

GPU Nuclear
P.O. Box 480
Middletown, Pennsylvania 17057
717-944-7621
Writer's Direct Dial Number:

10-12-82

TMI Program Office
Attn: Mr. L. H. Barrett, Deputy Program Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057-0191

Dear Sir:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Polar Crane Refurbishment

Enclosed for your information are two documents related to the refurbishment of the Polar Crane. Attachment 1 is the Polar Crane Functional Description. This document presents the minimum required crane movements and components necessary to meet the initial goal of crane recovery. Also included in the documents are the requirements for Licensing, QA/QC, and load tests required for initial refurbishment.

Attachment 2 is in response to Item 4 of NRC letter NRC/TMI-82-017 dated April 1, 1982, from L. H. Barrett to J. J. Barton. This item addresses a checklist of specific items of crane maintenance to be evaluated. Attachment 2 addresses, on a number-for-number basis, only those items which will be modified or deleted, including the rationale for change. All other items on the original checklist will be performed as listed in Item 4 of your letter.

DOO9

In order to support an accelerated schedule for crane refurbishment, GPU requests that if you have any questions, comments, or desire further clarification please contact us by October 15, 1982. Your cooperation in this matter is greatly appreciated.

Sincerely,

B. K. Kanga
B. K. Kanga
Director, TMI-2

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Attachment

CC: Dr. B. J. Snyder, Program Director - TMI Program Office

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POLAR CRANE FUNCTIONAL DESCRIPTION

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POLAR CRANE FUNCTIONAL DESCRIPTION

1.0 INTRODUCTION

The recovery of the crane can be incremented to support the various project milestones. The near-term project milestone is removal of the reactor vessel head. The initial goal of crane recovery is to reestablish the minimum crane motions necessary to move the missile shields and reactor vessel head. Material handling operations associated with the milestone of fuel removal such as plenum removal will be considered for initial crane recovery but will be subordinated to the initial goal. This document will define the crane functional, QA/QC, and licensing requirements for the initial crane recovery.

2.0 FUNCTIONAL REQUIREMENTS

2.1 GENERAL

Functional requirements for the crane are provided in terms of the minimum required crane movements and the minimum required crane components necessary to meet the initial goal of crane recovery. Recovery of the crane to meet only these functional requirements will result in the need for additional administrative controls to replace some unrecovered crane functions to ensure acceptable crane operation. In addition, some crane features are not included in the initial recovery since they are not required. Crane components are shown on the appended drawings (Appendix B).

2.2 REQUIRED CRANE MOVEMENTS

- a. Bridge - Rotation of the crane about the entire circumference of the containment is not required. The required bridge rotation is from azimuth 295 degrees (normal parked location) clockwise to azimuth 90 degrees (crane position required to park the missile shields in their designated location on the "B" D-ring).
- b. Trolley - End-stop to end-stop trolley travel is required.
- c. Main Hoist - Full main hoist movement is required.
- d. Auxiliary Hoist - The auxiliary hoist is not required. All material handling activities can be accomplished without this hoist.

2.3 REQUIRED CRANE COMPONENTS

- 2.3.1 Bridge - Two main bridge drive trains with electric brakes, one at each end of the bridge, are required. The hydraulic brakes and inching drive trains are not required. Administrative controls in the form of plant procedures can be used to help control bridge motion. See Appendix A, Table 1, for a listing of the required bridge components.

- 2.3.2 Trolley - The main trolley drive train with brake is required. The inching drive train is not required. Administrative controls in the form of operating procedures can be used to help control trolley motion. See Appendix A, Table 2, for a listing of the required trolley components.
- 2.3.3 Main Hoist - Except for the load sensing related components, all major components of the main hoist drive train and hoist unit including the inching drive and all brakes are required. (A load sensing device will be included with the rigging.) See Appendix A, Table 3, for a listing of the required main hoist components.
- 2.3.4 Auxiliary Hoist - No components are required since use of this hoist is not required.
- 2.3.5 Power Supply - The existing conductor/collector systems are extensively damaged. An alternate means to provide power to the bridge and trolley is required.
- 2.3.6 Controls - The existing crane controls (cab and pendant) were damaged as a result of the accident. A single set of crane controls are required to support the bridge, trolley and main hoist functions. These controls may take the form of restored cab or pendant controls or a new control station to support the required crane functions.
- 2.3.7 Structural - Integrity of the structure is required to support all other required crane functions as previously defined. See Section 4.2 for structural inspection considerations.

3.0 QA/QC REQUIREMENTS

3.1 GENERAL

The TMI-2 Quality Classification List contained in GPUN Standard Number ES-011 identifies the polar crane's structure as an Important To Safety Item. Upon completion of the crane initial recovery effort as defined herein and prior to use, an operational and load test shall be performed to verify the crane's structural ability to handle its load.

Prior to and immediately following the load test, the crane hook will be nondestructively examined in accordance with ANSI B30.10-1975 and ASNT-TC-1-A, as applicable. In addition, experienced crane and certified welding inspectors will inspect important crane components such as wire rope, brakes and the crane structure. Acceptance criteria will be identified in the implementing inspection documents or will be based on the judgement of personnel qualified for the particular inspection. Inspection document acceptance criteria will be concurred with by Engineering.

QC shall witness the operational and load tests and crane hook examinations. Additional QA/QC requirements will also be invoked for work on the crane structure and main hoist components as delineated in Section 3.2.

3.2 CRANE MAINTENANCE AND MODIFICATIONS

3.2.1 Crane Maintenance (Includes rework and repairs)

- a. Rework - Any work required to maintain conformance to prior specified requirements. QC receipt inspection is required for any replacement parts for the main hoist components.
- b. Repairs - Any work required to allow safe crane operation, e.g., repair welding, even though the crane will (after repair) not conform to the original requirements. The appropriate QA/QC requirements will be identified in the document approved by Engineering which authorizes the repair.

3.2.2 Crane Modifications

Crane modifications are defined as engineering changes to the crane components or functions. The authorizing document will be reviewed and approved by Engineering in accordance with existing project design control procedures and will specify QA/QC requirements when appropriate.

4.0 LICENSING

4.1 GENERAL

As a result of the initial crane recovery effort the original safety features identified in the FSAR will be restored. The main crane hoist structure (load supporting portions) including wire rope and hook will be inspected for damage prior to operational and load testing. Operational and load testing will be conducted to demonstrate the crane's ability to perform its required functions.

