NUS
CORPORATION

A Halliburton Company

Project No. 5484

NUS Report 3874

THE CONTROL OF HEAVY LOADS AT CRYSTAL RIVER-UNIT NO. 3 NUREG-0612 SIX MONTH ?T

PREPARED FOR

FLORIDA POWER CORPORATION

August 24, 1981

R. H. Hollenbacher

Prepared By

R. H. Hollenbacher

Project Engineer

A A Katterhenry

Approved By

A. Katterhenry

Project Manager

R. W. Hess

Reviewed By

R. W. Hess

Manager, Plant Engineering

TABLE OF CONTENTS

Section 1 - Introduction

Section 2 - Identification of Overhead Handling Systems

Section 3 - Justification of Excluded Overhead Handling Systems

Section 4 - Evaluation of Load Handling Systems

Section 5 - Lifting Device Compliance with ANSI N14.6-1978 and ANSI B30.9-1971

Section 6 - Verification of Testing and Inspection

Section 7 - Verification of Crane Design

Section 8 - Operator Training, Qualification and Conduct

LIST OF TABLES

2-1 Crystal River Unit 3 Containment Building Load Handling Systems

2-2 Crystal River Unit 3 Auxiliary Building Load Handling Systems

2-3 Crystal River Unit 3 Turbine Building Load Handling System

2-4 Crystal River Unit 3 Miscellaneous Structures Load Handling Systems

4-1 RCCR-1/Polar Crane Loads

4-2 FHCR-7/Missile Shield Gantry Crane and SFHT-7/Spent Fuel Pit Gate Hoist Loads

4-3 FHCR-5/Auxiliary Building Crane Loads

4-4 RCCR/2 Reactor Vessel Tool Handling Jib Crane Loads

LIST OF FIGURES

4-1 Through 4-30 Load Path Diagrams

Section 1

Introduction

To implement the recommendations of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," the USNRC sent a letter dated December 22, 1980 to all licensees of operating nuclear power plants. This letter requested that the Florida Power Corporation implement certain interim actions as soon as possible and submit a two-part report documenting the results of a review of the Crystal River Unit 3 Nuclear Plant relative to the guidelines of NUREG-0612. This report, the first of two parts, provides the general information requested in Section 2.1 of the December 22, 1980 letter and describes the Florida Power Corporation's ongoing efforts on the control of heavy loads. The second part of this report, providing information requested in Sections 2.2 through 2.4 of the December 22, 1980, letter, will be the 9-month submittal.

The subsequent sections of this report are structured to directly respond to the requests for information in Section 2.1 of the December 22, 1980 letter. The paragraphs under the heading "Requested Information" will reiterate NRC questions and the following "Response" will discuss the results of the Florida Power Corporation's review effort.

Section 2

Identification of Overhead Handling Systems

REQUESTED INFORMATION:

Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis).

RESPONSE:

All load handling systems in the Crystal River Unit 3 plant were reviewed to identify the load handling systems in accordance with the December 22, 1980, letter. Tables 2-1 through 2-4 provide a detailed listing of the load handling systems in the containment, auxiliary, turbine and other miscellaneous structures respectively.

The criteria used to identify the overhead handling systems of concern included:

1. The handling system must meet the definition of an Overhead Handling System as defined in NUREG-0612.

2. The overhead handling system rated lifting capacity is greater than 1000 pounds. This criteria is more conservative than the "heavy load" criteria defined in NUREG-0612, i.e. a spent fuel assembly and its handling tool, which is 2750 pounds for Crystal River Unit 3. The additional conservatism was included to take into account the drops of smaller loads which could potentially have high impact energies.

3. The travel path of the overhead handling system can pass over safe shutdown equipment, required for the reactor modes in which the load handling system can conceivably be operating, over spent fuel or equipment required for safe shutdown or decay heat removal.

The overhead handling systems identified with this criteria in each area are:

Containment Building

Reactor Building Polar Crane	RCCR-1
Reactor Vessel Tool Handling Jib Crane	RCCR-2
Incore Instrument Container Hoist	ICHT-8
Reactor Building Mechanized Scaffold	Mechanized scaffold for tendon surveillance

Auxiliary Building

Auxiliary Building Crane	FHCR-5
Spent Fuel Pool Missile Shield Crane	FHCR-7
Spent Fuel Pool Gate Chain Hoist	SFHT-7

Turbine Building

None

Miscellaneous Structures

Intake Gantry Crane	CWCR-1

The Reactor Building Polar Crane (RCCR-1), manufactured by the Whiting Corporation, is rated at 180/30 tons for the main and auxiliary hoists, respectively. The hook travel limits on the crane enable the main hook to be brought to within 9 feet 2 inches of the bridge rail (closest approach) and the auxiliary hook to be brought to within 7 feet 5 inches of the bridge rail (closest approach). The centerline to centerline spacing of the main and auxiliary hooks is 4 feet 4 inches.

The reactor vessel tool handling jib crane (RCCR-2) is a Shepard Niles monorail (boom) underhung crane supported from a hinged pivot point located 19 feet south and 36 feet east of the containment building center lines. The total length of the monorail is 38 feet with 34 feet available for trolley travel. The electric hoist has a 2-1/2 ton load capacity.

The incore instrument container hoist (ICHT-8) is a hand operated, 1-ton capacity chain hoist on a push-type trolley suspended from a monorail on the 176 foot elevation over the incore instrument area. The hoist, which is attached to the trolley by a hook, is equipped with a Weston type mechanical load brake. The maximum load lift height is 45 feet.

The reactor building mechanized scaffold, consisting of a carriage group, platform group and parking brace group, is a Sky Climber, Inc., mechanized scaffolding system which traverses the exterior perimeter of the reactor building. In addition to the work platform, a bridge crane is suspended from the platform trolley. This bridge crane is used to handle a work cage used to raise and lower two workers from ground level to the work platform and to suspend a 5-ton capacity hand geared trolley type electric chain hoist.

The auxiliary building crane (FHCR-5), manufactured by the Whiting Corporation, is a traveling bridge crane rated at 120/15 tons capacity on the main and auxiliary hooks respectively. This crane does not travel over spent fuel pool "A" and is equipped with a system of track limit switches which prevent the movement of the main hoist block over spent fuel pool "B." A 2 ton hoist has been added to the bridge to handle new fuel assemblies. This hoist is only used over the new fuel storage area.

The spent fuel pool missile shield crane (FHCR-7) is a single-leg gantry, deck-leg crane with a 10-ton capacity hoist suspended monorail fashion from a single 24-inch bridge girder. The crane travels the length of spent fuel pool "A."

The spent fuel pool gate hoist is a 2-ton capacity hand operated chain hoist suspended from a monorail over spent fuel pool "A." The hoist is equipped with a Weston type mechanical load brake and has a maximum load lift height of 36 feet. It is anticipated that this hoist will be replaced with an electric motor operated hoist prior to the third refueling outage.

The intake gantry crane is a 50-ton capacity through-leg gantry crane manufactured by Whiting Corporation. The gantry structure is 52 feet high with an 89-foot span and a 16-1/2 foot cantilever section. The maximum crane capacity while operating on the cantilever section is 12 tons. The crane is located at the circulating and service water intake structure.

TABLE 2-1

CRYSTAL RIVER UNIT 3 CONTAINMENT BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
RCCR-1	Polar crane	Elevation 245'	No	180 ton main hoist 30 ton auxiliary hoist
RCCR-2	Reactor vessel tool handling jib crane	Pivot is 19' South and 36' East of building center lines	No	2-1/2 ton capacity hoist
FHCR-1	Main fuel handling bridge	Elevation - 160'	Yes	Not an overhead handling system
FHCR-2	Aux fuel handling bridge	Elevation - 160'	Yes	Not an overhead handling system
FHCR-4A	Interconnecting fuel transfer system	Elevation - 125' 7"	Yes	Not an overhead handling system
DRCR-1	CRDM Jib Crane	Elevation - 238'	Yes	1 ton capacity hoist/does not pass over safe shutdown equipment

TABLE 2-1 (Cont'd)

CRYSTAL RIVER UNIT 3 CONTAINMENT BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
FHX-5A and 5B	Handling and transfer sling	N/A	Yes	Not an overhead handling system
ICHT-8	Incore instrument container removal	Elevation - 160'	No	1 ton chain hoist with trolley for monorail service
NICR-1	Incore instrument jib crane	Elevation - 177'	Yes	1/2 ton capacity system
Mechanized scaffold	Reactor building tendon surveil-lance	Reactor building roof edge	No	Mechanism is capable of traversing entire circum-ference of the reactor building

TABLE 2-2

CRYSTAL RIVER UNIT 3 AUXILIARY BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
FHCR-3	Fuel storage handling bridge	Elevation 162'	Yes	Not an overhead handling system
FHCR-4B	Interconnecting fuel transfer system	Elevation - 125' 7"	Yes	Not an overhead handling system
FHCR-5	Refueling crane	Elevation 193' 7"	No	120 ton main hoist 15 ton auxiliary hoist 2 ton auxiliary hoist
FHCR-6	New fuel elevator assembly	Elevation - 162'	Yes	Not an overhead handling system
FHCR-7	Spent fuel pool Missile shield crane	Elevation 143	No	10 ton
SFHT-7	Spent fuel pool gate	Elevation - 160'	No	2 ton chain hoist with trolley for monorail service

TABLE 2-2 (Cont'd)

CRYSTAL RIVER UNIT 3 AUXILIARY BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
SFHT-17 and SFHT-18	Spent fuel pool filter cartridges	Elevation - 158'	Yes	1/2 ton capacity system
WDCR-1	Waste drumming area crane	Elevation - 134'	Yes	Sufficient physical separation exists
WDCR-2	Waste drumming area monorail hoist	Elevation - 134'	Yes	3 ton capacity hoist with trolley; sufficient physical separation exists
WDHT-15	Evaporator condensate demineralizer filter cartridge	Elevation - 119'	Yes	1/2 ton capacity system
MACH-1	Hot machine shop crane	Elevation - 124' (hot side)	Yes	Sufficient physical separation exists

TABLE 2-2 (Cont'd)

CRYSTAL RIVER UNIT 3 AUXILIARY BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
MACR-2	Clean machine shop crane	Elevation - 124' (clean side)	Yes	Sufficient physical separation exists
MUHT-11	Make-up and purification prefilter	Elevation - 130'	Yes	Sufficient physical separation exists
MUHT-14 and 15	Make-up and purification filter cartridges	Elevation - 129'	Yes	1/2 ton capacity system
Monorail	Equipment hatch H1	Elevation - 105'	Yes	12 ton capacity monorail; sufficient physical separation exists
Monorail	Equipment hatch H2	Elevation - 105'	Yes	12 ton capacity monorail; sufficient physical separation exists
Monorail	Equipment hatch H3	Elevation - 138' 9"	Yes	10 ton capacity monorail; sufficient physical separation exists

TABLE 2-2 (Cont'd)

CRYSTAL RIVER UNIT 3 AUXILIARY BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
Monorail	Prefilters	Elevation - 138' 3"	Yes	Associated with MUHT-11
Monorail	Resin trap and purification filters	Elevation - 136'	Yes	Associated with MUHT-14 and MUHT-15; 1/2 ton capacity system
Monorail	Spent fuel coolant filters	Elevation - 158' 10"	Yes	Associated with SFHT-17 and 18; 1/2 ton capacity system
Monorail	Waste drumming area	Elevations - 234' and 136' 6"	Yes	Associated with WDCR-2; 3 ton capacity system; sufficient physical separation exists
Monorail	Turbine and motor driven emergency feed pumps	Elevation - 108'	Yes	Associated with EFHT-3 and 4; sufficient physical separation exists assuming hoist is used only when its EFP is out of commission (OOC)

TABLE 2-2 (Cont'd)

CRYSTAL RIVER UNIT 3 AUXILIARY BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
EFHT-3	Motor driven emergency feed pump	Elevation - 95'	Yes	3 ton capacity chainhoist with trolley for manual service; sufficient physical separation exists
EFHT-4	Turbine driven emergency feed pump	Elevation - 95'	Yes	2 ton capacity chainhoist with trolley for monorail service; sufficient physical separation exists
Chainhoists	Decay heat equipment removal	Elevations - 95' and 119'	Yes	10 ton capacity chainhoist with trolley for monorail service; sufficient physical separation exists

