-lbs until final torque (120-128 ft-lbs) is attained. Record inspection data on Data Sheet B.

27. Hold cylinder firmly, then untie hose and remove cylinder.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

INSTRUCTIONS: (continued)

28. Rotate axial loading device to unlocked position and remove, keeping hands free of device during removal.

29. Inspect threads of jackscrews for damage and inspect jackscrews and split-ring for cleanliness and proper lubrication. Record inspection data on Data Sheet B.

30. Install jack screw plate, as shown in figure 12 (item 4), over thermocouple support column.

31. Install split ring, as shown in same drawing, to thermocouple support column.

32. Install jack screws to jack screw plate.

33. Tighten jack screws uniformly (starting at 40 in-lbs and in increments of 10 in-lbs), staggering across the pattern until final torque (95-105 in-lbs) is obtained. This assures level raising of the plug.

34. Lockwire jackscrews using .030" to .035" stainless steel wire.

35. Replace shroud section removed and account for all hardware.

36. Remove 1/2 ton chainfall and nylon sling from cable support.

37. Repeat steps 1-36 for all instrumentation ports and verify that all instrument ports have been installed properly.

38. Reconnect all thermocouple plugs per MAI-3.

6.0 PERFORMANCE OF WORK (continued)

6.15.2 (continued)

INSTRUCTIONS: (continued)

39. Remove all conoseal tools and equipment from cavity for storage.

6.15.3 Install snubbers below seismic platform on 0°, 90°, and 180° UHI lines as follows:

1. Install scaffolding as required for access to snubbers 87-21, 87-22, 87-23, 87-37, 87-59, 87-60, 87-61, 87-62, 87-63, 87-64, 87-79, and 87-180.

Perform the following steps for each of the snubbers listed in step 1:

2. Remove snubber and hardware from storage box and account for all parts.

CAUTION: Do not drive pins with a hard-faced hammer.

3. Using approved procedures in MAI-16 install snubbers in correct location between cavity wall and UHI lines. Refer to figures 4, 5 and 6 to determine correct location for each snubber. Record verification data required on Data Sheet C, in Appendix A.

4. Inspect installation and cold position setting of snubber and initial on Data Sheet C in Appendix A.

6.15.4 Install CRDM ducts as follows:

PRECAUTION: Use nylon slings when rigging to lower duct sections. Do not use wire rope tied around duct.

INSTRUCTIONS: Refer to figure 2 for location of ducts. Perform the following steps for each of the two duct assemblies:

1. Install scaffolding as required for connecting duct joints.

6.0 PERFORMANCE OF WORK (continued)

6.15.4 (continued)

INSTRUCTIONS: (continued)

2. Rig to the branch duct sections stored atop the respective steam-generator compartments. Lower duct into position and tighten in place using attached wingnuts and the gasket removed previously.

3. Rig to the "Y" section, lower into position and tighten into place using attached wingnuts and the gasket removed previously.

4. Rig to the top (square) duct section, lower into position, and tighten in place, using attached wingnuts and the gasket removed previously.

5. Verify ducts are installed properly, all wingnuts are tight, and gaskets are compressed.

6. Remove all scaffolding from cavity except those sections adjacent to canal gate area.

7. Health physics shall check contamination levels of all equipment used inside cavity area.

6.15.5 Install CRDM seismic platform ties as follows. Refer to figure 7 for locations and color coding of seismic ties.

CAUTION: Do not use hard-faced hammers to drive pins into brackets. Use only soft mallets or brass bars.

INSTRUCTIONS: 1. Install temporary platforms as required for installing seismic ties.

6.0 PERFORMANCE OF WORK (continued)

6.15.5 (continued)

INSTRUCTIONS: (continued)

2. Clean and lubricate seismic tie pins as required. All pins to be driven into brackets should be lubricated with approved lubricant (graphite/isopropanol or Nickel Never-Seez).

3. Match colors on long seismic ties (270° north and south) with colors on tie brackets and pin each into place by driving pins through brackets and tie rod eyes. Install cotter pins through holes in pins.

4. Lower the four short seismic ties into position and pin each into place by driving pins through brackets and tie rod eyes. Install cotter pins through holes in pins.

5. Measure and record seismic tie distances per guidelines in Data Sheet D in Appendix A (Cognizant Engineer verification required.)

6. Verify CRDM seismic ties have been properly installed.

6.15.6 Install UHI check valve spool pieces as follows:

1. Notify health physics and the shift engineer that the UHI check valves are to be reinstalled.

2. Install scaffolding as required for installation of the check valves. Perform the following steps for each of the four check valves.

3. Clean internals of check valve and spool piece lines as required to remove all foreign matter. Use only clean lint-free rags and approved alcohol or DI water for cleaning.

6.0 PERFORMANCE OF WORK (continued)

6.15.6 (continued)

4. Attach the special lifting rig on the check valve cover plate using the tapped holes in the plate and rig with slings to the polar crane.

5. Remove covers and blanks from UHI mating lines for spool piece to be replaced and clean as instructed in step 3.

6. Check sealing surfaces of spool piece hubs, UHI line hubs, and seal rings for defects. Smooth minor burrs and scratches by rubbing lightly with scotchbrite or extremely fine sandpaper.

7. Inspect cleanliness of seal rings and internal surfaces of spool piece and lines. Record inspection results on Data Sheet B in Appendix A.

8. Inspect integrity of sealing surfaces of spool piece and line hubs and of seal rings. The sealing surfaces of all components must be free from nicks, burrs, and scratches which would impair sealing. Record inspection results on Data Sheet B in Appendix A.

9. Inspect standoff of seal ring in hubs. The seal ring lip must not seat flat on hub surface. Record inspection results on Data Sheet B in Appendix A.

10. Lubricate sealing area of seal rings with approved graphite/isopropanol.

11. Position spool piece between UHI line hubs, using come-alongs as required to spring piping and verifying that check valve is installed in the correct direction. (The direction of flow is toward reactor vessel.) Verify by arrow on side of check valve.

12. Install seal rings between hubs by springing piping back until rings can be inserted without touching either hub, then slowly releasing tension on piping to capture rings.

6.0 PERFORMANCE OF WORK (continued)

6.15.6 (continued)

13. Clean and lubricate clamp sliding surfaces, stud threads, and nut sperical surfaces with approved lubricant (graphite/isopropanol or Nickel Never-Seez).

14. Install clamps and tighten nuts handtight on studs.

15. Hold bottom nut while snugging top nuts on clamps, then torque nuts (in crossing pattern) in 100 ft-lbs. increments to 300 ft-lbs ± 10 percent. Check at slots in middle of top and bottom clamps for proper seating of clamps. (1/8 inch to 3/8 inch clearance through slot.) Inspect proper torquing and slot clearance and record inspection data on Data Sheet B in Appendix A. If slot clearance is out of tolerance, notify the cognizant engineer for corrective action per manufacturer's recommendations.

16. Remove lifting device from valve cover plate.

6.15.7 Coordinate with operations to begin filling and venting of reactor vessel. After all lines are filled, install vent blanks on UHI vents (8) and RPV vent. Perform the following steps for each blank.

1. Clean blanks, studs, nuts, and mating flange.

2. Check sealing surfaces of blank and mating flange for defects and repair as necessary.

3. Lubricate studs and sliding face of nuts with approved lubricant (graphite/isopropanol or Nickel Never-Seez).

4. Inspect cleanliness and lubrication of components and assemble blank on flange with new gasket. Record inspection data on data sheet B in Appendix A

5. Torque flange to 160 ft-lbs in 80 ft-lbs increments using a crossing pattern. Inspect torquing and record inspection data on Data Sheet B in Appendix A.

6.0 PERFORMANCE OF WORK (continued)

6.15.7 (continued)

6. Verify UHI and RPV vent blanks have been installed.

NOTE: In the following steps refer to color coding and steel stenciling of UHI line hanger components per Figure 4 to verify component is on correct line.

6.15.8 Remove cavity ladder cage and all hardware and equipment at cavity floor except scaffolding on canal gate side. Clean floor at canal gate seating area (between slots) and remove all barriers.

NOTE: In the remaining steps all hardware is to be cleaned, threads inspected for damage and repaired, and all bolts and pin lubricated with approved lubricant.

6.15.9 Install canal gates and first missile shield as follows:

PREREQUISITE: Copies of drawings 44N265, 44N266, 44N267, and 44N940 have been obtained and personnel have been familiarized with drawings and with applicable figures of missile shields and head attachments.

1. Clean and check missile shield bolt holes. Run a barrier post in each hole to check threads. Use a tap as required to repair threads.

2. Clean missile shield gasket groove and install portion of gasket under PC-6.

3. Position restraint 06-3 on floor at end of reactor cavity for attachment to missile shield PC-6.

4. Attach slings MK44N267-3 to main hook. Slings should still be attached to missile shield PC-6 on north (south) steam generator compartment. If not, attach slings to shield lifting rings.

5. Move missile shield PC-6 over floor at end of reactor cavity so that embedded plate on missile shield lines up with restraint 06-3 and arrow on missile shield points toward arrow on restraint.

6.0 PERFORMANCE OF WORK (continued)

6.15.9 (continued)

6. Lower missile shield to restraint and install restraint bolts handtight.

7. Verify cable support end plate is in up position.

CAUTION: In the following step, stop lowering missile shield if it appears restraint will touch UHI line and determine cause of problem before proceeding.

8. Lower shield into position on pressurizer side of reactor, verifying that restraint 06-2 lowers into correct position over 90° UHI line as missile shield is lowered and that scribe lines on cavity top line up with edge of missile shield.

9. Remove slings MK-3 from missile shield and use MK-3 slings to remove canal block, PC-3 from south (north) steam generator compartment and to stack on missile shield PC-6 so that top of canal block is toward pressurizer (see drawing 44N266).

10. Repeat for canal blocks PC-4 and PC-5 until all three blocks are stacked on missile shield, verifying that all lifting rings are placed in the horizontal (stored) position.

11. Remove slings MK-3 from main hook and store for future use.

12. Attach two MK-1 slings to main hook and one MK-2 sling to auxiliary hook and attach slings to top canal gate PC-5 with hooks facing as shown on drawing 44N266.

13. Lift and rotate canal gate PC-5 to vertical position using main hook and auxiliary hook as shown in drawing 44N266.

14. Remove MK-2 sling from canal gate PC-5 and install gate in position at bottom of cavity so that gate is centered in slots.

15. Repeat for canal gates PC-4 and PC-3, centering each at top of lower gate so that reactor side faces of gates line up properly.

6.0 PERFORMANCE OF WORK (continued)

6.15.9 (continued)

16. Remove MK-1 sling from main hook and store for future use. Remove MK-2 sling from auxiliary hook and store for later use with missile shield replacement.

17. Verify missile shield next to pressurizer, all canal gates, and restraint 06-2 has been installed.

6.15.10 Install snubbers and brackets to canal gates as follows. Refer to Figure 6 in performing the following steps. Verify correct location of hangers by steel stencil marks and color coding.

1. Install or add to scaffolding as required to install equipment covered in this section.

2. Using approved procedures in MAI-16, install snubbers, brackets and associated hardware for hangers 87-24, 87-25, 87-32, 87-36 and 87-150, recording the required verification and inspection information on Data Sheet C in Appendix A.

3. Remove all scaffolding, equipment, and tools from cavity below seismic platform elevation and final clean cavity floor for operation.

6.15.11 Install missile shield over canal gate as follows:

1. Position restraint 06-4 on floor at end of reactor cavity for attachment to missile shield PC-2. (Place plywood under restraint.)

2. Install two MK-2 slings on main hook and attach slings to missile shield PC-2 at the top of the north (south) steam generator.

3. Install portion of missile shield gasket under PC-2 and around edge of cavity and across top canal gate.

4. Move missile shield PC-2 over floor at end of reactor cavity so that embedded plate on missile shield lines up with restraint 06-4 and arrow on missile shield points toward arrow on restraint.

6.0 PERFORMANCE OF WORK (continued)

6.15.11 (continued)

5. Lower missile shield to restraint and install restraint bolts handtight.

6. Verify cable support end plate is in up position.

CAUTION: In the following step, stop lowering missile shield if it appears restraing will touch UHI line and determine cause of problem before proceeding.

7. Lower shield into position over canal gates, verifying restraint 06-4 lowers into correct position over 270° UHI line as missile shield is lowered and that scribe lines on cavity top line up with edge of missile shield.

8. Verify alignment of missile shield bolt holes and verify that span between restraint beam holes is proper (make sure bolts will fit through holes in beams).

9. Raise main hook to stored position with slings still attached.

6.15.12 Install attachments underneath outer two missile shields as follows. Refer to figure 5 for identification of hanger numbers referenced below. Verify correct locations by checking steel stenciling and color coding of components.

1. Install scaffolding and pickboards as required for installation of remaining equipment above seismic platform.

2. Attach nylon slings to restraint beams and raise beams into position under outer two missile shields. Bolt beams into place using square washers and bolts previously removed.

3. Install UHI restraints (06-1) and (06-3) underneath restraint beams above 0° and 180° UHI lines using square washers and bolting hardware previously removed.

6.0 PERFORMANCE OF WORK (continued)

6.15.12 (continued)

4. Install spring hangers/brackets 87-34, 87-72, and 87-76 underneath outer two missile shields. Verify all rods, bolts, nuts, and jamnuts are installed properly and all threaded connections are lubricated. Remove blocks from spring cans and adjust cold position settings of springs. Record verification information on Data Sheet C in Appendix A. Store block angles for future use.

5. Using approved procedures in MAI-16, install snubber/bracket 87-33, 87-58, and 87-24 underneath missile shields and snubber/clamp 87-57 to cavity wall bracket.

6. Verify installation of all restraints, spring hangers, and snubbers attached underneath missile shields and record verification information on Data Sheet C in Appendix A. (Inspection not required at this time.)

7. Install mirror insulation on UHI lines between elbows and check valves by clipping into place.

6.15.13 Connect CRDM, RPI, thermocouple instrumentation, tensioner hoist, and loose parts monitoring cables as follows:

NOTE: Refer to figure 7 for cable locations.

1. Notify shift engineer that the electrical connections to the head equipment are ready to be reconnected. Verify hold order on all circuits prior to continuing. List hold order no. on data sheet G, appendix A.

2. Remove pickboards as required and swing cable tray booms to head junction panels for connection (do not pin boom at this time).

3. Referring to tags or marking on cables, connect cables to junction panels. The loose parts monitoring wiring will have to be connected at the junction box (no plug supplied). Refer to 45N1632-15.

6.0 PERFORMANCE OF WORK (continued)

6.15.13 (continued)

QC Hold Point:

4. QC inspector shall verify all cable connectors properly connected to the matching panel connector and perform visual inspection of all connectors to ensure that no pins are recessed into the connector causing poor contact.

5. Notify Instrument Maintenance section to perform continuity checks.

6.15.14 Install snubber hanger 87-73 as follows:

1. Install temporary pickboards as required for installation of snubber 87-73.

2. Using approved procedures in MAI-16, install snubber/bracket/clamp 87-73.

3. Verify snubber hanger 87-73 has been properly installed.

6.15.15 Perform final inspection of all subbers, spring hangers, and restraings above CRDM platform and sign on Data Sheet C in Appendix A.

6.15.16 Raise CRDM cable support as follows:

1. Verify swing booms are clear of cable support brackets.

2. Using jacks or chainfalls, raise the CRDM cable support to the up position with end brackets seated against embedded plates under outer missile shields. Bolt end plates to missile shields.

3. Raise bolts on the bottom of the four legs of CRDM cable support unit.

4. Bolt CRDM cable swing booms to cable support brackets.

5. Raise cable support tie rods from cavity wall and pin into position by driving pins into brackets with soft-faced mallets or brass bars. Record verification data as required on Data Sheet D, in Appendix A.

6. Verify CRDM cable support has been raised, swing booms and support rods in place.

6.0 PERFORMANCE OF WORK (continued)

6.15.17 Install center missile shield as follows:

NOTE: Prior to installation of center missile shield the cognizant engineer shall inspect the reactor cavity to ensure that all tools and foreign objects have been removed.

1. Install missile sheild gasket under center missile shield.

2. Attach slings MK-2 to center missile shield at the top of the south (north) steam generator (slings should still be attached to main hook).

3. Lower missile shield in position verifying that scribe lines on cavity top line up with edge of missile shield.

NOTE: MS #1 will only bolt down in one orientation (check hole spacing).

4. Remove slings from main hook and from missile shield and store for future use. Leave all missile shield rings in the stored (horizontal) position.

5. Install and tighten all missile shield bolts, verifying by match marks that the correct bolts and hillside washers are installed in the correct holes.

6. Notify the shift engineer that all missile shields are installed and reassembly of the reactor is complete.

6.16 Remove tools, spare parts, and all potential fire hazard materials, such as rags, flammable and combustible liquids, clothing and plastic and properly dispose of them. Remove all maintenance items and equipment except for those items approved to be in the reactor building during operation.

6.17 Craft foreman shall perform a final inspection of the work area to ensure that all tools, spare parts, and potential fire hazard materials, such as rags, flammable and combustible liquids, and plastic have been removed and properly disposed of. The craft foreman shall verify by signing the data sheet G, in Appendix A.

6.18 List all parts that were replaced on the replacement parts list in Appendix A.

7.0 POST-MAINTENANCE CHECKOUT AND TESTS RETURN TO SERVICE

7.1 Verify that all SI's as described in Appendix B have been completed and results are satisfactory.

7.2 Release all hold orders as described in Appendix B.

FIGURES

WBN
MI-68.1
Figure
Page 2 of 17
Revision 5

FIGURE 1

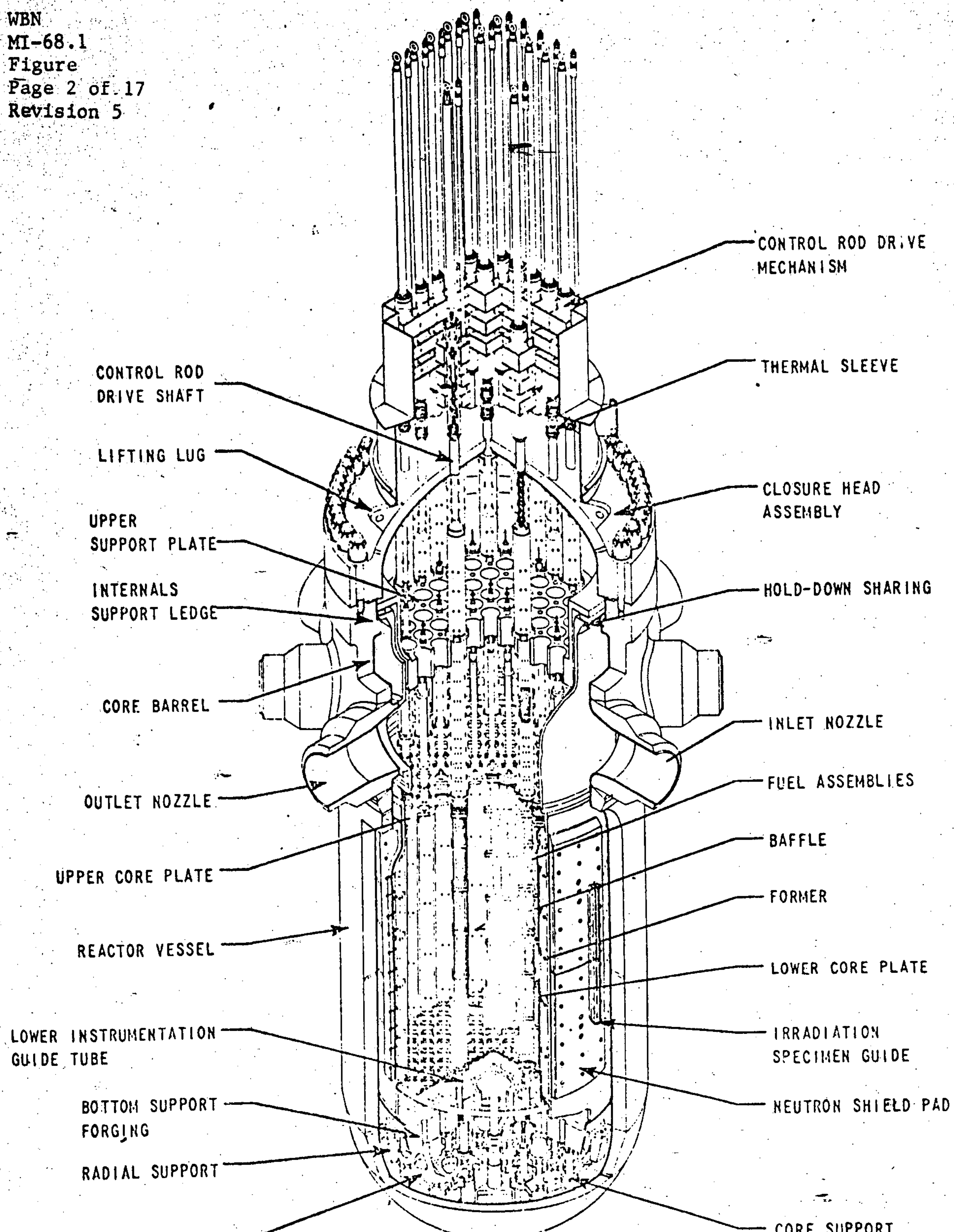


FIGURE 2

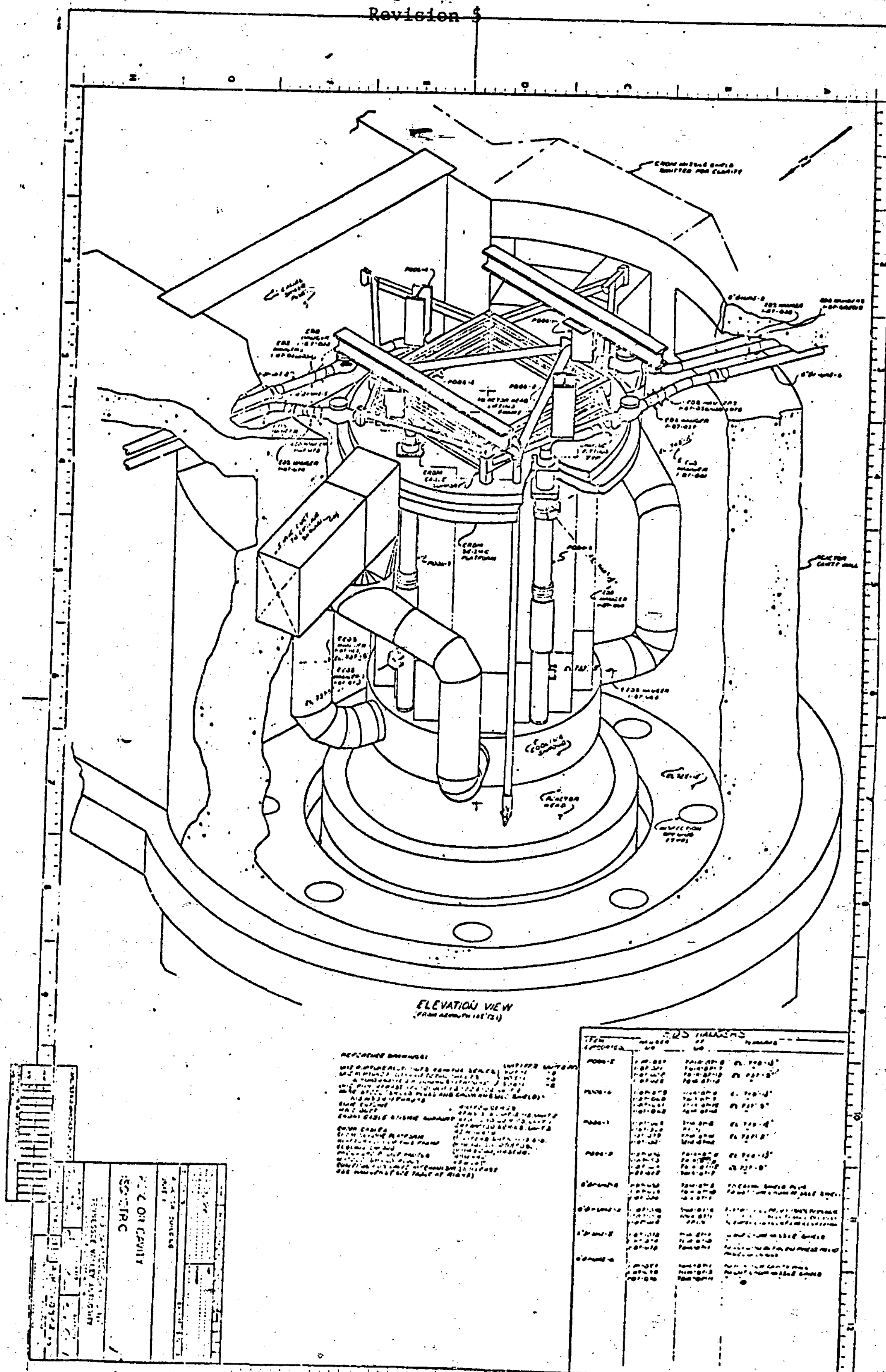


FIGURE 3

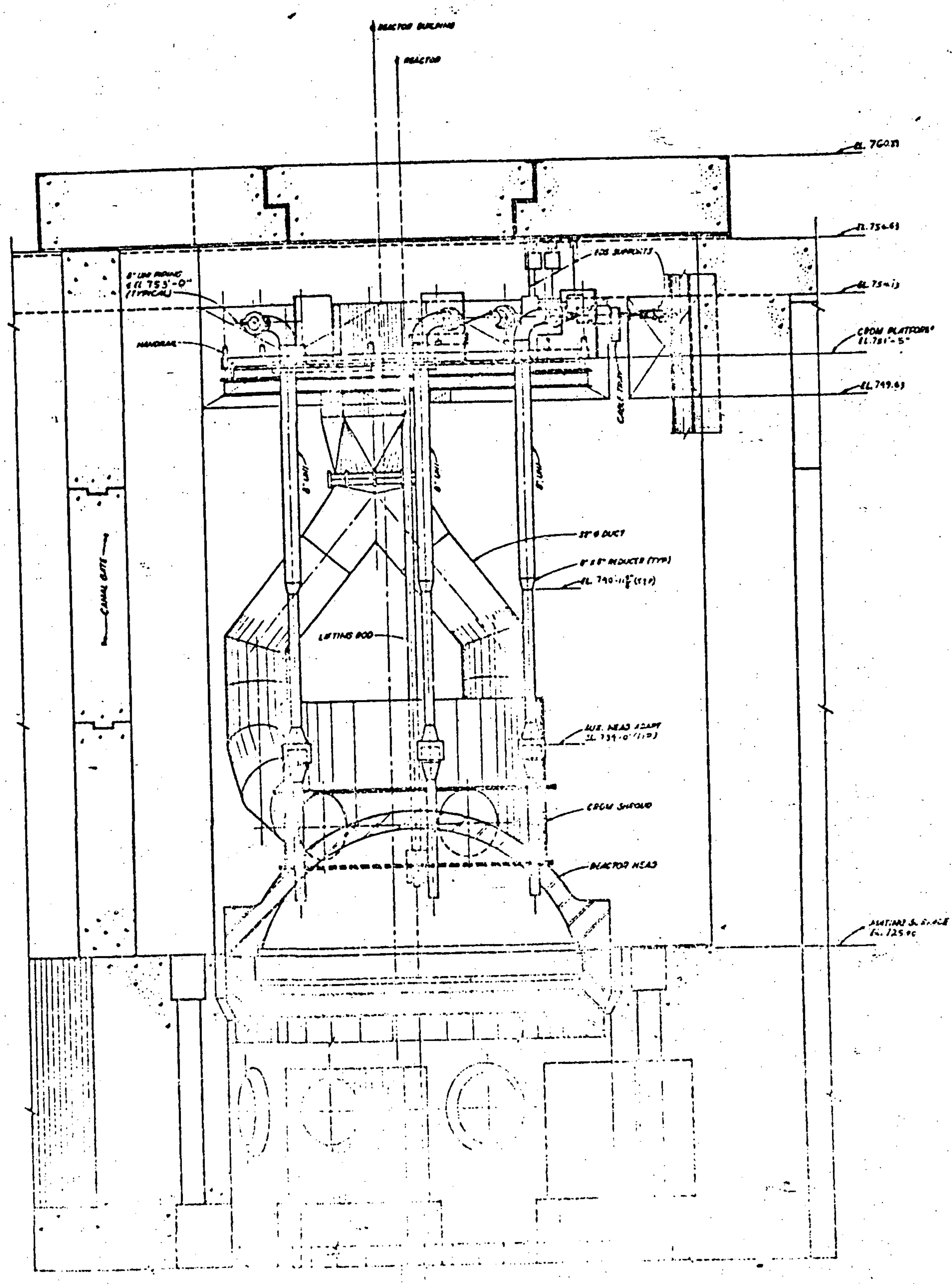
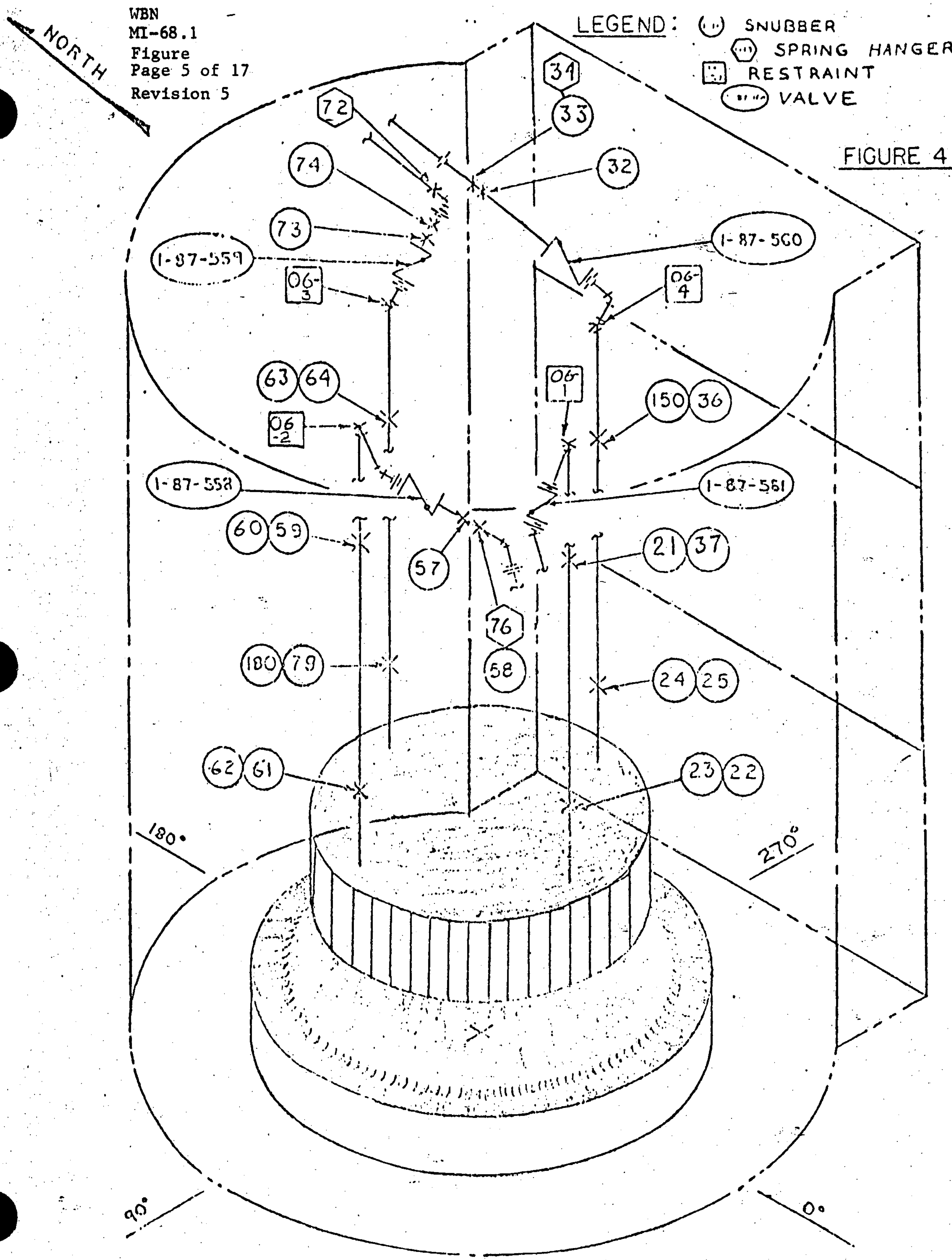