4.2 STRUCTURE AND HOISTING COMPONENTS

The original design of the crane structure was specified to satisfy Seismic Class I criteria. In accordance with the Project General Design Criteria, the seismic criteria will not be applied during the recovery effort.

The crane structure will be visually inspected by experienced crane and certified welding inspectors for damage resulting from the March 1979 accident. Any area identified as being damaged to the point that the crane's structural ability to lift the load is questioned may require further examination to determine the appropriate repair to be performed.

The main hoist wire ropes and hook will be inspected by a person qualified for the inspection prior to the load test. ANSI B30.2 Paragraphs 2-2.4.1 and 2-2.4.2 will be used for guidance in inspecting the rope. Following the load test the rope and hook will be reinspected to verify its acceptability for lifting the maximum load.

4.3 FSAR IDENTIFIED SAFETY FEATURES

The following safety features are identified in the TMI-2 FSAR:

- a. Main hoist redundant brake
- b. Main hoist redundant upper limit switches
- c. Separate main hoist control and drive devices (i.e., one normal drive and one inching)

These safety features will be restored on the crane.

4.4 OPERATIONAL TEST

An operational test (no load test) will be performed in accordance with ANSI B30.2-1976, Paragraph 2-2.2.1. The purpose of the test is to verify the crane functions identified in Section 2.0.

4.5 LOAD TEST

Upon completion of the initial crane recovery efforts, a load test will be conducted. The test will generally meet the requirements of ANSI B30.2-1976, Paragraph 2-2.2.2. Exceptions to be noted are the actual test load weight and the distance the test load is to be transported.

The maximum load to be handled by the crane is approximately 163 tons. A lifting capacity of 170 tons is sufficient, allowing a margin for in-line load indicating device(s) and additional rigging.

The test load will consist of the lift rigging (not the reactor vessel head lift rigging), load indicating device, test frame and the missile shields from over the reactor pressure vessel and pressurizer. The resultant weight will be at least 195 tons. ANSI B30.2 recommends a test load of approximately 212 tons for a rated capacity of 170 tons (rating is 80% of maximum test load). The addition of weight to the 195 ton, minimum, test load to increase the test load weight is not planned. Providing additional weights will increase worker exposures and, if brought from outside the reactor building, will increase the inventory of contaminated materials. The proposed test load is within 17 tons or less of the 125% load maximum allowed by ANSI. Since the designated lifting capacity (170 tons) is less than 35% of the original 500 ton design rating of the crane and the test load exceeds this capacity by at least 25 tons, the test load will be adequate to demonstrate the crane's ability to perform the required lifts.

The test load will be lifted so it is supported by the crane and held by the hoist brakes. The load will then be transported by the trolley and bridge a distance sufficient to allow at least one full revolution of the trolley and bridge gearing. The test load will not be transported over the Reactor Coolant System (RCS). Movement will be restricted so that a load drop will not impair either the RCS system or any equipment required to maintain the plant in a safe shutdown condition.

Table 4 provides an acceptable sequence for conducting the load test.

Table 1
REQUIRED BRIDGE DRIVE COMPONENTS

<u>COMPONENT</u>	<u>REQUIRED?</u>	<u>REMARKS</u>
<u>Main Bridge Drives</u>		Two of four main bridge drives on opposite ends are required. Indicated number of required components are those associated with the two required main bridge drives.
Main Bridge Drive Motors (2 of 4)	Yes	Required for operational bridge drives.
SESA Electric Brakes (2)	Yes	Originally these brakes were for parking only. As a minimum, brakes will be recovered sufficiently to act as drag brakes.
Hydraulic Brakes (2)	No	Crane can be positioned without these brakes.
Zero Speed Switch-Bridge Drive #1	No	Zero speed switch prevents engaging inching drive when hoist speed would cause inching drive to overspeed. Not required since inching drives are not required. Even if inching drives are recovered, switch is not required since operator control can be used to replace function.
Coupling, Zero Speed Switch to #1 Main Bridge Motor	No	Since zero speed switch is not required.
Whiting 8" Flexible Couplings (2 of 4)	Yes	Operational main bridge drives only.
10 VWSM Gear Drives (2 of 4)	Yes	Operational main bridge drives only.
Flexible Coupling (4 of 8) - Amerigear FS-103	Yes	Operational main bridge drives only.
Pillow Block Bearings (8)	Yes	All required unless bridge wheel drive assembly is dismantled.
6 P.D. Gear and 24 P.D. Gear (4)	Yes	All required unless bridge wheel drive assembly is dismantled.
Bridge Drive 4:1 Gear Reducers (2 of 4)	Yes	Operational main bridge drives only.
Bridge Wheels (16)	Yes	
Bridge Wheel Bearings (32)	Yes	
Resistors related to main drive motors (2 of 4)	Yes	Operational main bridge drives only.
All control components related to the main bridge drives such as starters, resistor contactors (1A-4A) and overload units on bridge panel.	Yes	Operational main bridge drives only. All five speeds will be recovered.

Table 1
REQUIRED BRIDGE DRIVE COMPONENTS

<u>COMPONENT</u>	<u>REQUIRED?</u>	<u>REMARKS</u>
<u>Inching Bridge Drives</u>		Inching bridge drives are not required since bridge can be final positioned by jogging with main bridge drives.
Inching Motors (4)	No	
Magnetic Clutch (4)	No	
Resistors related to inching drive motors (2 of 4)	No	
Slow speed motor rectifier sets	No	
<u>Miscellaneous</u>		
Control transformer (2 KVA) mounted in cab	Yes	
Warning horns, light and associated controls	No	Not essential to crane operation.
Master and selector switches in cab	No	
Start-stop pushbutton, bell foot switch, crane fast-slow switch in cab	No	It is assumed a pendant type control will be used.
Runway and bridge conductor collector system	No	System will be replaced with a temporary system powered from the existing polar crane feeder disconnect at elevation 347'-6".
Motor heater and other space heaters	No	Not essential to crane operation.
Crane lights	No	Not essential to crane operation.
Pendant controls	Yes	It is assumed the pendant control will be restored to support the main hoist bridge and trolley function.