TABLE 2-3

CRYSTAL RIVER UNIT 3 TURBINE BUILDING LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
TBCR-1	Turbine building crane	Elevation - 145'	Yes	160 ton main hoist 30 ton auxiliary hoist See Section 3
TBHT-9	Turbine room vent fans	Elevation - 119'	Yes	1 ton chainhoist with trolley for monorail service; sufficient physical separation exists
TBHT-10	Turbine room vent fans	Elevation - 119'	Yes	1 ton capacity with trolley for monorail service; sufficient physical separation exists
Monorail	Water box removal	Elevation - 116' 7"	Yes	Total of six monorails; sufficient physical separation exists
Monorail	Feedwater booster pumps	Elevation - 95'	Yes	Total of two monorails; sufficient physical separation exists
Monorail	Main feedwater pumps	Elevation 166' 10"	Yes	6 ton capacity hoist; sufficient physical separation exists
Jib crane	General purpose lifting	Elevation - 145'	Yes	2 ton capacity hoist; sufficient physical separation exists

TABLE 2-4

CRYSTAL RIVER UNIT 3 MISCELLANEOUS STRUCTURES LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
Monorail	Control complex servicing	Control complex 304-G; elevation - 183' 10"	Yes	Associated with ICHT-2; sufficient physical separation exists
Monorail	Penthouse roof slab	Control complex; elevation - 195'	Yes	Not an overhead handling system
Trolley Rails	Penetration area	Intermediate building 308-H and 309-K; elevations - 128' 4" and 129'	Yes	Total of four 2 ton capacity rails; sufficient physical separation exists
Chainhoists	Penetration area	Intermediate building 308-H and 309-K; elevation 119'	Yes	Total of four 2 ton capacity chainhoists; sufficient physical separation exists
EGHT-5 and EGHT-6	Emergency diesel generator service	Emergency diesel generator building 300-P; elevation - 119'	Yes	2 ton capacity chainhoist with trolley for monorail service; sufficient physical separation exists assuming diesel OOC when hoist used

TABLE 2-4 (Cont'd)

CRYSTAL RIVER UNIT 3 MISCELLANEOUS STRUCTURES LOAD HANDLING SYSTEMS

Description or Tag Number	Function	Location	Exclusion	Remarks
ICHT-2	Control complex service	Control complex 304-G; elevation - 164'	Yes	4 ton capacity chainhoist with trolley for monorail service; sufficient physical separation exists
Monorail	Emergency diesel generator service	Emergency diesel generator building 300-P; elevation - 141'	Yes	Associated with EGHT-5 and 6; sufficient physical separation exists assuming the diesel generator is OOC when the hoist is used
CWCR-1	Intake gantry crane	Intake structure	No	50 ton capacity system

Section 3

Justification of Excluded Overhead Handling Systems

REQUESTED INFORMATION:

Justify the exclusion of any overhead handling system from the above category by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or core decay heat removal.

RESPONSE:

The cranes excluded from the list in Section 2 have all been excluded from consideration because they did not meet the criteria listed in Section 2. Therefore, the reasons for justification of excluding these cranes are simply stated as follows:

1. Does not meet the NUREG-0612 definition of an overhead handling system.

2. The rated capacity is less than or equal to 1000 pounds.

3. The handling system path of travel does not pass over or near safe shutdown or decay heat removal equipment or spent fuel.

The justification for the exclusion of most handling systems is succinctly described in the remarks column of Tables 2-1 through 2-4. Additional explanations, however, are necessary for the main fuel handling bridge, the auxiliary fuel handling bridge and the turbine building crane. Both the main and auxiliary fuel handling bridges handle no loads greater than the weight of a spent fuel assembly and its associated handling tool. Since these load drops have already been addressed in the Crystal River FSAR, they need not be reconsidered under NUREG-0612.

The turbine building crane was excluded from the list because it does not travel over safe shutdown or decay heat removal equipment. It is noted that the bus bar from the startup transformer to the 4160 KV essential switchgear located in the control building passes through the turbine building near the main equipment hatchway. While this is the preferred power source for safe shutdown equipment, the transformer, and the bus bar are not classified as safety-related. Alternate sources of power exist through separate circuits from Unit 1 and 2 and the emergency diesel generators. There is also a suction line running from the main condenser hotwell to the auxiliary feed pumps. However, the condensate storage tank is the primary source of water for the auxiliary feed system and the condenser hotwell is not considered safety-related.

As part of the Florida Power Corporation's comprehensive program designed to implement the interim actions addressed in Enclosure 1 to the December 22, 1980, letter, testing, maintenance and operating procedures and an operator training program have been developed for the turbine building crane. While not defining any safe load paths, the operating instructions for the turbine building crane do designate exclusion areas (see Figure 4-8) where load handling operations should be kept to a minimum and where additional precautions should be taken.

Section 4

Evaluation of Load Handling Systems

REQUESTED INFORMATION:

With respect to the design and operation of heavy-load-handling systems in the containment and the spent-fuel-pool area and those load-handling systems identified in 2.1-1, above, provide your evaluation concerning compliance with the guidelines of NUREG 0612, Section 5.1.1. The following specific information should be included in your reply:

a. Drawings or sketches sufficient to clearly identify the location of safe load paths, spent fuel, and safety-related equipment.

b. A discussion of measures taken to ensure that load-handling operations remain within safe load paths, including procedures, if any, for deviation from these paths.

c. A tabulation of heavy loads to be handled by each crane which includes the load identification, load weight, its designated lifting device, and verification that the handling of such load is governed by a written procedure containing, as a minimum, the information identified in NUREG 0612, Section 5.1.1(2).

RESPONSE:

To implement the interim actions described in Enclosure 2 to the December 22, 1980 "Eisenhut" letter, Florida Power Corporation has developed a comprehensive load handling program for Crystal River Unit 3. To specifically address the issue of controlling heavy loads, the program has consisted of three distinct phases:

1. Identifying heavy loads which could be handled over spent fuel or equipment required for safe shutdown or decay heat removal (Tables 4.1 through 4.4).

2. Defining load paths for these load handling operations to avoid or minimize the time of load travel over spent fuel or equipment required for safe shutdown or decay heat removal. (Figures 4-1 through 4-30).

3. Developing crane operating procedures and an extensive operator training program to ensure that load handling operations follow the defined load paths.

It is planned that this program will be fully implemented prior to the third refueling outage. Information obtained from the analyses made in conjunction with the 9-month report as well as operations and maintenance comments are intended to be factored into the operating procedures and training program as they become available.

The following paragraphs discuss the loads, load paths and load handling procedures for the cranes of concern identified in Section 2.

REACTOR BUILDING POLAR CRANE

The defined heavy loads for the polar crane are listed in Table 4-1. Each of these loads is controlled administratively by applicable refueling or maintenance procedures and by the polar crane operating procedure, "Operation of the Reactor Building Polar Crane", which identifies the load paths for each load. It is noted that due to the concern for load handling operations around the reactor vessel, the heavy load definition used in Table 4-1 was expanded to include loads whose cumulative weight when added to the weight of 800 pound crane auxiliary hook and bottom block assembly equaled approximately 1000 pounds. The following paragraphs discuss the information provided in Table 4-1 and the polar crane load path figures.

Three, 26 ton missile shields are normally placed over the reactor vessel and supported from the D ring walls at elevation 180 feet. In moving these missile shields to their laydown area along the west wall of containment, care is taken to keep the edge of the missile shield over the D ring wall so that any load drop would be onto the wall rather than the reactor vessel or refueling canal. As the missile shields leave the D ring wall heading west they are lowered to the 160 foot elevation floor. A 10 inch decay heat return line and the 14 inch core flood line are located at elevation 112 feet directly west of the D ring wall. Figures 4-9, 4-15 and 4-16 show this load path.

The seven pressurizer missile shields, maximum weight of 15 tons, are supported by the D ring wall at the 180 foot elevation above the pressurizer. These shields are moved off the D ring wall, lowered to the 160 foot elevation floor and then moved to lay down area along the west containment wall. Care is taken to avoid the possibility of allowing the pressurizer missle shields to rotate and fall on the pressurizer and reactor coolant system piping. Leaving the D ring, one of the two pressurizer missile shield load paths passes over core flood piping and the 12 inch decay heat return line at elevation 112. Figures 4-9, 4-15 and 4-16 show the pressurizer load paths.

Handling of the stud tensioners, stud handling tools, studs, alignment studs, stud support spacers, stud hole seal plugs, control rod drive cooling water header spool pieces and the triangular service structure platforms all takes place while the head is on the reactor vessel. Aside from passing over the reactor vessel, these loads are carried above the 160 foot elevation floor and all pass over the decay heat return line located west of the D ring walls at elevation 112 feet. Figures 4-10, 4-11, 4-16, 4-19, 4-20 and 4-21 show these load paths.

The refueling cavity seal plate can be installed when the head is either on or off the reactor vessel although it is normally installed with the head on the reactor vessel. Because the seal plate can not impact spent fuel, the only drop targets are the reactor vessel primary coolant piping and the decay heat return line west of the D ring walls at elevation 112. Figure 4-20 shows the load path.

The fuel transfer tube covers are unbolted from the transfer tube flanges at the east end of the refueling canal and moved to storage. The flanges can pass over a 10 inch core flood line located under the refueling canal. The load path is shown on Figures 4-11 and 4-19.

The head lifting pendants are normally pinned to the reactor vessel head and internals lifting device for transport from the laydown area to the reactor vessel head but can be handled separately and first pinned to the head. The reactor vessel head and internals handling fixture is pinned to the main crane hook and lifted over the auxiliary fuel handling bridge to the reactor vessel where it is pinned to the head lifting pendants. Possible load drop targets are the 10 inch decay heat return lines and core flood lines located west of the D ring wall at elevation 112 foot, the reactor vessel, and primary coolant piping located under the refueling canal. Figures 4-11 and 4-23 show the load path.

The reactor vessel head and lifting rig weighs approximately 160 tons. It is lifted off the reactor vessel flange to an elevation high enough to clear the guide studs. Then it is moved west and raised to approximately the 172 foot elevation to clear the auxiliary fuel handling bridge before being lowered to the 160 foot elevation floor and placed on the head stand. The reactor vessel, primary coolant piping under the refueling canal and the 10 inch decay heat return and core flood lines are all possible targets. Figures 4-11 and 4-17 show the load path.

The internals handling fixture is pinned to the reactor head and internals lifting fixture (tripod section) and moved as a unit from the internals handling fixture laydown area to the reactor vessel to remove the plenum. Possible load drop targets include the 10 inch decay heat return line, primary coolant piping located under the refueling canal and the reactor vessel. Figures 4-10 and 4-23 show the load paths.

The indexing fixture and associated equipment is pinned to the reactor vessel head and internals lifting device and moved from its laydown area to the reactor vessel flange (plenum removed). The combined assembly weighs approximately 12 tons. Along the load path, possible load drop targets include the decay heat return line, the primary coolant piping under the refueling canal and the reactor vessel and core. Figures 4-10 and 4-23 show the load path.

The plenum is lifted from the reactor vessel and moved to the internals storage stand at the west end of the refueling canal. Possible load drop targets are the reactor vessel, spent fuel, and primary coolant and core flood (decay heat removal) system piping located under the refueling canal. Figures 4-11 and 4-17 show the load path.

The internals stand is moved the length of the refueling canal passing over the reactor vessel with the head on. Possible load drop targets are primary coolant piping and the core flood (decay heat) piping located under the refueling canal and the reactor vessel. Figures 4-11 and 4-24 show the load path.

The plenum and core barrel can only be moved when the core is unloaded, Figure 4-17. Therefore, no possible load drop targets exist.

The specimen container is moved from the specimen storage stand located near the reactor vessel head storage area to the refueling canal near the reactor vessel flange. Possible load drop targets include the decay heat return line and primary coolant piping located under the refueling cavity. Figures 4-11 and 4-17 show the load path.

The 50 ton reactor coolant pump motors can be removed for maintenance while the core remains in the vessel. The motors must be lifted from elevation 140 feet over the top of the D ring wall at elevation 180 and then lowered to the 160 foot elevation floor and moved to the maintenance area. Possible load drop targets include the reactor coolant pumps, reactor coolant piping and, in the case of pump B1, the single, 12 inch decay heat suction line. The load paths are shown on Figures 4-10 and 4-18. The reactor coolant pumps are removed along the same load paths as the reactor coolant pump motors and pass over the same load drop targets.

The control rod drive modules and components can be removed from the reactor vessel head while the head is either on the vessel or at the head storage area. Load drop targets include the reactor vessel primary coolant piping under the refueling canal and decay heat piping west of the D ring wall at elevation 112 feet. Figures 4-11, 4-16 and 4-22 show the load paths.

Miscellaneous parts and/or components of the refueling machines and fuel transfer carriage and upender can be moved by the polar crane. A possible load drop target is the decay heat return and core flood lines at the 112 foot elevation. Figures 4-10 and 4-24 show the load paths.

Floor hatch covers are stored adjacent to the hatch and are not moved over safety related equipment.