REACTOR BUILDING
REACTOR
HANDRAIL
CANAL GATE
LIFTING ROD
CRDM SHROUD
REACTOR HEAD

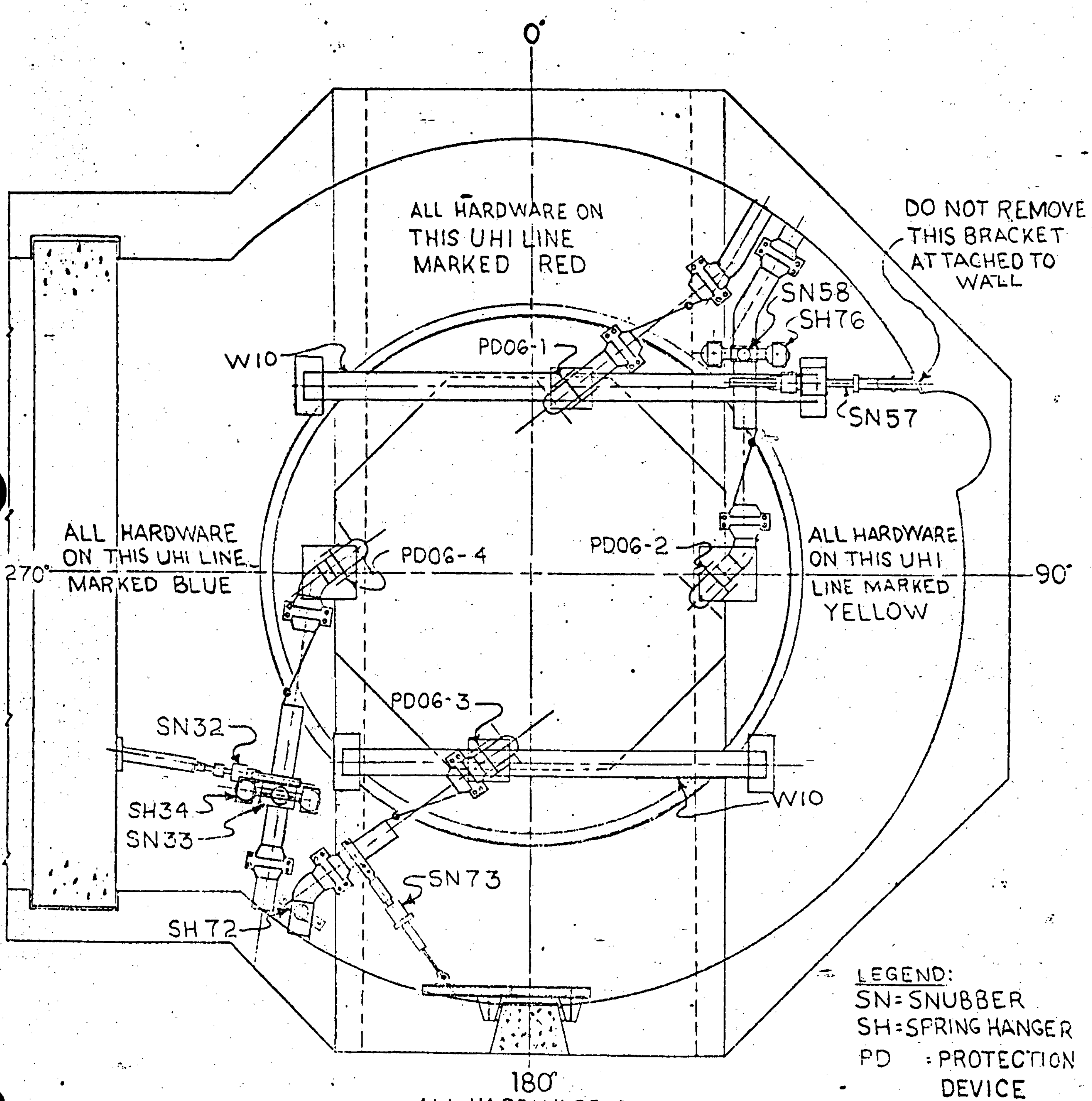
FIGURE 4



WBNP UNIT 1 UHI PIPE HANGERS & RESTRAINTS

WBNP UNIT 1
UHI PIPE HANGERS & RESTRAINTS
PLAN VIEW

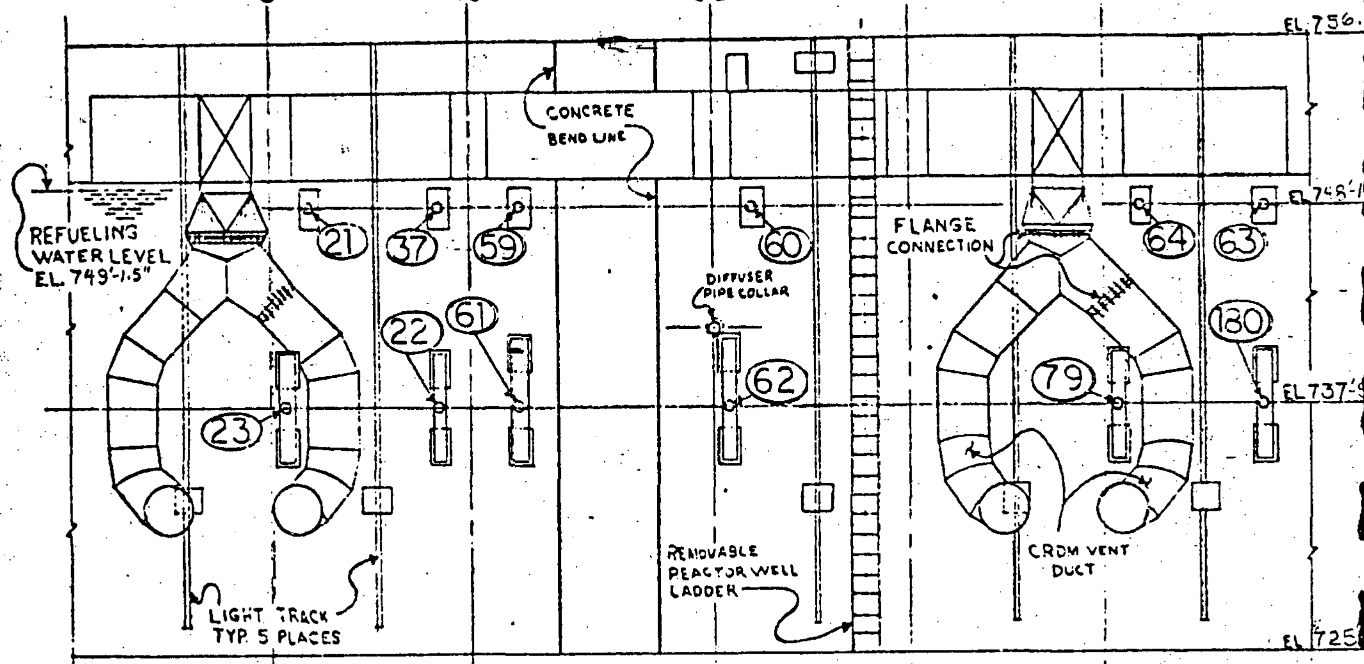
FIGURE 5



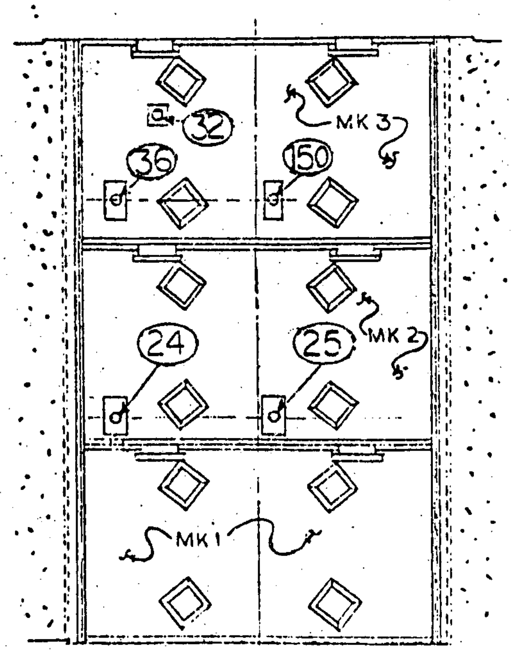
ALL HARDWARE ON THIS UHI LINE MARKED GREEN

FIGURE 6

REACTOR WELL
DEVELOPED VIEW



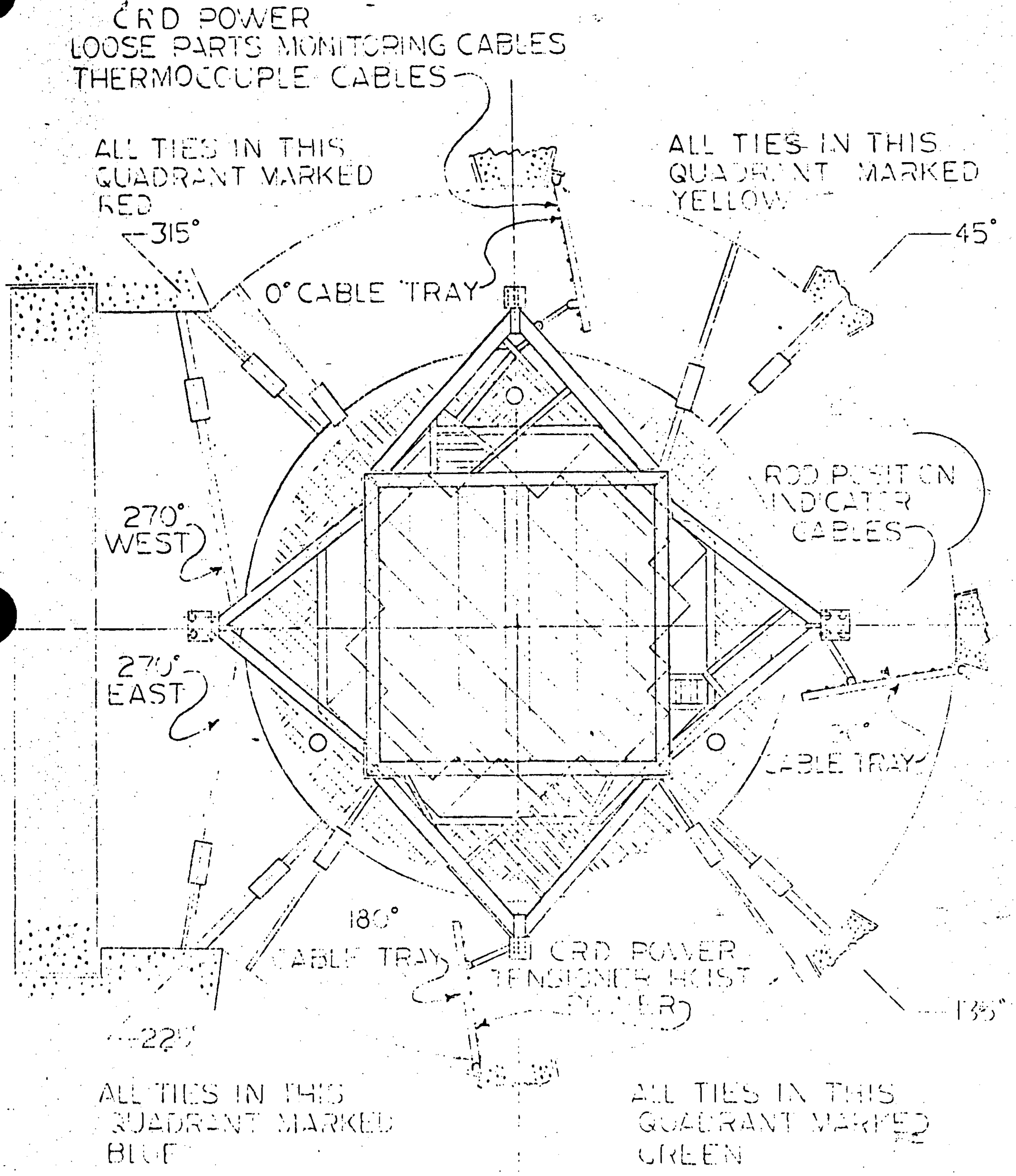
NOTE: ◯ DENOTES SNUBBER LOCATION

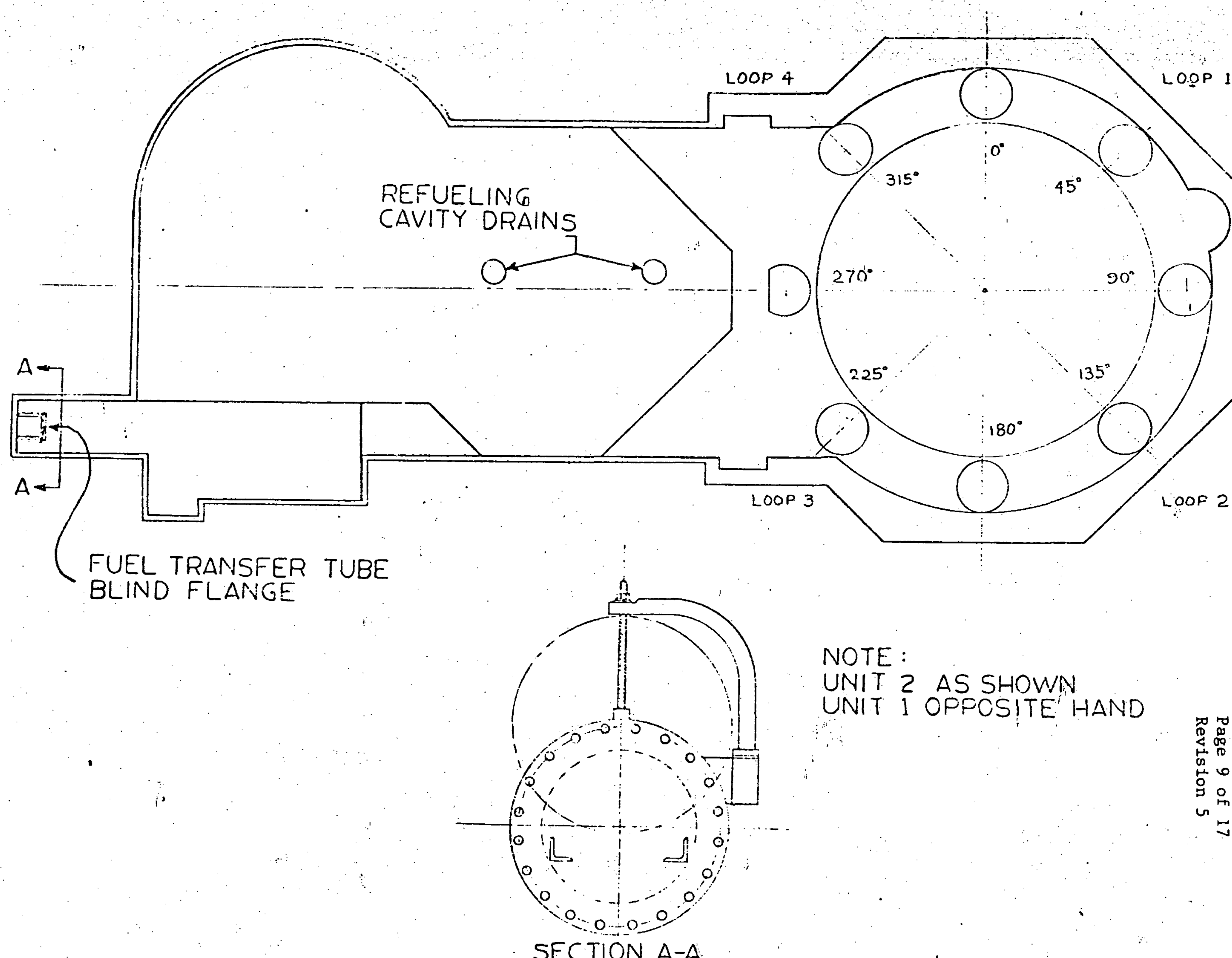


REFUELING CANAL
GATE BLOCKS

CRDM SEISMIC PLATFORM
CABLE SUPPORTS AND TRAYS
PLAN VIEW

FIGURE 7





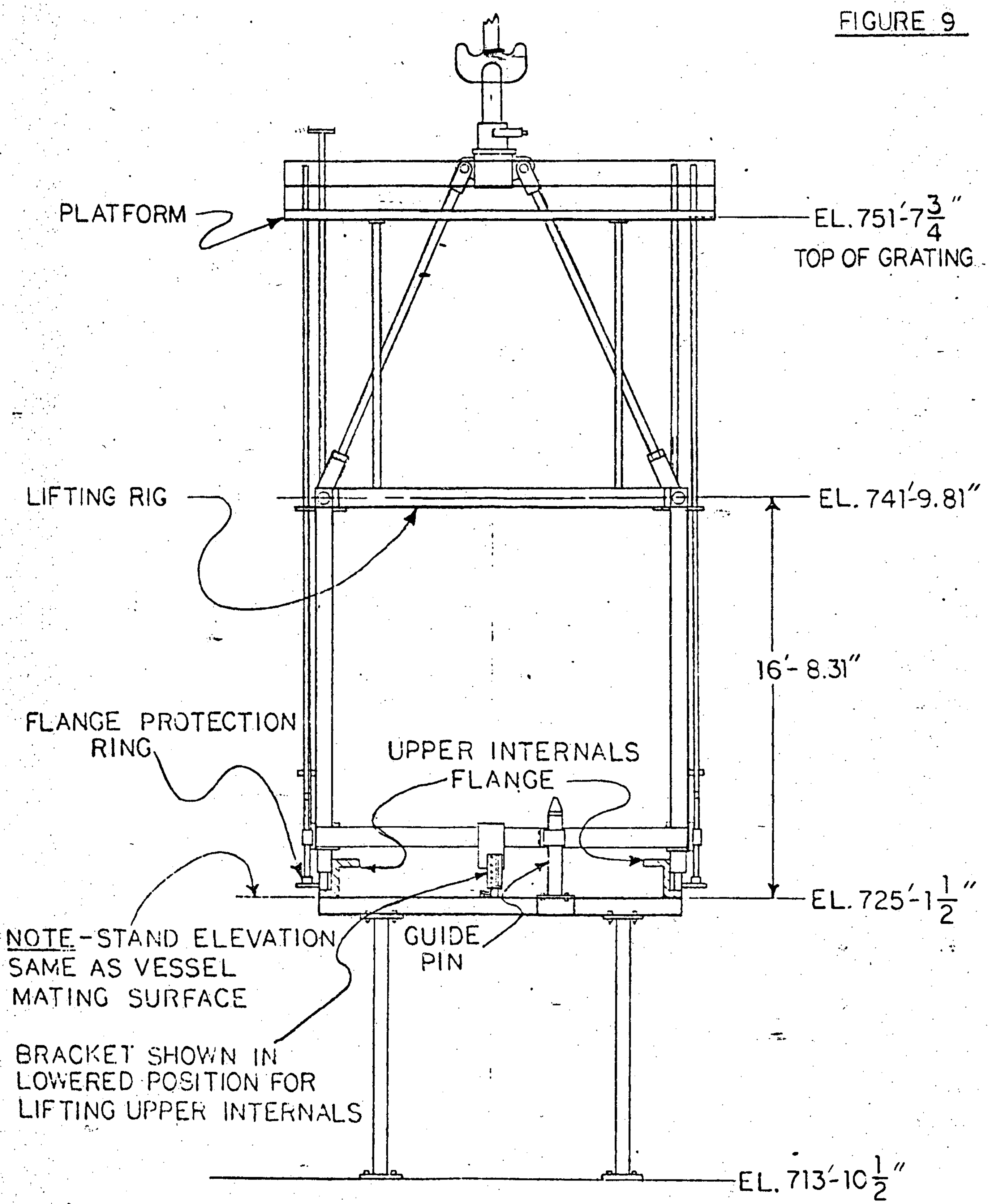
100

NOTE:
UNIT 2 AS SHOWN
UNIT 1 OPPOSITE HAND

FIGURE 8

INTERNALS LIFTING RIG AND UPPER INTERNALS STORAGE STAND

FIGURE 9



CLOSURE HEAD LIFTING RIG

FIGURE 10

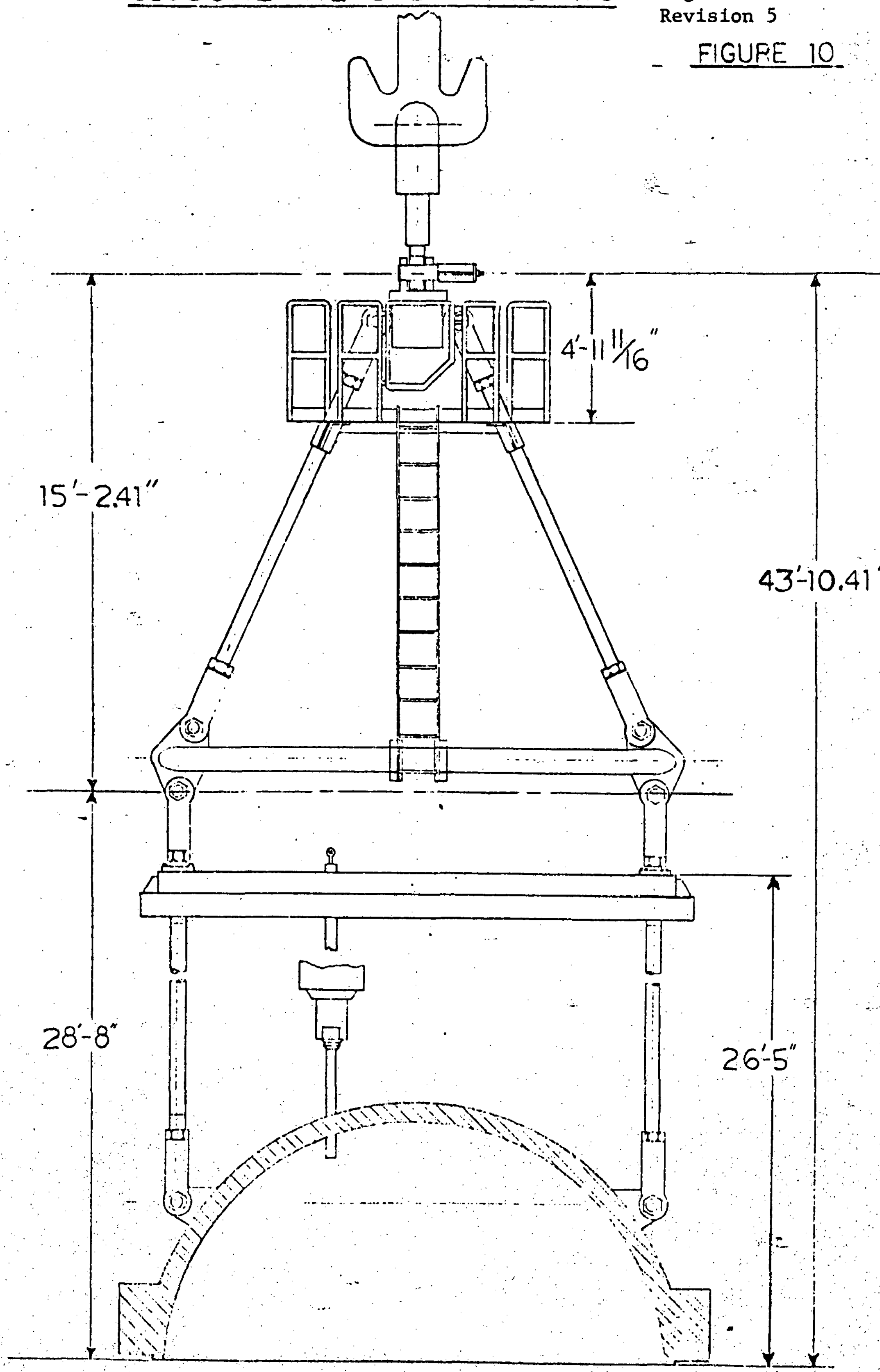


FIGURE 11

REACTOR VESSEL HEAD
PLAN VIEW

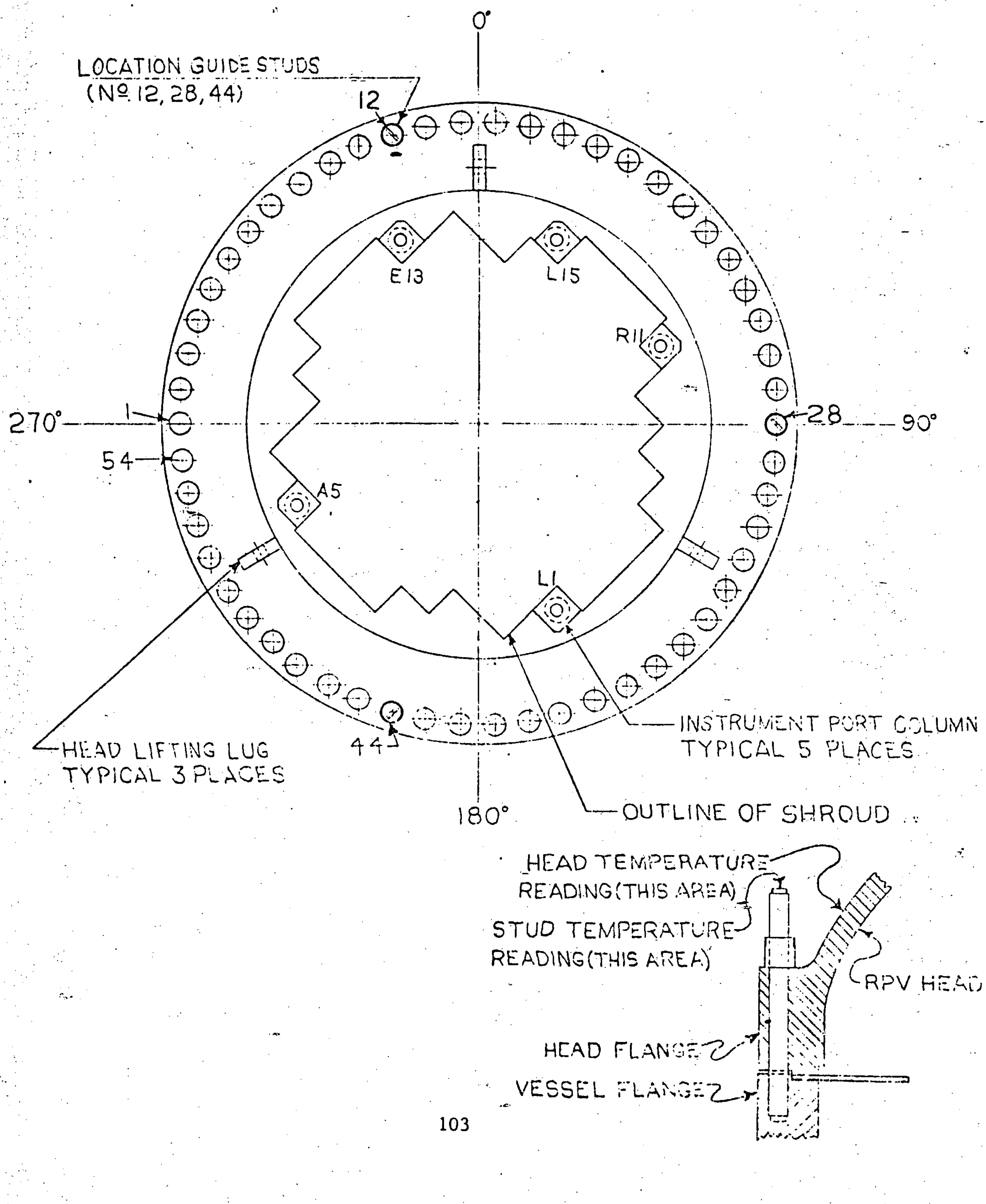
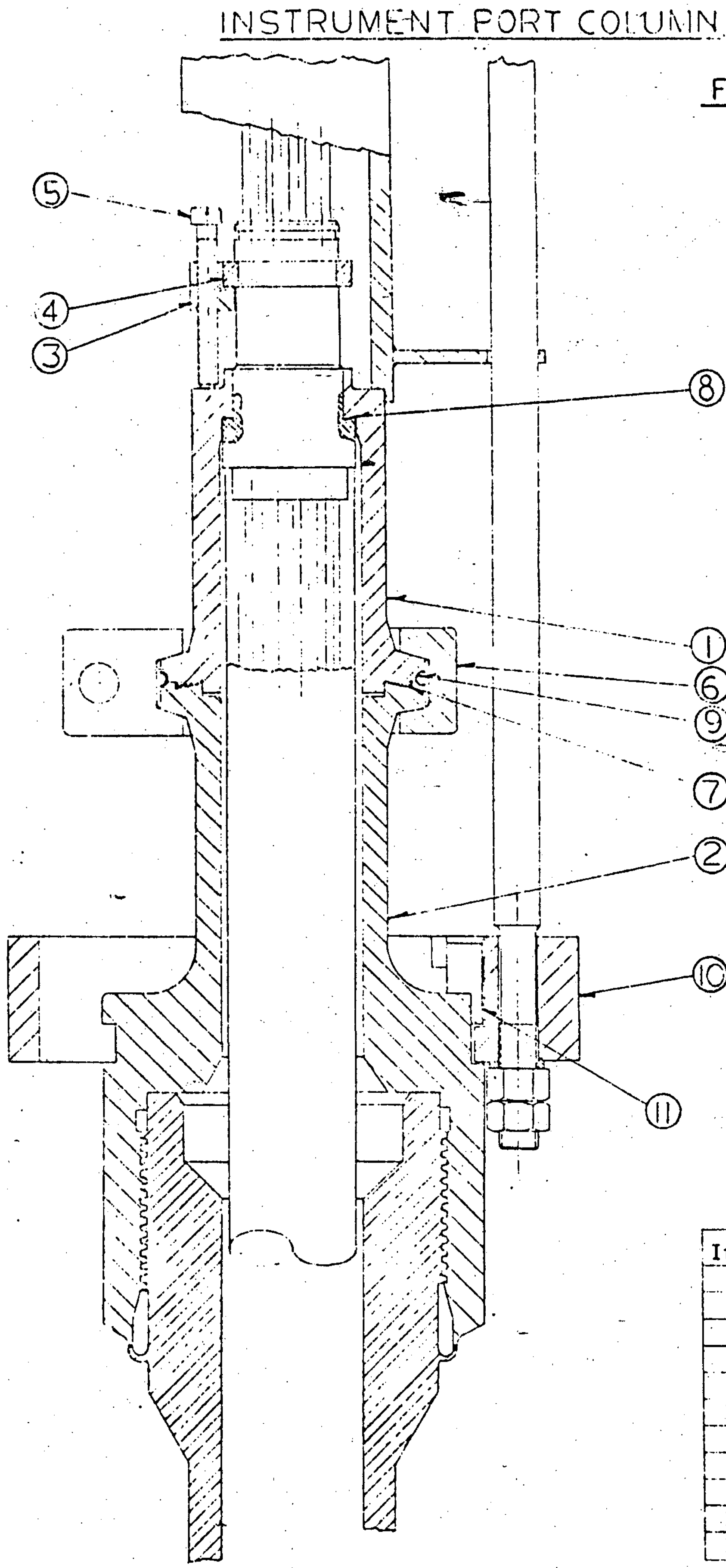


FIGURE 12



Item	Title
1	Male Flange
2	Female Flange
3	Jack Screw Plate
4	Split Ring
5	Jack Screw
6	Coupling Assembly
7	Gasket #MGC-67802
8	Gasket #50887-200-S
9	Weld Ring
10	Loading Device Assy.
11	Spanner Wrench