Table 2
REQUIRED TROLLEY DRIVE COMPONENTS

<u>COMPONENT</u>	<u>REQUIRED?</u>	<u>REMARKS</u>
<u>Main Trolley Drives</u>		
Trolley Main Drive Motor (1)	Yes	
Trolley Brake - 8" SESA (1)	Yes	As a minimum, brake will be recovered sufficiently to act as a drag brake.
Trolley Motor Zero Switch Speed Switch	No	Zero speed switch prevents engaging inching drive when trolley speed would cause inching drive to overspeed. Not required since inching drives are not required. Even if inching drives are recovered, switch is not required since operator control can be used to replace function.
Coupling for Zero Speed Switch	No	Since zero speed switch is not required.
Amerigear C-101 1/2 Flexible Coupling (2)	Yes	
Amerigear FS 104 Flexible Coupling (4)	Yes	
Flexible Coupling (2)	Yes	
ABART Gear Reducer (1)	Yes	
40 V Rack Unit (1)	Yes	
17 ST Rack Unit (2)	Yes	
Trolley Truck Bearing Assemblies	Yes	
Trolley Wheels (8)	Yes	
Trolley Main Drive Motor Resistors	Yes	
All control components such as starter, resistor contactors (1A-4A) and overload units associated with high speed drive	Yes	
Forward and reverse limit switches next to end stops	Yes	
Alarm limit switches 9" from end stops	No	Operator control will be adequate.

Table 2
REQUIRED TROLLEY DRIVE COMPONENTS

COMPONENT	REQUIRED?	REMARKS
<u>Inching Trolley Drives</u>		Inching drives are not required since trolley can be final positioned by jogging the trolley main drive motors.
Inching Drive Motor (1)	No	
Magnetic Clutch (1)	No	
Resistors related to inching drive motors	No	
Slow speed rectifier sets	No	

Table 3
REQUIRED MAIN HOIST COMPONENTS

<u>COMPONENT</u>	<u>REQUIRED?</u>	<u>REMARKS</u>
<u>Main Hoist Main Drive Train</u>		
Main Hoist Motor	Yes	
Main Hoist Drive Motor Resistors	Yes	
Main Hoist Motor Zero Speed Switch	Yes	
Coupling, Main Hoist Motor to Zero Speed Switch	Yes	
Flexible Couplings (2) - Amerigear F-103	Yes	
Crosshead Drive Gear Unit	Yes	
Main Hoist Driveshaft Support Bearing	Yes	
All control components such as breakers, starters, switches & relays in Main Hoist Control Panel & Main Hoist Slow Speed Control Panel	Yes	
All contactors (1A-4A) overload devices & fuses related to Main Hoist System	Yes	
<u>Main Hoisting Unit</u>		
Main Hoist Solenoid Brakes (2)	Yes	Redundant brakes required based on a licensing (PSAR) commitment.
Main Hoist Solenoid Brakes Rectifiers & Transformers	Yes	
No. 500-C Main Hoist Gear Unit	Yes	
Main Hoist Drum Pinion Drive Gears (2)	Yes	
Main Hoist Drum Support Bearings (4)	Yes	
Drum Pinion Drive Gear Support Bearings (2)	Yes	
Main Hoist Drums (2)	Yes	
Main Hoist Wire Rope	Yes	
Main Hoist Weight Type Limit Switch	Yes	Required based on a licensing (PSAR) commitment.

Table 3
REQUIRED MAIN HOIST COMPONENTS

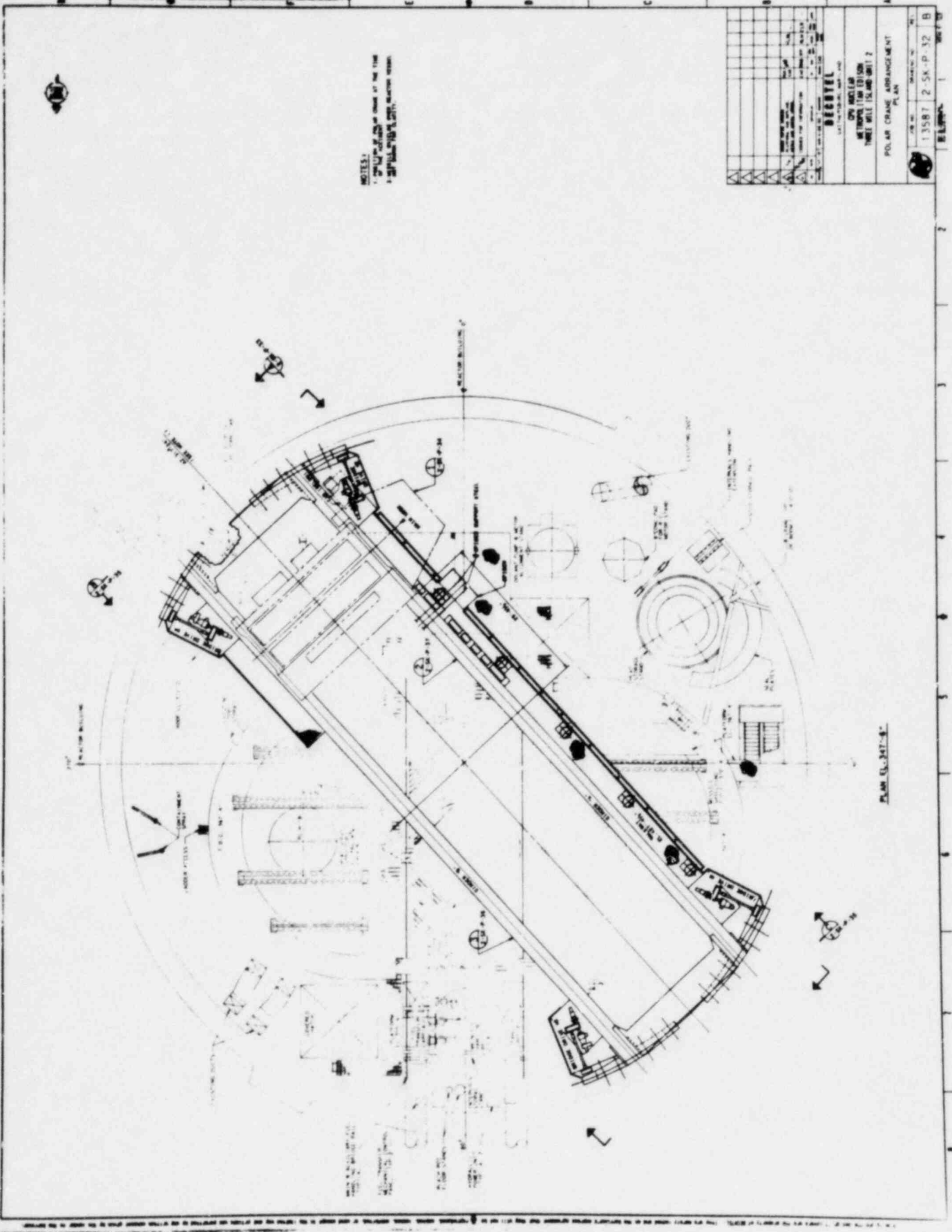
<u>COMPONENT</u>	<u>REQUIRED?</u>	<u>REMARKS</u>
Main Hoist Screw Type Limit Switch	Yes	Required based on a licensing (PSAR) commitment.
Main Hoist Load Sensing Device on trolley	No	Load indication will be provided at load.
Selector Switch for Main Hoist Load Sensing Device	No	Since load sensing device on crane is not required.
Adjustable Dial for Main Hoist Load Sensing Device	No	Since load sensing device on crane is not required.
Main Hoist Upper Sheave Nest	Yes	
Main Hoist Bottom Block Assembly	Yes	
Main Hoist Hook	Yes	
<u>Main Hoist Inching Drive Train</u>		
Inching Drive Gear Motor	Yes	
Inching Drive Magnetic Clutch	Yes	
Inching Drive Magnetic Clutch Rectifier & Transformer	Yes	
Inching Drive Eddy Current Brake	Yes	
Inching Drive Eddy Current Brake Rectifier, Resistors & Transformers	Yes	
Flexible Coupling - Amerigear F-1024	Yes	