The ISI tool, ARIES, is moved into the containment in crates and assembled. It is used for periodic inspections of the reactor vessel and, while it is mainly used when the core is removed, it can be used to inspect the upper reactor vessel nozzles with fuel in the core. The ISI tool is moved from the assembly area to the reactor vessel flange. Possible load drop targets include the decay heat return line at elevation 112 feet, primary coolant piping under the refueling canal the reactor vessel and spent fuel. Figures 4-10, 4-22 and 4-24 show the load path.

The east ladder cage must be removed from the east and of the refueling canal to permit storage of the plenum and core barrel. A possible load target is the decay heat removal/core flood piping located under the cavity. Figures 4-11 and 4-19 show the load path.

The crane main hook and bottom block assembly and auxiliary hook and bottom block assembly are both considered as heavy loads. With a hook centerline to hook centerline distance of 4 feet 4 inches, both hooks can be over the reactor vessel at one time. All safety equipment in containment required during crane operation and spent fuel can be considered as a load drop target.

Although not a routine practice, it is possible that the polar crane can require a load test. The safe load test area designated for this test is shown on Figure 4-14.

REACTOR VESSEL TOOL HANDLING JIB HOIST

The defined heavy loads for the reactor vessel tool handling jib hoist are listed on Table 4-4. Handling of all these loads is governed by the applicable refueling procedures and the hoist operating procedure, "Operation of Miscellaneous Cranes and Hoists". The loads listed in Table 4-4 are all moved to and from the top head panel storage area to the reactor vessel. These loads are considered significant because they can be dropped on spent fuel and, as the jib hoist beam is swung inside the D ring wall, a load drop can impact on the 12 inch decay heat suction line and reactor coolant piping. Figure 4-25 shows the load path and Figure 4-1 shows the hoist safe load test area.

INCORE INSTRUMENT CONTAINER HOIST

The incore instrument container hoist moves incore instrument containers from the refueling canal to the instrument pit. Handling of these loads is governed by the hoist operating procedure, "Operation of Miscellaneous Cranes and Hoists". The listed loads can only be moved along the stationary hoist track travel path shown in Figure 4-25. A possible load drop target is spent fuel stored in failed fuel containers in the refueling canal.

REACTOR BUILDING MECHANIZED SCAFFOLD

The reactor building mechanized scaffold is used during reactor modes 5 and 6 to retension the reactor containment tendons. For this operation the heaviest tool used is a 5 ton hydraulic jack. If this jack is dropped from the scaffold while over the Auxiliary Building, the jack would drop through the roof and could hit the spent fuel pool. To prevent this, load handling operations using the scaffold over the auxiliary building are limited to times when the missile shields are inplace over the spent fuel pool. Other areas which could be impacted by a load drop include electrical penetration rooms, the intermediate building, etc. Operation of this scaffold is governed by the procedure, "Operation of Miscellaneous Cranes and Hoists". The mechanized scaffold test area is shown on Figure 4-4.

AUXILIARY BUILDING CRANE

The heavy loads defined for the Auxiliary Building Crane are shown on Table 4-3. Each of these loads is controlled administratively by applicable refueling or maintenance procedures and by the crane operating procedure, "Operation of the Auxiliary Building Crane", which identifies the load paths for each load.

The loading bay hatch covers are removed from the hatch and stored in the missile shield storage area when the hatchway is in use. The load path for the hatch covers does not come in proximity to spent fuel or equipment required for safe shutdown or decay heat removal. Figures 4-12 and 4-26 show the load path.

Spent fuel casks are not presently handled at Crystal River Unit 3. The safe handling of spent fuel casks will be addressed in detail as a separate issue apart from NUREG 0612. However, load paths are shown on Figures 4-12, 4-26 and 4-29.

The new fuel shipping cask is moved from the hatchway to and from the spent fuel pool missile shield laydown area. It does not cross over spent fuel or equipment required for safe shutdown or decay heat removal. Figures 4-12 and 4-27 show the load path.

The 1532 pound new fuel assemblies are removed from the new fuel shipping cask and moved to either the decontamination pit for inspection and then to the new fuel storage pit or directly to the new fuel pit for storage. From the new fuel storage pit, the new fuel assemblies are moved to the new fuel elevator located in spent fuel pool "B". Possible load drop targets are essential motor control centers and cable trays located on the 143 foot elevation and spent fuel. Figures 4-12 and 4-30 show the load paths.

The missile shield handling fixture is a lifting beam used to move the new fuel pit missile shields and the spent fuel pool missile shields. The new fuel pit missile shields are only lifted high enough to be stacked on their adjacent missile shield thereby allowing access to one half of the new fuel storage pit. There are no potential load drop targets for this lift. The spent fuel missile shields are moved from the spent fuel pool to and from the missile shield laydown area. Since the spent fuel pool missile shields float (FSAR Section 9.6.1.5), spent fuel is not considered as a possible load drop target. Possible load drop targets are considered to be the makeup tank, the boric acid storage tank and essential motor control centers and cable trays located on the 143 foot elevation. Figures 4-12, 4-28 and 4-29 show the load paths.

New control components and their containers are lifted up through the crane hatchway and moved to the missile shield laydown area. There the control components are removed and moved to the decontamination pit for inspection and then to the new fuel pit for storage. From the new fuel storage pit, control components are moved to the new fuel elevator. Possible targets for load drops include spent fuel and essential motor control centers and cable trays located on the 143 foot elevation. Load paths are shown in Figures 4-13 and 4-30.

The spent fuel cask loading pit gate is lifted from the gate slots in the pit opening and stored in spent fuel pool "B" north of the cask loading pit opening. A load drop of the spent fuel cask loading pit gate could damage the spent fuel pool liner or spent fuel if it is stored nearby. Figures 4-12 and 4-29 show the load path.

The new fuel elevator may require maintenance. This would necessitate first decontaminating the elevator in the decontamination pit and then moving it to and lowering it down through the hatchway so that it can be taken to the maintenance shop. Possible load drop targets are the essential motor control centers and cable trays on the 143 foot elevation. Figures 4-12 and 4-29 show the load path.

Miscellaneous load handling operations have been considered for various unprogrammed load handling operations involving load storage in the spent fuel pool missile shield storage area and maintenance operations which involve load handling over the "B" spent fuel pool. The various loads moved from the hatchway to the missile shield storage area are not moved over spent fuel or equipment required for safe shutdown or decay heat removal. For the various loads moved from the "A" Spent Fuel Pool area and transferred to the auxiliary building crane and moved over the "B" spent fuel pool, possible load drop targets are spent fuel and essential motor control centers and cable trays on the 143 foot elevation. Figures 4-12, 4-26, 4-27 and 4-28 show the load paths.

The main and auxiliary hoist hook and bottom block assemblies are also considered as heavy loads. Assuming unrestricted travel of the crane, possible loads drop targets include spent fuel, essential motor control centers and cable trays on the 143 foot elevation and the boric acid storage tanks.

In the event that the auxiliary building crane is extensively modified and will require a load test, Figure 4-2 shows the auxiliary building crane load test path that would be used.

SPENT FUEL POOL MISSILE SHIELD GANTRY CRANE AND SPENT FUEL POOL GATE HOIST

Table 4-2 lists the heavy loads defined for the spent fuel pool missile shield gantry crane and the spent fuel pool gate hoist. Handling of these loads is governed by applicable surveillance and refueling procedures and by the crane and hoist operating procedure, "Operation of Miscellaneous Cranes and Hoists", which defines load handling paths. For the spent fuel pool missile shield gantry crane, the loads of concern are various maintenance lifts in the spent fuel pool "A" area. Because the missile shields float, they are not considered as having a damage potential. The potential load drop target is spent fuel. The hoist which handles the spent fuel pool gate is used to raise the gate out of the slotted opening between the "A" and "B" spent fuel pools and place the gate against the east wall of the "A" spent fuel pool. Possible load drop targets include the spent fuel pool liner and spent fuel. Figure 4-28 shows the load paths.

A load test path for the spent fuel pool missile shield gantry crane is shown in Figure 4-3.

INTAKE GANTRY CRANE

The gantry crane at the intake structure is used primarily for pulling the circulating water pumps and motors for maintenance and for placing the stop logs in the intake structure. The essential equipment at the intake structure consists of the buried conduits which carry water to the nuclear service water (NSSW) pumps and the traveling screens and associated equipment for these conduits. The conduits traverse the crane runways east of the circulating water pumps. The pump maintenance area is west of the circulating water pumps while the stop log storage area is east of the essential service water conduits. Figures 4-6 and 4-7 show safe load exclusion areas when either of the NSSW conduits is operable. Figure 4-5 shows the area to be avoided if a load test is conducted on the gantry crane.

TABLE 4-1

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Reactor vessel missile shields (3)	26 tons	Slings	FP-409	3-6
Pressurizer missile shields (7)	15 tons	Slings	None identified	3-6
Stud tensioners (2)	1 ton	Sling	Ref. FP-409 (8.14) FP-405 (8.6)	4-6
			Ref. FP-405 (8.1) FP-409 (8.14)	5, 6
Stud handling tools	170 lb.	N/A	Ref. FP-405 (9.1)	5, 6
Studs #15 & #45 (#15 - North) (#45 - South)	640 lb.	Stud handling tool	Ref. FP-405 (9.8)	6
Alignment studs (2)	400 lb.	Stud handling tool	Ref. FP-405 (9.9)	6

TABLE 4-1 (Cont'd)

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
ISI tool - ARIES (assembled)	17 ton	Sling	None Identified	6
East ladder cage (deep end of refueling canal)	150 lb.	Sling	Cage must be removed for storage of core barrel and plenum	4-6
Crane main hoist botom block and hook	5 ton	N/A	N/A	3-6
Crane auxiliary hoist bottom block and hook	800 lb.	N/A	N/A	3-6

TABLE 4-1 (Cont'd)

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
CRDM's and components	914 lb	Handling Tool	Ref. MP-157; MP-108	3-6
Parts and components of refueling machines	2500 lb	Sling	Maintenance or replacement of large or heavy components	4-6
Fuel transfer carriage, upender, or parts for same	150 lb	Sling	Maintenance or replacement of large or heavy components SP-601	4-6
Hatch covers	10 ton	Sling	Maintenance Procedure	5, 6
ISI tool - ARIES (unassembled in crates)	16 ton	Sling	None Identified	4-6

TABLE 4-1 (Cont'd)

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Plenum	58.5 ton	Internals Handling Fixture and Adapter	Ref. FP-501 (11.5) (15.5)	6
Internals storage stand	8,200 lb.	Sling	Ref. FP-501 (13.5)	5, 6
Plenum and core barrel or core barrel alone	162 ton	Internals Handling Fixture and Adapter	Ref. FP-501 (13.21) (17.20)	6
Specimen storage container (rack)	400 lb	Sling	Ref. FP-501 (19.2.1.3)	6
RP motors	50.5 ton	Sling	Ref. MP-115	5, 6
RCP, components, structural or supporting steel above or around RCP's	23 ton	Sling	Ref. MP-115 For removal from reactor building	4-6

TABLE 4-1 (Cont'd)

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Head lifting pendants (3)	850 lb.	N/A	REF. FP-409	6
Head and internals handling fixture	6 ton	N/A	Ref. FP-409 (8.25) Alternate path	6
Reactor vessel head with lift rig (tripod)	160 ton	Handling fixture	Ref. FP-409 (8.36)	6
Internals handling extension	3400 lb.	N/A	Ref. FP-501 (8, 8, 9)	6
Tripod	6 ton	N/A	Ref. FP-501 (9.2)	6
Index fixture and associated adapters and pendants and spreader ring	12,500 lb.	Slings	Ref. FP-501 (9.5) (11.3) (11.4)	6

TABLE 4-1 (Cont'd)

RCCR-1/POLAR CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Stud support spacers (in crate)	50 lb.	Sling	Ref. FP-40[illegible] ([illegible])	5, [illegible]
Stud hole seal plugs (58) (in crate)	200 lb.	Sling	Ref. FP-407, 408	5, 6
CRDM cooling water header spool pieces	100 lb.	Sling	Ref. FP-409 (8.9)	4-6
Service Structure platforms (triangular)	1-1/2 ton	Sling	Ref. FP-409 (8.18)	4-6
Refueling cavity seal plate	1-1/2 ton	Sling	None Identified	6
Fuel transfer tube covers (2)	1 ton	Sling	Ref. MP-125	5, 6

TABLE 4-2

FHCR-7/MISSILE SHIELD GANTRY CRANE AND
SFHT-7/SPENT FUEL PIT GATE HOIST LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Spent fuel pool missile shields A thru P with SFMS	6300 lb.	Sling and spreader beam	Ref. SP-434 (6.1.10) (6.1.13)	1-6
Various items in spent fuel pit "A" area (i.e., re-fueling machine parts, fuel trans-fer carriages and hydraulic units, etc.)	Variable Less than 1 ton	Slings	Ref. FP-601 (2.7) For maintenance and/or testing	1-6
Spent fuel pool "A-B" gate	3900 lb.	Sling	Gate is moved by mono-rail hoist SFHT-7 FP-1001	1-6