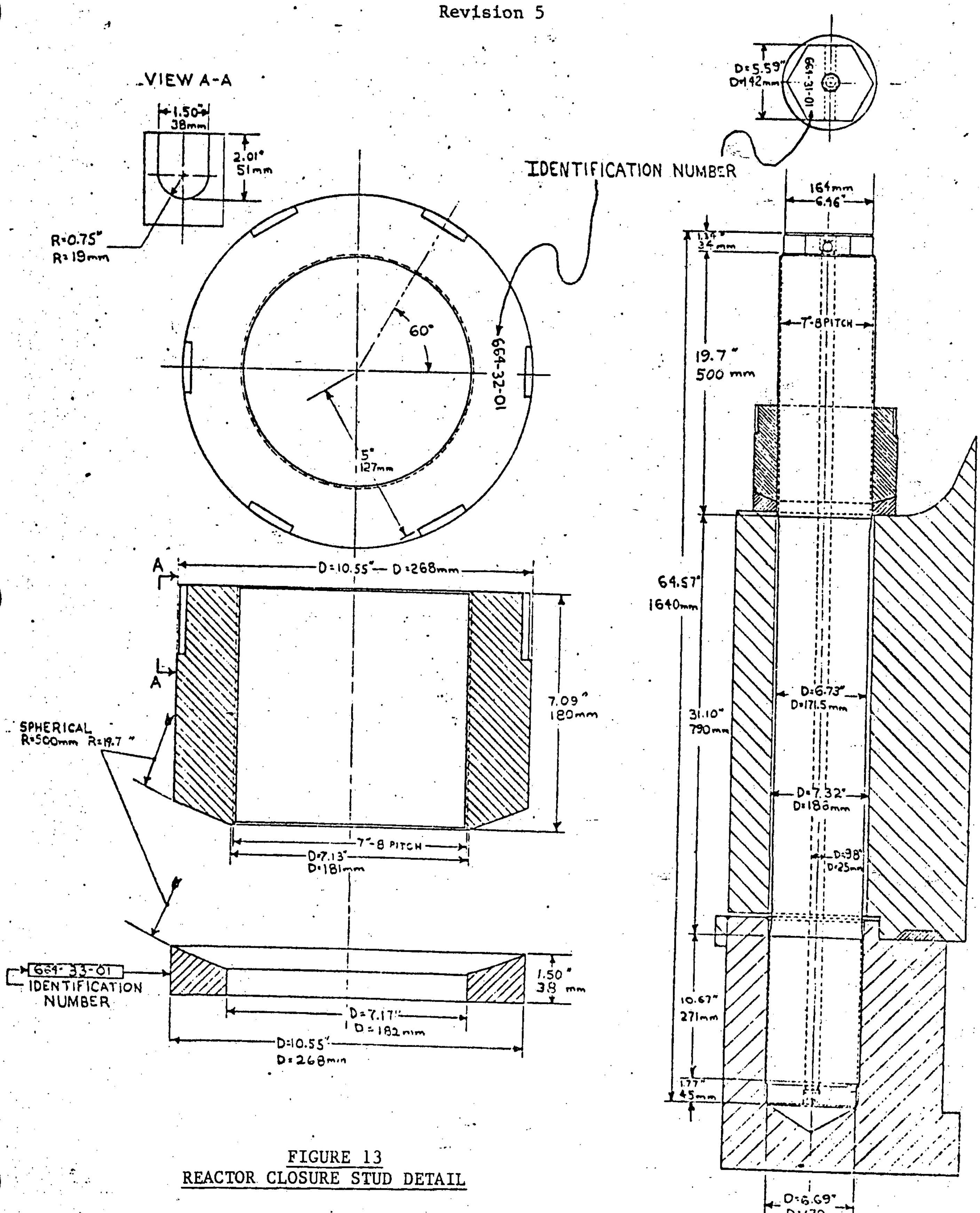


FIGURE 13
REACTOR CLOSURE STUD DETAIL

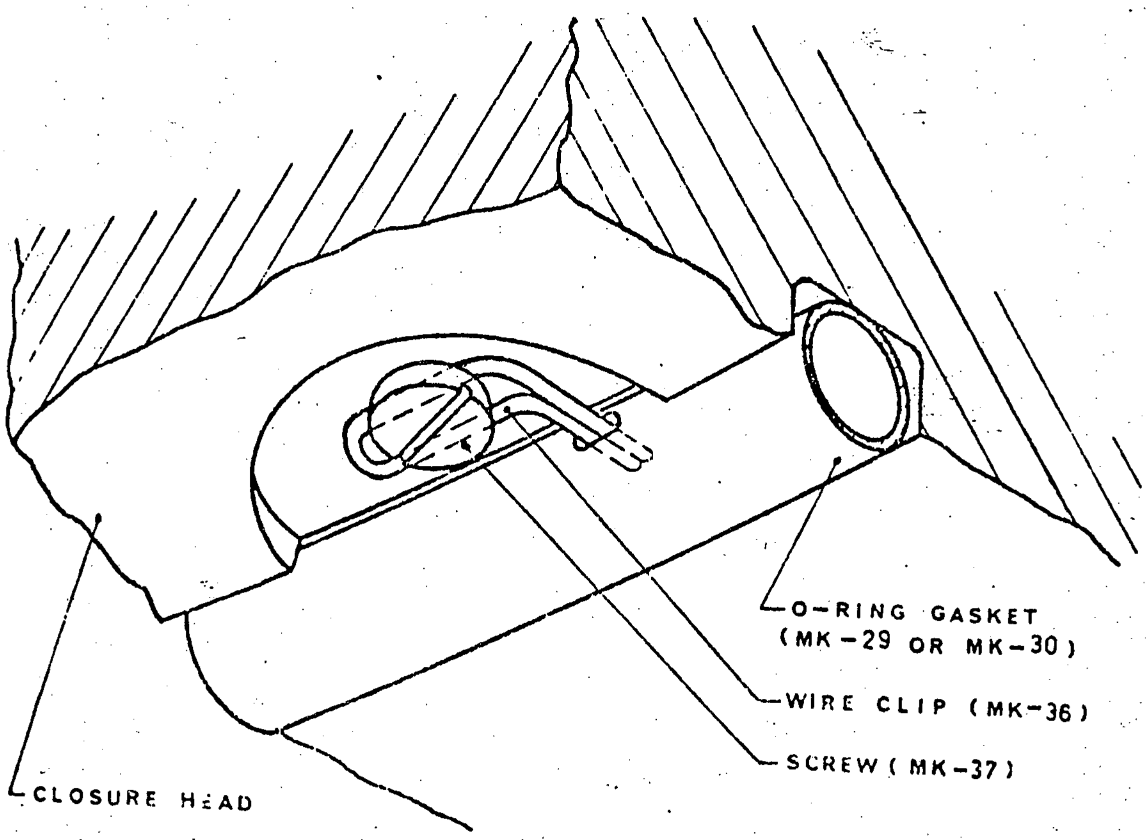
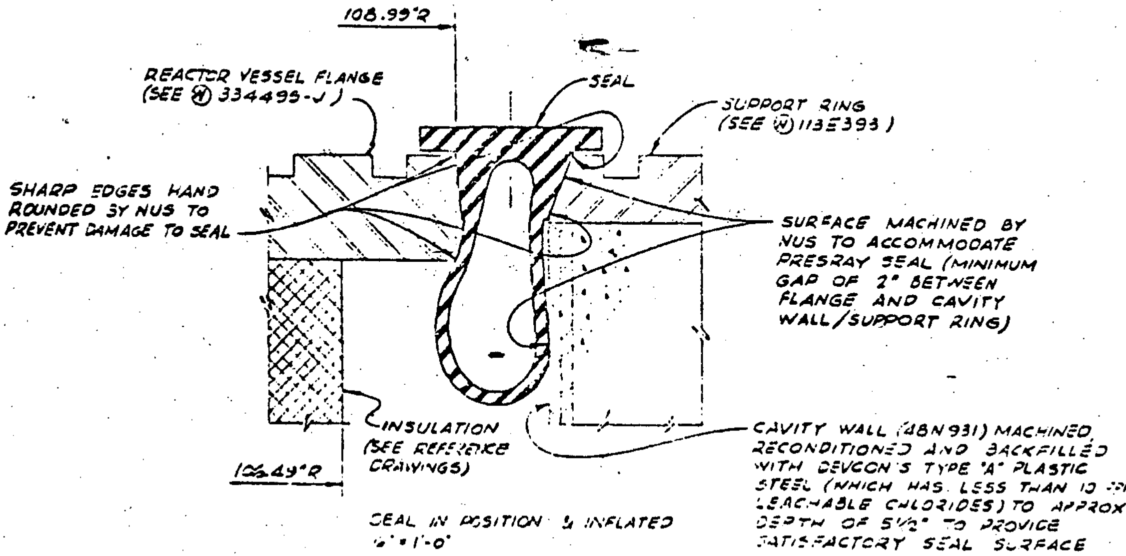


FIGURE 14
O-Ring Gasket Retainer



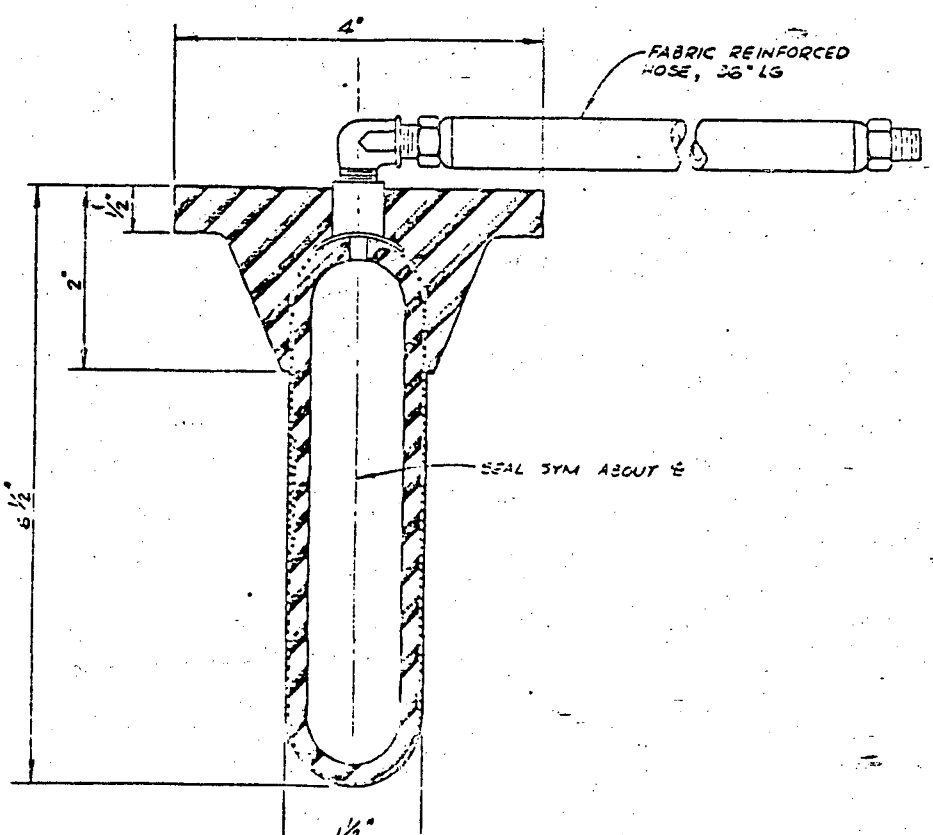
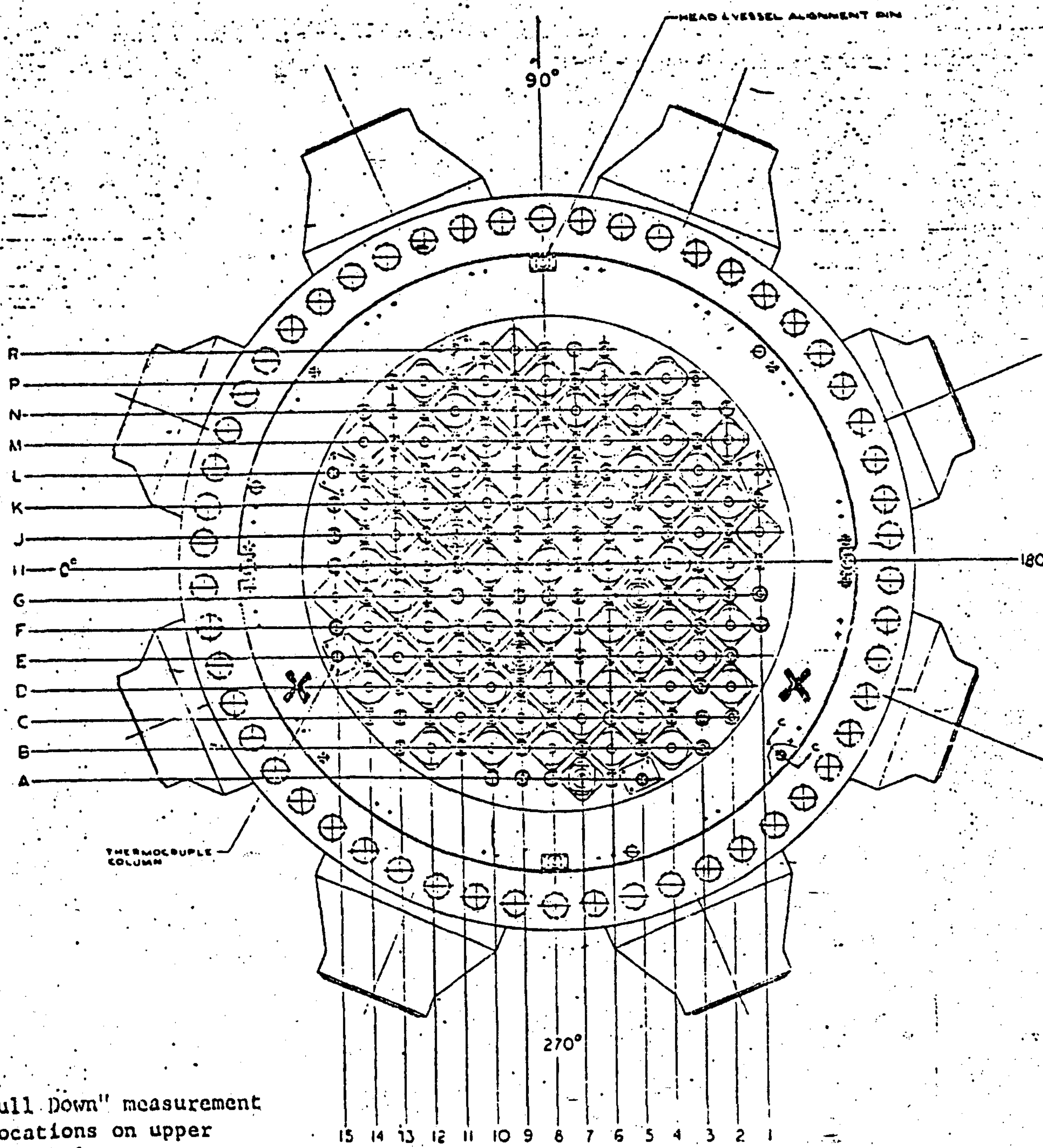


FIGURE 15

INFLATABLE SEAL RING



X -"Full Down" measurement locations on upper internals

FIGURE 16

PLAN VIEW WITH HEAD REMOVED
(CONDUIT RUNS NOT SHOWN)

APPENDIX A
DATA COVER SHEET

REMOVAL AND REPLACEMENT OF REACTOR VESSEL HEAD AND ATTACHMENTS

Unit__________ Reference MR No.______________

Performed by______________________________/____________________/__________
Title Date

Results Reviewed by____/____________
Refuel Floor Coordinator Date

Results Reviewed and Approved_________________________________/____________
FSG Supervisor Date

FQE Review Completed____/____________
FQE Supervisor Date

Forward to Master File

Remarks____

____

____

INDEX

Date ________________

REPLACEMENT PARTS

Part Name	Part No.	Material Procurement Number

Date ______________

INSTRUMENT DATA

Test Equipment	TVA Tag No.	Calibration Due Date

Date______________

Record below the initial condition of parts and components as applicable (include the visible portions of the head and vessel internals during the course of head removal).

____

____

____

____

____________________________/______________

Cognizant Engineer Date

Record below pertinent notes, unusual conditions, recommendations, and final condition of parts and components as applicable.

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____________________________/______________

Cognizant Engineer Date

RCS BOUNDARY CLOSURE INSPECTION (QC)

Section 6.7 Replacement of Closure Head O-Rings

Indicate acceptability by initial/date below

	Inspection	QC Inspector's Initial/Date	
6.7.7	O-ring grooves inspection	_____/_____	
6.7.8 & 6.7.9	Inner O-ring installation inspection	_____/_____	S/N: _____
6.7.10 & 6.7.11	Outer O-ring installation inspection	_____/_____	S/N: _____
6.7.13	Final O-ring installation inspection	_____/_____	

Section 6.10.19 Installation of Closure Head

QC Inspector Initial/Date

Inspect reactor vessel O-ring seal surface.
Indicate acceptability: _____/_____

Section 6.15.2 Closing of Instrument Ports

Indicate acceptability by initial/date below

[1]Instrument Port No.	Sealing Surfaces	Gasket Integrity	Cleanliness (General)	Clamp Torque/ Lubrication	CSSC No.	Cal Due	Jackscrew Torque/ Lubrication	CSSC No.	Cal Due
	/	/	/	/			/		
	/	/	/	/			/		
	/	/	/	/			/		
	/	/	/	/			/		
	/	/	/	/			/		

Ram Hydraulic Gauge CSSC No. __________ Cal Due __________

[1] See Figure 11 for identification of instrument port numbers

RCS BOUNDARY CLOSURE INSPECTION (QC)

Section 6.15.6 Installation of UHI check valves.

Indicate acceptability by initial/date

[1]Line Azimuth	Color	Cleanliness (General)	Sealing Surfaces Hubs	Sealing Surfaces Seal Rings	Seal Ring Standoff	Stud Torque/ Lubrication	Slot Clearance	CSSC No	Cal Due
0°	Red								
90°	Yellow								
180°	Green								
270°	Blue								

See Figure 5 for azimuth and color identification.

Section 6.15.7 Installation of Vent Blanks
Indicate acceptability by initial/date

Line Azimuth	Line Location	Cleanliness (General)	Sealig Surfaces	Stud Torque/ Lubrication	CSSC No	Cal Due
0°	Vessel side	/	/	/		
	Accum. side	/	/	/		
90°	Vessel side	/	/	/		
	Accum. side	/	/	/		
180°	Vessel side	/	/	/		
	Accum. side	/	/	/		
270°	Vessel side	/	/	/		
	Accum. side	/	/	/		
	Vessel vent	/	/	/		

DATA SHEET C
Removal and Reinstallation of UHI Hangers and Restraints
Page 1 of 3

150	36	32	34		72	76	74	33	57		TVA HANGER/RESTRAINT NUMBER (87-XX)	
SNUB	SNUB	SNUB	SPRG HGR		SPRG HGR	SPRG HGR	SNUB	SNUB	SNUB		TYPE	
BLUE 270°	BLUE 270°	BLUE 270°	BLUE 270°		GREEN 180°	YELLOW 90°	GREEN 180°	BLUE 270°	YELLOW 90°	Color Azmth.	Line location & color	
PSA 35	PSA 35	PSA 3	VS4G Size 9		VS4R Size12	CSV-LB1 Size13	PSA 3L	PSA 10	PSA 3		Size/Model	
PSA	PSA	PSA	B-P		B-P	B-P	PSA	PSA	PSA		Manufacturer	
										Initial /Date	Verify proper identification	
5 3/4"	5 3/4"	4 5/8"	1838 LBS		1971 LBS	1089 LBS	7 1/8"	4 1/8"	2 13/16"		Cold position Baseline Setting	
										Intls. /Date	Verify reinstall in proper location	(1)
										Intls. /Date	Verify anti-seize lubricant on pins and threads	
			N/A		N/A	N/A				Intls. /Date	Verify piston rod & adaptor full Thd. engagement	(1)
										Intls. /Date	Verify clevis pins & cotter pins are secure	(1)
										Intls. /Date	Verify all jam nuts are tight	(1)
										Intls. /Date	Verify all mounting bolts are tight	(1)
										Meas. /Intls.	Cold position after reinstallation	(1)
										Intls. /Date	(1) QC inspector Verification	

DATA SHEET C
Removal and Reinstallation of UHI Hangers and Restraints
Page 2 of 3

23	22	180	79	60	59	62	61	25	24	TVA HANGER/RESTRAINT NUMBER (87-XX)		
SNUB	SNUB	SNUB	SNUB	SNUB	SNUB	SNUB	SNUB	SNUB	SNUB	TYPE		
RED 0°	RED 0°	GREEN 180°	GREEN 180°	YELLOW 90°	YELLOW 90°	YELLOW 90°	YELLOW 90°	BLUE 270°	BLUE 270°	Color Azmth	Line location & color	
PSA 3	PSA 10	PSA 10	PSA 3	PSA 10	PSA 35	PSA 3	PSA 10	PSA 10	PSA 10		Size/model	
PSA	PSA	PSA	PSA	PSA	PSA	PSA	PSA	PSA	PSA	Manufacturer		
										Intls /Date	Verify proper identification	
$4\frac{3}{4}$"	$2\frac{1}{8}$"	$5\frac{3}{4}$"	$4\frac{3}{4}$"	$5\frac{3}{4}$"	$5\frac{3}{4}$"	$4\frac{3}{4}$"	$5\frac{3}{4}$"	$5\frac{3}{4}$"	$5\frac{3}{4}$"		Cold position baseline setting	
										Intls /Date	Verify reinstalled in proper location	(1)
										Intls /Date	Verify anti-seize lubricant on pins and threads	
										Intls /Date	Verify piston rod & adaptor full thd. engage	(1)
										Intls /Date	Verify clevis pins & cotter pins are secure	(1)
										Intls /Date	Verify all jam nuts are tight	(1)
										Intls /Date	Verify all mounting bolts are tight	(1)
										Meas. Intls	Cold position after reinstallation	(1)
										Intls Date		
										Intls /Date	(1) QC Inspector Verification	
										Comments		

DATA SHEET C
Removal and Reinstallation of UHI Hangers and Restraints
Page 3 of 3

73	06-2	06-4	06-1	06-3	58	21	37	63	64	TVA HANGER/RESTRAINT NUMBER (87-XX)		
SNUB	REST.	REST.	REST.	REST.	SNUB	SNUB	SNUB	SNUB	SNUB		TYPE	
GREEN 180°	YELLOW 90°	BLUE 270°	RED 0°	GREEN 180°	YELLOW 90°	RED 0°	RED 0°	GREEN 180°	GREEN 180°	Color Azmth	Line location & color	
PSA 3	n/a	n/a	n/a	n/a	PSA 3L	PSA 10	PSA 35	PSA 35	PSA 35		Size/model	
PSA	TVA	TVA	TVA	TVA	PSA	-		PSA	PSA		Manufacturer	
										Intls /Date	Verify proper identification	
2 15/16"	n/a	n/a	n/a	n/a	6 5/8"	5 3/4"	5 3/4"	5 3/4"	5 3/4"		Cold position baseline setting	
										Intls /Date	Verify reinstalled in proper location	(1)
										Intls /Date	Verify anti-seize lubricant on pins and threads	
	n/a	n/a	n/a	n/a						Intls /Date	Verify piston rod & adaptor full thd. engage	(1)
	n/a	n/a	n/a	n/a						Intls /Date	Verify clevis pins & cotter pins are secure	(1)
	n/a	n/a	n/a	n/a						Intls /Date	Verify all jam nuts are tight	(1)
										Intls /Date	Verify all mounting bolts are tight	(1)
	n/a	n/a	n/a	n/a						Meas. Intls	Cold position after reinstallation	(1)
										Intls Date		
										Intls /Date	(1) QC Inspector Verification	
										Comments		

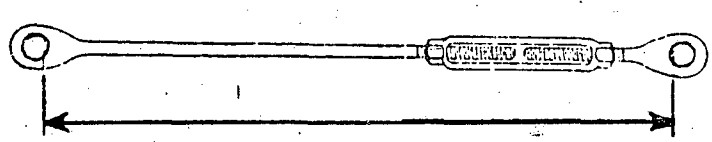
Tie Rod Data Sheet

Azimuth	Tie Point	Color	Baseline Dimension	Reinstalled Dimension	Verified By/Date
45°	Seismic Platform	Yellow			/
135°	Seismic Platform	Green			/
225°	Seismic Platform	Blue			/
270°	Seismic Platform	Blue			/
270°	Seismic Platform	Red			/
315°	Seismic Platform	Red			/
45°	Cable Support	Yellow			/
135°	Cable Support	Yellow			/
225°	Cable Support	Blue			/
315°	Cable Support	Red			/

NOTES:

1. See Figure 7 for azimuth and color identification.

2. Eye-to-eye dimensions are to be measured as below:



3. If a positive means is used of guaranteeing that the seismic tie adjustment has not been disturbed (such as Loctite or equivalent), the pin-to-pin distance does not have to be measured. In this case, record "unchanged" in the distance column and sign in the verify column.

FUEL TRANSFER TUBE BLIND FLANGE INSTALLATION

Section 6.14.1 Fuel transfer tube blind flange installation

Inspection	Verified by QC Inspector Initial/Date
Cleanliness (General)	/
Bolt Torque/Lubrication	/

UPPER INTERNALS INSTALLATION

Section 6.9.20 refueling machine to upper internals full down measurement.

UNIT 1	Measured	Acceptable	UNIT 2	Measured	Acceptable
210°	________	(punchlist)	210°	________	(punchlist)
330°	________	(punchlist)	330°	________	(punchlist)

Tensioning and Detensioning Data Sheet

Reference Step	Data		
6.3.12	Temperature reading =	HF ____ H ____ S ____	Inst. No. ____ Cal. Due ____ Cog. Eng./Date ____/____
6.3.13	Tensioner pump hydraulic gauge		Inst. No. ____ Cal. Due ____ Cog. Eng./Date ____/____
6.3.26	Temperature Reading =	HF ____ H ____ S ____	Inst. No. ____ Cal. No. ____ Cog. Eng./Date ____/____
6.13.7	Tensioner pump hydraulic gauge		Inst. No. ____ Cal. Due ____ Cog. Eng./Date ____/____
6.13.12	Temperature reading =	HF ____ H ____ S ____	Inst. No. ____ Cal. Due ____ Cog. Eng./Date ____/____
6.13.14	Hand-held dial indicators		Inst. No. ____ Cal. Due ____ QC Insp/Date ____/____
6.13.26	Temperature reading =	HF ____ H ____ S ____	Inst. No. ____ Cal. Due ____ Cog. Eng./Date ____/____

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.1	Verify prerequisites satisfied for commencement of work under MI-68.1	______/_____
6.1.1	Remove and store center missile shield	______/_____
	Begin venting and draining of UHI lines and RPV as practical in paralled with subsequent steps.	N/A
6.1.2	Lower CRDM cable support to seismic platform.	______/_____
6.1.3	Remove snubber/hanger 87-73 and store.	______/_____
6.1.4	Verify Hold Order on all electrical connections at head/CRDM assembly, swing booms to wall and secure. H.O. #__________	______/_____
6.1.5	Remove attachments from underneath outer two missile shields except restraints 06-2 & 06-4.	______/_____
6.1.6	Remove and store missile shield MSPC #2 over canal gates and remove restraint 06-4 in the process.	______/_____
6.1.7	Remove & store hangers attached to canal gates.	______/_____
6.1.8	Remove all canal gates & store per drawing 44N266. Remove & store last missile shield #6 & remove restraint 06-2 in the process.	______/_____
6.1.9	Prepare for work in cavity	______/_____
6.1.10	Remove restraint beams from cable support and store.	______/_____
6.1.11	Verify Hold Order on RCS. #__________	______/_____

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.1.11 (continued)	Install air eductor to RPV vent when practical & begin eductor operation. Verify UHI lines are vented on the accumulator side.	______/______
	Remove UHI and RPB vent blanks & coordinate draining of UHI lines and RPV.	______/______
6.1.12	Notify health physics & the shift engineer that the UHI check valve spool pieces are ready to be removed.	______/______
	Remove and store all four UHI check valve spool pieces. (Cog. eng. ensure that system cleanliness is maintained)	______/______
6.1.13	Remove or raise CRDM platform seismic ties (as applicable)	______/______
6.1.14	Remove and store CRDM cooling ducts.	______/______
6.1.15	Remove all remaining UHI snubbers.	______/______
6.1.16	Notify health physics and the shift engineer that the conoseals are to be removed.	______/______
	Remove and store conoseal hardware at all instrument ports.	______/______
6.1.17	Remove and store reactor vessel head insulation.	______/______
6.2.1	Install cavity seal	______/______
6.2.2	Install nozzle shield plugs (if required) and refueling gaskets.	______/______
6.2.3	Install refueling cavity drain plugs	______/______
6.2.4	Verify prerequisites are complete for fuel transfer tube blind flange removal.	______/______
	Remove fuel transfer tube blind flange.	______/______
6.3.1	Verify all prerequisites complete for closure head detensioning.	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.3.2	Connect tensioner hoist power cable and release Hold Order for tensioner hoist power.	______/______
6.3.7 thru 6.3.10	Assemble all tensioners and tensioning equipment in cavity.	______/______
6.3.11	Measure and record minimum temperature of head flange, head, and studs on Data Sheet F.	______/______
6.3.13	Record required CSSC information on tensioner pump hydraulic gauge on Data Sheet F.	______/______
6.3.14	Detension head per sequences given in Table A-1.	______/______
6.3.26	Measure and record final minimum temperature of head flange, head, and studs in Data Sheet F.	______/______
6.3.28	Remove tensioners and tensioning equipment from cavity.	______/______
6.4.6	Using fast stud spinout tools, turn studs out of RPV and set on stud supports.	______/______
6.4.13	Remove closure head studs and install guide studs or stud hole plugs as applicable.	______/______
6.4.14	In parallel with subsequent steps, clean, lubricate, and wrap studs in plastic in preparation for reassembly.	______/______
6.4.17	Obtain Hold Order for tensioner hoist power circuit and disconnect cable from 180 degree cable tray. H.O. # __________.	______/______
6.5.1	Perform final preparations for closure head removal as detailed in steps 6.5.1 through 6.5.24.	______/______
6.5.25	Complete QC Cleanliness Inspection of the cavity and upper compartment Verified by ____________________/__________ QC Inspector Date	______/______
6.5.26	Establish controls of upper compartment per AI-2.6.	______/______
6.6.1	Verify all prerequisites have been completed for removal of closure head.	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.6.2	Verify that the shift engineer and H.P. are ready for the closure head to be removed.	______/______
6.6.3	Coordinate with operations to raise the vessel water level to between 4 and 12 inches below the vessel flange.	______/______
6.6.5	Verify that health physics is monitoring radiation levels during head lifting operations. Raise head one inch and check levelness.	______/______
6.6.6	Raise closure head approximately 24 inches and have operations verify that source range instrumentation indicates no control rods have been lifted.	______/______
6.6.8	Raise closure head to approximately 128 inches above the vessel flange and verify by source range instrumentation and visual inspection that drive shafts were not raised with closure head.	______/______
6.6.10	Raise water level to just above flange and verify that cavity seals and incore instrumentation plugs do not leak.	______/______
6.6.11	Raise water level in cavity to approximately 5 feet above the vessel flange.	______/______
6.6.12	Verify by health physics survey that shielding of upper internals is acceptable.	______/______
6.6.13/ 6.6.15	Raise and move closure head to storage stand and set in place.	______/______
6.6.14	Raise water level in cavity to approximately 10 feet above the vessel flange and turn on cavity lights.	______/______
6.7.1	Verify that a RWP has been issued for replacement of closure head O-rings.	______/______
6.7.2	Remove closure head O-rings, clean and prepare head sealing surfaces for O-ring installation.	______/______
6.7.7	Complete QC inspection of O-ring sealing grooves and O-rings and install on closure head. (Data Sheet B).	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.7.13	Final QC inspection of O-ring installation, verify O-rings have not sustained damage and all screws and wire clips have been installed properly. Verify that screws do not protrude below the head seating surface (Data Sheet B).	______/______
6.8.1	Verify prerequisites satisfied for removal of upper internals.	______/______
6.8.11	Move upper internals rig with flange protection ring attached to seat on upper internals.	______/______
6.8.15	Disengage flange protection ring and engage upper internals and install locking pins.	______/______
6.8.17	Notify the shift engineer & health physics the upper internals are ready to be lifted.	______/______
6.8.18	Remove upper internals and place on storage stand while raising water level to normal refueling level and monitoring source range instrumentation.	______/______
6.8.25	Notify the shift engineer the upper internals have been removed and stored and the flange protection ring is in position on the RPV flange.	______/______
6.9.1	Notify the shift engineer and health physics the upper internals are to be replaced and verify that all Operations and Maintenance prerequisites are satisfied.	______/______
6.9.3	Attach polar crane hook to lifting rig.	______/______
6.9.13	Verify proper disengagement of internals & proper engagement of flange protection ring with locking pins installed	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.9.17	Remove internals lifting rig from reactor vessel and place on upper internals storage stand with flange protection ring in place.	______/______
6.9.20	Upper internals measurement taken and recorded on Data Sheet E, in Appendix A.	______/______
6.9.21	Notify the shift engineer that the upper internals package has been reinstalled.	______/______
6.10.1	Verify that all prerequisites are satisfied for installation of the closure head.	______/______
6.10.9	Final preparations for installation of closure head per Section 6.10 are complete.	______/______
6.10.10	Raise head and verify levelness.	______/______
6.10.11	Drain cavity to approximately 5 feet above vessel flange.	______/______
6.10.14	Move head over reactor and lower to approximately 128 inches above vessel flange.	______/______
6.10.15	Lower water level to approximately 4 inches below vessel flange.	______/______
6.10.16	Verify health physics is prepared to monitor flange area and has issued RWP for work to be performed in this area.	______/______
6.10.17	Verify with a flashlight that all CRD shafts and instrument columns align properly with guides.	______/______
6.10.19	Complete QC inspection of vessel mating surface (Data Sheet B, Appendix A).	______/______
6.10.22	Lower head into position and remove lifting rig.	______/______
6.11	Decontaminate cavity and prepare for reassembly.	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.12.1	Verify all prerequisites are satisfied for installation of closure studs.	______/______
6.12.2	Connect tensioner hoist power cable and release Hold Order for this circuit.	______/______
6.12.4/9	Remove stud hole plugs and guide studs, clean and lubricate holes and install studs in holes on supports. Chase threads per Appendix H if required.	______/______
6.12.16	Verify each hole is dry and free from rust or foreign matter.	______/______
6.12.19	Spin studs into holes using fast stud spinout tools.	______/______
6.13.1	Verify all prerequisites have been satisfied for tensioning of the closure head.	______/______
6.13.4	Install elongation rods into studs.	______/______
6.13.6/9	Install tensioners and tensioning equipment in cavity.	______/______
6.13.7	Record required CSSC information on tensioner pump hydraulic gauge on Data Sheet F (QC verification).	______/______
6.13.12	Measure and record minimum temperature of head flange head, and studs on Data Sheet F (QC verification).	______/______
6.13.13	Notify the shift engineer that tensioning is ready to begin. Verify vessel water temperature is between 80°F and 120°F and request notification if temperature leaves this range.	______/______
6.13.14	Measure initial elongation readings and record on Table A3 (cognizant engineer and QC initials required).	______/______
6.13.21	Tension studs per sequences given in Table A2.	______/______
6.13.22/24	Measure final and corrected elongations (if required) and record on Table A3. No QC inspection required.	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.13.25	After all studs are within the target elongation, measure and record "final inspection" elongation data on Table A3 (cognizant engineer and QC initials required).	______/______
6.13.26	Measure and record final minimum temperature of head flange, head, and studs on Data Sheet F (QC inspection).	______/______
6.13.30	Remove elongation rods, tensioners, & tensioning equipment from cavity & install stud inserts.	______/______
6.13.32	Obtain Hold Order for tensioner hoist power circuit & disconnect cable from 180° cable tray. H.O. #__________	______/______
6.14.1	Verify all prerequisites are complete for installing the fuel transfer tube blind flange.	______/______
	Replace fuel transfer tube blind flange, completing required QC inspection data on Data Sheet E.	______/______
6.14.2	Remove refueling cavity drain plugs and install top hat assemblies.	______/______
	______/______ SRO Date ________/______ QC Inspector Date	______/______
6.14.3	Notify the shift engineer and health physics that the nozzle shield plugs are to be removed.	______/______
	Remove nozzle shield plugs (if installed) & install inspection plate operational gaskets.	______/______
6.14.4	Raise cavity seal ring.	______/______
6.15.1	Install reactor head insulation	______/______
6.15.2	Notify the shift engineer & health physics that the instrument port conoseals are to be replaced.	______/______
6.15.2 step 13	Complete QC inspection of conoseal gaskets, male & female flange cleanliness, & sealing integrity. Record results on Data Sheet B	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.15.2 step 24	Assemble conoseal & apply load to ram while clamp is torqued.	______/______
6.15.2 step 26 & 33	Complete QC torque inspection of clamp bolts and jackscrews. Record results on Data Sheet B.	______/______
6.15.2 step 38	Verify thermocouple plugs are reconnected per MAI-3.	______/______
6.15.3	Install snubbers below seismic platform.	______/______
6.15.4	Install CRDM ducts.	______/______
6.15.5	Install CRDM seismic ties.	______/______
6.15.6	Notify the shift engineer & health physics the UHI check valves are to be reinstalled.	______/______
6.15.6 step 6, 7, 8, 9	Complete QC inspection of check valves & seal rings. Record results on Data Sheet B.	______/______
6.15.6 step 12	Assemble check valves in position.	______/______
6.15.6 step 13, 15	Complete QC inspection of bolt integrity, lubrication & torquing, and record results on Data Sheet B.	______/______
	Complete QC inspection of valve bonnet cover bolt torque & record results on Data Sheet B (if required).	______/______
6.15.7	Coordinate with Operations to begin filling and venting of vessel.	______/______
	Install UHI and RPV vent blanks after vessel filled, completing required cog. eng. inspection of cleanliness, sealing surface integrity and torquing on Data Sheet B.	______/______
6.15.8	Remove cavity ladder cage.	______/______
6.15.9	Install missile shield next to pressurizer & all canal gates, installing restraint 06-2 in the process.	______/______