Table 4
LOAD TEST SEQUENCE

1. Attach lifting rig including load indicating device to internals indexing fixture.
2. Lift internals indexing fixture 1 to 3 inches. Hold the test load approximately five minutes and observe for settling of the load or other abnormal conditions.
3. If no settling or other abnormal conditions occur, lift internal indexing fixture sufficiently to move it to the designated storage location.
4. Release hold-down bolts on RPV missile shield R-4 (the northern-most shield) and attach lifting rig including load indicating device.
5. Lift missile shield R-4 1 to 3 inches off the D-ring concrete and stop. Hold the test load for approximately five minutes and observe for settling of the test load or other abnormal conditions.
6. If no settling or other abnormal conditions occur, lift the missile shield 2'-4" to just clear the hold-down studs and transfer the shield over missile shields R-1, R-2, and R-3 to the designated laydown area on elevation 347'-6" for assembly of the test load. Lower the missile shield and stop to set the brakes with the missile shield still suspended. Observe for settling. Lower the missile shield onto the test load frame.
7. Repeat Steps 4 through 6 for missile shield R-3.
8. If no problems are encountered while lifting and moving missile shields R-4 and R-3, then remove missile shields R-1, R-2, and the pressurizer missile shield P-1 without stopping load to observe for settling. If any settling or other problems are encountered, correct the deficiency and then proceed to remove the remaining missile shields, stopping each to observe for settling or other abnormal functions.
9. Secure the missile shields to the test load frame.
10. Attach the lifting rig, including load indicator, to the load frame.
11. Lift the test load approximately 1 to 3 inches off the floor and stop. Hold the test load for approximately five minutes and observe for settling or other abnormal conditions.
12. If no settling or other abnormal conditions occur proceed with the remaining load test steps. If problems occur, correct deficiency before proceeding.
13. Raise load to allow designated bridge and trolley motions, and stop.
14. Move the trolley not less than 10 feet in either direction within the boundary designated as the load test area. Reverse the trolley

direction and move the trolley at least 10 feet. Park the trolley in the designated area for the bridge test.

15. Move the bridge about 15 feet in either direction within the boundary designated as the load test area. Reverse the bridge direction and move the bridge at least 15 feet.
16. Observe, document, and correct any problems that occur during the load test. Problems shall be corrected and testing performed to verify corrective actions have resolved the problem.