TABLE 4-3

FHCR-5/AUXILIARY BUILDING CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Loading bay hatch cover	Less than 1 ton	Sling	Ref. FP-301 (5.1) FP-302 (6.5) FP-1001 (6.8)	1-6
Spent fuel cask (loaded)	To be addressed as a separate licensing issue	Cask yoke	Ref. FP-301 (5.17) FP-1001 (Enc. A,13) Ref. FP-301 (5.46	1-6
New fuel shipping cask (loaded - 2 assemblies)	7300 lb.	Sling	Ref. FP-302 (6.7)	1-6
New fuel assemblies	1532 lb.	New fuel handling tool	Ref. FP-302 (9.0) (10.0) (12.0)	1-6
Missile shield handling fixtures (SFMS)	500 lb	Sling	FP-302	1-6

TABLE 4-3 (Cont'd)

FHCR-5/AUXILIARY BUILDING CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
Various loads which are hoisted up to the operating deck from the loading bay	Variable Less Than 2 ton	Slings	None Identified	1-6
Various loads on missile shields above spent fuel pool "B" after transferral by the missile shield crane from the spent fuel pool "A" area	Variable Less than 1000 lb	Slings	For removal from building OR For maintainence or storage	1-6
Crane main hoist bottom block and hook	3-1/2 ton	N/A	N/A	1-6
Crane auxiliary hoist bottom block and hook	700 lb.	N/A	N/A	1-6

TABLE 4-3 (Cont'd)

FHCR-5/AUXILIARY BUILDING CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
New fuel pit missile shields with SFMS	7 tons	Handling fixture	Ref. FP-302 (12.2) Missile shields are stacked on top of each other	1-6
New control component container	1,[illegible] lb	Sling	Ref. FP-303 (6.2.5) (7.2.3)	1-6
New control component	132 lb	Sling/Short handling tool	Ref. FP-303 (9.2.10) (9.3.12)	1-6
Spent fuel cask pit gate	2 ton	Sling	Ref. FP-301	1-6
Spent fuel pool missile shields	8900 lb.	Sling and spreader beam	Ref. SP-434	1-6
New fuel elevator and associated equipment	220 lb	Sling	No identified procedure	1-6

TABLE 4-4

RCCR-2/REACTOR VESSEL TOOL HANDLING JIB CRANE LOADS

Crane Load	Weight	Designated Lifting Device	Governing Handling Procedure	Mode(s) of Operation Expected for Load Move
CRDM cooling water header spool pieces	100 lb	Sling	Ref. FP-409 (8.9)	5, 6
Incore instrument tube plug tool	300 lb	N/A	May be moved by RCCR-1 also	4-6
Rod assembly handling tool, leadscrew tool, stator/water jacket tool, hold down bolt tool	150 lb and less	N/A	Tools used for maintenance and removal of CRDM's. May be moved by RCCR-1 also.	4-6
Long handled tool and attachments	40 lb	N/A	This tool is used for various manipulations around or above the core when RV head is off. May be moved by RCCR-1 also.	4-6
Source handling tool	30 lb	N/A	Tool is used when RV head is off. May be moved by RCCR-1 also.	6