Reference Section	Control Instruction	Verification (Cog Eng/Date)
6.15.10	Install hangers to canal gates & record required verification & inspection data on Data Sheet C.	______/______
	Remove all scaffolding & other equipment from cavity & perform final cavity cleaning.	______/______
6.15.11	Install missile shield over canal gates, installing restraint 06-4 in the process.	______/______
6.15.12	Install attachments underneath outer two missile shields, recording required verification and QA inspection data in Data Sheet C.	______/______
6.15.13	Hold order on head elect. equip. H.O.#______ All cables connected properly and connector integrity verified. Verified by ______________/______ QC Inspector Date	______/______
6.15.14	Install hanger 87-73.	______/______
6.15.15	Complete verification of QC inspection of hangers above the CRDM seismic platform per data sheet C.	______/______
6.15.16	Raise CRDM cable support & bolt swing booms and support rods in place.	______/______
6.15.17	Install center missile shield	______/______
	Install all missile shield bolts & washers verifying proper match markings, tighten bolts.	______/______
	Notify the shift engineer that all missile shields are installed & reassembly of the reactor is complete.	______/______
6.17	Verify that all tools, spare parts, & potential fire hazard materials, such as rags, flammable & combustible liquids, & plastic have been removed from the work areas & have been properly disposed of. Verified by ______________/______ Craft Foreman Date	______/______
7.1	SI's complete	______/______
7.2	All H.O.'s released	______/______

Unloading Procedure for Normal Full Power

Step 6.3.14 through 6.3.25

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)
	5	Red	
1	23	Yellow	5700
	41	Blue	
	14	Red	
2	32	Yellow	5700
	50	Blue	
	17	Red	
3	35	Yellow	5400
	53	Blue	
	8	Red	
4	26	Yellow	5400
	44	Blue	
	3	Red	
5	31	Yellow	4800
	39	Blue	
	12	Red	
6	30	Yellow	4800
	48	Blue	
	15	Red	
7	33	Yellow	4800
	51	Blue	

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)
	6	Red	
8	24	Yellow	4800
	42	Blue	
	1	Red	
9	19	Yellow	----
	37	Blue	
	10	Red	
10	28	Yellow	----
	46	Blue	
	13	Red	
11	31	Yellow	----
	49	Blue	
	4	Red	
12	22	Yellow	----
	40	Blue	
	18	Red	
13	36	Yellow	----
	54	Blue	
	9	Red	
14	27	Yellow	----
	45	Blue	

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)
	7	Red	
15	25	Yellow	4800
	43	Blue	
	16	Red	
16	34	Yellow	----
	52	Blue	
	2	Red	
17	20	Yellow	----
	38	Blue	
	11	Red	
18	29	Yellow	----
	47	Blue	
	5	Red	
19	23	Yellow	----
	41	Blue	
	14	Red	
20	32	Yellow	----
	50	Blue	
	17	Red	
21	35	Yellow	----
	53	Blue	

Unloading Procedure for Normal Full Power

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)
	8	Red	
22	26	Yellow	4800
	44	Blue	
	3	Red	
23	21	Yellow	----
	39	Blue	
	12	Red	
24	30	Yellow	----
	48	Blue	
	15	Red	
25	33	Yellow	----
	51	Blue	
	6	Red	
26	24	Yellow	----
	42	Blue	

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)

Seq. No.	Stud No.	Ten. Color Code	Loosening Pressure (psi)

133

TENSIONING SEQUENCE FOR NORMAL FULL-POWER
O-RING SEATING PASS

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
A	5 23 41	Red Yellow Blue	2000
B	14 32 50	Red Yellow Blue	2000

TENSIONING SEQUENCE FOR NORMAL FULL-POWER
O-RING SEATING PASS

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
1	1 19 37	Red Yellow Blue	4000
2	10 28 46	Red Yellow Blue	4000
3	6 24 42	Red Yellow Blue	4000
4	15 33 51	Red Yellow Blue	4000
5	12 30 48	Red Yellow Blue	4000
6	3 21 39	Red Yellow Blue	4000
7	8 26 44	Red Yellow Blue	4000
8	17 35 53	Red Yellow Blue	4000

TENSIONING SEQUENCE FOR NORMAL FULL-POWER
O-RING SEATING PASS

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
9	14 32 50	Red Yellow Blue	4000
10	5 23 41	Red Yellow Blue	4000
11	11 29 47	Red Yellow Blue	4000
12	2 20 38	Red Yellow Blue	4000
13	16 34 52	Red Yellow Blue	4000
14	7 25 43	Red Yellow Blue	4000
15	9 27 45	Red Yellow Blue	4000
16	18 36 54	Red Yellow Blue	4000

TENSIONING SEQUENCE FOR NORMAL FULL-POWER

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
17	13 31 49	Red Yellow Blue	4000
18	4 22 40	Red Yellow Blue	4000
19	1 19 37	Red Yellow Blue	8000
20	10 28 46	Red Yellow Blue	8000
21	6 24 42	Red Yellow Blue	8000
22	15 33 51	Red Yellow Blue	8000
* * * 23	12 30 48	Red Yellow Blue	8000
24	3 21 39	Red Yellow Blue	8000

TENSIONING SEQUENCE FOR NORMAL FULL-POWER

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
25	8 26 44	Red Yellow Blue	7700
26	17 35 53	Red Yellow Blue	7700
27	14 32 50	Red Yellow Blue	7300
28	5 23 41	Red Yellow Blue	7300
29	11 29 47	Red Yellow Blue	6800
30	2 20 38	Red Yellow Blue	6800
31	16 34 52	Red Yellow Blue	6600
32	7 25 43	Red Yellow Blue	6600

TENSIONING SEQUENCE FOR NORMAL FULL-POWER

1 Sequence Number	2 Stud Number	3 Tensioner Color Code	4 Tensioner Hydraulic Pump Pressure Setting (psi)
33	9 27 45	Red Yellow Blue	6300
34	18 36 54	Red Yellow Blue	6300
35	13 31 49	Red Yellow Blue	6100
36	4 22 40	Red Yellow Blue	6100
37	1 19 37	Red Yellow Blue	6100
38	10 28 46	Red Yellow Blue	6100
39	6 24 42	Red Yellow Blue	6100
40	15 33 51	Red Yellow Blue	6100

Stud Elongation Data For Normal Full Power

1	2	3			4		5	6		7	8		9
		Initial Readings			Normal Pass			Corrected (if required)			Final Inspection		
Seq. No.	Stud No.	Step 6.13.14 Initial Elong. Gage	Inspected By	Verified By	Step 6.13.22 Final Elong. Gage	Verified By	Elong. Diff. (4-3)	Corr. Elong. Gage	Verified By	Corr. Elong Diff. (6-3)	Step 6.13.25 Final Elong. Gage	QC Inspected By	Corr. Diff. (8-3)
13	9 27 45												
14	18 36 54												
15	4 22 40												
16	13 31 49												
17	6 24 42												
18	15 33 51												

Stud Elongation Data For Normal Full Power

1	2	3			4		5	6		7	8		9
		Initial Readings			Normal Pass			Corrected (if required)			Final Inspection		
Seq. No.	Stud No.	Step 6.13.14 Initial Elong. Gage	Inspected By	Verified By	Step 6.13.24 Final Elong. Gage	Verified By	Elong. Diff. (4-3)	Corr. Elong. Gage	Verified By	Corr. Elong Diff. (6-3)	Step 6.13.25 Final Elong. Gage	QC Inspected By	Corr. Diff. (8-3)
1	1 19 37												
2	10 28 46												
3	5 23 41												
4	14 32 50												
5	8 26 44												
6	17 35 53												

Stud Elongation Data For Normal Full Power

1	2	3			4		5	6		7	8		9
		Initial Readings			Normal Pass			Corrected (if required)			Final Inspection		
Seq. No.	Stud No.	Step 6.13.14 Initial Elong. Gage	Inspected By	Verified By	Step 6.13.24 Final Elong. Gage	Verified By	Elong. Diff. (4-3)	Corr. Elong. Gage	Verified By	Corr. Elong Diff. (6-3)	Step 6.13.25 Final Elong. Gage	QC Inspected By	Corr. Diff. (8-3)
7	3 21 39												
8	12 30 48												
9	7 25 43												
10	16 34 52												
11	2 20 38												
12	11 29 47												

Unit ______________

Date ______________

CLEARANCE INSTRUCTION - MI-68.1

A. Maintenance Information Requirements:

1. Work to be done: MI-68.1, "Removal and Replacement of the Reactor Vessel Head and O-ring"

2. Estimated Duration of Work ____

3. Time and Date Work to Begin ________________________ / ______________

4. Requested by ________________________ Time/Date ________________

NOTE: This clearance is provided for a specific task as indicated by the above title. If other work items are involved or arise, this clearance must be reevaluated for adequacy.

B. Initial Conditions: Date ____________________

1. _____ The unit is shut down and RHR System maintaining RCS temperature 140°F.

2. _____ The SHUTDOWN MARGIN $\geq$ 5% Δ K/K.

3. _____ Containment entry is permitted

4. _____ Radiation Work Permit issued for draining RCS.

5. _____ RCS H_2 concentration $<$ 5 cc/kg.

6. _____ RHR letdown, CVCS cleanup system and one charging pump in service.

Unit ____________________

Date ____________________

C. Tagging Instructions: Date____________

1. _____Check RHR letdown FCV-74-1 and -2 open, then make inoperable and tag with Hold Order Clearance (shift engineer only).

   NOTE: This would apply to FCV-74-8 and -9 if they are being used for RHR cooling.

2. _____Tag the RCPs (4) (electrically as a minimum) on separate clearances.

3. _____Tag PZR heaters electrically.

4. Tag the following as RCS clearances:

   a. Check closed the four CL Accumulator isolation MOVs; open 480-V ACB and tag with HN. Tag each valve handwheel with HN and benchboard control with HN.

      (1) _____FCV-63-118
      (2) _____FCV-63-98
      (3) _____FCV-63-80
      (4) _____FCV-63-67
      (5) _____Close CL Accum #1 fill manual valve 63-610 and tag with HN.

Unit ____________________

Date ____________________

C.4 a (continued)

(6) _____Close CL Accum #2 fill manual valve 63-611 and tag with HN.

(7) _____Close CL Accum #3 fill manual valve 63-612 and tag with HN.

(8) _____Close CL Accum #4 fill manual valve 63-613 and tag with HN.

(9) _____Close Accum check valve leak test line manual isolation valve 63-601 to HUT (d/s of leak check flow indicator) and tag with HN.

b. Check the following UHI valves:

(1) _____FCV 87-21 closed and gagged. Open 480V gag motor supply and tag with HN. Tag gag motor control HS-87-21B with HN.

(2) _____FCV 87-22 closed and gagged. Open 480V gag motor supply and tag with HN. Tag gag motor control HS-87-22B with HN.

(3) _____FCV 87-23 closed and gagged. Open 480V gag motor supply and tag with HN. Tag gag motor control HS-87-23B with HN.

Unit ________________

Date ________________

C.4.b (continued)

(4) _____FCV 87-24 closed and gagged. Open 480V gag motor supply and tag with HN. Tag gag motor control HS-87-24B with HN.

(5) _____Close manual valve 87-525 and tag with HN.

c. Tag SI Pumps and valves as follows:

(1) SI Pump A-A

_____6900V ACB racked out to disconnected position and tag with HN.

_____Check closed discharge isolation FCV-63-156; open 480V ACB on RX MOV board A-1A, tag control switch on main control board, 480V ACB, and valve handwheel with HNs.

(2) SI Pump B-B

_____6900V ACB racked out to disconnected position and tag with HN.

_____Check closed discharge isolation FCV-63-157; open 480V ACB on RX MOV board B-1B, tag control switch on main control board, 480V ACB, and valve handwheel with HNs.

Unit ______________

Date ______________

C.4.c (continued)

(3) Close SI cold leg injection FCV-63-22. Open 480V ACB on RX MOV board B-1B.

_____FCV 63-22 checked closed valve, handwheel, main control board switch and ACB tagged with HNs.

d. Tag BIT outlet as follows:

NOTE: Breakers on the 2 charging pumps not being used should be racked out.

(1) _____Close BIT outlet FCV-63-25; open 480V ACB on RX MOV board B1-B and tag with HN.

(2) _____Close BIT outlet FCV-63-26, open 480V ACB on RX MOV board A1-A and tag with HN.

(3) _____Check closed BIT 1" bypass manual valve 63-564 and tag with HN.

(4) _____Tag FCV-63-25 benchboard control with HN.

(5) _____Tag FCV-63-26 benchboard control with HN.

e. Tag Excess Letdown as follows:

_____Close FCV-62-54, tag benchboard control with HN.

_____Remove FCV-62-54 fuses (125V dc Vital bd II (IV), ckt D21) and tag with HN.

Unit ________________

Date ________________

C.4 (continued)

f. Tag RHR Pump suction from RWST as follows:

_____Check closed FCV-63-1, tag benchboard control switch with CAUTION ORDER # _____________ worded as follows: "Open only for emergency RCS makeup, notify SRO."

g. Tag charging pump suction from RWST isolation valves as follows:

_____Check closed FCV-62-135, tag benchboard control switch with CAUTION ORDER, # ___________, to read "Open only for VCT makeup or emergency core cooling needs" .

_____Check closed FCV 62-136, tag benchboard control switch with CAUTION ORDER, # __________, to read "Open only for VCT makeup or emergency core cooling needs."

h. Tag RCS makeup system as follows (to be issued to SE only):

(1) _____Verify VCT within normal operating band.

(2) _____Place FCV-62-128 control switch in CLOSE and tag with HN.

(3) _____Remove fuses for FCV-62-128 on 125V dc Vital bd I (III), ckt A28 and tag with HN.

(4) _____Check manual boration valve 62-929 closed and tag with HN.

Unit ______________

Date ______________

C.4.h (continued)

(5) _____Place FCV-62-144 control switch in CLOSE and tag with HN.

(6) _____Remove fuses for FCV-62-144 on 125V dc Vital bd I (III), ckt A29, and tag with HN.

(7) _____Check PW to charging pump suction manual valve 62-932 closed, tag with HN.

i. Tag Normal Letdown as follows:

(1) _____Check letdown isolation FCV-62-69 control switch in CLOSE and tag with HN.

(2) _____Remove fuses for FCV-62-69 on 125V dc bd I (III), ckts A3 and B3, and tag with HN.

j. (1) _____Issue Hold Order to shift engineer and attach to clearance sheet.

(2) _____Coordinate with MI-68.1 and drain the RCS per SOI-68.1C for removing reactor vessel head.

(3) Upon completion of draining operation, verify following:

(a) _____Water level in system is stabalized at about 4 inches below reactor vessel flange per SOI-68.1C.

Unit ______________

Date ______________

C.4.j(3) (continued)

(b) _____One charging pump operating and breakers on other two pumps are racked to inoperative position.

(c) _____Operating RHR System maintaining RCS temperature with lowest flow practicable to minimize turbulence in RCS (min flow is 2500 gpm per Tech Spec).

(d) _____VCT water level in operating range.

(e) _____Coordinate with MI-68.1 and fill reactor cavity to just below reactor vessel head level per SOI 78.1F.

(f) _____Fill reactor cavity to equilibrium with spent fuel pit as vessel head is raised per SOI-74.1C.

(g) _____Comply with FHI-6 for reactor vessel head removal.

CAUTION: S/Gs are not drained. Level should be observed occasionally to verify a S/G tube leak is not allowing a loop to drain slowly.

(4) _____Emergency Boration FCV-63-138B closed and control switch tagged under CAUTION ORDER, # _______, worded: "In the event it becomes necessary to open this valve, notify the shift engineer immediately."

NOTE: It is becomes necessary to add water to VCT for makeup purposes during time of clearance, the shift engineer must be notified and work temporarily stopped so clearance can be temporarily lifted on makeup system long enough to add the desired amount.

Unit ________________

Date ________________

C.4 (continued)

k. Tag CRDM cooler fans as follows:

(1) _____Open and rack to inoperable position 480-V ACB for A-A cooler and tag with HN.

(2) _____Open and rack to inoperable position 480-V ACB for C-A cooler and tag with HN.

(3) _____Open and rack to inoperable position 480-V ACB for B-B cooler and tag with HN.

(4) _____Open and rack to inoperable position 480-V ACB for D-B cooler and tag with HN.

(5) _____Issue Hold Order to shift engineer and place HO card on MCR tag board or with clearance sheet.

l. Tag the following on one clearance, separate from the RCS. Tag supply to coil stack and LVDTs as follows:

(1) _____Check reactor trip breakers open (main and bypass, A or B train). Place in non-operating position and tag with HN.

(2) _____Open 120V ac power supply breaker to RPI LVDTs and tag with HN (120V ac Inst Pwr rack B, bkr 1, M-7).

(3) _____Tag reactor trip-reset switch RT-1 panel M-4 with HN.

(4) _____Place HO card on MCR tag board or with clearance sheet.

m. Tag the stud tensioner hoists 480V ACB with HN. Issue Hold Order to shift engineer and place HO card on MCR tag board or with clearance sheet.

Unit ____________

Date ____________

C.4 (continued)

Tagged by ____________

Remarks ____________

D. Releasing and Aligning for Operation:

1. _____All persons holding clearance have released it.
2. _____Inspect assembly of coil stack and LVDT connection.
3. _____Replace fuses for FCV-62-69 letdown isolation valve and pickup tags on control switch and fuses.
4. _____Remove tags from manual isolation valves 62-932 and 62-929 (manual boration and PW to charging pump suction).
5. _____Replace fuses for FCV-62-128 and 144.
6. _____Remove tags from control switches for FCV-62-128 and -144.
7. _____Release caution order on emergency boration FCV-62-138B.
8. _____Remove tags and close 480V ACBs for FCV-62-135 and -136.
9. _____Remove tags on local handwheel of FCV-62-135 and -136.

Unit ______________

Date ______________

D. (continued)

10. _____Remove tags on control board switches for FCV-62-135 and -136.

11. _____Remove tag and close 480V ACB for FCV-63-1 (RHR suction).

12. _____Remove tag on local handwheel of FCV-63-1

13. _____Remove tag on benchboard control switch for FCV-63-1.

14. _____Remove tag and replaced fuses for FCV-62-54 and removed tag from benchboard control switch.

15. _____Remove tags and close 480V ACBs for FCV-63-25 and -26 and remove tags from benchboard control switches and place in normal position.

16. _____Remove tag from manual valve 63-564 (BIT bypass).

17. _____Remove tag and close 480-V ACB for FCV-63-22 (SIS cold leg inj). Remove tag from handwheel and benchboard control switch. Place valve in open position.

18. _____Continue next step (this step reserved).

19. _____Remove tags and close 480V ACBs for FCV-63-156 and -157 and remove tags from handwheels and benchboard control switches.

20. _____Remove tags from SI Pumps A-A and B-B 6900V ACBs (leave racked out) and remove tags from benchboard control switches.

Unit ________________

Date ________________

D. (continued)

21. _____Remove tag from manual valve 87-525 (UHI - charging pump line).

22. _____Remove tags and close 480V ACBs to gag motors for FCV-87-21, 87-22, 87-23, and 87-24 (UHI) and remove tags from control board switches.

23. _____Remove tag from and open manual valve 63-601 (leak test).

24. _____Remove tags from and open CL accum fill isolation valves 63-610, 63-611, 63-612, and 63-613.

25. _____Remove tags from 480V ACBs for CL accum isolation MOVs FCV-63-118, FCV-63-98, FCV-63-80, FCV-63-67, and remove tags from handwheels and benchboard control switches.

26. _____Remove tags and rack 480V ACBs to operable position for (4) CRDM cooler fans.

27. _____Remove tags and close 120V ac supply to LVDTs.

28. _____Remove tags and rack to operating position reactor trip breakers under clearance.

29. _____Remove tag from reactor trip-reset switch.

30. _____Remove Hold Order Clearance on RHR letdown FCV-74-1, 74-2, (or 74-8, and -9) and make operable.

31. _____Remove tag from stud tensioner hoist 480V ACB.

Unit ________________

Date ________________

D. (continued)

32. _____Fill system per SOI-68.1B.

33. Cleared By: ________________

E. Post Maintenance Testing: Date____________

1. _____Perform SI-4.14, structural integrity.
2. _____Perform SI-4.4 RCS leak test.
3. _____Perform SI-1.13, rod drop time measurement if required.

System operability demonstrated and ready to return to service.

________________________ / ________
SRO Date

All safety-related valves have been returned to their correct position following necessary manipulation for tagging and post-maintenance testing.

________________________ / ________
SRO Date

F. Return completed Appendix B to FSG Refuel Floor Coordinator for inclusion in completed data package.

TENNESSEE VALLEY AUTHORITY
WATTS BAR NUCLEAR PLANT
Hazard Control Instruction

ALCOHOL (ISOPROPANOL)

Isopropyl alcohol is a highly flammable liquid used for a variety of purposes. It acts as a local irritant and in high concentrations as a narcotic. Serious eye damage can occur upon contact with isopropyl alcohol.

Precautions

1. All safety precautions for flammable liquids (HCI-HM1) shall apply to the use of isopropyl alcohol.

2. Chemical goggles, or faceshields shall be worn when handling isopropyl alcohol. Rubber gloves are also required where prolonged contact is necessary.

3. Good ventilation shall be provided where isopropyl alcohol is handled.

4. Proper respiratory equipment shall be required where concentrations produce irritation or other uncomfortable effects.

5. Fire protection shall be readily available in areas of use.

6. If the eyes are affected, they should be washed immediately with clean water for at least 15 minutes. After washing medical personnel shall be consulted.

Approved Cylinders & Pressures
Required for Conoseal Loading

ENERPAC CYLINDER MODEL NUMBER	COLLAPSED HEIGHT (IN)	CYLINDER EFFECTIVE AREA (IN^2)	HYDRAULIC PUMP PRESSURE REQUIRED TO ACHIEVE (ALLOWABLE RANGE)	
			17,000 lbs.	19,000 lbs.
JSL-101 RC-102 RLC-101	3.41 4.78 3.47	2.236	7,603	8,497
JSH-121 JSH-123 RCH-121 RCH-123	4.25 7.25 4.88 7.25	2.761	6,157	6,882
RCH-102	7.31	2.973	5,718	6,391
JSL-200 JSL-201 RLC-201	2.03 3.88 3.88	4.439	3,830	4,280
JSH-202 RCH-202	6.31 6.31	4.725	3,598	4,021
JSL-302 RLC-302	4.56 4.63	6.490	2,619	2,928
JSH-302 RCH-302	7.00 7.00	7.216	2,356	2,633
JSL-502 RLC-502	4.81 4.81	9.620	1,767	1,975
JSL-1002 RLC-1002	5.56 5.56	19.640	866	967

Hydraulic pump pressure rea. $= \dfrac{\text{17,000 lbs. or 19,000 lbs.}}{\text{cylinder effective area (in}^2\text{)}} = \text{lbs./in}^2$

Conoseals are to be rammed to a total pressure between 17,000 and 19,000 lbs. during Marman clamp installation.

Due to insufficient capacity of the cylinder DO NOT use the following: JSL-50, RC-50, RC-53, and RC-55.
Cylinder numbers mean the following:
1) 2 digit: 1st number = capacity in tons; 2nd number = stroke in inches.
2) 3 digit: 1st 2 numbers = capacity in tons; 3rd number = stroke in inches.
3) 4 digit: 1st 3 numbers = capacity in tons; 4th number = stroke in inches.

Effective Date Page Date

REACTOR VESSEL STUD HOLE CHASING

Step 6.12.5
PREREQUISITES

1. Chase tool operator extended to span the thickness of the vessel head flange and stud hole depth plus one foot.
2. Add guide to chase tool operator to center tool in the vessel head stud hole.
3. Reactor vessel head installed on reactor vessel.
4. Stud hole plugs, guide studs, and guide stud sleeves have been removed to allow access to the affected stud holes.
5. All moisture and loose debris has been removed from the stud holes.

PERFORMANCE

1. Suspend the chase tool from a stud tensioner hoist with a spring scale.
2. Position tool over stud hole and lower into stud hole until spring scale reads 0 lbs.
3. Jog hoist upward until spring scale reads 1/2 the weight of the tool. Maintain this weight throughout chasing operation.
4. Slowly rotate tool in the clockwise direction 1/4 turn, then 1/8 turn counterclockwise. Do not force tool.
5. Repeat step 4 as necessary until the tool has passed the damaged threads or has bottomed in the stud hole.
6. Slowly unthread and remove tool.
7. Remove all metal shavings from stud hole with a vacuum cleaner with a high efficiency filter.
8. Slowyly thread go-gage into the stud hole until the gage bottoms in the stud hole. Do not force go-gage.
9. Lubricate stud hole and install vessel stud.

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-67.3

ERCW MOTOR REMOVAL

Rev. By	Rev. No.	Date	Revised Pages
N/A	0	12-8-81	All
RLB	1	1-4-82	1 & 5
JDS	2	REL 1-26-82	Pages 2,5,6,7 and Added Pg. 9

The last page of this instruction is number 9.

1C	Plant Master File
	Superintendent
	Assistant Superintendent
1C	Mechanical Maintenance Supervisor
	Results Supervisor
1C	Operations Supervisor
2C	Quality Assurance Supervisor
	Health Physicist
	Administrative Supervisor
	Chemical Laboratory
	Instrument Shop
1C	Shift Engineer's Office
1C	Unit Control Room
	Health Physics Laboratory
	PSU Supervisor
	Mechanical Engineer
	Reactor Engineer
	Chemical Engineer
	Instrument Maintenance Supervisor
1C	Asst. Director of Nuc Power (Oper)
2C	Electrical Maintenance Supervisor
1U-1C	Plant Services Supervisor
1C	Field Services Group
1U	NRC
1C	Nuclear Safety Review Staff
1U	Nuclear Maintenance Branch
1C	Asst. Mechanical Maintenance Supervisor

Prepared By C. E. Wood, Jr.

Submitted By [signature] Supervisor

PORC Review 12-8-81 Date

Approved By [signature] Superintendent

Date Approved 12-8-81

1.0 STATEMENT OF APPLICABILITY

This instruction is written to provide guidelines for the removal of ERCW motors. This instruction is applicable in all modes of operation. # denotes signoff required in the data package.

NOTE: This instruction may be performed in conjunction with MI-67.1.

2.0 REFERENCES

2.1 Siemens-Allis Instruction Book, Contract 820089

2.2 MI-57.15

3.0 PREREQUISITES

3.1 Mechanical maintenance assistance is required to uncouple the motor from the pump and for disconnecting the water pipes.

#3.2 Obtain separate hold orders on the ERCW motor power (6900V shutdown board) and the ERCW motor space heater (480V IPS distribution panel).

3.3 Notify QC for torquing requirements.

4.0 PRECAUTIONS

4.1 Ensure electrical leads are de-energized before touching.

5.0 PREPARATIONS FOR WORK

5.1 Foreman survey the work to determine exact requirements for scaffolding, ladders, proper wrench sizes, etc.

5.2 Obtain and position adequate cribbing to set the motor on after it is removed from the base. Evaluate the need for reconnecting the motor heaters and providing protective coverings for the motor if the storage period is to be extensive or environmental conditions necessitate.

6.0 PERFORMANCE OF WORK

NOTE: All wire lifts are to be documented by two-party sign-off in the data package.

NOTE: All bolts and washers that are removed shall be placed in a container and they shall be identified so that they will be replaced in the same slot from which they were removed.

#6.1 Mark (if necessary) and disconnect the main leads (T1, T2, T3 and if applicable T4, T5, and T6) and conduit from the main lead terminal box.

#6.2 Disconnect the ground wire from the junction box and disconnect the ground strap from the motor housing.

6.0 PERFORMANCE OF WORK (Continued)

#6.3 Mark (if necessary) and disconnect the thermocouple leads and the conduit from the thermocouple junction box.

#6.4 Mark (if necessary) and disconnect the space heater leads and the conduit from the space heater terminal box.

#6.5 Disconnect the two ½ inch water pipes from the upper bearing cooler. Upon disconnecting all piping or connections the open ends shall be taped.

#6.6 Uncouple the motor shaft from the pump shaft. Upon removal all bolts and washers are to be identified in such a manner that they may be reinstalled in the same slot from which they were removed. Also, the coupling shall be marked in such a manner that the top and bottom halves may be realigned in their original position.

#6.7 Remove the motor housing bolts from the pump housing.

6.7.1 Matchmark all bolts prior to removing.

6.7.2 If shims were used, matchmark shims.

6.8 The motor is now ready for removal, and may be removed using the lifting eyes (4) provided in the motor housing.

CAUTION: The motor should be placed in a vertical position on cribbing for temporary storage or shipment.

To reinstall the motor, after it has been aligned and coupled to the pump (for alignment and coupling see MI-67.1), perform the following steps:

#6.9 Install motor housing hold down bolts and snug the bolts. Torquing of bolts to be done during alignment.

#6.10 Reconnect all leads and conduit. Note: Refer to ESL-5.2 for torque value. Use the Motor Lead Insulation Guide, Attachment C of this instruction. QC Inspector to verify proper reconnection of all leads and conduit.