NOTES:
 1. ALL DIMENSIONS ARE IN FEET AND INCHES.
 2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE NOTED.
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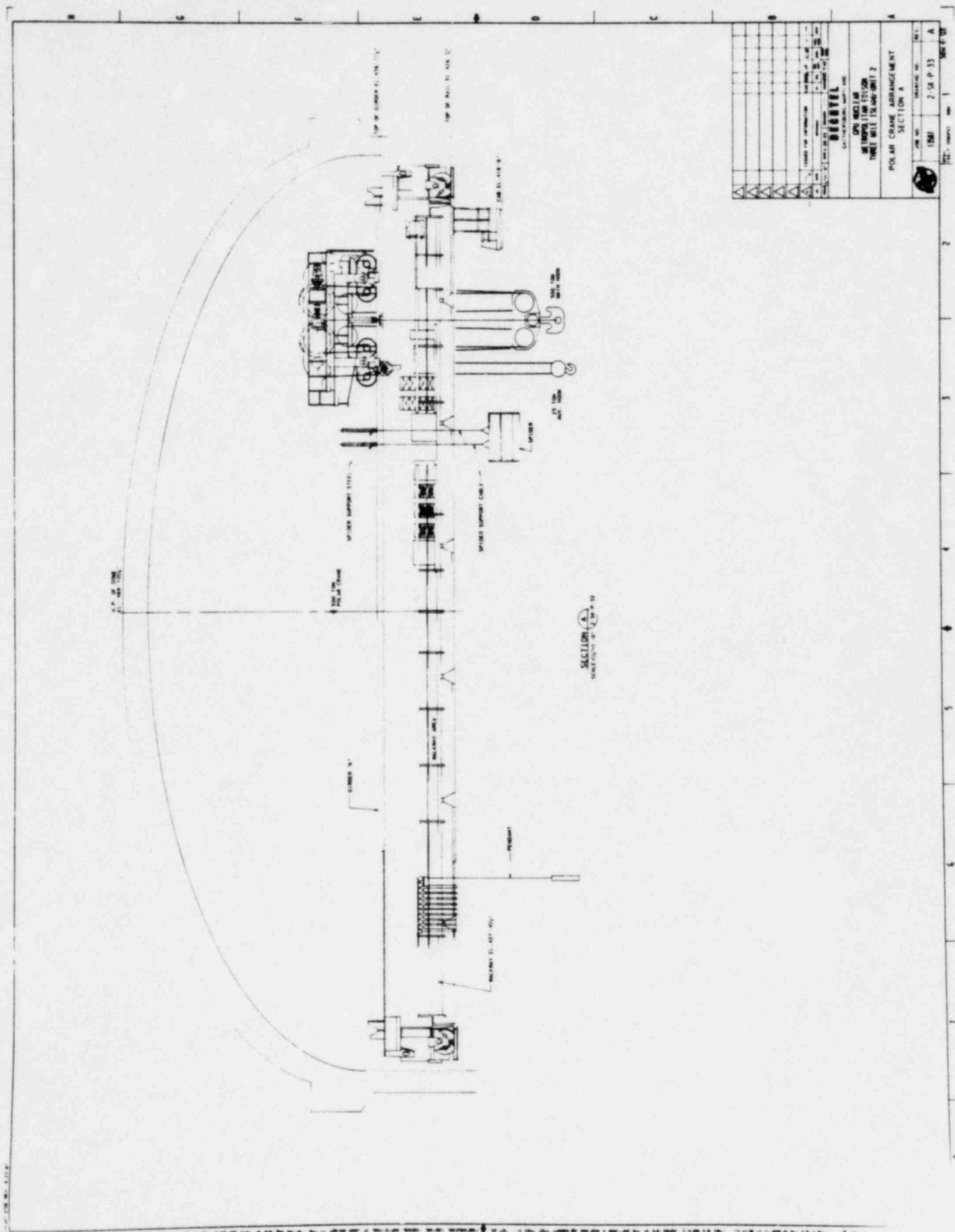
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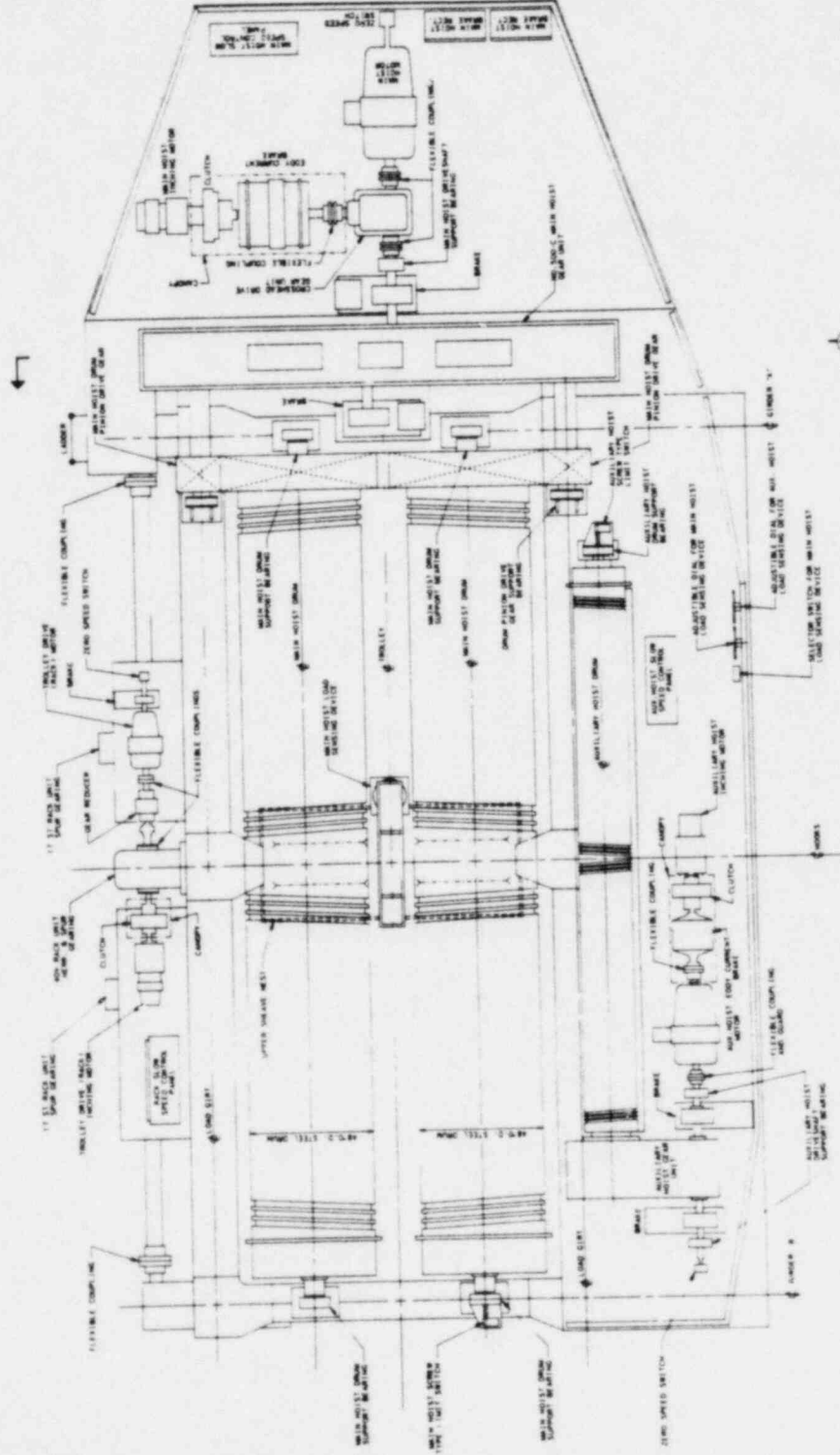