FIGURE 4-1

LOAD TEST AREA - RCCR-2

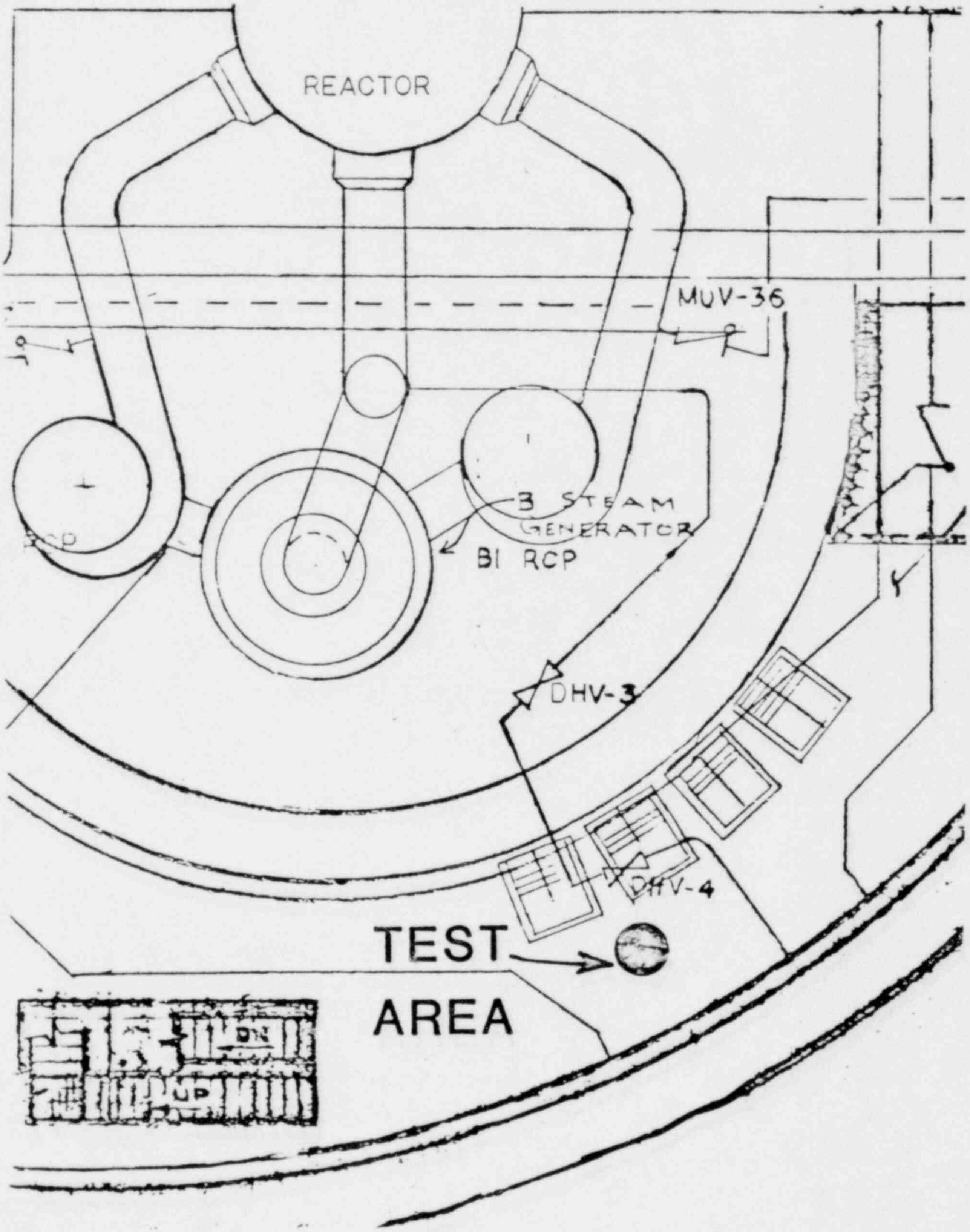


FIGURE 4-2

REFUELING CRANE FHCR-5 LOAD TEST PATH

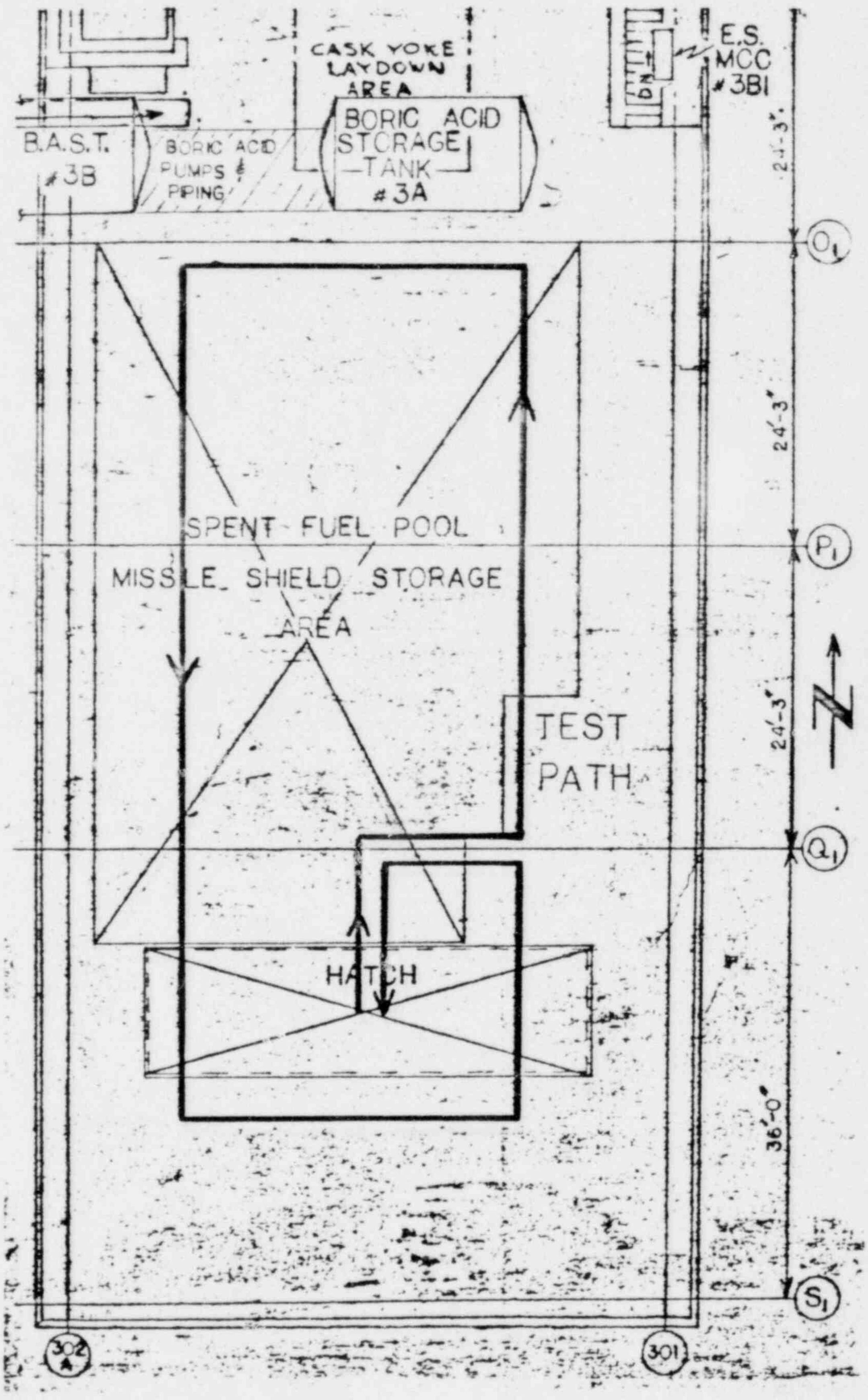


FIGURE 4-3

SPENT FUEL POOL MISSILE SHIELD HANDLING CRANE
LOAD TEST PATH

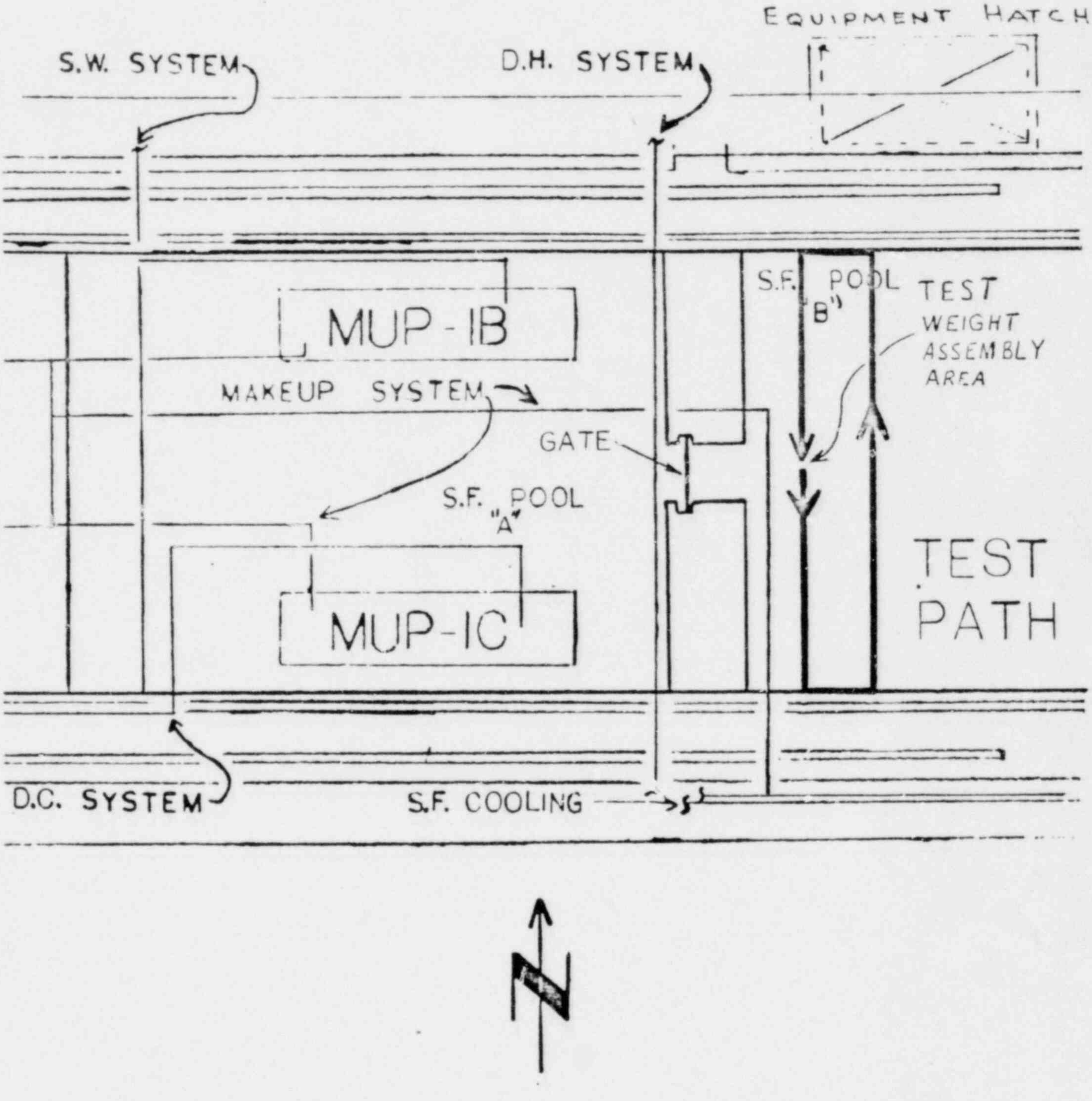


FIGURE 4-4

LOAD TEST AREA - MECHANIZED SCAFFOLD

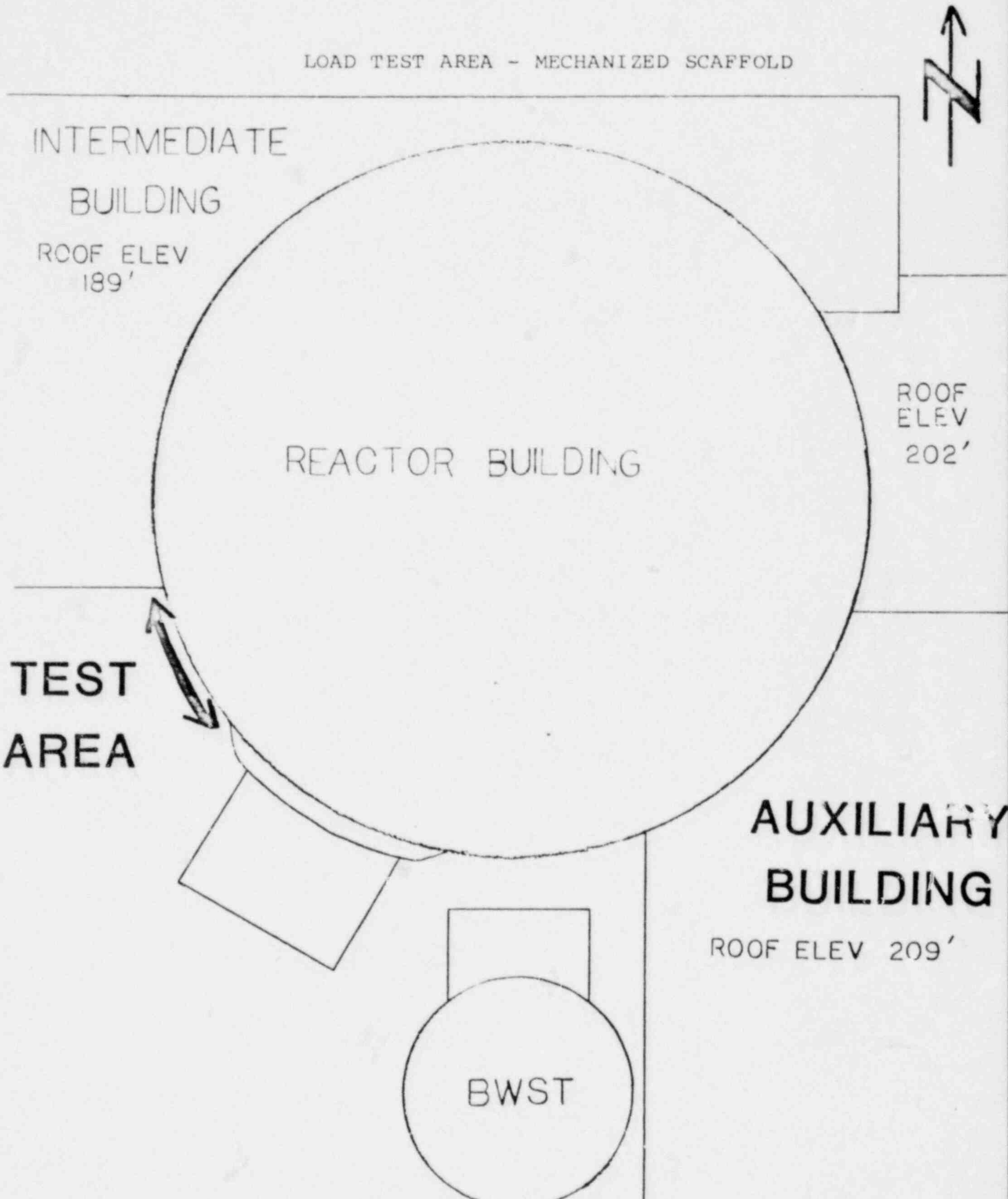


FIGURE 4-5

LOAD TEST EXCLUSION AREA - CWCR-1