#6.11 HOLD POINT: Craftsman Foreman to verify motor leads reconnected properly.

#6.12 Reconnect the two ½ inch upper bearing water cooling pipes. Refer to MSL-16 for proper torque values by finding appropriate bolt in the tables of MSL-16. QC to verify proper reconnection. QC Inspector to verify torquing and appropriate level of cleanliness.

#6.13 Mechanical Maintenance engineer to verify proper reconnection of the motor coupling.

CAUTION: Be sure motor coupling half is not touching adjusting plate on pump shaft.

6.0 PERFORMANCE OF WORK (Continued)

#6.14 After aligning, ensure that the motor housing holddown bolts are properly torqued per MSL-16. QC Inspector to verify proper torquing.

#6.15 Release the hold order on the motor and bump the motor for proper rotation. If acceptable, release the motor for vibration testing. Release the hold order on the heaters.

NOTE: Pump rotation is counterclockwise.

#6.16 Contact Mechanical Engineering (Results) to check motor vibration.

ERCW MOTOR REMOVAL AND REPLACEMENT

Unit ________

Performed By ______________________________ Date ________________
Craftsman

TR # ________________

Review of Test Results

______________________________ Date ________________
Foreman

Review and Approval of Test Results

Cognizant Engineer ____________________ Date ________________

Remarks ____

____

____

____

QA Staff Review ____________________ Date ________________

UNIT________ DATE____________

TR NO. ________

ERCW MOTOR NO.___________

3.2 Hold Order (motor) #__________

Hold Order (heater #__________

	LOCATION	WIRE NO.	TERMINAL POINT	LIFT INIT	LIFT INIT	REPLACE INIT	REPLACE INIT	QC TORQUE
6.1	MAIN LEAD JB	T1						
		T2						
		T3						
*		T4						
*		T5	Connected Together					
*		T6						
6.3	THERMOCOUPLE JB		+1					*
			-1					
			+2					
			-2					
			+3					
			-3					
			+4					
			-4					
			+5					
			-5					
			+6					
			-6					
			B+					
			B-					
			B2+					
			B2-					
			GROUND					

DATE ________

	LOCATION	WIRE NO.	TERMINAL POINT	LIFT		REPLACE		
				INIT	INIT	INIT	INIT	*
6.2	MOTOR HOUSING	GROUND WIRE GROUND STRAP						
6.4	SPACE HTR JB		1 2 3 4					

6.5 Water pipes disconnected ________

6.6 Motor shaft uncoupled ________

6.7 Bolt removal log

I.D. Number	Number Shims	Match Marked	Removed By/Date	Installed By/Date

6.9 Motor housing holddown bolts installed ______ ______

6.10 All leads and conduit properly reconnected

______ / ______
QC Inspector   Date

6.11 Motor leads reconnected ______ / ______
Foreman   Date

6.12 Water pipes reconnected and cleanliness maintained

______ / ______
QC Inspector   Date

6.13 Motor coupling properly reconnected

______ / ______
Mechanical Foreman   Date

6.14 Motor housing holddown bolts properly torqued

______ / ______
QC Inspector   Date

6.15 Hold Order released on motor ______ ______

Motor bumped and released for operation ______ ______

Hold Order released on motor heaters ______ ______

6.16 Motor vibration readings acceptable ______ / ______
Mech.Engr.(Results)   Date

Unit__________

Train__________

CLEARANCE INSTRUCTIONS - ERCW PUMP

A. Work To Be Done: Pump__________ Date__________

1. Removal of ERCW motor

B. Initial Conditions: Date__________

1. Technical Specification 3.7.4 has been considered for outage.

C. Tagging Instructions: Pump__________ Date__________

1. Check open, make inoperable 6.9-kV breaker for applicable ERCW pump and tag with Hold Notice.
2. Close applicable ERCW pump discharge valve and tag with Hold Notice.
3. Tag applicable ERCW pump control switch in control room with Hold Order.

D. Releasing and Aligning for Operation: Pump__________ Date__________

1. Hold Order is released.
2. Remove Hold Notice and slowly open applicable ERCW pump discharge valve.
3. Remove Hold Notice and place applicable ERCW pump 6.9-kV breaker and make operable.
4. Remove Hold Order from applicable ERCW pump control switch in the control room.

E. Return completed Appendix B to maintenance section for inclusion in completed data package.

F. 47W845-1

____________________ / __________
SE/ASE Date

ERCW MOTOR CONNECTION INSULATION GUIDE

1. After connections are retorqued to proper valves,fill all voids with Scotch Insulating Putty to eliminate sharp edges.

2. Wrap connections with three (3) overlapping layers of Scotch Insulating Putty. Overlap each layer 1/2 inch.

3. Cover insulating putty with three (3) layers of Scotch 33 (or equivalent) electrical insulating tape.

NOTE: Insulation should be a minimum of (1) one inch below Cable Lug Connection.

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-68.3

REMOVAL AND REPLACEMENT OF THE REACTOR VESSEL LOWER INTERNAL PACKAGE

UNIT 1 OR 2

Rev. By	Rev. No.	Date	Revised Pages
	0	10/10/78	All
JDB	1	8/12/80	All

The last page of this instruction is number 11

1C	Plant Master File
	Superintendent
	Assistant Superintendent
1C	Mechanical Maintenance Supervisor
	Results Supervisor
1C	Operations Supervisor
1C	Quality Assurance Supervisor
1C	Health Physicist
	Administrative Supervisor
	Chemical Laboratory
	Instrument Shop
1C	Shift Engineer's Office
	Unit Control Room
	Health Physics Laboratory
	PSU Supervisor
	Mechanical Engineer
	Reactor Engineer
	Chemical Engineer
	Instrument Maintenance Supervisor
2U	Asst. Director of Nuc Power (Oper)
1C	Electrical Maintenance Supervisor
2C	Plant Industrial Engineer
1C	Outage Director
1U	NRC
1C	Nuclear Safety Review Staff
1U	Nuc. Maintenance Branch - C
1C	Assistant Maintenance Supervisor

Prepared By S. M. Anthony

Submitted By James L. Callie
Supervisor

PORC Review 8/12/80
Date

Approved By Eddi B[illegible]
for Superintendent

Date Approved 8/12/80

PUNCH LIST

1. Weights will be added to step 4.3 when a determination is made.

Estelo J. Prinn Signature

7/14/78 Date

MAINTENANCE INSTRUCTION MI-68.3

REMOVAL AND REPLACEMENT OF THE REACTOR VESSEL LOWER INTERNAL PACKAGE

Table of Contents

1.0 STATEMENT OF PURPOSE

This instruction describes the procedure for the removal and replacement of the reactor vessel lower internal package of Units 1 or 2. This instruction is applicable any time the lower internal package is removed for any reason and can be performed whenever the reactor is in operation mode 6.

2.0 REFERENCES

2.1 FHI-10

2.2 Standard Practice WB8.2

2.3 Instruction Manual, 173 inch I.D. reactor pressure vessel, Rotterdam Dockyard Company, 4/08/76

2.4 Contract no. 54114-1

2.5 MI-68.1

2.6 **WBNP Health Physics Manual**

3.0 PREREQUISITES

3.1 Coordinate the performance of this instruction with the shift engineer by obtaining his authorization of the trouble report that requires the performance of this MI. (Record the TR number on the Data Cover Sheet.)

3.2 Obtain the necessary clearances for the performance of this instruction.

3.3 Contact Health Physics personnel to determine the applicable health physics requirements for the performance of this instruction.

3.4 Notify the QA section that QC inspector coverage will be required during the performance of this instruction.

3.5 The reactor head shall have been removed, the upper internal package removed and stored, and all fuel elements removed from the lower internal package. **(Refer to MI-68.1)**

3.6 Reactor/refueling cavity water is below elevation 741' 1.5"

3.7 Bottom mounted instrumentation tubes are withdrawn 22' 3".

3.8 The shift engineer should be notified (by telephone) immediately before lifting the internal package.

3.9 Observe the guidelines of WB8.2.

4.0 PRECAUTIONS

4.1 To minimize unwanted swinging and oscillation of the lifting rig and internals, avoid jogging the crane hook.

4.2 Health Physics will provide a means to monitor the area during lifting and moving of internals.

4.3 Monitor the load cell reading at all times when assemblies are being lifted. If the load cell indication is greater than that shown in the column for that assembly, the operation should be stopped immediately and the cause of the higher load determined and corrected. The weights for each assembly are given below.

Lifting rig weight = (submerged =)

Lower internal package plus lifting rig = (submerged =)

Note: Approximately 12 percent lower weight will be noted when components are submerged.

4.4 Do not submerge the load cell at any time. If it is accidentally submerged, it should be thoroughly dries, and calibration checked by Instrument Shop.

4.5 Exercise caution when screwing the engaging screws in or out of the internals flange. Although design precautions were taken and threads cleaned and lubricated, galling may occur if care is not taken while turning the screws. Always rotate the tools very slowly. If some unusual drag occurs, do not force the tool or apply excessive torque but work it back and forth slowly until the excessive drag dissipates.

4.6 Ensure that all work is done in accordance with the applicable health physics requirements.

4.7 Every precaution should be made to maintain a clean work area. All requirements for cleanliness given in this instruction shall be followed.

CAUTION: Due to the extremely high radiation levels of the lower internal package extreme caution should be taken to prevent the internals from coming near or breaking the surface of the water during lifting and moving.

5.0 PREPARATIONS FOR WORK

5.1 Obtain for use in this instruction the following special instrument. Record the instrument I.D. number and calibration due date in Appendix A, page 11.

5.1.1 Load Cell

6.0 PERFORMANCE OF WORK

NOTE: The closure head and upper internals must be removed per MI-68.1.

6.1 Removal of the lower internals package.

6.1.1 Suspend the mechanical handling tool from the manipulator crane hoist. Move the tool over each of the engaging screw locations and unscrew the engaging screws from the upper internals package, using the platform on the internals rig for access to operate the tool. Craftsman to verify disengagement in appendix A, page 8, prior to lifting tool.

NOTE: The engaging screws thread into the tapped holes a distance of 3.00 inches.

6.1.2 Lower the main crane hook and load cell linkage assembly down over the internals lifting rig, positioning the load cell adapter between the tow lugs of the sling block. Insert the connecting pin by use of the pull rod mechanism which is attached to one of the lugs. When the pin extends approximately 0.130 inch beyond the far lug, tighten and pull rod locknut.

6.1.3 Monitoring the load cell, slowly raise the lifting rig off the upper internals package. Raise the rig until it clears the water and move it to a position near the manipulator crane. Remove the four reactor vessel alignment pin guide brackets at the bottom of the rig and reattach them to the rig in the retacted position. Use the tag lines on the main hook to rotate the rig for access to these brackets.

6.1.4 Move the manipulator crane to a position clear of the reactor vessel.

6.1.5 Move the lifting rig to the reactor vessel and lower it down over the lower internals package, guiding it initially on the reactor vessel studs and then on the reactor vessel alignment pins.

6.1.6 Move the manipulator crane adjacent to the main crane hook and disconnect the load cell assembly from the lifting rig. Raise the main hook clear of the manipulator crane.

HOLD POINT: QC INSPECTOR

6.1.7 Moving the manipulator crane as required and using the handling tool as a wrench, screw the three internals rig engaging screws into the tapped holes on the flange of the lower internals assembly. The weight of the tool must rest on the top of the engaging screw torque tubes while turning the screws. The engaging screws thread into the tapped holes a distance of 3.00 inches. Scribe a reference line at a convenient spot on the tool body while it is

6.0 PERFORMANCE OF WORK (continued)

resting on the top of each engaging screw torque tube before engagement and measure the change in elevation of that reference line after engagement is complete. Maintenance craftsman shall record measurements on Data Sheet A, page 8. QC Inspector to verify the engaging screws are screwed into the flange a minimum of three inches.

6.1.8 Move the manipulator crane to a position near the center of the reactor but between the reactor vessel and upper internals storage stand.

6.1.9 Install the two lower internals storage stand guide stud brackets and guide studs above the lower internals storage stand.

6.1.10 Unbolt and remove the center section of the manipulator crane walkway on the monorail side. The crane is designed with this feature. This removal is necessary to avoid interference with the guide stud bushing on the rig during this operation.

6.1.11 Lower the main crane hook and attach the load cell assembly to the internals rig, positioning the load cell adaptem between the two lugs of the sling block. Insert the connecting pin by use of the pull rod mechanism which is attached to one of the lugs. When the pin extends approximately 0.130 inch beyond the far lug, tighten and pull rod locknut.

6.1.12 Move the manipulator crane into its extreme parked position.

HOLD POINT: QC inspector will verify digital readout monitor of the load cell to ensure weights specified in 4.3 are not exceeded. Verify in appendix A, page 8.

6.1.13 Monitoring the load cell, slowly lift the lower internals out of the reactor. See section 4.3.

6.1.14 When the lower internals package is clear of the reactor vessel, move it to the area of lower internals storage stand.

6.1.15 Monitoring the load cell, slowly lower the internals package into the storage stand using the two guide studs for positioning.

6.1.16 Disconnect the load cell and remove.

6.2 Replacement of Lower Internals Package

6.2.1 Connect the load cell assembly and main crane hook to the lifting rig.

...ORMANCE OF WORK (Continued)

?.2 Move the manipulator crane to its extreme parked position and remove walkway.

HOLD POINT: QC inspector will monitor the digital readout of the load cell to ensure weights specified in 4.3 are not exceeded. Verify in Appendix A, page 8.

6.2.3 Health Physics will provide a means to monitor the area during lifting and moving of internals.

.2.4 Carefully raise the lower internal package while monitoring the load cell.

.2.5 Transport the package over the reactor and align the rig with the guide studs.

NOTE: Do not apply torque through the lifting rig--attach ropes to the crane hook.

.2.6 While monitoring the load cell, slowly lower the internal package until it is seated on the internal support ledge. See section 4.3.

HOLD POINT: Maint. Engr. and QC Inspector will verify that internals are seated by signed Data Sheet A, page 9.

6.2.7 Visually verify that the package is seated on the ledge and note on Data Sheet A, Appendix A, page 9.

.2.8 Move the manipulator crane to the center of the reactor, and disconnect the load cell assembly from the lifting rig.

HOLD POINT: QC Inspector to inspect disengagement

6.2.9. Using the mechanical handling tool, loosen the lifting rig from the lower internal package. Verify disengagement by using the reference lines that were scribe at step 6.1.7 Craftsman to verify in Appendix A, page 10. QC Inspector to inspect to assure the lifting rig has been loosened from the lower internal packa...

6.2.10 Connect the load cell assembly to the lifting rig. While monitoring the load cell, slowly raise the lifting rig from the reactor; transport it to the upper internal package; and after removing and reinstalling the pin guide brackets in the extended position, carefully lower the rig onto the upper internal package.

PERFORMANCE OF WORK (continued)

.11 Working from the manipulator, disconnect and store the load cell assembly.

HOLD POINT: Maintenance craftsman to verify engaging screws are screwed into the upper internals.

.12 Using the method described in 6.1.7 of this instruction, screw the engaging screws into the upper internal section. Craftman to sign on Data Sheet A, page 10.

2.13 Notify the shift engineer that installation of lower internal package is complete.

.14 Install upper internals by performance of MI-68.1.

CHECKOUT AND TESTS

.1 Review this procedure for improvements to be implemented during future performances of this instruction.

APPENDIX A

DATA COVER SHEET

REMOVAL AND REPLACEMENT OF THE
REACTOR VESSEL LOWER INTERNAL PACKAGE

Unit ________________ Reference TR No. __________

Performed by ______________________ / __________ / ________
Title Date

All calibrated instruments and tools utilized in this instruction have been recorded in the CSSC Instrument and Tool Log.

__________________ / ________
Toolroom Personnel Date

Results Reviewed By ______________________ / ________
Maintenance Engineer Date

Results Reviewed and Approved ______________________ / ________
Maintenance Supervisor Date

QA Review Completed ______________________ / ________
QA Supervisor Date

Return to Maintenance Section

REMARKS: ____

____

____

Step 6.1.1 Engaging screws have been disengaged from the upper internals

Verified by ______________ / ______
Craftsman Date

HOLD POINT: QC INSPECTOR

Record dimension of engagement of screws where engaging into lower internals (.30 inches minimum).

Position	Dimension	Craftsman/Date
		/
		/
		/

Engaging screws properly engaged. Verified By ______________ / ______
QC Inspector Date

HOLD POINT: QC Inspector

6.1.15

The internals were acceptably lifted; weight limitation set forth in 4.3 were not exceeded.

Inspected by ______________ / ______
Q.C. Inspector Date

HOLD POINT: QC Inspector

6.2.6

The internals were acceptably lifted, weight limitation set forth in 4.3 were not exceeded.

Inspected by ______________ / ______
Q.C. Inspector Date

[illegible] POINT: Maintenance Engineer and QC Inspector

[illegible]e internals are seated on the internals support ledge.

Verified by ____________________/ __________
Maint. Engr. Date

Inspected by ____________________/ __________
Q.C. Inspector Date

[illegible]: QC INSPECTOR

9 [illegible]er internals package seated on support ledge. Record dimension of dis-[illegible]gagement of screws when removing the lifting rig from the lower internals. [illegible]gage screws to the minimum shown in step 6.1.7 above.

Position	Dimension	Craftsman/Date

[illegible]ing rig disengaged from lower internals.

Verified By ____________________/ __________
Craftsman Date

[illegible] [illegible]NT: Maintenance Craftsman

12 [illegible] dimension of engagement of screw when engaging into upper internals ([illegible] inches minimum).

Position	Dimension	Craftsman/Date

[illegible] screws have been threaded into the upper internals a minimum of 3.00 inches

Verified By ______________________ / ______
Maintenance Craftsman Date

Date ____________________

INSTRUMENT DATA

Test Equipment	TVA Tag No.	Calibration Due Date

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-68.5

REMOVAL AND REPLACEMENT OF REACTOR COOLANT PUMP MOTOR

Unit 1 or 2

Rev. By	Rev. No.	Date	Revised Pages
CAR	2	5/13/80	General Revision

The last page of this instruction is number 27.

1C	Plant Master File
	Superintendent
	Assistant Superintendent
1C	Mechanical Maintenance Supervisor
	Results Supervisor
1C	Operations Supervisor
1C	Quality Assurance Supervisor
	Health Physicist
	Administrative Supervisor
	Chemical Laboratory
	Instrument Shop
1C	Shift Engineer's Office
	Unit Control Room
	Health Physics Laboratory
	PSU Supervisor
	Mechanical Engineer
	Reactor Engineer
	Chemical Engineer
	Instrument Maintenance Supervisor
2U	Asst. Director of Nuc. Power (Oper)
1C	Electrical Maintenance Supervisor
2C	Plant Industrial Engineer
1C	Outage Director
1U	NRC
1C	Nuclear Safety Review Staff
1C	~~Asst. Mechanical Maint. Supervisor~~
1U	Plant Maintenance Branch - C

Prepared By J. T. Maddox/R. Norman

Submitted By [signature]
Supervisor

PORC Review 5/13/80
Date

Approved By [signature]
for Superintendent

Date Approved 5/13/80

1.0 PURPOSE AND APPLICABILITY

The purpose of this instruction is to describe the procedure for the removal and replacement of a reactor coolant pump motor. This instruction applies to the motor on any of the eight reactor coolant pumps located on elevation 718.0 of unit 1 and 2 reactor buildings. This instruction can be performed only in mode 5 & 6.

NOTE: All instruction steps preceded with the numeric symbol, #, require documentation in Appendix A, data sheet.

2.0 REFERENCES

2.1 Westinghouse Instruction Book, Reactor Coolant Pump, Model W-11010-A1 (93-AS), Instruction Book 5710-100-02.

2.2 TVA 44N267, R0

2.3 TVA 44N260, R2

2.4 TVA 44N260, R2

2.5 TVA 44N262, R0

2.6 Technical Specification, 3/4.1.1

2.7 Maintenance Instruction, MI-2.1

3.0 PREREQUISITES

#3.1 Obtain approval of Shift Engineer or his designated representative to perform this instruction. Record the TR number on the data sheet cover page that requires the performance of instruction.

3.2 Obtain the necessary clearances for the performance of this instruction. (Tagging procedure is attached as Appendix B.)

3.3 Contact Health Physics personnel to determine the applicable health physics requirements for the performance of this instruction. If it is determined by Health Physics that this instruction will be performed in a high radiation or contaminated area, the foreman shall conduct a pre-work ALARA analysis per ESL4.2.

3.4 Notify the QA section that QC inspector coverage will be required during the performance of this instruction.

4.0 PRECAUTIONS

4.1 The reactor coolant pump motors are located in the four reactor coolant loops on elevation 718.0 of the reactor buildings. Positively identify the proper pump motor before beginning work. The motors are designated as 1-1, 1-2, 1-3, 1-4, 2-1, 2-2, 2-3, and 2-4.

4.0 PRECAUTIONS (Continued)

4.2 Ensure that barricades are positioned around the open reactor coolant pump/motor removal hatch to prevent possible personnel injury.

4.3 A suspended RCP motor shall not be allowed to travel directly over an open reactor vessel.

4.4 Efforts shall be made to maintain a clean work area.

4.5 Ensure that all power is disconnected from the motor and the motor leads are grounded before any removal work is started.

4.6 Ensure that all auxiliary water systems are cool, depressurized, and isolated.

4.7 Ensure that all work is done in accordance with the applicable health physics requirements.

4.8 All component cooling water is potentially radioactively contaminated and must be handled utilizing proper radiological controls until proven non-contaminated.

5.0 PREPARATION FOR WORK

5.1 Obtain the special material listed below:

5.1.1 Neolube or Fel-Pro Thread Compound C5A
5.1.2 Five 55-gallon drums (empty and clean)
5.1.3 Oil pump with 30' hose
5.1.4 Clean lint-free rags
5.1.5 0.001", 0.003", 0.005", and 0.010" SST 4" square shims W 620B493E81
5.1.6 Slings (MK 44N267-4)
5.1.7 Duct tape
5.1.8 265 gallons of Std-2 oil (W P.D.S. 55125GB oil)
5.1.9 Hook lifting bracket (Mk 44N260-1)
5.1.10 3-leg sling assembly (Mk 44N260-2)
5.1.11 Three turnbuckles (Mk 44N260-3)
5.1.12 Lifting beam (Mk 44N260-4)
5.1.13 Three single slings (Mk 44N260-5)
5.1.14 Three lug lifting brackets (Mk 44N260-6)
5.1.15 Six portable track sections (one each Mk 44N260-7, 8, 9, 10, 11, and 12)
5.1.16 Twenty splice joint bars with bolts, nuts, and lockwashers (Mk 44N260-13)
5.1.17 Cart (Mk 44N261-14)
5.1.18 One bridge (Unit 1 - Mk 44N262-15; Unit 2 - Mk 44N262-16)
5.1.19 Safety barricades
5.1.20 Cribbing material
5.1.21 Twenty-four plantleg lock washers (for 1.5" dia. bolt) W part No. 160A909H25
5.1.22 Motor jacking bolts (4) W 913C602
5.1.23 Motor shaft centering screws (4), W drawing 930C126

5.0 PREPARATION FOR WORK (Continued)

5.2 Special tools required (verify the tool calibration date in appendix A):

5.2.1 Torque wrench, 1" drive, 1000 ft. lbs. ±10% of setting
5.2.2 2-1/4" socket, 1-1/2" drive
5.2.3 1" female to 1-1/2" male adapter
5.2.4 1-1/2" socket, 1" drive
5.2.5 Adjustable parallel gauge set, 3/8" - 2-1/4"
5.2.6 Mechanics level, 6"
#5.2.7 Outside micrometer caliper 0-1"
#5.2.8 Dial indicators (3) 0.0001" graduations, 0.200" range
5.2.9 Gauge holding rods (2) including clamping mechanism, 1/4" dia.
#5.2.10 Universal dial test indicator, 0.001" graduation, 0.200" range
5.2.11 Clamp, 5/16" diameter port, 1-5/16" capacity
5.2.12 Heavy duty magnetic bases (2)
5.2.13 Sleeve clamps (2) to suit magnetic base post and 1/4" diameter gauge holding rods
#5.2.14 Torque screwdriver, 50 in-lbs. ±10% of setting
#5.2.15 Torque wrench, 300 in-lbs. ±10% of setting
5.2.16 Electric scribing tool

6.0 PERFORMANCE OF WORK

6.1 Removal of concrete plug

6.1.1 Connect slings (Mk 44N267-4) as shown on TVA drawing 44N267 R0.

6.1.2 Lift and remove plug using the polar crane.

NOTE: Place barricades around coolant pump removal hatch.

6.2 Removal of reactor coolant pump motor

6.2.1 Drain and/or disconnect the following before attempting to remove the motor:

CAUTION: Be sure the motor leads are grounded before beginning disassembly.

NOTE: Throughout the following, adequately identify and tag all leads to aid in reconnection.

6.2.1.1 Power leads and conduit from the motor terminals in the main conduit box. Tape the exposed terminals with duct tape (section 5.1.7) Label each power lead.

6.2.1.2 All auxiliary leads and the grounding cables. Label all wires.

6.2.1.3 The leads to the oil lift pump motor. Label each motor lead.

6.2.1.4 The water inlet and outlet piping from the bearing oil coolers and the stator air coolers.

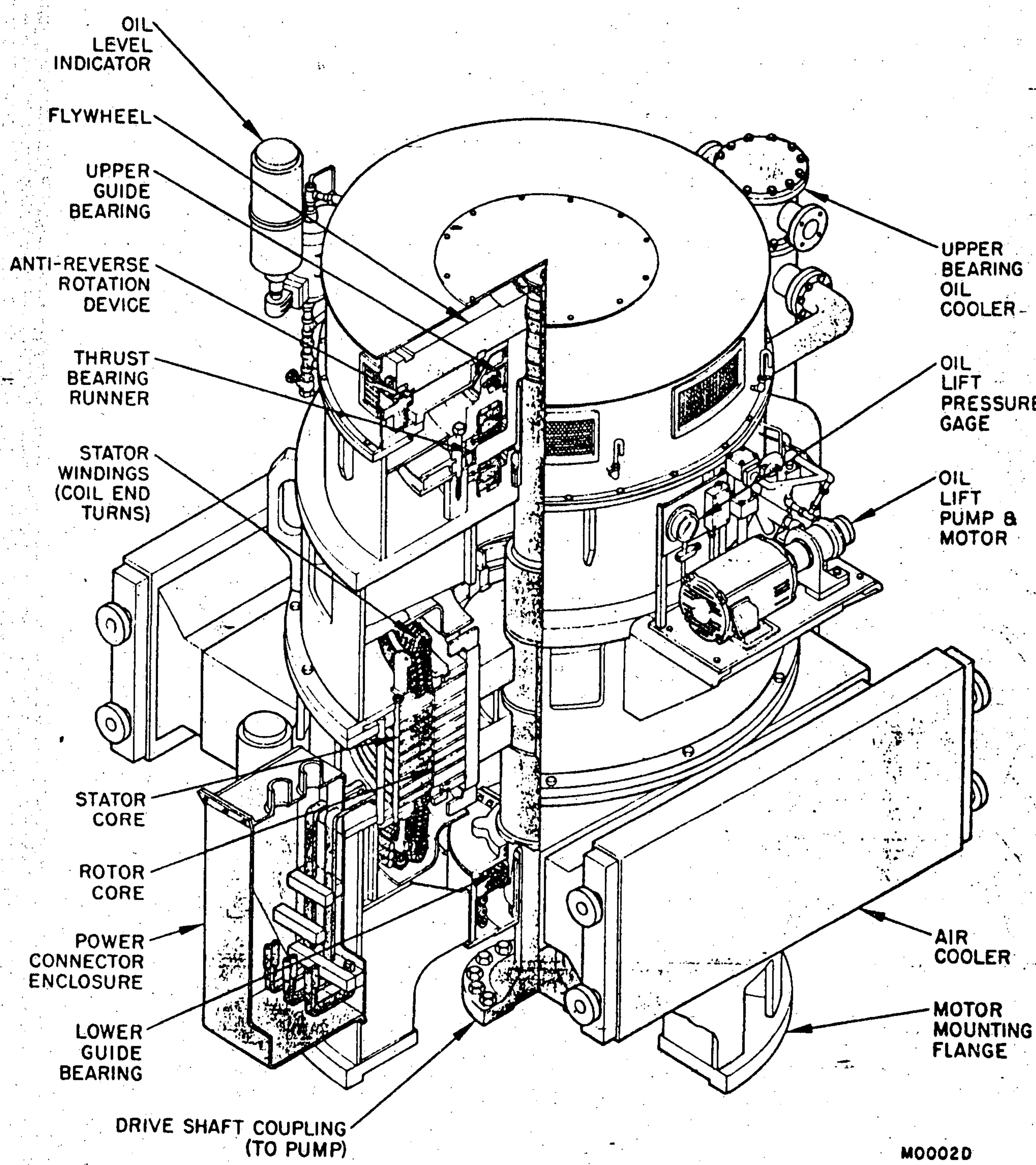


Figure 1
Typical Motor For Reactor Coolant Pumps

6.0 PERFORMANCE OF WORK (Continued)

NOTE: Any component cooling water drained from the system shall be collected and returned to the system or processed through the evaporators so the chemicals can be concentrated and drummed prior to releasing the water to the environment. Contact Chemical Section prior to draining. See 4.7 also.

NOTE: Step 6.2.1.5 is only necessary if the motor support is to be removed with the motor; otherwise, it is not applicable.

6.2.1.5 No. 1, No. 2, and No. 3 seal leakoff line and the seal bypass cover ends of piping with duct tape to prevent contamination.

6.2.1.6 Vibration pickup connecting cables and vibration pickups are removed.

6.2.2 Drain the oil (265 gallons) from the upper bearing oil reservoir, the upper bearing oil cooler, and the lower bearing oil reservoir. Store in 55-gallon drums. (See Figure 2 and Figure 3). Lower drain (item 15), upper drain located on side of upper oil pot.

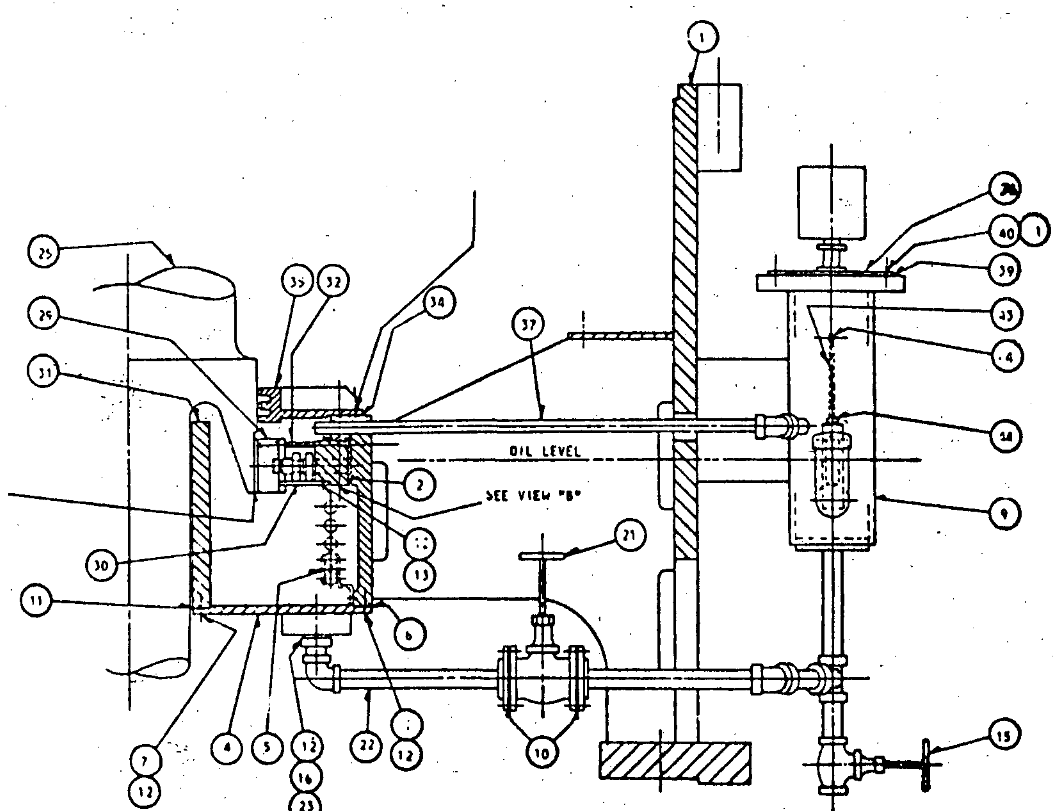


Figure 2

Lower Bearing Oil Reservoir

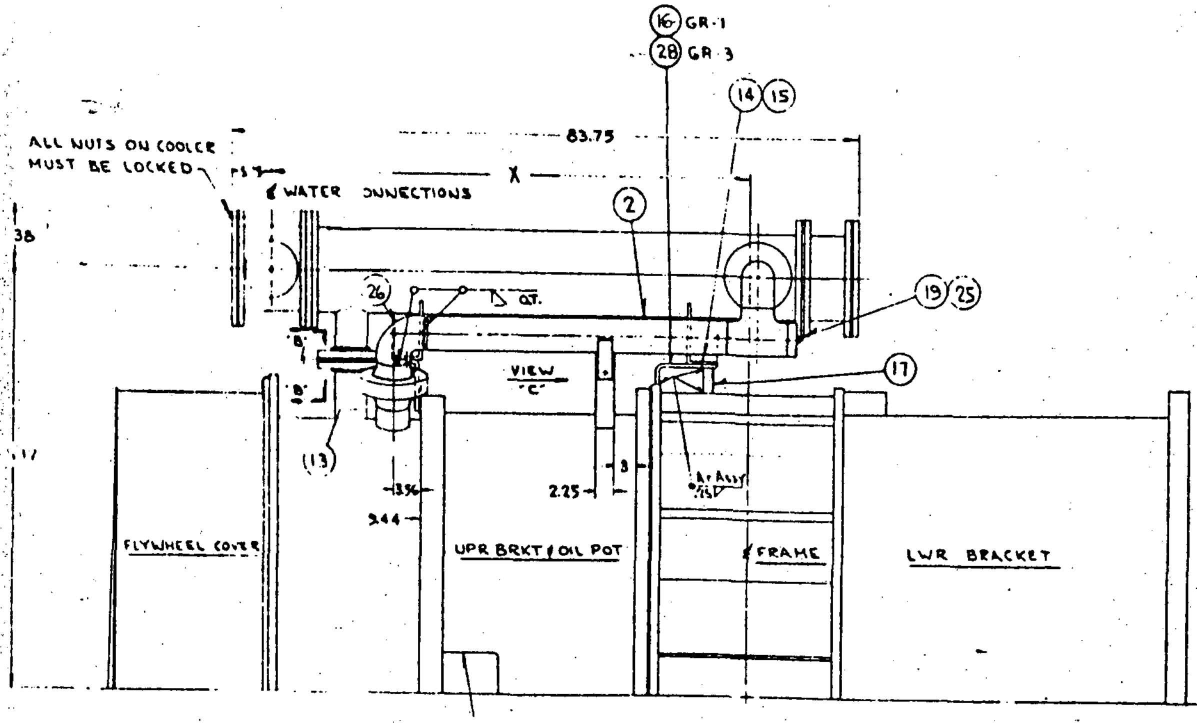


Figure 3

Upper Bearing Oil Cooler

6.2.2.1 Open the drain valves and drain the oil completely from the upper bearing oil pot and the lower bearing oil pot. Remove the drain plug (item 25) and drain the oil from the upper bearing oil cooler.