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 POLAR CRANE ARRANGEMENT
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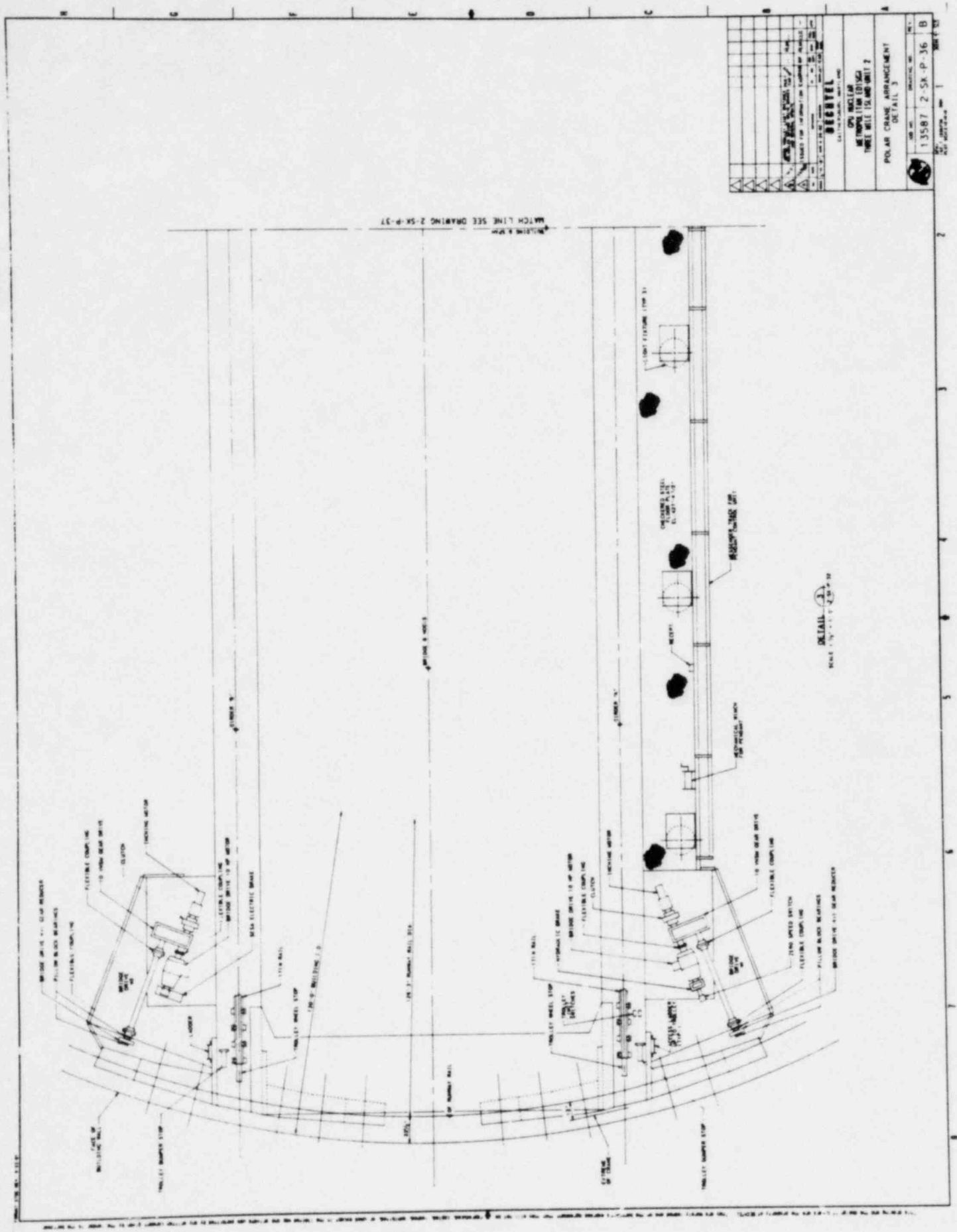
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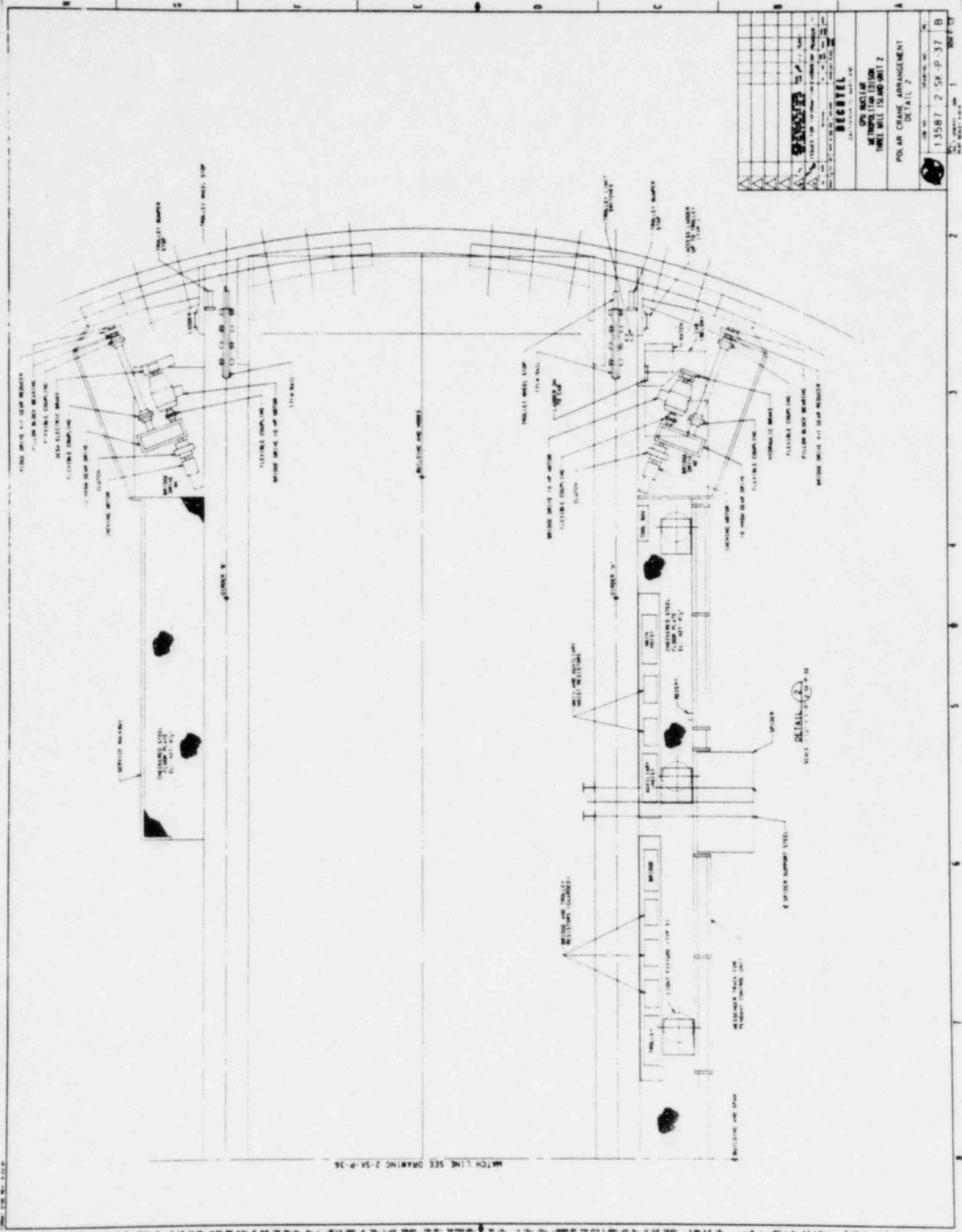
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SCALE 1" = 4" P. 12