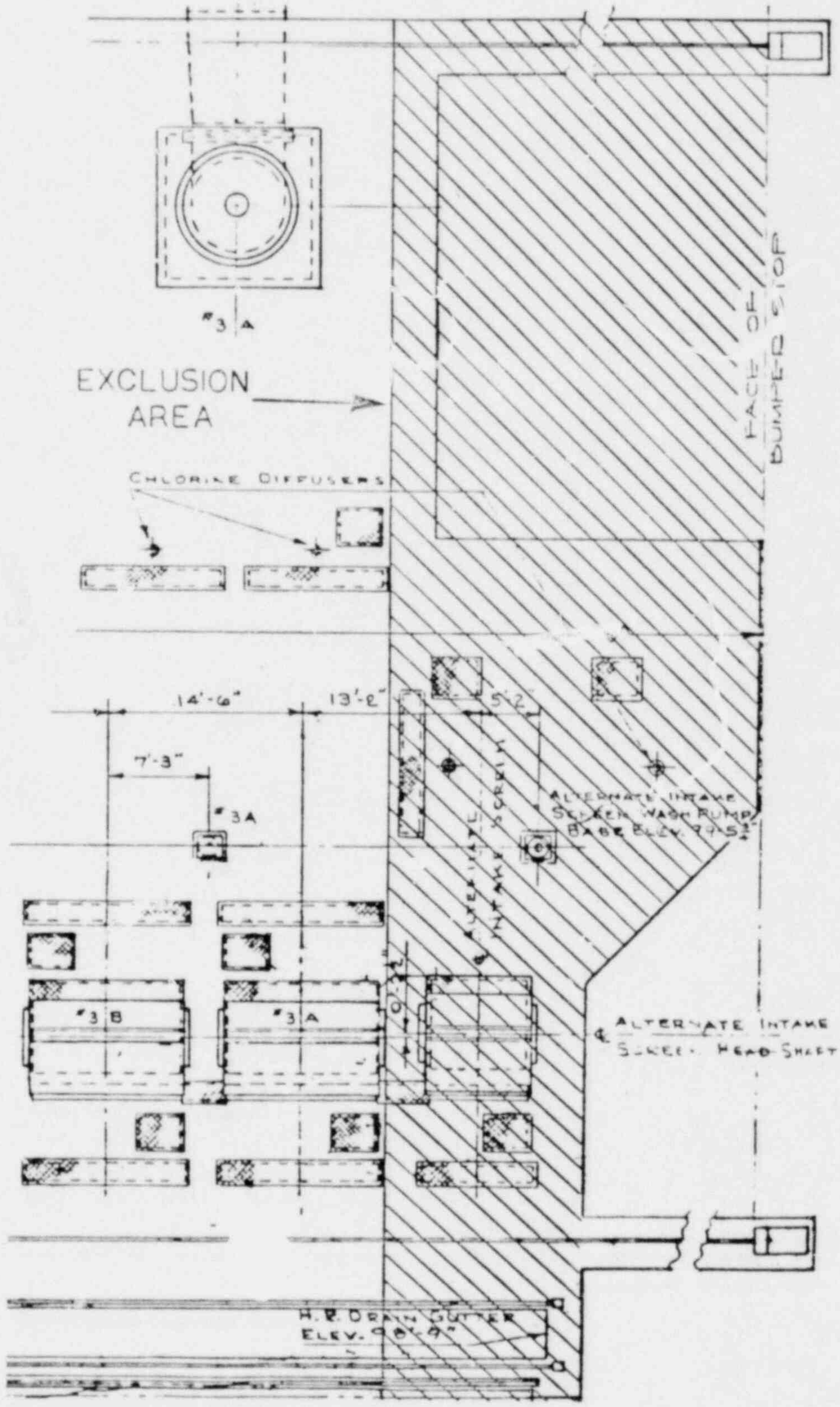


FIGURE 4-6

CWCR-1 SAFE LOAD PATH SKETCH - NORMAL NSSW OPERABLE

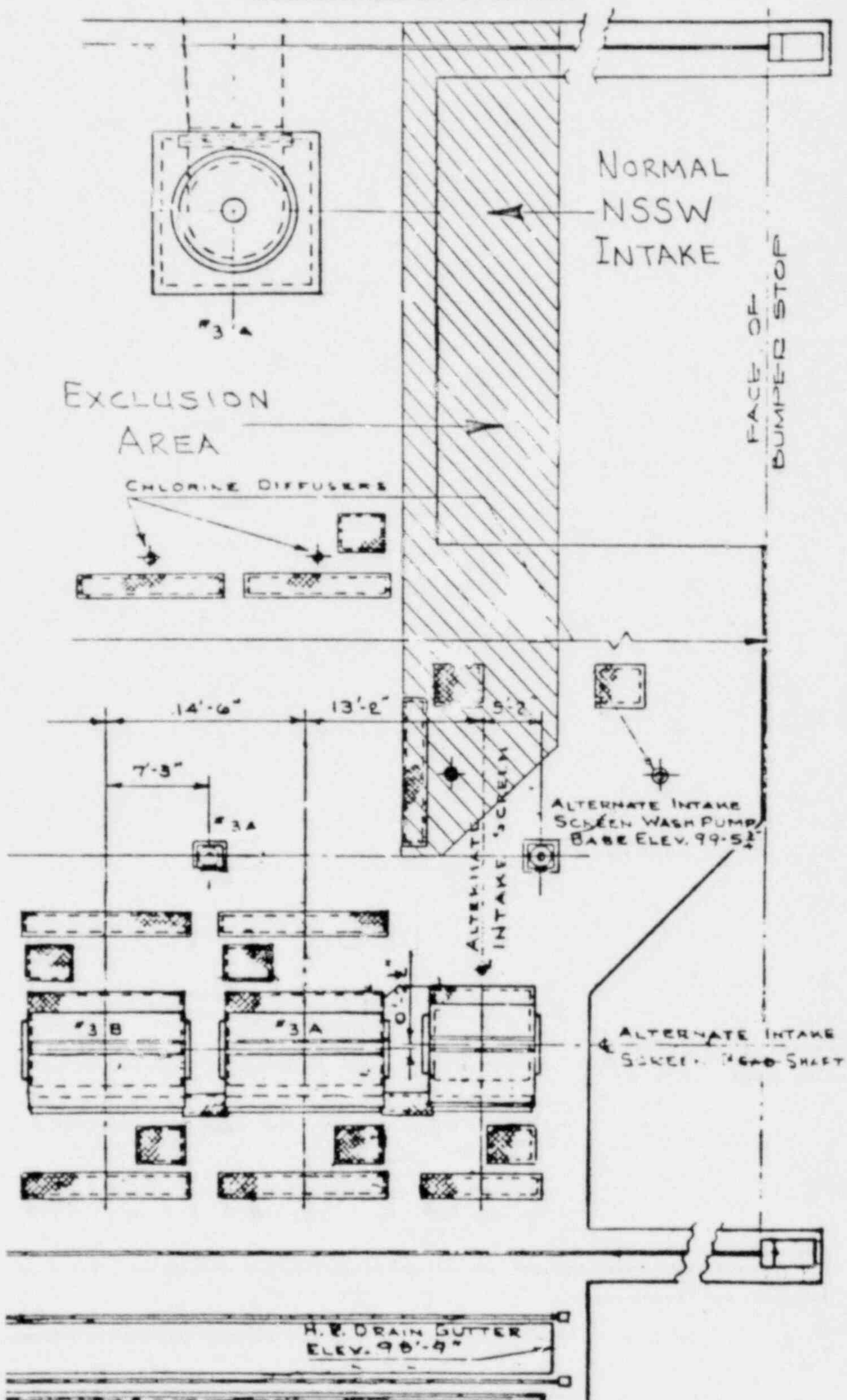
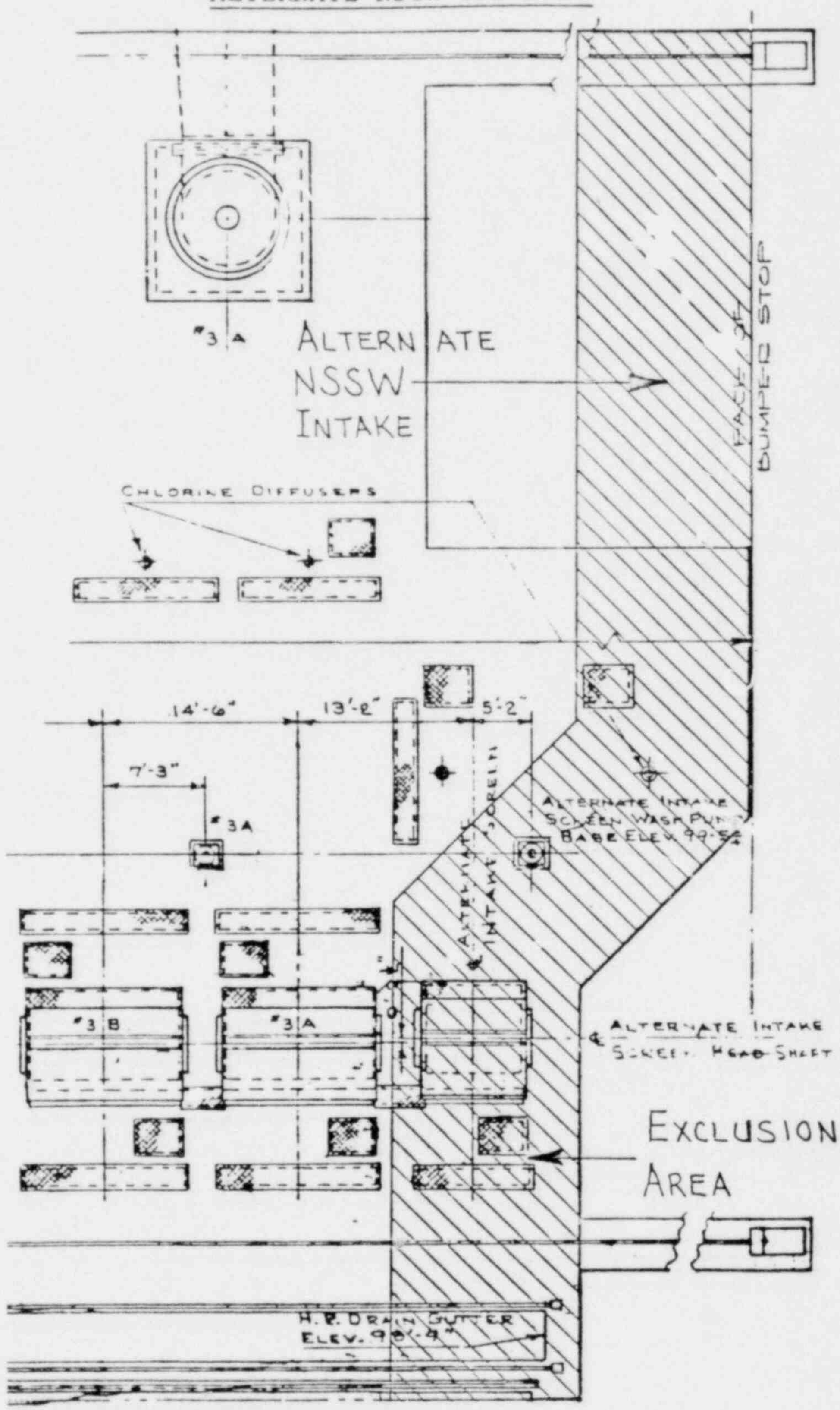


FIGURE 4-7

CWCR-1 SAFE LOAD PATH SKETCH - ALTERNATE NSSW OPERABLE



NOTE: Exclusion areas are shown heavy black or cross-hatched.
Exclusion areas shall be avoided during modes 1 through 4.

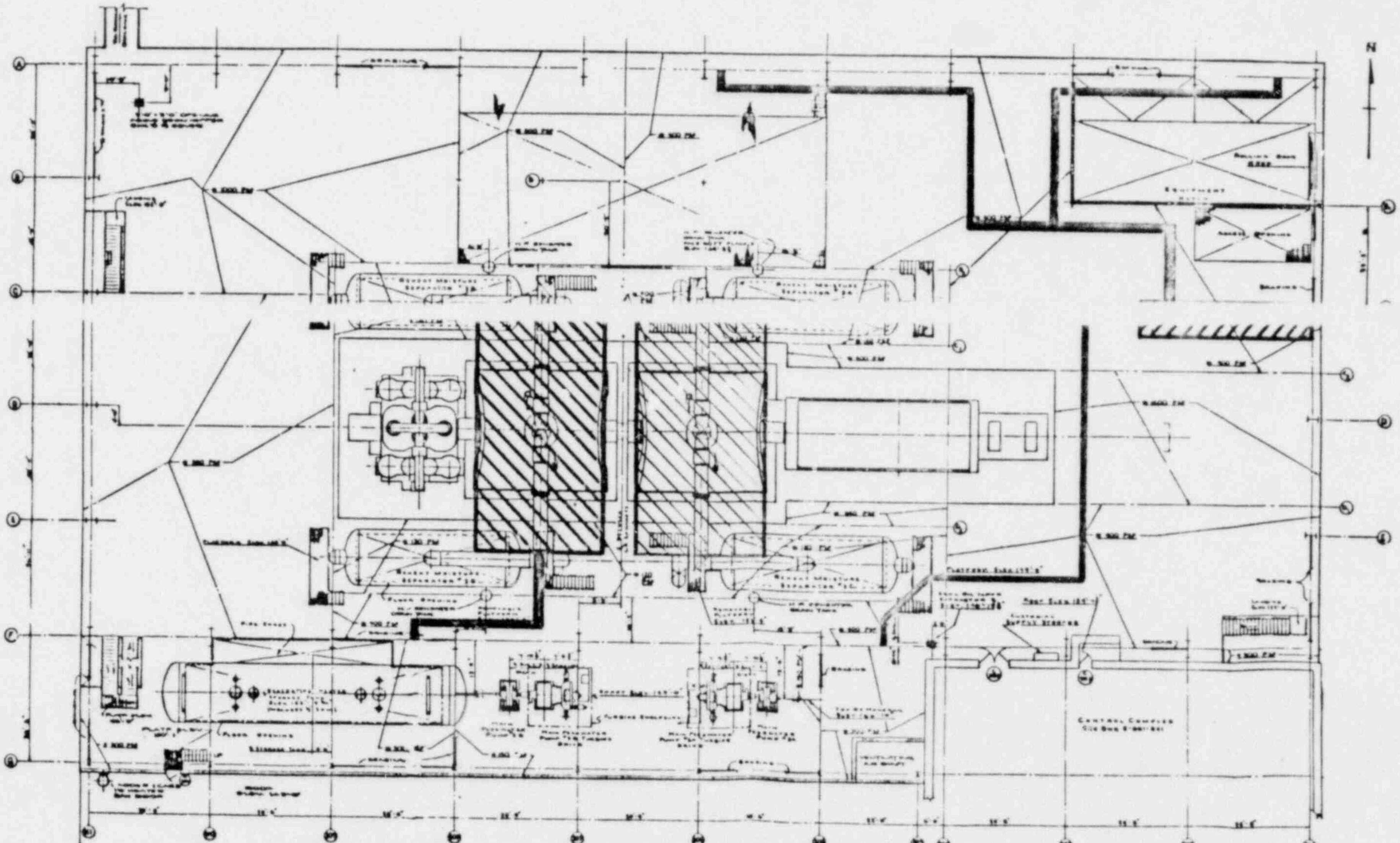
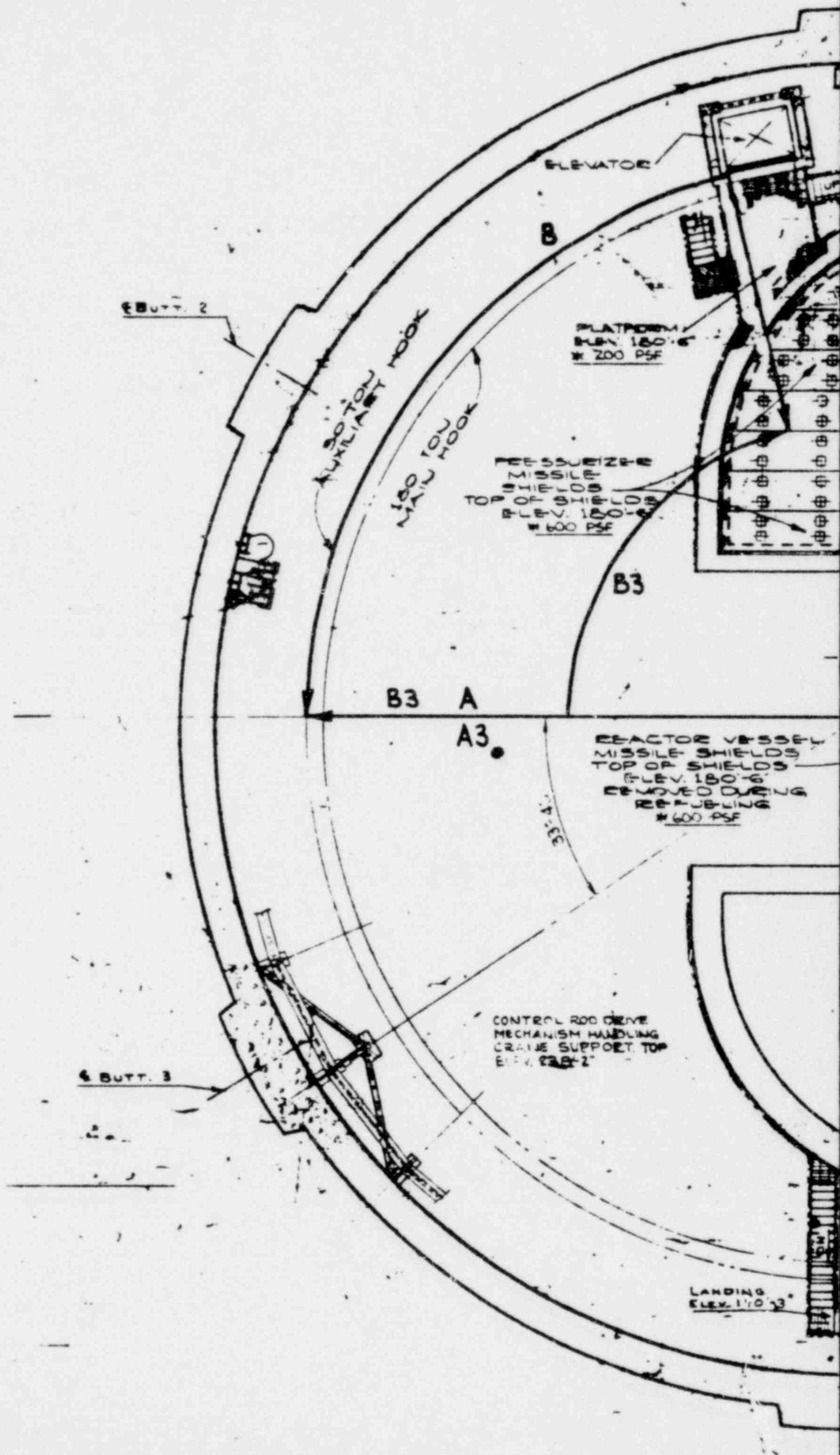