6.2.2.2 Close the drain valves and install the drain plug in the oil cooler.

6.2.3 Drain the water from the oil coolers and air coolers.

NOTE: Any component cooling water drained from the system shall be collected and returned to the system or processed through the evaporators so the chemicals can be concentrated and drummed prior to releasing the water to the environment. Contact Chemical Section prior to draining. See 4./ also.

6.2.4 Remove both air coolers and cooler transition ducts. (See Figure 1.)

6.2.5 Remove upper bearing oil cooler, cover ends of piping with duct tape to prevent contamination.

6.2.6 Remove oil lift support assembly. (See Figure 4.)

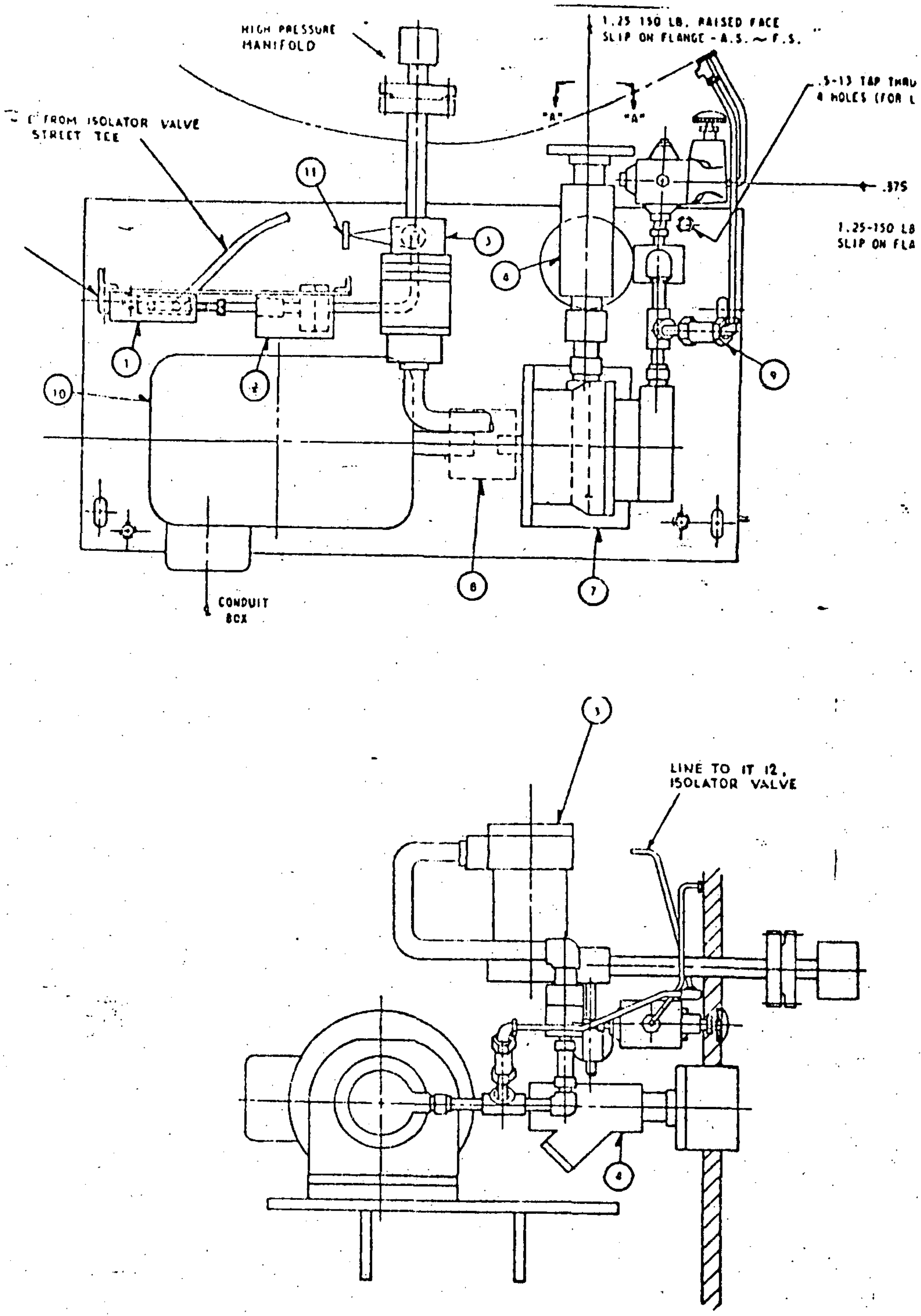


Figure 4

Bearing Oil Lift Assembly

6.2.7 Remove main lead, auxiliary lead, and RTD junction boxes. Ensure all leads are labeled.

6.2.8 Rig the reactor coolant pump motor for lifting as shown on TVA drawings 44N260-R2 and 44N261-R1.

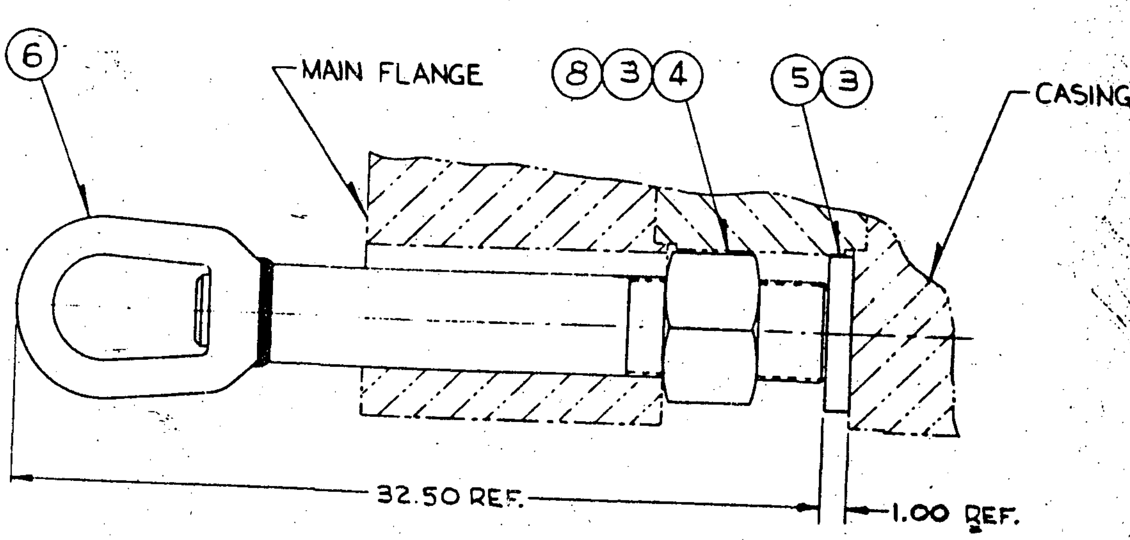
6.2.9 Assemble bridge, rails, and cart for removal of the reactor coolant pump motor as shown in TVA drawings 44N260-R2, 44N261-R1, and 44N262-R0.

6.2.10 Matchmark the spool and motor shaft coupling and number all the upper spool bolts and bolt holes with scribing tool (5.2.16) to aid in reconnection.

6.2.11 Loosen all the bolts and nuts holding the spool to the motor coupling. Remove all bolts except two which are located 180° apart.

6.2.12 Slowly loosen the nuts from the remaining two bolts allowing the pump shaft to settle carefully on the back seat. When the pump shaft has seated on the back seat, remove the two bolts and nuts. If the shaft does not lower of its own weight, carefully use the jacking screws in the motor coupling to push the spool downward.

<u>CAUTION</u>: When using jacking screws (see Figure 5), keep the two bolts in place allowing only a .125 inch possible gap between the retaining nuts and the coupling. <u>Under no circumstances allow the shaft to drop suddenly</u>.



<u>Figure 5</u>

Jacking and Lifting Bolt

NOTE: The following steps 6.2.13 and 6.2.14 are for replacement or repair of the pump motor only. (No removal of pump seals or internals.) These steps are NON-APPLICABLE if the pump internals are to be removed.

6.2.13 Matchmark the motor support housing and the motor to aid reassembly with scribing tool.

6.2.14 Loosen and remove all the motor-to-support bolts and nuts.

NOTE: The following steps 6.2.15 and 6.2.16 are for removal and inspection of the pump internals. The steps are NON-APPLICABLE if the pump internals are not to be removed.

6.2.15 Matchmark the motor support housing and the pump main flange to enable correct reassembly.

6.2.16 Unlock and remove the 24 hex head bolts and pantleg washers which secure the motor support housing to the pump to the pump main flange.

6.2.17 HOLD POINT: At this time, an inspection by a maintenance engineer shall be made to ensure that the motor is ready to lift. Inspector shall check to see that all piping and conduits are disconnected and clear of motor, all required items have been removed from the motor to allow passage through the hatch, and connection bolts have been removed. Inspection shall also verify that the reactor coolant pump motor is properly rigged for lifting. Verify and document each item by completing the appendix A Hold Point Checklist (step 6.2.17).

6.2.18 Lift the motor (and support if removed together) free of the motor housing. Note the location of any shims and tag in such a way as to enable their proper replacement. Remove all shims.

6.2.19 Position the motor onto the cart (Mk 44N261-14) being sure that the motor is resting level, or position the motor onto cribbing on the reactor building floor (elevation 756.63) as specified in Note C of TVA drawing 44N260.

NOTE: If the motor is to be stored for more than 48 hours, a temporary connection shall be made to the space heaters (3Ø, 4 wire, 460-V, 2.75 kW) to keep the windings dry.

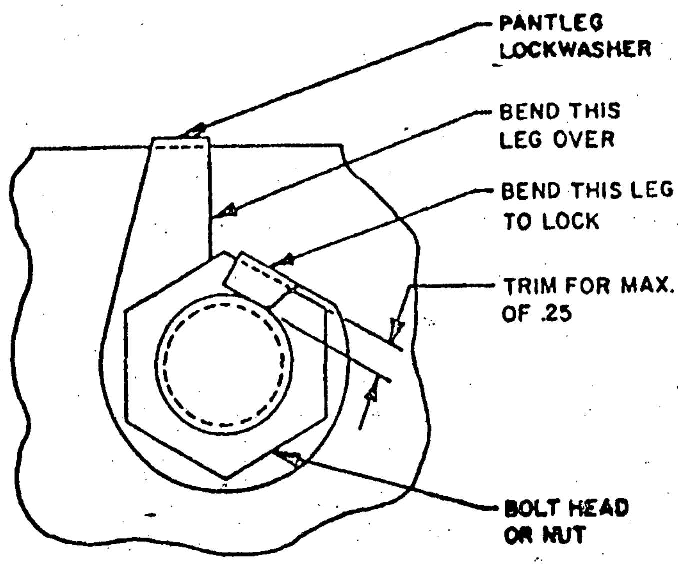
6.3 Installation of reactor coolant pump motor

NOTE: The following steps 6.3.1 and 6.3.2 are for the replacement of the motor and motor support as a unit only. These steps are NON-APPLICABLE if the motor was removed separately.

#6.3.1 Lift motor and support using the lifting device and clean and deburr all flange mating surfaces. Orient the windows in the motor support for the proper connection of all water connections and to align any previously made matchmarks. Replace on the pump flange any shims found there during motor removal.

#6.3.2 Lower motor and support on to the main flange being sure to align previously made matchmark. Install pantleg washers and bolts. Lubricate bolts with Neolube.

6.3.2.1 <u>HOLD POINT</u>: Torque bolts installed in step 6.3.2 to 1000 ft-lbs in 250 ft-lbs increments and bend tabs on pantleg washers as shown in Figure 6. Torque should be verified by a QC inspector.



<u>Figure 6</u>

Proper Bending of Pantleg Washer

<u>NOTE</u>: The following steps 6.3.3 and 6.3.4 are for the replacement of the motor only. These steps are <u>NON-APPLICABLE</u> if the motor and support were removed together.

6.3.3 Lift motor and clean and deburr flange and coupling surfaces.

NOTE: Back off the motor jacking bolts located on the motor lower flange.

6.3.4 Replace on upper motor support flange any shims found there during motor removal if the same motor is being reinstalled. Lower motor on to motor support, being sure to align previously made matchmarks. Install, but do not tighten, all motor-to-support bolts and nuts. Install reactor coolant pumps seals and spool pieces per MI-68.4 if necessary

6.3.5 Install the transition ducts and the motor air coolers.

6.3.6 Install the upper and lower bearing oil cooler supports and coolers. Connect the oil piping from the cooler to the motor housing.

6.3.7 Install the oil lift pump, motor, and stand.

6.3.8 Install the auxiliary leads terminal box, main lead terminal box and stator RTD junction box.

6.3.9 Connect the leads to the oil lift pump motor.

6.3.10 Fill the upper and lower bearing with oil (approximately 265 gallons - Use Std-2 or W PDS 55125-GB).

6.3.11 HOLD POINT: At this time, an inspection by a maintenance inspector shall be made to ensure that hardware previously removed has been installed properly. Verify and document each item by completing the Hold Point Checklist 6.3.11 in appendix A.

6.3.12 Install the four motor shaft centering screws (section 5.1.23). Mark the four screws as North, South, East, and West. (North is an arbitrary point - see Figure 7.)

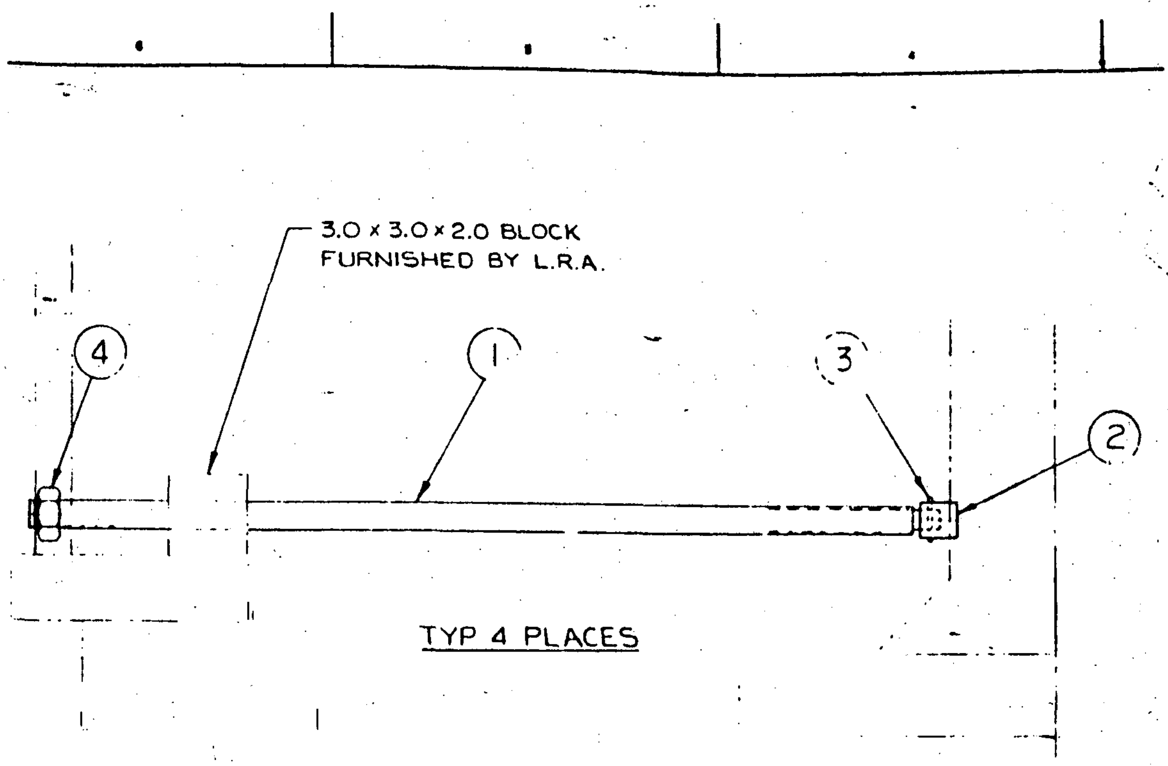


Figure 7

Motor Shaft Centering Screws

6.3.13 Mount two dial indicators 90° apart on the motor base cutouts with the tips in contact with the motor rotor O.D. and in line with the respective centering screws. See Figure 8.

6.3.14 Have the Hold Order released on the oil lift pumps, energize them, and check for proper rotation. Correct if necessary. The RCP motor rotor can now be moved laterally by turning the motor shaft centering screws. (Do not at any time tighten the screws to move more than 20 lbs-ft torque.)

#6.3.15 Back off the North centering screw and move the rotor to the extreme North position with the South centering screw. Record the indicator reading in appendix A.

#6.3.16 Now back off the South centering screw and move the rotor to the extreme South position with the North centering screw. Record the indicator reading in appendix A.

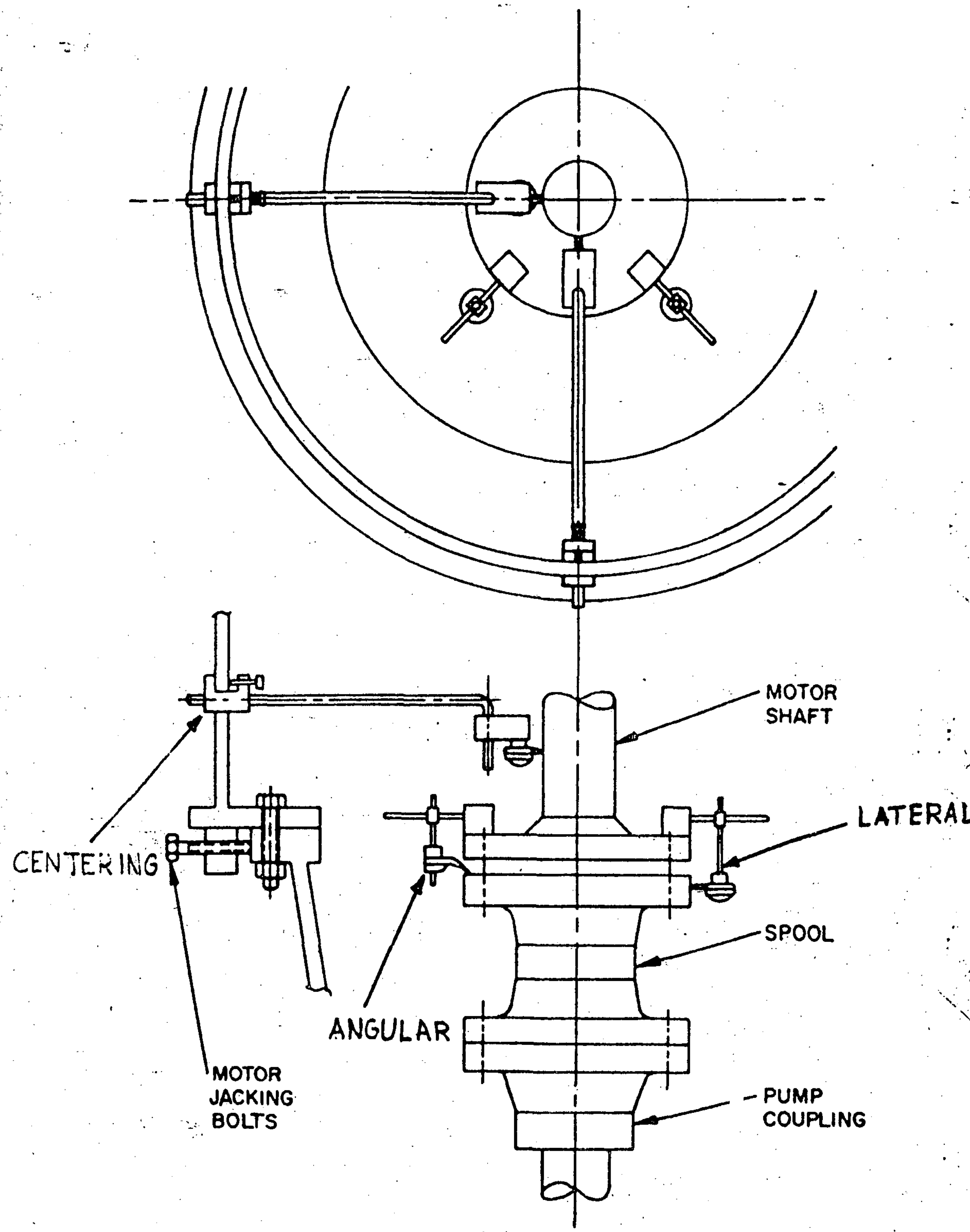


FIGURE 8 Motor/Pump Alignment

6.3.17 Next back off the East centering screw and move the rotor to the extreme East position with the West centering screw. Record the indicator readings.

6.3.18 Back off the West centering screw and move the rotor to the extreme West position with the East centering screw. Record the indicator readings.

6.3.19 Calculate the mid-position of the motor rotor and adjust the centering screws to obtain this position. The centering screw swivel blocks should be tight enough on the rotor to limit lateral movement to less than .001 inch, but not so tight as to prevent the motor rotor from turning freely. The total motion before centering of the rotor should not exceed .020 inch.

6.3.20 Turn off the oil lift motor.

NOTE: Before temporarily tightening down the motor, roughly center it over the pump shaft using the motor jacking bolts and a straight edge.

6.3.21 To pull the motor down securely, tighten every other mounting bolt to 250 lbs-ft torque.

6.3.22 Measure the space between the motor coupling and pump spool piece faces to the nearest .0005 inch at eight places around the coupling. Use parallel wedges, a telescopic gage, or dial indicator as shown in Figure 8. From the readings, establish the maximum thickness of the shims required under the motor mounting flange to correct for angular misalignment. Take into account the fact that the motor mounting diameter is about three times that of the coupling diameter so that three times as much shimming will be required at the motor mounting flange. Shims should be stainless steel and about four inches square. If the maximum shim required exceeds .002 inch in thickness, shims of lesser thickness should be provided around the other portions of the flange to permit equal load bearing. Record the thickness and position of all shims.

6.3.23 Loosen those mounting bolts which were tightened to pull the motor down securely; then lift the motor slightly to permit installation of the shims between the motor support and motor mounting flange.

6.3.24 Lower the motor and again tighten every other mounting bolt.

6.3.25 Recheck the angularity per step 6.3.22. If the angularity varies by more than .001 inch, recalculate and readjust the shims.

6.3.26 Loosen the mounting bolts after the final check has indicated satisfactory angular alignment.

6.3.27 When the angularity has been corrected, proceed with the lateral alignment check. The purpose of this is to move the motor horizontally until the motor rotor centerline lines up with the pump shaft centerline.

6.3.28 Mount a third dial indicator with its base securely clamped to the motor coupling flange and with its tip resting on the O.D. of the spool upper flange. (Refer to Figure 8.)

6.3.29 Start the oil lift pump.

6.3.30 Identify the four motor jacking bolts as North, South, East, West. (North is an arbitrary point.) Refer to Figure 8.

6.3.31 Rotate the motor rotor one complete turn in 90° increments. Record the dial indicator readings at each 90° increment. (These increments should be in line with the North, South, East, and West motor jacking bolts.

6.3.32 Using the jacking bolts, move the motor one half the difference of the total indicator readings (N-S and/or E-W). Repeat as often as necessary until a maximum of .002-inch T.I.R. is obtained.

6.3.33 Tighten the motor support-to-motor bolts to 500 lbs-ft in 250 lbs-ft increments using a crisscross sequence.

6.3.34 HOLD POINT: Recheck parallelism and concentricity. If the readings are not within the limits specified, loosen the motor bolts and repeat the parallelism and concentricity alignment procedures. Have a QC inspector verify T.I.R., then tighten the motor bolts to 1000 lbs-ft torque in 500 lbs-ft increments with verification by the QC inspector. Remove the indicators and motor shaft centering screws.

6.3.35 HOLD POINT: Recheck and record the final gap between the coupling bolting faces to the nearest .005 inch. This gap should be .847/1.029 inch. Have QC inspector verify this measurement.

6.3.36 Turn the motor rotor until the bolt holes in the motor coupling and spool flange are aligned with the matchmarks.

6.3.37 Turn off the oil pump.

6.3.38 Assemble four upper spool bolts and nuts, making sure matchmarks are aligned. Tighten the nuts evenly to take up on the pump shaft. Remove pump shaft centering screw (if installed).

6.3.39 HOLD POINT: Continue evenly tightening the nuts until the motor coupling face and spool coupling face just contact. Install the remaining bolts and nuts. Torque to 1000 ft-lbs in 250 ft-lb increments using crisscross sequence. Lubricate threads with Neolube. QC inspector to verify torquing.

6.3.40 Connect the following:

6.3.40.1 HOLD POINT: Power leads to the motor terminals at the main conduit box. Torque to 30 ft-lbs and have QC inspector verify.

6.3.40.2 Water inlets and outlets to the upper and lower motor oil coolers and to the air coolers.

6.3.40.3 Resistance temperature detectors, space heater leads, magnetrol switches, and ground connections.

6.3.40.4 Oil lift pressure switch leads.

NOTE: Step 6.3.40.5 is only necessary if the motor support was removed with the motor.

6.3.40.5 No. 1 and No. 2 seal leakoff pipes, the seal bypass, and the No. 3 seal leakoff line.

6.3.40.6 All leads to the auxiliary leads terminal box and the stator RTD junction box.

6.3.40.7 Install vibration pickups and vibration pickup connecting cables.

6.3.41 Remove all tools and material left in the pump area.

#6.3.42 HOLD POINT: At this time, an inspection shall be made to verify that the motor is ready to be released and that the alignment meets the required standards. Verify and document each item by completing the Hold Point Checklist in appendix A.

6.3.43 Replace concrete plug removed in step 6.1.

7.0 POST MAINTENANCE TESTING

7.1 Release the hold order to the shift engineer for filling of reactor coolant system and test of reactor coolant pump motor. Instructions for aligning reactor coolant system for motor test is found in appendix B.

#7.2 Verify appendix B is completed and attached to appendix A data sheets.

7.3 Notify the Shift Engineer or his designated representative that the performance of this instruction is complete.

#7.4 If this instruction was performed in a high radiation or contaminated area, the foreman shall conduct a post-work ALARA review per ESL.4.2.

APPENDIX A

DATA COVER SHEET

REMOVAL AND REPLACEMENT OF REACTOR COOLANT PUMP MOTOR

Unit 1 or 2

ID#__________________ Reference TR#________________

Performed by ______________________ / ________
Craftsman Date

______________________ / ________
Craftsman Date

Reviewed by ______________________ / ________
Electrical Engineer Date

Results Reviewed and Accepted ______________________ / ________
Electrical Maint. Supv. Date

QA Review Complete ______________________ / ________
Date

Return to Electrical Maintenance Section

REMARKS: ____

____

____

3.1 Approval to perform this instruction ____________________ / ________
Shift Engineer or his Designated Representative / Date

NOTE: Numbered steps correspond to numbered steps in the body of the instruction

	Instrument	TVA Tag No.	Calibration Due Data
1	Torque wrench (1,000 ft-lb)		
5	Torque wrench (300 in-lb)		
14	Torque screwdriver (50 in-lb)		
	Dial indicator (0.0001" grad)0.200"range		
8	Dial indicator (0.0001" grad)0.200"range		
	Dial indicator (0.0001" grad)0.200"range		
0	Dial indicator (0.001" grad) 0.200"range		
	Outside micrometer 1"		

		Verifying Initials
6.2.1.1	Power leads and conduit from the motor terminals are disconnected and labeled.	
6.2.1.2	Auxiliary leads and grounding cable are disconnected	
6.2.1.3	Leads to the oil lift pump motor are disconnected and labeled	
6.2.7	Main lead, auxiliary lead, and RTD junction boxes are remove removed and labeled	
6.2.13	Motor support housing and the motor have been matchmarked	
6.2.15	Motor support housing and the pump main flange have been matchmarked	

Verifying Initials

6.2.17 HOLD POINT

1. Motor leads and conduit disconnected. ______

2. Water inlet and outlet piping for the upper and lower motor oil coolers and motor air coolers are removed. ______

3. Resistance temperature detectors, spare heater leads, magnetrol switches, ground connections, and related conduit are disconnected. ______

4. Leads to the oil lift pump motor, oil lift pressure switches, and related conduit are disconnected. ______

5. No. 1 and No. 2 seal leakoff pipes, the seal bypass, and the No. 3 seal leakoff line are removed (if the motor support is to be removed). ______

6. Vibration pickups and connecting cables are removed. ______

7. Auxiliary leads terminal box, stator R.T.D. box, and the main conduit box are removed. ______

8. Upper bearing oil cooler, cooler supports, and oil piping are removed. ______

9. Oil lift pump, motor, piping, and stand are removed. ______

10. Motor air coolers (2) and transition ducts (2) are removed. ______

11. Reactor coolant pump motor is properly rigged for lifting (see TVA Drawings 44N260R1 and 44N261R1). ______

12. Motor shaft is completely disconnected from the pump shaft. ______

13. All motor-to-support bolts and nuts or all motor support-to-pump flange bolts and nuts are removed. ______

Inspected by ______________________ Date ______________
Maintenance Engineer

6.2.18 All shims have been removed and position has been labeled ______

6.3.1 Shims have been replaced onto pipe flange ______

6.3.2 Matchmarks have been aligned ______

6.3.2.1 HOLD POINT: Bolts torqued to 1000 ft-lbs. ______

Inspected by ______________________ Date ______________
QC Inspector

Verifying Initials

6.3.4 Shims have been replaced and matchmarks have been aligned ______

6.3.11 HOLD POINT

1. Matchmarks aligned on motor to motor support or motor support to pump housing. ______

2. Air coolers and transition ducts installed. ______

3. Upper and lower bearing oil coolers and supports are installed. ______

4. Oil lift pump, motor, and stand installed. ______

5. Power terminations connected and torqued to oil lift pump. ______

6. Upper and lower bearings filled with oil ______

Verified by ______________________ / ______
Maintenance Engineer Date

6.3.14 - 6.3.17 SHAFT CENTERING

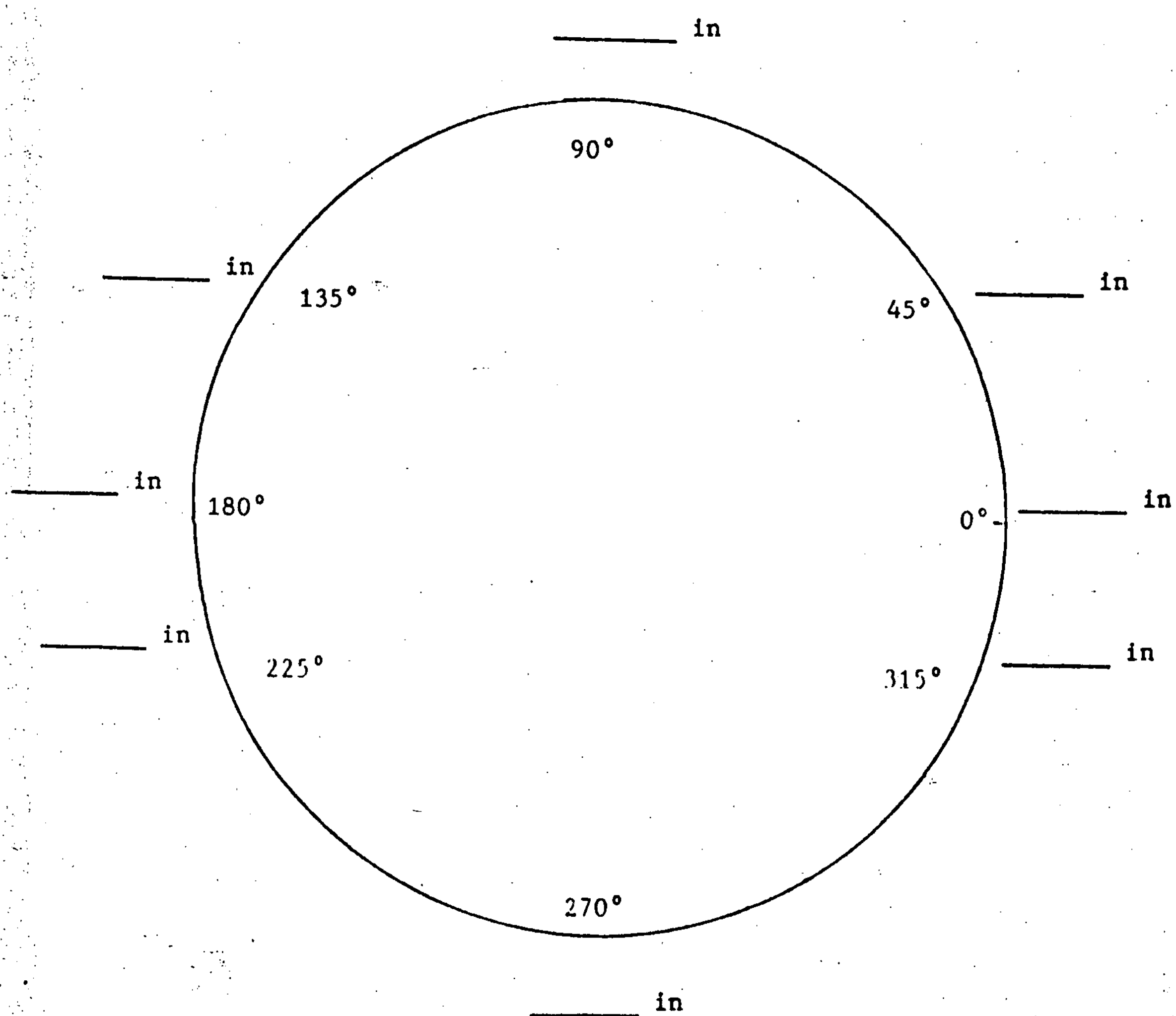
Dial Indicator	6.3.15 North	6.3.16 South	6.3.17 East	6.3.18 West
Calculate Midpoint (6.3.1.9)	(North-South) ÷ 2 (______ - ______) ÷ 2= ______		(East-West) ÷ 2 (______ - ______) ÷ 2= ______	

NOTE: The total motion before centering of the rotor should not exceed .020 inch.