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62	62	10/1/61	J. S. [unreadable]	[unreadable]
63	63	10/1/61	J. S. [unreadable]	[unreadable]
64	64	10/1/61	J. S. [unreadable]	[unreadable]
65	65	10/1/61	J. S. [unreadable]	[unreadable]
66	66	10/1/61	J. S. [unreadable]	[unreadable]
67	67	10/1/61	J. S. [unreadable]	[unreadable]
68	68	10/1/61	J. S. [unreadable]	[unreadable]
69	69	10/1/61	J. S. [unreadable]	[unreadable]
70	70	10/1/61	J. S. [unreadable]	[unreadable]
71	71	10/1/61	J. S. [unreadable]	[unreadable]
72	72	10/1/61	J. S. [unreadable]	[unreadable]
73	73	10/1/61	J. S. [unreadable]	[unreadable]
74	74	10/1/61	J. S. [unreadable]	[unreadable]
75	75	10/1/61	J. S. [unreadable]	[unreadable]
76	76	10/1/61	J. S. [unreadable]	[unreadable]
77	77	10/1/61	J. S. [unreadable]	[unreadable]
78	78	10/1/61	J. S. [unreadable]	[unreadable]
79	79	10/1/61	J. S. [unreadable]	[unreadable]
80	80	10/1/61	J. S. [unreadable]	[unreadable]
81	81	10/1/61	J. S. [unreadable]	[unreadable]
82	82	10/1/61	J. S. [unreadable]	[unreadable]
83	83	10/1/61	J. S. [unreadable]	[unreadable]
84	84	10/1/61	J. S. [unreadable]	[unreadable]
85	85	10/1/61	J. S. [unreadable]	[unreadable]
86	86	10/1/61	J. S. [unreadable]	[unreadable]
87	87	10/1/61	J. S. [unreadable]	[unreadable]
88	88	10/1/61	J. S. [unreadable]	[unreadable]
89	89	10/1/61	J. S. [unreadable]	[unreadable]
90	90	10/1/61	J. S. [unreadable]	[unreadable]
91	91	10/1/61	J. S. [unreadable]	[unreadable]
92	92	10/1/61	J. S. [unreadable]	[unreadable]
93	93	10/1/61	J. S. [unreadable]	[unreadable]
94	94	10/1/61	J. S. [unreadable]	[unreadable]
95	95	10/1/61	J. S. [unreadable]	[unreadable]
96	96	10/1/61	J. S. [unreadable]	[unreadable]
97	97	10/1/61	J. S. [unreadable]	[unreadable]
98	98	10/1/61	J. S. [unreadable]	[unreadable]
99	99	10/1/61	J. S. [unreadable]	[unreadable]
100	100	10/1/61	J. S. [unreadable]	[unreadable]

UNIT NO. 100
 13587
 2-58-P-34 A



GENERAL NOTES	
1.	CRANE ARRANGEMENT
2.	MECHANICAL BRACKET
3.	THREE WIRE ISLAND UNIT 2
4.	DETAIL 3
SCALE 1/4" = 1'-0"	
NO.	REV.
1	1
13587	2-SK-P-36
POLAR CRANE ARRANGEMENT	



BECKETT CONSULTING ENGINEERS 100 N. W. 10th St. MIAMI, FL 33136	
PROJECT NO. 13587 SHEET NO. 2-SK-P-37 OF 37	
TITLE POLAR CRANE ARRANGEMENT DETAIL 2	
DATE	NOV 1982
BY	...
CHECKED BY	...
APPROVED BY	...

CLARIFICATIONS AND EXCEPTIONS TO THE
"CRANE MAINTENANCE INSPECTION SPECIFICATION" CHECKLIST

ITEM NO.	ITEMS TO BE INSPECTED	CRANE MAINTENANCE INSPECTION SPECIFICATION	CLARIFICATIONS AND EXCEPTIONS
1	BRIDGE AND TRUCKS	Inspect for bent, or damaged members, evidence of loose bolts, rivets, guards and broken welds.	Only accessible portions of bridge and trucks will be inspected for specification defects. Not a riveted crane.
2	TROLLEY AND RAILS	Inspect for bent, or damaged members, evidence of loose bolts, rivets, guards, trolley rail clamps, end stops and broken welds.	Only accessible portions of trolley and rails will be inspected for specification defects.
3	RUNWAY RAILS AND CLAMPS	Inspect for loose, broken or missing rail clamps, bolts, wedges, connectors, runway rail end stops and rail switches.	Only accessible portions of runway rails and clamps will be inspected for specification defects. Crane has no runway rail stops.
4	HANDRAILS, WALKWAYS AND LADDERS	Inspect for loose, missing, bent, deteriorated or misaligned members, loose bolts, rivets, broken welds and hangers.	Inspection is not necessary as these items are not required for safe load handling.
6	GUARDS	Inspect for loose, missing, broken or bent members.	Inspection of guards for rotating parts is not necessary as these items are not required for safe load handling.
7	CRANE ALIGNMENT	Inspect for unusual wear on rails. Check by running crane bridge or trolley assembly against end rail stop to check alignment.	Alignment of trolley rails will be checked by inspecting accessible lengths of rail for unusual deformations and by running the trolley assembly to near the end stops as limited by the trolley forward and reverse limit switches. Alignment of the runway rail will be checked by inspecting accessible lengths of rail for unusual deformations and by running the bridge assembly along the length of rail of intended use. The runway rail does not have end stops.
8	JIB BOOM	Inspect for bent members, misalignment, worn pins, column fasteners, trolley stops and boom markings for rated capacity.	Not applicable
15	MAIN HOIST MAGNETIC	Inspect for wear in linkage, pins, and cams, weakness of springs, wear and condition of linings, smoothness of drum, and clearance between drum or disks. Inspect for improper solenoid air gap, evidence of overheating, damaged brass air gap material, and loose core lamination; delay or restriction in opening of brakes. On hydraulic brakes inspect fluid level.	Inspection of the redundant DC shunt wound brakes is not required since both brakes will be replaced.
16	MAIN HOIST LOAD BRAKE	Inspect for lubrication, leaks, and smooth operation. Inspect condition of screw threads, cams, and friction plates; worn, peened, or chipped ratchets and pawls, and proper clearance between friction plates.	Inspection of the eddy current brake includes visual inspection, manual rotation and electrical testing.