FIGURE 4-8 TURBINE BUILDING SAFE LOAD PATH SKETCH



ELEVATOR
B
℄ BUTT. 2
50 TON AUXILIARY HOOK
180 TON MAIN HOOK
PLATFORM ELEV. 180'-6" * 200 PSF
PRESSURIZER MISSILE SHIELDS TOP OF SHIELDS ELEV. 180'-6" * 600 PSF
B3
B3
A
A3
REACTOR VESSEL MISSILE SHIELDS TOP OF SHIELDS ELEV. 180'-6" REMOVED DURING REFUELING * 600 PSF
CONTROL ROD DRIVE MECHANISM HANDLING CRANE SUPPORT TOP
℄ BUTT. 3
LANDING

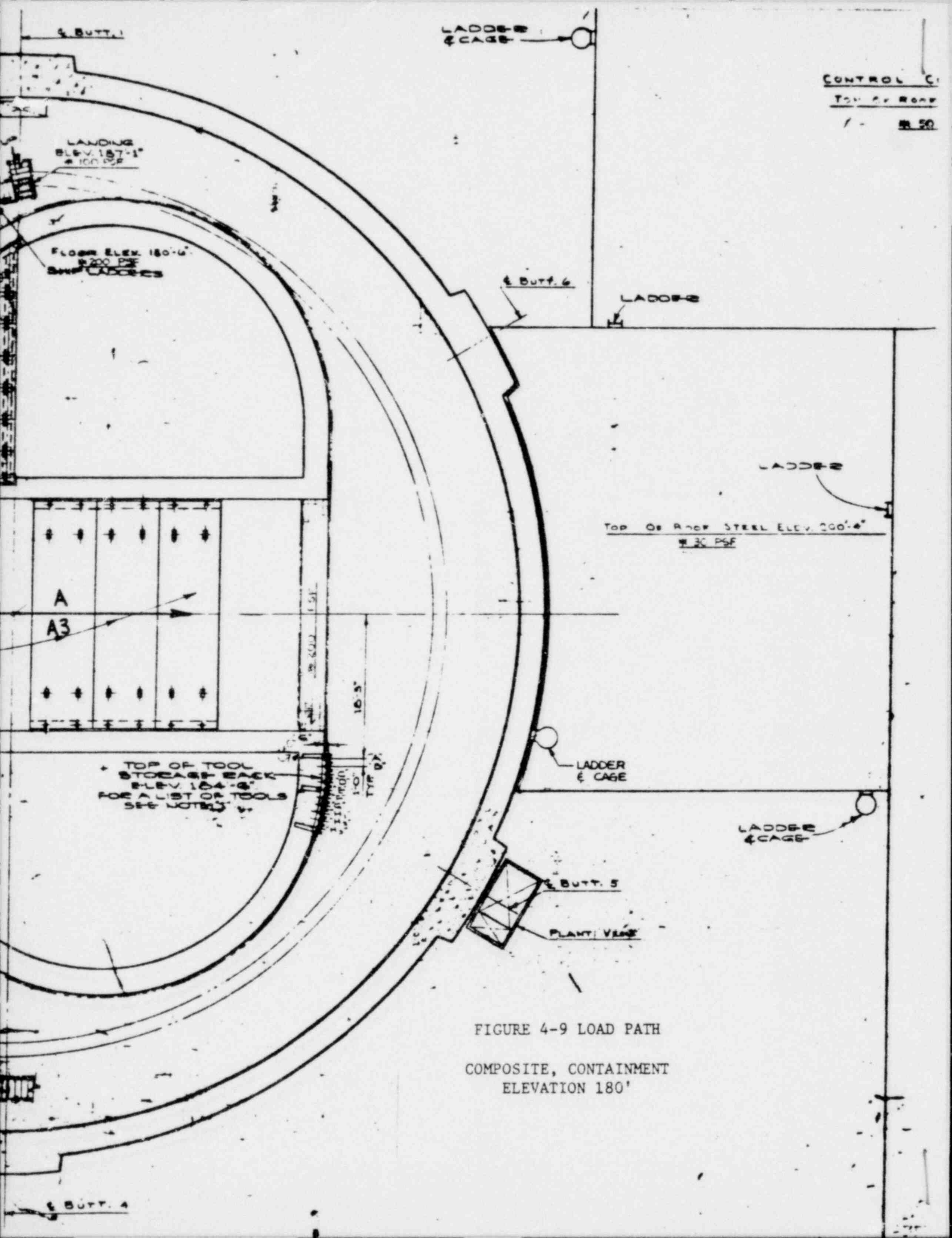
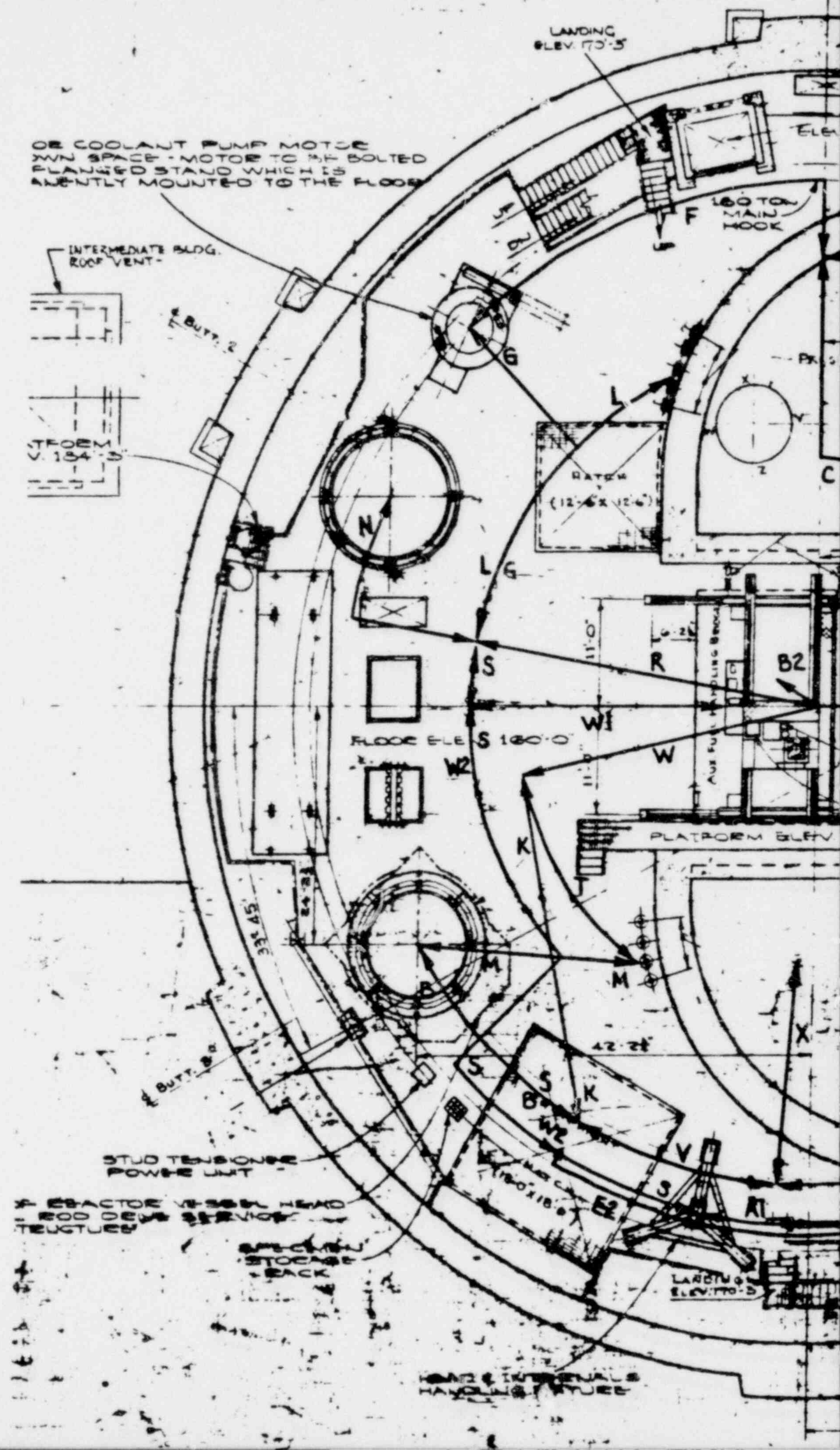


FIGURE 4-9 LOAD PATH

COMPOSITE, CONTAINMENT
ELEVATION 180'


LANDING
ELEV. 173'-3"
INTERMEDIATE BLDG.
ROOF VENT
160 TON
MAIN
HOOK
HATCH
FLOOR ELEV. 160'-0"
PLATFORM ELEV.
STUD TENSIONER
POWER UNIT
SPECIMEN
STORAGE
RACK
HANDLING FIXTURE