Data Recorded by ______________________

Verified by ______________________ Date ____________
Maintenance Engineer

6.3.22 MOTOR COUPLING ANGULARITY



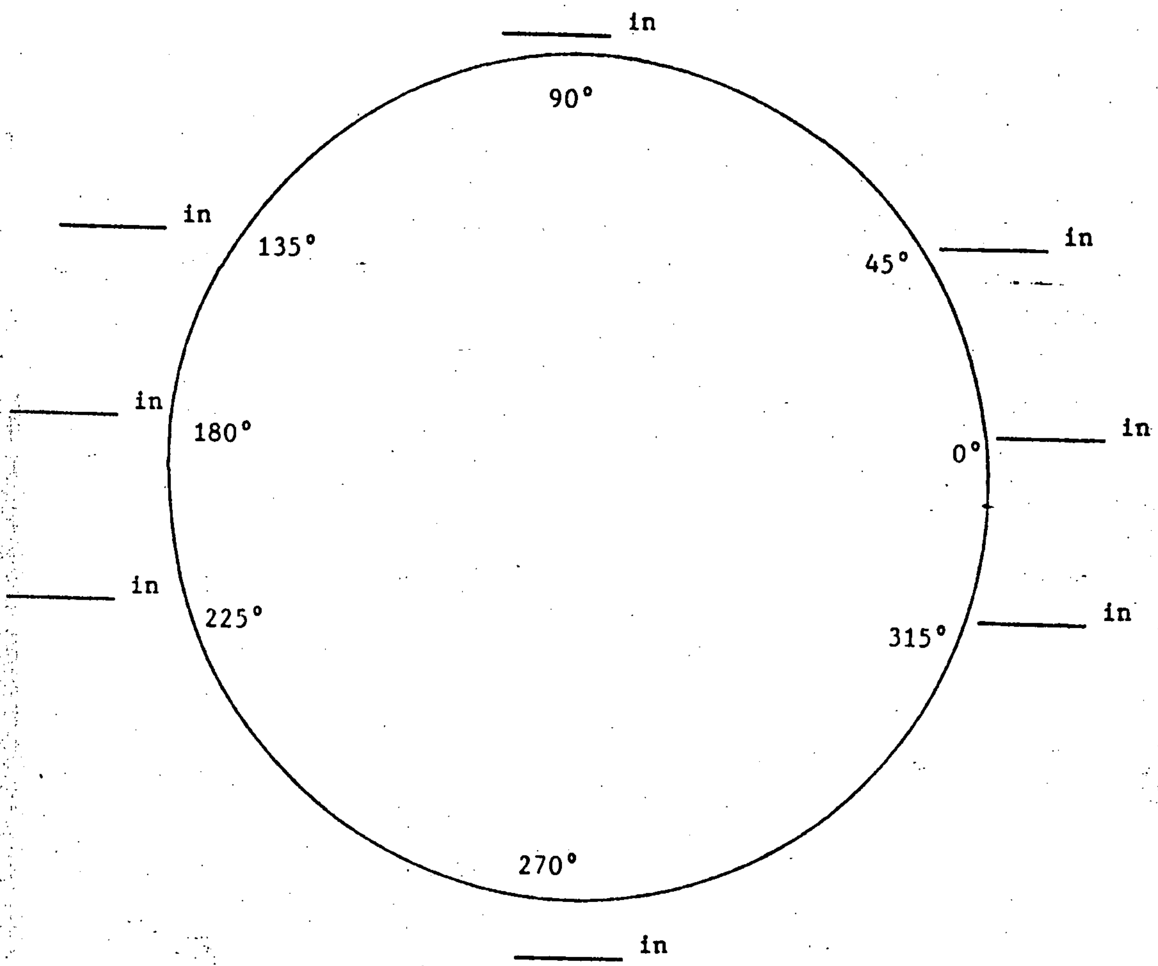
NOTE: Take into account the fact that the motor mounting diameter is about three times that of the coupling diameter so that three times as much shimming will be required at the motor mounting flange.

Shims Required

0° = _______ in	180° = _______ in
45° = _______ in	225° = _______ in
90° = _______ in	270° = _______ in
135° = _______ in	315° = _______ in

Data Recorded by ______________________ Date ______________

6.3.25 RECHECK THE ANGULARITY

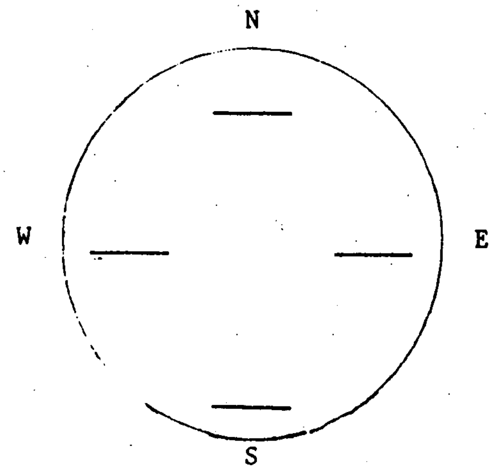


Shims Required (if necessary)

0° =	______ in	180° =	______ in
45° =	______ in	225° =	______ in
90° =	______ in	270° =	______ in
135° =	______ in	315° =	______ in

Data Recorded by ______________________ Date __________

6.3.31 LATERAL ALIGNMENT CHECK



N - S = T.I.R.

_____ - _____ = _______

E - W = T.I.R.

_____ - _____ = _______

Data taken by ______________________________ Date ___________
Craftsman

6.3.34 HOLD POINT: Motor bolts torqued to 1000 ft-lbs and T.I.R. does not exceed .002 inch.

Inspected by ______________________ / ______________
QC Inspector Date

6.3.35 HOLD POINT: Final gap between the coupling bolt faces to the nearest .005 equals ________ in.

NOTE: This gap should be .847" to 1.029".

Inspected by ______________________ / ______________
QC Inspector Date

Initials

6.3.36 Motor coupling and spool flange matchmarks are aligned ________

6.3.39 HOLD POINT: The four upper spool bolts torqued to 1000 ft.-lbs. in 250 ft.-lbs. increments using a crisscross sequence.

Inspected by ______________________ / ______________
QC Inspector Date

6.3.40.1 HOLD POINT: Power leads connected and torqued to 30 ft-lbs.

Inspected by ______________________ / ______________
QC Inspector Date

Verifying Initials

6.3.42 HOLD POINT CHECKLIST

1. Water inlets and outlets to upper and lower oil coolers and air coolers connected. ________

2. Resistance temperature detectors, space heater leads, magnetrol switches, ground connections, and related conduits are connected. ________

3. Oil lift pressure switch connected. ________

4. No. 1 and No. 2 seal leakoff pipes, the seal bypass, and the No. 3 seal leakoff lines are connected (if motor support was removed). ________

5. Leads to the auxiliary terminal box and stator RTD junction box are connected. ________

6. Vibration pickups and cables are connected. ________

7. All tools and material removed from work area. ________

Verified by ____________________ Date __________
Maintenance Engineer

6.3.45 Appendix B attached. ________

POST MAINTENANCE TESTING

7.2 Appendix B completed and attached. ________

7.3 The performance of this instruction is complete

____________________ / ________
Shift Engineer or his Designated Representative / Date

7.4 Post-work ALARA review has been completed (if required)

____________________ / ________
Electrician Foreman / Date

Unit ____________

RCP No. ________

Date ____________

CLEARANCE INSTRUCTIONS - REACTOR COOLANT PUMP

A. Work To be Performed: Date ____________

1. MI-2.2 - Complete Removal of Reactor Coolant Pump Motor

B. Initial Conditions: Date ____________

1. _______ The unit is in the cold shutdown mode with RCS <150° or in refueling mode.

2. _______ The RCS is being maintained at above 1 psig via hose connected from PRZR 3/4" vent (68-577) to PRT 3/4" vent (68-573) if not in refueling mode.

3. _______ RHR system operating in shutdown cooling mode maintaining a steady RCS temperature <150°F.

4. _______ Reactor containment floor and equipment drain sump and at least one pump operable.

5. _______ Containment entry is permitted.

6. _______ The other three RCP's are held under Hold Order clearance (as a minimum electrically).

C. Clearance Instructions: Date ____________

1. _______ Check open and place in disconnected position 6.9-kV circuit breaker power supply to applicable RCP.

2. _______ Tag applicable RCP 6.9-kV normal circuit breaker and alternate circuit breaker with Hold Notice.

3. _______ Close applicable RCP seal water supply valve (RCP A 62-564, RCP B 62-565, RCP D 62-567, RCP C 62-566) and tag with Hold Notice.

4. _______ Close applicable RCP No. 1 seal leakoff air operated isolation valve (RCP A FCV 62-9, RCP B FCV 62-22, RCP C FCV 62-35, RCP D FCV 62-48) and tag with Hold Notice.

5. _______ Close RCP No. 1 seal leakoff bypass air operated isolation valve FCV 62-53.

Unit ________
RCP No. ______
Date ________

6. ______ Close applicable RCP No. 2 seal stand pipe primary water supply isolation (RCP A 62-620, RCP B 62-621, RCP C 62-622, RCP D 62-623, and tag with Hold Notice.

7. ______ Drain applicable RCP No. 2 seal standpipe.

8. ______ Close applicable RCP No. 2 seal standpipe drain (RCP A 62- 632, RCP B 62-633, RCP C 62-634, RCP D 62-635) and tag with Hold Notice.

9. ______ Close applicable RCP No. 2 seal standpipe outlet (RCP A 62-628, RCP B 62-629, RCP C 62-630, RCP D 62-631) and tag with Hold Notice.

10. ______ Remove blank flanges from applicable RCP No. 1 seal bypass and No. 1 seal leak line vents adjacent to the RCP and slowly open vent and leave open.

11. ______ Close CCS supply to RCP's motor oil coolers, valve 70-693 and tag with Hold Notice.

12. ______ Close CCS outlet from RCP's motor oil coolers, valve 70-734 and tag with Hold Notice.

NOTE: Open vent within clearance zone to zero pressure and leave open.

13. ______ Thermal barrier booster pumps are under Hold Order clearance. Tag out if not.

14. ______ Close RCP's CCS supply to thermal barriers, valve 70-680 and tag with Hold Notice.

15. ______ Close RCP's CCS outlet from thermal barriers, valve 70-736 and tag with Hold Notice.

NOTE: Open vent within clearance and zero pressure, leave vent open.

16. ______ Close ERCW supply valve to RCP motor air coolers (RCP A TCV 67-86, RCP B TCV 67-94, RCP C TCV 67-102, RCP D TCV 67-110) and tag with Hold Notice.

17. ______ Close ERCW outlet valve from RCP motor coolers (RCP 67-572A, RCP B 67-572B, RCP C 67-572 C, RCP D 67-572 D) and tag with Hold Notice.

NOTE: Open vent within clearance and zero pressure, leave vent open.

18. ______ Open 480-V ACB power supply to applicable RCP motor heaters and tag with Hold Notice.

Unit No. __________

RCP No. __________

Date __________

19. Tag applicable RCP oil lift pump on separate Hold Order as follows:

   a. _______ Open 480-V ACB power supply to applicable RCP oil lift pump and tag with Hold Notice.

   b. _______ Tag applicable RCP oil lift pump control on benchboard with Hold Order.

20. _______ Tag applicable RCP benchboard control switch with Hold Order.

D. Releasing and Aligning for Operations: RCP __________ Date __________

1. Realign pump for operation per SOI 62.1C and SOI 68.2.

2. Return this Appendix B to the maintenance section.

E. Post Maintenance Inspection

NOTE: Notify the maintenance section for assistance in the performance of this inspection.

1. _______ RCP Local Inspect Checklist of SOI-68.2 completed.

2. _______ Check motor for correct rotation (counterclockwise).

NOTE: The anti-reverse rotation device will prevent backward turning of the motor. If the motor fails to rotate within two seconds, remove power and determine cause.

CAUTION: Ear protection must be worn when in the area where the reactor coolant pump motors are in operation.

3. _______ After the motor has reached operating speed, record vibration readings. Readings are acceptable if ≤ 3 mils (0.003 inch). Readings should be taken on motor housing connection to pump in two perpendicular points.

NOTE: If readings are >3 mils, the cause of vibration shall be determined and corrected.

REMARKS:

Performed by ______________________________ / __________
Date

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-67.1

REMOVAL, INSPECTION, AND REPAIR OF THE ESSENTIAL RAW COOLING WATER PUMPS

UNIT 1 OR 2

CURRENT REVISION LEVEL 4

Prepared By J. D. Beavers/L. M. Nobles

Revised By D. M. Watson

Submitted By [signature]
Supervisor

PORC Review Date 2/8/83

Approved By [signature]
Superintendent

Date Approved 2/8/83

Last page of this instruction: 28

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
	Plant Superintendent
	Asst. Plant Supt. (Operations)
	Asst. Plant Supt. (Maintenance)
	Adm. Svs. Supervisor
	Asst. Mechanical Maint. Sup.
	Chemical Laboratory
	Chemical Unit Supervisor
2C	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint. Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Services Supervisor
	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint. Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Svs. Supervisor
1C	Mechanical Maint. Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	OPQA - Plant Coordinator
1C & 1U	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
1C	Quality Assurance Supervisor
	Reactor Unit Supervisor
	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room
1C	Mech. Maint. Shop Office
	Nuclear Training Branch

bw

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
1	6/10/80	All	
2	3/24/81	2, 10	
3	12/11/81	Index; pages 1, 2, 4, 5, 8, 9, 11-16, 19, 21-26, 28. Deleted old page 28 and pages 30-31.	
4	2/8/83	Pages 1, 4-8, 11-15, 19, 26, 27.	Current revision is a result of experience gained during removal of ERCW pump.

PUNCH LIST

1. WBNP Tech Spec's draft II, dated 1/23/80

Jerry L Collins 06/09/80
Signature Date

INDEX

*

1.0 PURPOSE AND APPLICABILITY

The purpose of this instruction is to describe the procedure for disassembling, inspection, and repairing the essential raw cooling water pump. Conditions and restraints are specified in the Technical Specification 3.7.4.1. This instruction is applicable to operational modes 1, 2, 3, 4, 5, and 6.

2.0 REFERENCES

2.1 Byron Jackson Instruction Manual for Essential Raw Cooling Water Pumps

2.2 TVA Contract No. 76K31-83158

2.3 Technical Specification 3.7.4.1

3.0 PREREQUISITES

* 3.1 Coordinate the performance of this instruction with the shift engineer by obtaining his authorization of the maintenance request that requires the performance of this MI. (Record the MR number on the Data Cover Sheet.)

3.2 Obtain the necessary clearances for the performance of this instruction. (Tagging procedure is attached as Appendix B.)

3.3 Notify the QA section that QC inspector coverage will be required during the performance of this instruction.

3.4 All supports and restraints that have to be removed to perform this instruction must be removed per MAI-16.

3.5 Contact safety engineer for evaluation of transient fire loads.

4.0 PRECAUTIONS

4.1 Essential raw cooling pumps are located on elevation 741 at the intake pumping station. Positively identify the proper pump before beginning work. The pumps are marked A-A through D-A and E-B through H-B.

4.0 PRECAUTIONS (Continued)

4.2 Every precaution should be made to maintain a clean work area. All requirements for cleanliness given in this instruction shall be followed.

4.3 Ensure that the affected pump and its system is cool, depressurized, vented, and isolated.

4.4 Any oil drained from the unit should be removed immediately from the work area to the waste oil storage area after draining.

* 4.5 Refer to HCI-HM13 and HCI-HM14 for safety precautions on handling acetone or Isopropyl Alcohol.

* 4.6 Bolted connections that have to be loosened or removed to perform this instruction must be identified on the bolted connection data sheet in Appendix A. Prior to removing any welded connection, the maintenance supervisor must be notified.

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5.0 PREPARATION FOR WORK

5.1 The responsible foreman shall review the task to be performed.

5.1.1 To preclude the possibility of a maintenance initiated common mode failure, crew personnel and M and TE should not be the same for two consecutive performances of this MI unless the performance of the component covered by the previous MI has been tested and proven satisfactory.

5.2 The following is a list of spare parts that are normally needed to do this job. These parts are listed and shown in Figure-01 (drawing No. 1F-7879). These parts should be checked for availability prior to starting work. Any part that has to be replaced must have its part number and materials procurement numbers recorded on the data sheet provided in Appendix A.

NOTE: Do not unwrap any part until it is actually needed.

Item Number	Part Name	Quantity Required
1	Lock screw-bearing	1
2	Suction bell	1
3	Sand cap	1
4	Lock screw-sand cap	2
5	Thrust collar	1
6	Impeller - 1st stage	1
7	Case wear ring	2
8	Bottom bearing	1
9	Split ring-impeller	1
10	Key-impeller	2

List continues on next page.

5.0. PREPARATION FOR WORK (Continued)

Item Number	Part Name	Quantity Required
12	"O"-ring - cases	2
13	Impeller liner	2
14	Impeller - 2nd stage	1
15	Split ring - impeller	1
16	Thrust collar - 2nd stage	1
18	"O" ring - top case	1
19	Case bearing	2
20	Pump shaft	1
25	Column shaft - intermediate	10
26	Column bearing	10
27	"O" ring - column	10
28	Gib key - coupling	22
29	Split ring - coupling	11
30	Shaft coupling	11
31	Key coupling	22
34	Top column shaft	1
35	Lock screw - throttle bushing	1
36	Throttle bushing	1
37	Stuffing box	1
38	Shaft sleeve	1
39	Gib key - sleeve	1
40	Retaining ring - sleeve	1
41	Key - coupling	1
42	"O" ring stuffing box	1
43	"O" ring sleeve	1
44	Case ring	2
45	Packing 1/2" square - 3-5/16" I.D. John Crane 100M	5 rings
50	Split ring - motor	1
51	"O" ring stuffing box	1
	Suction bell to case, case to case, and case to column	
	Studs 1-8 UNC x 4-1/2" lg	72
	Hex nuts 1-8 UNC	72
	Column flanges	
	Hex head cap screws 1-8 UNC x 5" lg	240
	Hex nuts 1-8 UNC	240
	Stuffing box to head	
	Studs 7/8-9 UNC x 4" lg	4
	Hex nuts 7/8-9 UNC	4

5.0 PREPARATION FOR WORK (continued)

5.3 The following work aids will be required for this job and shall normally be at the work area prior to beginning work.

5.3.1 A container for temporary storage of miscellaneous parts

5.3.2 Lint-free rags

5.3.3 Hook chain or cable sling

5.3.4 Thread compound - Felpro or equal (approved by TI-35)

5.3.5 Eye bolt with 1-8 UNC thread

5.3.6 Tube of petrolatum jelly

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* 5.3.7 Lifting equipment
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* 5.3.7.1 Saddle support column

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* 5.3.7.2 Lifting spider

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* 5.3.7.3 Shaft lifting eye

* 5.3.8 Isopropyl Alcohol or acetone - See HCI-HM13 and HCI-HM4 for those materials and supplies needed for the safe use of acetone or isopropyl alcohol.

5.0 PREPARATION FOR WORK (continued)

5.4 Obtain for use in this instruction the following special tools and instruments. Record the tool number (if applicable) or instrument TVA number and calibration due date on data sheet provided in Appendix A.

5.4.1 Torque wrench-capable of torquing 150 ft./lbs.

* 5.4.2 Dial Indicator (grad. 0.001")

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* 5.4.3 Snap gauge 3" to 4"

* 5.4.4 O.D. micrometer 3" to 4"

* 5.4.5 I.D. micrometer 14" to 15"

* 5.4.6 O.D. micrometer 13" to 14"

6.0 PERFORMANCE OF WORK

6.0.1 Remove any conflictive supports and restraints per MAI-16.

6.0.2 Disassembly any conflictive or restrictive bolted connections. As each bolted connection is disassembled, the craftsman must record it and its bolt size on the bolted connection data sheet in Appendix A.

NOTE: Number in ( ) refer to Figure-01.

6.1 Remove pump from its sump.

6.1.1 Remove motor per MI-67.3

6.0 PERFORMANCE OF WORK (continued)

6.1.2 Disconnect auxiliary and main piping. Disconnect the driver half coupling from the adjusting plate (48), then detach and remove the driver. Store driver in an upright position.

6.1.3 Remove the adjusting plate (48), pump half coupling (47), coupling key (41), gland (46), packing (45), and cage ring (44).

6.1.4 Remove the discharge head (33) to sole plate (32) bolts.

6.1.5 Lift the pump until there is sufficient clearance between the outer column flange and the sole plate to install the saddle support assembly.

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* 6.1.6 Install and bolt together the saddle assembly. Lower the pump slowly until it is supported in the assembly by the upper flange of the outer column.

* 6.1.7 Remove the discharge head (33) from the pump assembly.

6.0 PERFORMANCE OF WORK (Continued)

6.1.9 Clean the shaft above the shaft coupling (30).

6.1.10 Remove the cap screws that lock the shaft coupling sleeve (30) and gib keys (28) in place on the shaft.

CAUTION: The area on the pump shaft directly above the coupling must be clean and free of all dirt and scale prior to raising the shaft coupling.

6.1.11 Raise the shaft coupling (30) and remove the gib keys (28) and split clamp ring (29).

NOTE: As parts are removed they should be matched marked and placed in an area to prevent damage.

6.1.12 Remove the top column shaft (34) with shaft coupling (30) and coupling keys (31) still attached.

* 6.1.13 Attach lifting fixture to upper flange of outer column and lift pump assembly to relieve the pressure from the saddle * support.

6.1.14 Open the saddle support, then lift the pump assembly until the upper flange of the next outer column section is above the saddle support.

6.1.15 Close the saddle support, then lower the pump assembly until it is supported by the upper flange of the outer column.

6.1.16 Remove the outer column from the pump assembly.

6.1.17 Clean the shaft above the shaft coupling (30).

6.1.18 Remove the cap screws that lock the shaft coupling sleeve (30) and gib keys (28) in place.

CAUTION: Area on the shaft above the coupling must be clean and free of all dirt and scale to help prevent galling of the coupling to the shaft.

6.1.19 Raise the shaft coupling (30) and remove the gib keys (28) and split clamp ring (29).

6.1.20 Remove the column shaft (25) with its shaft coupling (30) and coupling keys (31) still attached.

6.0 PERFORMANCE OF WORK (continued)

6.1.21 Repeat steps 6.1.13 through 6.1.20 until all sections of the outer column have been removed except one.

* 6.1.22 The last section of the outer column and the bowl assembly can
* now be removed as one assembly and taken to shop for easier
* removal of the last outer column from the bowl assembly.

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* 6.1.23 After the bowl assembly has been removed from the pit, the pit should be covered to prevent any objects from falling into it.

6.2 Disassemble bowl assembly

6.2.1 Disconnect and remove the suction bell (2).

6.2.2 Disconnect and remove top case (17).

6.2.3 Remove in turn the lock screws (4), sand cap (3), cap screws, thrust collar (5), split ring (9), impeller (6), key (10), series case (11), cap screws, thrust collar (16), split ring (15), and key (10).

6.2.4 Clean all parts for inspection using solvent wash and dry using clean, dry filtered compressed air. Clean, lint-free rags may be substituted for the compressed air.

6.3 Inspection of pump internals and cases. Craftsman performing the inspection shall verify the results by signing the data sheet in Appendix A. Any part that is unsatisfactory must be replaced.

6.0 PERFORMANCE OF WORK (Continued)

6.3.1 Craftsman to visually inspect the following parts for unusual wear or damage caused by erosion or corrosion. Parts are acceptable if there are no cracks, unusual wear, or damage visible. If any part is unsatisfactory, it must be replaced.

6.3.1.1 Suction bell (2)
6.3.1.2 Thrust collar (5) and (16)
6.3.1.3 Impeller - 1st stage (6)
6.3.1.4 Case wearing ring (7)
6.3.1.5 Split ring impeller (9) and (15)
6.3.1.6 Series case (11)
6.3.1.7 Impeller liner (13)
6.3.1.8 Impeller 2nd stage (14)
6.3.1.9 Top case (17)
6.3.1.10 Column shaft (21)(22)(34)
6.3.1.11 Split ring (29)
6.3.1.12 Shaft coupling (30)
6.3.1.13 Throttle bushing (36)
6.3.1.14 Stuffing box (37)
6.3.1.15 Shaft sleeve (38)
6.3.1.16 Retaining ring (40)
6.3.1.17 Cage ring (44)
6.3.1.18 Pump shaft (8)

* HOLD POINT: QC Inspector

6.3.2 Craftsman to measure and record the diametral clearances of the following parts. The QC Inspector is to verify by signing data sheet in Appendix A.

6.3.2.1 Clearance between bottom bearing (8) and pump shaft (20). Total clearance should be .010" to .013". Clearance is acceptable if it does not exceed .013". If bearing is acceptable, omit step 6.3.2.1.1.

6.3.2.1.1 Remove bottom bearing and replace with a new one. (NOTE: Clearance should be rechecked after it has been installed. Bearing may have to be reamed out.)

6.0 PERFORMANCE OF WORK (Continued)

6.3.2.2 Clearance between the case bearings (19) and pump shaft (20). Total clearance should be .010" to .013". Clearance is acceptable if it does not exceed .013". Note there are two case bearings. If case bearing clearance is acceptable, omit step 6.3.2.2.1.

6.3.2.2.1 Remove case bearings (19) and replace with the new ones. (NOTE: Clearance should be rechecked after they have been installed. Bearings may have to be reamed.)

6.3.2.3 Clearance between the case wear rings (7) and the 1st stage impeller (6) and the 2nd stage impeller (14). Total clearance should be .020" to .035". Clearance is acceptable if the clearance does not exceed .035". (NOTE: If the case wear rings are acceptable, omit steps 6.3.2.3.1, 6.3.2.3.2, and 6.3.2.3.3).

6.3.2.3.1 Remove the wear ring set screws and then either machine out the wear rings or remove by separating with a diamond pointed chipping tool.

6.3.2.3.2 Install new wear rings in case and lock in place with set screws.

6.3.2.3.3 Bore new case wear rings to obtain total clearance of .020" to .024".

6.3.2.4 Clearance between column bearings (26) and the column shaft (25). Total clearance should be .010" to .013". Bearings are acceptable if the clearance does not exceed .013". (NOTE: There are ten column bearings. If the column bearings are acceptable, omit steps 6.3.2.4.1.)

6.3.2.4.1 Remove coupling bearing (26) from outer column and replace with new ones. (NOTE: New bearing clearance should be checked after they are installed. If new bearing clearance is not at least .010", they will have to be reamed out.)

6.0 PERFORMANCE OF WORK (Continued)

6.4 Reassembly pump

6.4.1 Reclean all parts using approved solvent, wash and dry, using clean, dry, filtered compressed air. Clean, lint-free rags may be substituted for the compressed air.

NOTE: All gaskets and "O" rings removed during disassembly are to be discarded and replaced with new ones.

HOLD POINT: QC Inspector to verify installation of impeller key.

6.4.2 Install impeller key (10), 2nd stage impeller (14), split ring (15), thrust collar (16), thrust collar cap screws, and series case (11) with case bearing (19) installed.

HOLD POINT: QC Inspector to verify installation of impeller key.

6.4.3 Install impeller key (10), 1st stage impeller (6), split ring (9), thrust collar (5), thrust collar cap screws, sand cap screws (3) and sand cap lock screws.

6.4.4 Install top case (17) with new "O" ring (12) and case bearing (19) installed.

NOTE: Before installing O-rings, lightly coat the O-rings with petrolatum jelly and apply protective compound to all permanent threads.

6.4.5 Install suction bell (2).

* 6.4.6 Remove cover from pump pit and open impeller casing. Support fixture and place the bowl assembly so the top flange of the series case (11) rests on the support.

6.4.7 Lubricate the "O"-ring (18) and install it in the groove in the upper face of the top case (17).

6.4.8 Connect the first section of column shaft (25) as follows:

6.4.8.1 Install two keys (31) and a coupling sleeve (30) on the column shaft (25) and restrain the sleeve above the clamp ring groove while lowering the shaft to mate with the pump shaft (8).

6.4.8.2 Install the split clamp ring (29) and gib keys (28) in the pump shaft. Lower the sleeve as far as possible and install the cap screws to lock the gib keys to the sleeve.

6.0 PERFORMANCE OF WORK (continued)

Hold Point: QC Inspector to witness and verify final torquing.

6.4.9 Lift and install the bottom column (21) and connect the column-to-case fasteners. Craftsman to torque bolts to 90 ft./lbs. ± 5% and sign data sheet. QC Inspector to verify torquing by signing data sheet in Appendix A.

NOTE: Bolts are to be installed with the heads down.

* 6.4.10 Lift the assembly using the lifting fixture. Lower the assembly
* until the saddle support can be closed. After the saddle support has been closed, continue to lower the pump assembly until it is supported by the upper flange of the outer column.

6.4.11 Repeat steps 6.4.7 through 6.4.10 to install the remaining column sections, shaft sections, and discharge head at which time the pump will be supported by means of the top flange of column (28).

6.4.12 Lift up on the pump assembly. Remove the saddle support and I-beam assembly and lower the pump assembly onto the sole plate (32), fastening the sole plate to the discharge head.