CLARIFICATIONS AND EXCEPTIONS TO THE
"CRANE MAINTENANCE INSPECTION SPECIFICATION" CHECKLIST

ITEM NO.	ITEMS TO BE INSPECTED	CRANE MAINTENANCE INSPECTION SPECIFICATION	CLARIFICATIONS AND EXCEPTIONS
17	AUXILIARY HOIST MAGNETIC BRAKE	Inspect for wear in linkage, pins, and cams, weakness of springs, wear and condition of linings, smoothness of drum and clearance between drum or disks. Inspect for improper solenoid air gap, evidence of overheating, damaged brass air gap material, and loose core lamination; delay or restriction in opening of brakes. On hydraulic brakes inspect fluid level.	Inspection of the redundant, solenoid brakes is not required since both brakes will be replaced only if the auxiliary hoist is to be used.
18	AUXILIARY HOIST LOAD BRAKE	Inspect for wear in linkage, pins, and cams, weakness of springs, wear and condition of linings, smoothness of drum, and clearance between drum or disks. Inspect for improper solenoid air gap, evidence of overheating, damaged brass air gap material, and loose core lamination; delay or restriction in opening of brakes. On hydraulic brakes inspect fluid level.	Inspection of the eddy current brake includes visual inspection, manual rotation and electrical testing. Inspection required only if the auxiliary hoist is to be used.
22	CAPACITY SIGNS	Inspect for mounting bolts, brackets, damage. Check markings on load signs for proper rating.	Inspection is not necessary as these items are not required for safe handling of the load.
24	MAIN CONDUCTORS, COLLECTORS	Inspect insulators and clamps for loose connectors, bent, pitted or damaged wires or collectors, loose or damaged staff or staff insulation, shoes, and loose, damaged or misaligned wheels.	Inspection is not required since a temporary system will be installed.
25	TROLLEY CONDUCTORS, COLLECTORS	Inspect insulators and clamps, loose connectors, bent, pitted or damaged staff or staff insulation, shoes, and loose, damaged or misaligned wheels.	Inspection is not required since a temporary system will be installed.
26	WIRING AND FUSES	Inspect for damaged insulation, evidence of overheating, and loose connections.	Only exposed wiring will be inspected for specification defects.
27	CONTROL PANEL RELAYS AND COILS	Inspect all contacts for proper alignment, signs of excess heating, or unusual arcing. Inspect all coils, contact leads, shunts and wires, fuses or overload devices for loose connections and signs of overheating. Inspect panel boards and arc shields for cracks, loose bolts, dirt, and moisture. Check panel markings for legibility. Inspect speed control resistors for damaged insulation, cracked or broken grids, loose connections and bolts, and brackets. Test overload relays for proper operation and settings. (See specification.)	Items will be inspected for specification defects except that panel markings will not be checked for legibility.
28	BRIDGE CONTROLLER (ELECTRIC)	Inspect for loose tension springs, broken, cracked or loose handles, rough or burned contact segments, broken segment dividers and insulators, and proper contact pressure, unusual arcing, worn or loose cams, rollers or pins, and loose connections.	Pendant (pushbutton) control unit will be replaced. Crane is equipped with a magnetic controller.

CLARIFICATIONS AND EXCEPTIONS TO THE
"CRANE MAINTENANCE INSPECTION SPECIFICATION" CHECKLIST

ITEM NO.	ITEMS TO BE INSPECTED	CRANE MAINTENANCE INSPECTION SPECIFICATION	CLARIFICATIONS AND EXCEPTIONS
29	TROLLEY CONTROLLER	Inspect for loose tension springs, broken, cracked or loose handles, rough or burned contact segments, broken segment dividers and insulators, and proper contact pressure, unusual arcing, worn or loose cams, rollers or pins, and loose connections.	Pendant (pushbutton) control unit will be replaced. Crane is equipped with a magnetic controller.
30	MAIN HOIST CONTROLLER	Inspect for loose tension springs, broken, cracked or loose handles, rough or burned contact segments, broken segment dividers and insulators, and proper contact pressure, unusual arcing, worn or loose cams, rollers or pins, and loose connections.	Pendant (pushbutton) control unit will be replaced. Crane is equipped with a magnetic controller.
31	AUXILIARY HOIST CONTROLLERS	Inspect for loose tension springs, broken, cracked or loose handles, rough or burned contact segments, broken segment dividers and insulators, and proper contact pressure, unusual arcing, worn or loose cams, rollers or pins, and loose connections.	Pendant (pushbutton) control unit will be replaced. Crane is equipped with a magnetic controller. Inspection is required only if auxiliary hoist is to be used.
35	AUXILIARY HOIST MOTOR	Inspect for damage, bearing noise, vibration, and lubrication, sparking, and clean lines of commutator and brush wear, loose hold down bolts and motor brackets. Inspect commutator or slip rings for evidence of overheating and brush sparking. Inspect motor leads and insulators for damaged or deteriorated insulation and loose connections.	Inspection required only if the auxiliary hoist is to be used.
37	LIGHTING SYSTEM	Inspect lighting fixture for adequate support, proper location, damage, evidence of overheating, and damaged or broken socket and lenses. Inspect switches for proper operation, broken or missing parts, and covers. Inspect conductors for loose or damaged wires, supports, and conduit junction boxes and raceways.	Inspection required only if these lights are to be used. Adequate lighting can be provided by other means.
38	HEATERS AND SWITCHES (PERSONNEL HEATERS)	Inspect for damaged wiring, proper electrical connections, guard/covers and switch operation.	Not applicable

CLARIFICATIONS AND EXCEPTIONS TO THE
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ITEM NO.	ITEMS TO BE INSPECTED	CRANE MAINTENANCE INSPECTION SPECIFICATION	CLARIFICATIONS AND EXCEPTIONS
39	WARNING DEVICES	Inspect for proper operation of sirens, horns, bells, and lights. Check switches and inspect wiring and connections.	Inspection of the horn, light and bell is not necessary as these items are not required for safe handling of the load. The horn and light were designed to be activated by limit switches when the trolley travels to within 9 inches of trolley stops. Forward and reverse limit switches are provided closer to the trolley stops to shut off power to the trolley drive motor. Forward and reverse limit switches will be inspected. The bell was designed to be activated manually when moving a load. Loads can be safely handled without a bell. A siren was not provided on this crane.
40	CONTROL PANELS AND ASSOCIATED CIRCUITS	Measure and record insulation resistance and ambient temperature of power and control circuits (Minimum Allowed 1 Megohm).	Inspection specification testing will be performed on all power circuits. Majority of control circuits will also be tested. Control circuits not tested will be selected based on unsuccessful testing of associated circuits and based on difficulty in accessing circuits.