6.4.13 Install the gland (46). Do not install the cage rings (44) or packing (45) at this time.

6.4.14 Install the pump half coupling key (41), pump half coupling (47), and adjusting plate (48). Screw the adjusting plate all the way down on the top shaft (34).

6.4.15 Mount motor per MI-67.3.

6.0 PERFORMANCE OF WORK (continued)

HOLD POINT: QC Inspector to verify coupling alignment.

6.4.16 Craftsman to check alignment of motor coupling to pump coupling by clamping a dial indicator on the motor coupling half and placing the indicator button on the O.D. of the pump coupling half. Rotate the motor shaft and measure the runout. The runout should not exceed .007" T.I.R. To check for squareness, measure the gap between the adjusting plate and motor coupling half in four places. Squareness is satisfactory if the gap measurement does not vary more than .003". QC Inspector to verify coupling alignment is satisfactory by signing data sheet in Appendix A.

6.5 Set impeller clearance

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* 6.5.1 Move coupling adjusting plate to give 0.075" clearance between it and the motor coupling half. If the coupling halves do not align to allow bolt up at this clearance, increase impeller clearance to allow bolt up (to next nearest bolt hole).

* 6.5.2 Craftsman to measure and record this clearance in three places in Appendix A.

* 6.5.3 Insert bolts through the coupling halves and tighten nuts slowly and evenly in opposite pairs until secure.

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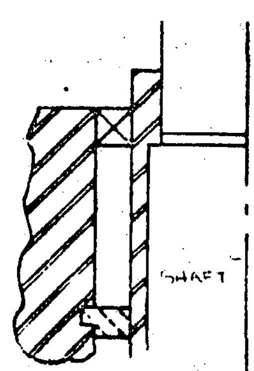
6.0 PERFORMANCE OF WORK (continued)

6.6 Install packing and piping

6.6.1 Remove gland (46) and check stuffing box and sleeve are clean.

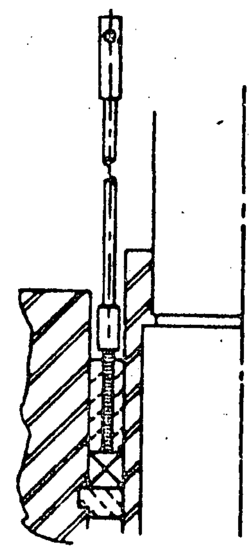
6.6.2 Insert one ring of packing (45) pressing by hand to point of maximum entrance. (Refer to Sketch-01).



SKETCH-01

6.0 PERFORMANCE OF WORK (Continued)

6.6.3 Insert spacer ring with packing tools attached and press on the packing tool handles to guide and tamp the packing ring solidly and squarely against the back of the stuffing box. Retract packing tools (refer to Sketch-02).



SKETCH-02

6.6.4 Insert sufficient spacer rings to fill the stuffing box.

6.6.5 Install and pull in the gland, tightening stud nuts evenly and firmly so that gland does not cock on the shaft. Remove gland and spacer rings.

6.6.6 Repeat steps 6.6.2 through 6.6.5 to install each remaining ring of packing.

NOTE: Each ring of packing must be rotated so the joint of the preceding ring does not line up with one being installed.

6.6.7 When all rings of packing are installed, loosen the gland stud nuts, then secure stud nuts finger tight.

* 6.6.8 Clean piping flanges, install gasket, and install studs and nuts hand tight. Craftsman to verify Class D cleanliness per TI-27, Part III, and attach a cleanliness class sheet with this step number.

* 6.6.9 Install auxiliary and main piping to the discharge header using new gaskets if required. Craftsman to verify Class D cleanliness per TI-27, Part III, and attach a cleanliness class sheet with this step number.

6.0 PERFORMANCE OF WORK (Continued)

6.6.10 Torque the disconnected conflictive bolted connections to the torque value as shown in the chart on the bolted connection data sheet. All bolted connections are to be tightened and torqued using a criss-cross pattern. QC Inspector and craftsman shall sign the data sheet in Appendix A after each connection has been torqued. *

6.6.11 Install supports and restraints that were removed during disassembly per MAT-16. *

6.6.12 Clear the work area and properly dispose of all potential fire hazards such as rags, flammable and combustible liquids, clothing, and plastic. The craftsman is to verify the area is clear and material properly disposed of by signing data sheet in Appendix A. *

6.6.13 List all parts that were replaced on parts data sheet in Appendix A. *

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7.0 POST MAINTENANCE CHECKOUT AND RETURNING EQUIPMENT TO SERVICE

7.1 Remove any material left in pump area.

7.2 Arrange for replaced parts in container and any new parts not used to be surveyed for contamination.

7.3 Return all unused new parts to the storeroom.

7.4 Release Hold Order to shift engineer for filling and pressurizing as described in the tagging procedure in Appendix B. *

7.4.1 Have an operator start the pump. The discharge gauge should show an increase in the pressure as the pump picks up speed. If it does not, shut down the pump and investigate.

NOTE: If any loud or unusual noise is heard coming from the pump, shut it down and investigate.

7.4.2 While the pump is running, adjust the shaft packing by tightening gland nuts. It is suggested that this be done slowly, one flat at a time until leakage is satisfactory.

NOTE: Do not make final adjustment of gland until pump has been in operation at operating temperature and pressure conditions for approximately four (4) to eight (8) hours.

DATA COVER SHEET

REMOVAL, INSPECTION, AND REPAIR OF THE
ESSENTIAL RAW COOLING WATER PUMPS

Unit ________ Reference MR No. ________

Performed by ______________________ / ____________ / ________
Title Date

All calibrated instruments and tools utilized in this instruction have been recorded in the CSSC Instrument and Tool Log.

______________________ / ________
Toolroom Attendent Date

Results Reviewed By ______________________ / ________
Maintenance Engineer Date

Results Reviewed and Approved ______________________ / ________
Maintenance Supervisor Date

QA Review Completed ______________________ / ________
QA Supervisor Date

* Transmit to Master Files

REMARKS: ______________________

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Date ____________

INSTRUMENT DATA

Test Equipment	TVA Tag No.	Calibration Due Date

Date ______________

REPLACEMENT PARTS

* * Part Name	Part No.	Material Procurement No.

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Step 6.3.1 Craftsman to visually inspect the following parts for unusual wear or damage caused by erosion or corrosion. Parts are acceptable if there are no cracks, unusual wear, or damage visible.

Step	Part Name/Number	Acceptable	Unacceptable	Verified By	Date
6.3.1.1	Suction Bell (2)				
6.3.1.2	Thrust Collar (5)				
	Thrust Collar (16)				
6.3.1.3	Impeller 1st stage (6)				
6.3.1.4	Case Wearing Ring (7)				
6.3.1.5	Split Ring Impeller (9)				
	Split Ring Impeller (15)				
6.3.1.6	Series Case (11)				
6.3.1.7	Impeller Liner (13)				
6.3.1.8	Impeller 2nd Stage (14)				
6.3.1.9	Top Case (17)				
6.3.1.10	Column Shaft (21)				
	Column Shaft (22)				
	Column Shaft (34)				
6.3.1.11	Split Ring (29)				
6.3.1.12	Shaft Coupling (30)				
6.3.1.13	Throttle Bushing (36)				
6.3.1.14	Stuffing Box (37)				
6.3.1.15	Shaft Sleeve (38)				
6.3.1.16	Retaining Ring (40)				
6.3.1.17	Cage Ring (44)				
6.3.1.18	Pump Shaft (8)				

* HOLD POINT: QC Inspector

Step 6.3.2.1 The diametral clearance between the bottom bearing (8) and the pump shaft (20) is ______". Clearance is satisfactory if it is .010" to .013". If clearance exceeds .013", the bearing is to be replaced. Clearance was recorded by

______________________ / __________
Craftsman Date

Hold Point Verified by ______________________ / __________
QC Inspector Date

*

* HOLD POINT: QC Inspector

Step 6.3.2.2 The diametral clearance between the case bearing (19) and pump shaft (20) is as follows.
Upper bearing clearance is __________".
Lower bearing clearance is __________".
Bearings are satisfactory if they are .010" to .013". If the clearance on either bearing exceeds .013", both bearings must be replaced. Bearing clearances were recorded by

______________________ / __________
Craftsman Date

Hold Point Verified by ______________________ / __________
QC Inspector Date

*

* HOLD POINT: QC Inspector

Step 6.3.2.2 The diametral clearance between the case wear rings (7) and 1st and 2nd stage impellers are as follows.
1st stage impeller (6) and wear ring (7) clearance is ______".
2nd stage impeller (14) and wear ring (7) clearance is ______".
Impeller clearance is satisfactory if it is .020" to .024".
If the clearance on either impeller exceeds .024", both wear rings must be replaced. Impeller clearances were taken and recorded by

______________________ / __________
Craftsman Date

Hold Point Verified by ______________________ / __________
QC Inspector Date

*

* HOLD POINT: QC Inspector

Step 6.3.2.4 The diametral clearance between the column bearings (26) and the shaft (25) are to be taken and recorded below. Bearing clearance is satisfactory if it is .010" to .013". If the bearing clearance exceeds .013", it must be replaced.

NOTE: Bearing number 1 is the bottom bearing.

Bearing No.	Actual Clearance	CONDITION		Recorded By	Date
		Sat	Unsat		
1	___.____"	___	___	_____	_____
2	___.____"	___	___	_____	_____
3	___.____"	___	___	_____	_____
4	___.____"	___	___	_____	_____
5	___.____"	___	___	_____	_____
6	___.____"	___	___	_____	_____
7	___.____"	___	___	_____	_____
8	___.____"	___	___	_____	_____
9	___.____"	___	___	_____	_____
10	___.____"	___	___	_____	_____

Hold Point Verified By ______________________ / ________
QC Inspector Date

*

*HOLD POINT: QC Inspector

*Step 6.4.2 Second stage impeller key installed.

* Hold Point verified by: ______________________ / ________
QC Inspector Date

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*Step 6.4.3 First state impeller key installed.

* Hold Point verified by: ______________________ / ________
QC Inspector Date

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Hold Point: QC Inspector

Step 6.4.9 QC Inspector to verify that the outer column bolts have been installed with the bolt head on the bottom side of the flange and that the nuts have been torqued to 90 ft. lbs. ± 5%.

NOTE: The number 1 column is on the bottom.

Description of Bolts Torqued	Torqued By	Date	QC Inspector Inspect. By
Bowl Flange to Lower Column			
Lower Column to Inter Column No. 1			
Column No. 1 to Column No. 2			
Column No. 2 to Column No. 3			
Column No. 3 to Column No. 4			
Column No. 4 to Column No. 5			
Column No. 5 to Column No. 6			
Column No. 6 to Column No. 7			
Column No. 7 to Column No. 8			
Column No. 8 to Column No. 9			
Column No. 9 to Discharge Head			

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HOLD POINT: Maintenance Engineer

Step 6.4.16 Craftsman to check shaft runout by clamping a dial indicator on the motor coupling half and placing the indicator button on the O.D. of the pump coupling half. Rotate the motor shaft by hand and read the T.I.R. Shaft runout is satisfactory if the T.I.R. does not exceed .007". The craftsman is to check squareness of couplings by measuring the gap between the motor coupling half and the pump coupling half. The gap is to be measured in four placed using feeler gauges. The squareness is satisfactory if the gap measurements do not vary more than .003".

	Sat	Unsat
Shaft runout is	☐	☐
Coupling square is	☐	☐

Performed By ______________________ / __________
Craftsman Date

Hold Point Verified By ______________________ / __________
QC Inspector Date

*

*Step 6.5.2 Craftsman to record impeller clearance setting in 3 locations.

* ____________ ____________ ____________

* Recorded by: ______________________ / __________
* Craftsman Date

*Step 6.6.8 Craftsman to complete and attach TI-27, Part III, Cleanliness Class
* & 6.6.9 D sheets and label with appropriate step number.

Step 6.6.12 The work area has been cleared of all potential fire hazard materials and the same have been properly disposed of.

Verified by ______________________ / __________
Craft Foreman Date

Step 6.6.9 and 6.6.10

Bolted Connection Data Sheet

Torque Table for alloy steel stud bolts, ASME SA-193, Gr. B7 and SA-453, Gr. 660 used on gasketed flanged connections

Nominal Diameter (In.)	Torque (Ft.-Lbs.)	Nominal Diameter (In.)	Torque (Ft.-Lbs.)
1/4	6	1-1/4	750
5/16	12	1-3/8	1020
3/8	18	1-1/2	1200
7/16	30	1-5/8	1650
1/2	45	1-3/4	2250
9/16	68	1-7/8	3000
5/8	90	2	3300
3/4	150	2-1/4	4770
7/8	240	2-1/2	6600
1	368	2-3/4	8880
1-1/8	533	3	11580

NOTES: 1. Torque Tolerances = ± 10%

Bolted Connection Description	Dia. Bolts (Inch)	Torqued To (Ft.-Lbs.)	Torqued By/Date Craftsman	*This column deleted.

Unit____________

Train__________

CLEARANCE INSTRUCTIONS - ERCW PUMP

A. Work To Be Done: Pump______________ Date______________

1. Maintenance on ERCW Pump

B. Initial COnditions: Date______________

1. Technical Specification 3.7.4 has been considered for outage.

C. Tagging Instructions: Pump______________ Date______________

1. Check open, make inoperable 6.9-kV breaker for applicable ERCW pump and tag with Hold Notice.

2. Close applicable ERCW pump discharge valve and tag with Hold Notice.

3. Tag applicable ERCW pump control switch in control room with Hold Order.

D. Releaseing and Aligning for Operation: Pump____________ Date____________

1. Hold Order is released.

2. Remove Hold Notice and slowly open applicable ERCW pump discharge valve.

3. Remove Hold Notice and place applicable ERCW pump 6.9-kV breaker and make operable.

4. Remove Hold Order from applicable ERCW pump control switch in the control room.

E. Post Maintenance Testing: Date______________

1. ____________ Perform S.I.-4.0.5.6

F. Return completed Appendix B to maintenance section for inclusion in completed data package.

G. 47W845-1

______________________ SE/ASE ______________________ / ______________________ Date

WATTS BAR NUCLEAR PLANT

MAINTENANCE INSTRUCTION

MI-57.28

DAILY INSPECTION OF POLAR AUXILIARY, AND TURBINE BUILDING CRANES

UNITS 1 & 2

1C	Document Control Unit, 1520 CST2-C
1U	NRC
1C	Nuclear Safety Review Staff
1C	Plant Master File
	Plant Superintendent
	Asst. Plant Supt. (Operations)
	Asst. Plant Supt. (Maintenance)
	Adm. Svs. Supervisor
	Asst. Mechanical Maint. Sup.
	Chemical Laboratory
	Chemical Unit Supervisor
2C	Chief, Nuclear Training Branch
	Compliance Unit
	DPSO-WBN
	Document Control Supervisor
2C	Electrical Maint. Supervisor
	Electrical Shop
	Engineering Supervisor
1C	Field Services Supervisor
1C	Field Quality Engineering Supv.
	Health Physicist
	Health Physics Laboratory
	Instrument Engineer
	Instrument Maint. Supervisor
	Instrument Shop
	Janitor & Labor Supervisor
	Management Svs. Supervisor
	Mechanical Maint. Supervisor
	Mechanical Unit Supervisor
1C	Operations Supervisor
	Plant Program Section Supv.
1C&1U	Plant Services Supervisor
	Plant Training Officer
	Plant Training Shift Engineer
	Power Stores Unit Supervisor
	Preop Test Supervisor
	Public Safety
	QA Manager, QA and Audit Staff
	Reactor Unit Supervisor
	Safety Engineer
1C	Shift Engineer's Office
1U	Stationary Equipment Group
	Technical Support Center
1C	Unit 1 Control Room
	Unit 2 Control Room

CURRENT REVISION LEVEL 0

Prepared By John Maddux

Revised By N/A

Submitted By C. Bruce
Supervisor

PORC Review Date 8/31/83

Approved By [illegible] for
Superintendent

Date Approved 8/31/83

Last page of this instruction: 9

C4

HISTORY OF REVISION/REVIEW

REV. NO.	DATE	REVISED PAGES	REASON FOR CURRENT REVISION (INCLUDE ALL TEMPORARY CHANGE NUMBERS)
0	8/31/83	All	Replaces MI-271.2 and MI-271.3

DAILY INSPECTION OF POLAR, AUXILIARY BUILDING AND TURBINE BUILDING CRANES

Operator ____________________ Date ______________ Crane ______________

The following checks shall be conducted by each operator prior to the use of the crane each shift as required by AI-6.4.

1. Visually inspect the bridge, trolley, hoists, control cabinets, and controls for obvious defects that could interfere with operation.

   ☐ Acceptable ☐ Unacceptable

   Remarks: ____

   ____

2. Check the operation of the crane including hoisting, lowering, trolley travel, and bridge travel.

   ☐ Acceptable ☐ Unacceptable

   Remarks: ____

   ____

3. Check the limit switches, locking, and safety devices. As a precaution, the limit switches shall be checked at slow speed or by "inching" into the limit.

   ☐ Acceptable ☐ Unacceptable

   Remarks: ____

   ____

CAUTION: If any check is determined to be unacceptable, notify the foreman immediately and do not operate crane until permission is given by the foreman.

Reviewed by foreman ______________________________

Corrective Action Initiated ______________________________

NOTE: The following steps are to be performed on the Auxiliary Building and polar cranes for loads over 2000 lbs to comply with the heavy loads program (NUREG 0612). No action will be required on the Turbine Building crane.

4. Heavy load control of <u>LOADS OVER 2000 LBS.</u>

4.1 Precautions

4.1.1 Maintain a minimum clearance between the load and the floor or object over which the load must pass.

4.1.2 Clearance over the steam generators from the #1 and #2 RCP area will not be sufficient in some control lifts. These lifts can only be performed over an open reactor head when shield head blocks are in place.

4.2 Lift Documentation

4.2.1 Only approved lifts shall be made. Verify that the lift to be made is an approved lift (see Attachment A). Note the referenced procedures and safe load path.

4.2.2 Complete the prelift requirements on Attachment A, page 7.

4.2.3 Raise and transfer the load to its destination, following the safe path given. A "standard" safe load path is the most direct path into and out of the critical zone, which minimizes time and proximity to the open vessel or fuel racks.

4.2.4 Indicate satisfactory completion of the lift on the data sheet.

4.2.5 Submit the data package at the end of each shift to the appropriate supervisor for review.

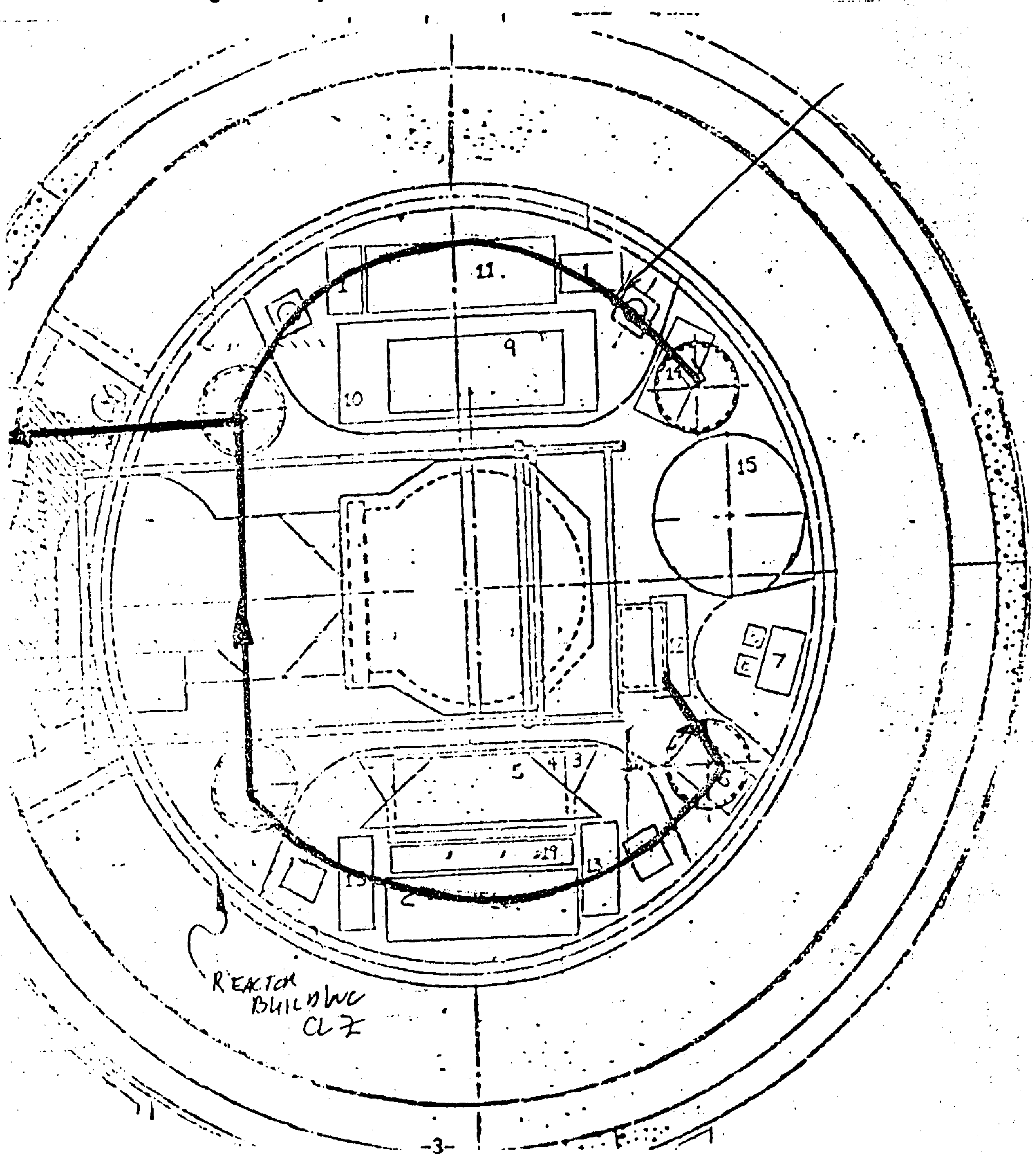
4.2.6 This data package shall be submitted to the Master File as a QA record.

NOTE: Several unrelated lifts may be documented on a single data sheet.

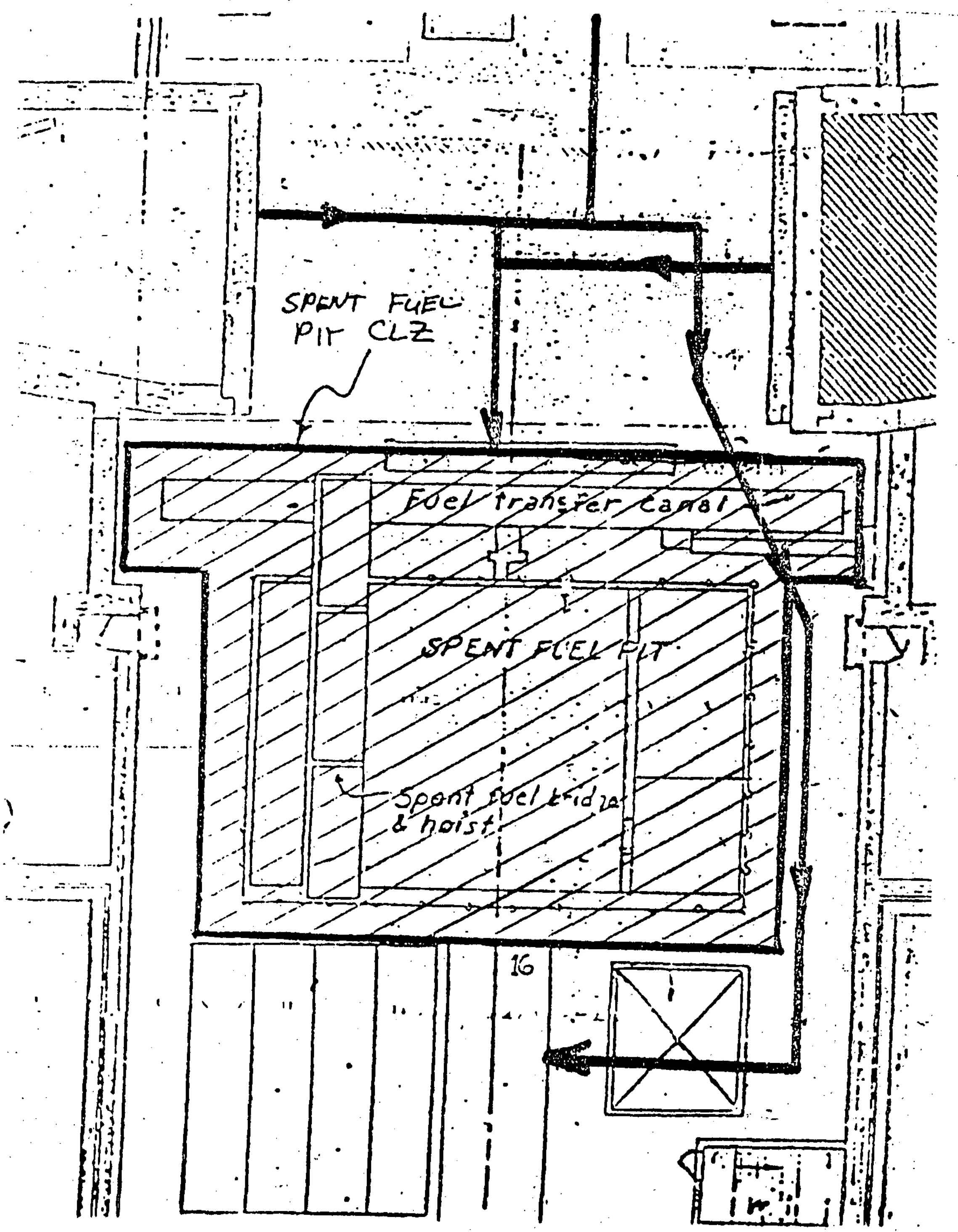
ATTACHMENT A

REACTOR BUILDING CRITICAL LIFT ZONE (CLZ)

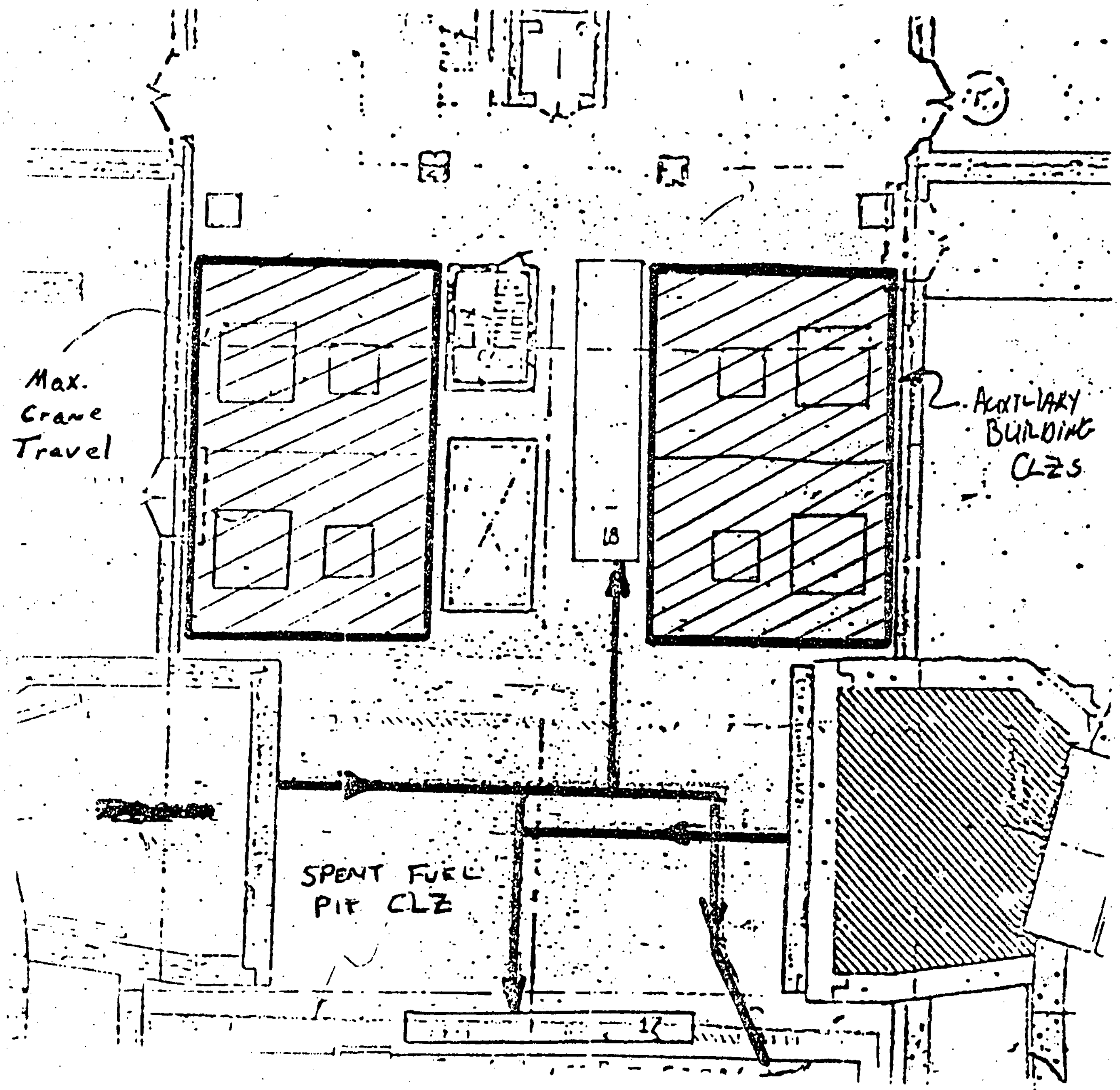
NOTE 1: All miscellaneous lifts shall follow the paths indicated.
NOTE 2: All other lifts shall take the shortest safe path to the designated laydown area.



SPENT FUEL PIT CRITICAL LIFT ZONE (CLZ)



AUXILIARY BUILDING CRITICAL LIFT ZONE (CLZ)



REACTOR BUILDING CLZ LIFTS

LIFT NO.	R. B. POLAR HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
RB-1	Main	2 Slings MK	Missile Shields PC-1 PC-2				Attachment A, Page 1
RB-2	Main and Aux.	2 Slings MK and 1 Sling MK	Canal Gates PC-3 PC-4 PC-5				"
RB-3	Main	2 Slings MK	Canal Gates PC-3 PC-4 PC-5 Missile Shield PC-6				"
RB-4	Main	Closure Head Lifting Rig	RV Head				"
RB-5	Main	Internals Lifting Rig	Upper Internals				"
RB-6	Aux.	4 Part Sling MK	Reactor Coolant Pump Plug				"
RB-7	Aux.	4 Part Sling MK	Hatch Plug				"
RB-8	Main	Lifting Assembly MK	R.C. Pump Motor				"
RB-9	Main		R.C. Pump				"
RB-10	Main	Approved Slings or Rigging	Miscellaneous Equip in R. B. (not otherwise listed)				"

SPENT FUEL PIT CLZ LIFTS

LIFT NO.	AUX BLDG HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
SF-1	Main	Lifting Beam MK Slings MK per Ref. Dwg.	R.B. Equipment Hatch Plugs A B C				Attachment A, Page 2
SF-2			Pool Divider Gates				"
SF-3			Fuel Transfer Canal Door				"
SF-4			Irradiated Specimen Shipping Cask				"
SF-5			Spent Resin, Filter or other radioactive mat'l shipping casks				"
SF-6			New Fuel Shipping Containers w/fuel				"
SF-7			Spent Fuel Shipping Cask				"
SF-8			Failed Fuel Container				"
SF-9			Fuel Transfer Carriage				"
SF-10	Aux. or Main	Approved Rigging	Misc. Equipment				"

AUXILIARY BUILDING CLZ LIFTS

LIFT NO.	AUX BLDG HOIST	LIFTING DEVICE OR RIGGING	LIFT	WEIGHT (TONS)	REF. DRAWINGS	REFERENCE PROCEDURES	SAFE LOAD PATH
AX-1			Containment Spray Shield Blocks				Attachment A, Page 3
AX-2			RHR Shield Blocks				"

8

CRITICAL ZONE LIFT CHECKLIST

Date ______________

APPROVED LIFT NUMBER	DATE	TIME	PRE-LIFT CHECKS COMPLETED THIS SHIFT (INITIAL)	HANDLING DEVICE, RIGGING CORRECT PER ATTACHMENT A, PAGES 4,5,OR 6 (CHECK)	SLING## CAPACITY RATED FOR LOAD ( )OR N/A	LIFT COMPLETED SATISFACTORY (INITIAL)	REMARKS

##N/A for lifts using special lifting devices designed for the lift.

Reviewed By ______________________
Foreman

QA Review ______________________