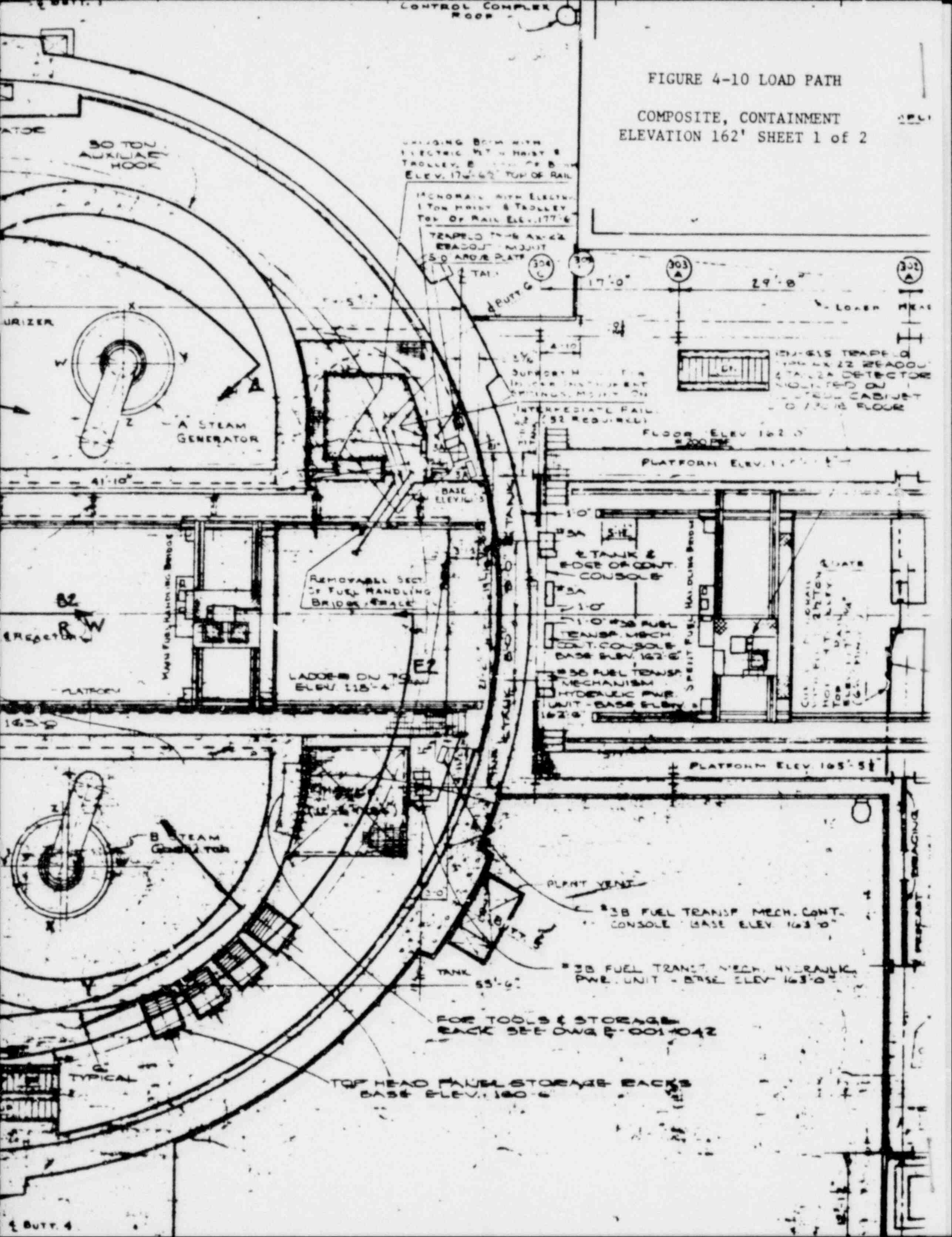
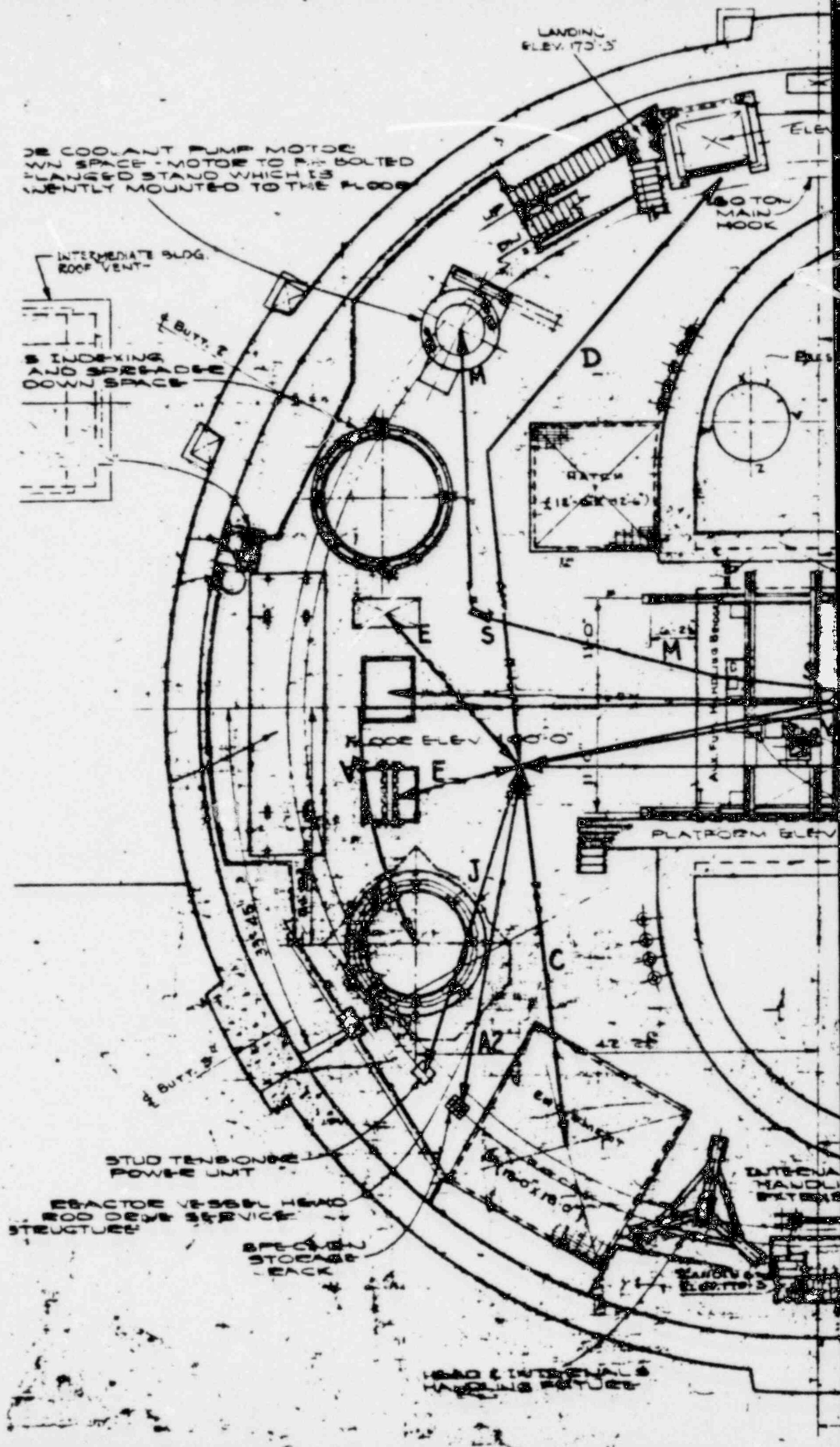


FIGURE 4-10 LOAD PATH

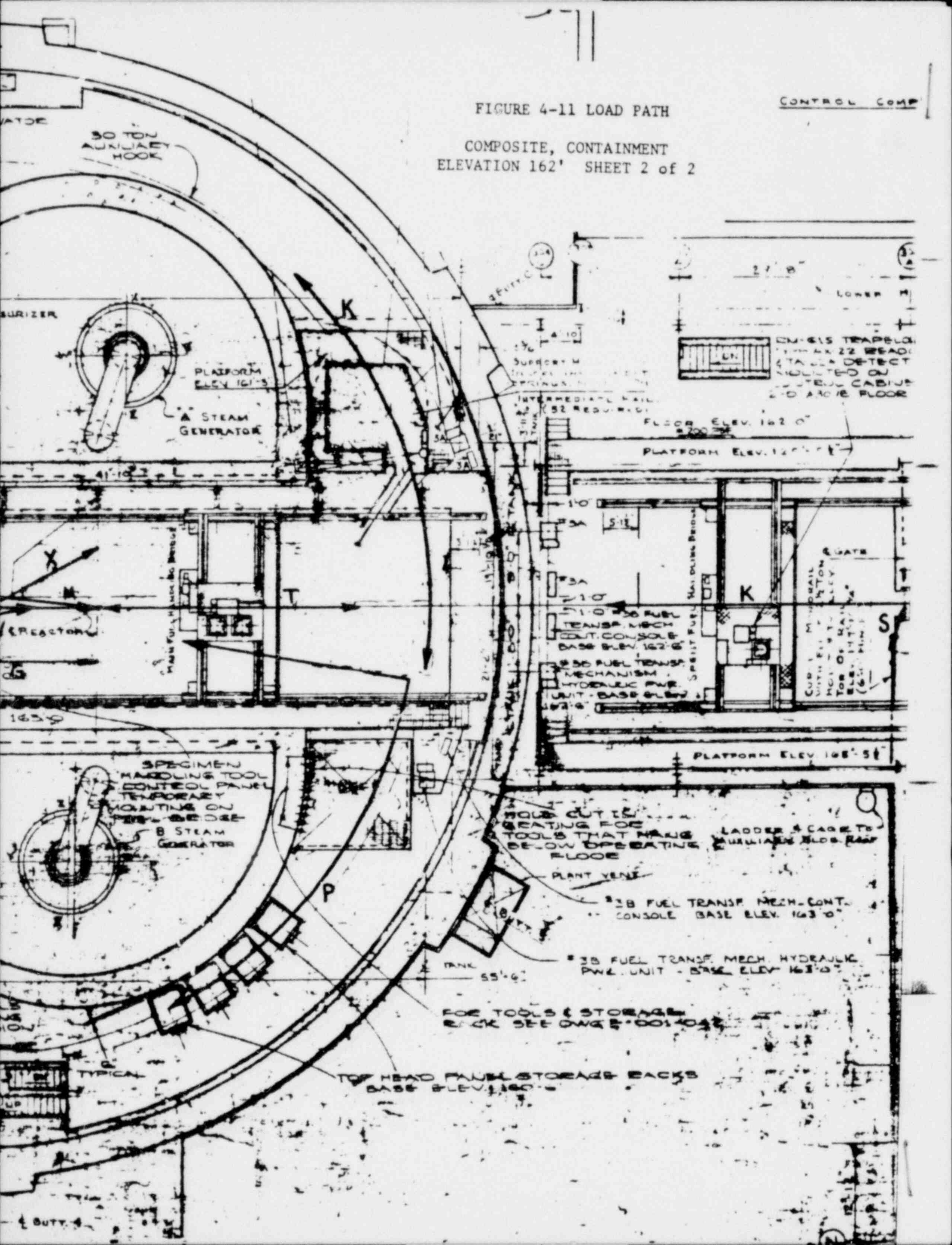
COMPOSITE, CONTAINMENT ELEVATION 162' SHEET 1 of 2

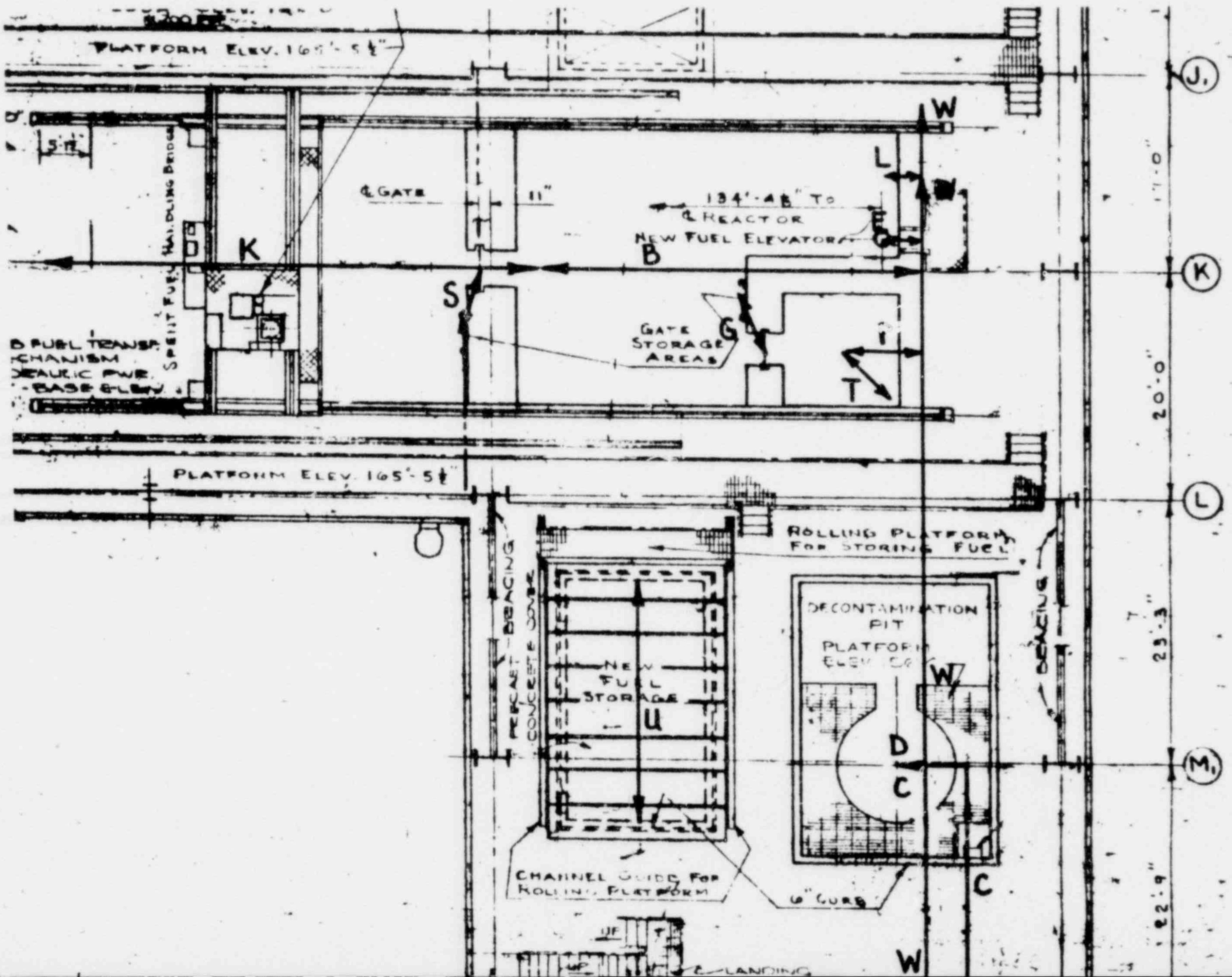


LANDING
ELEV. 175'-3"
INTERMEDIATE BLDG. ROOF VENT
90 TON MAIN HOOK
D
M
HATCH
E
S
FLOOR ELEV
E
PLATFORM ELEV
J
C
STUD TENSIONER POWER UNIT
SPECIMEN STORAGE RACK
HEAD & INTERNALS HANDLING FIXTURE

FIGURE 4-11 LOAD PATH

COMPOSITE, CONTAINMENT
ELEVATION 162' SHEET 2 of 2





PLATFORM ELEV. 165'-5½"
₵ GATE
11"
134'-4B" TO ₵ REACTOR OR NEW FUEL ELEVATOR
GATE STORAGE AREAS
SPENT FUEL HANDLING BRIDGE
PLATFORM ELEV. 165'-5½"
ROLLING PLATFORM FOR STORING FUEL
DECONTAMINATION PIT
PLATFORM
NEW FUEL STORAGE
PRECAST BRACING
CONCRETE CURB
BRACING
CHANNEL GUIDE FOR ROLLING PLATFORM
6" CURB
LANDING
J₁
K
L
M₁
11'-0"
20'-0"
23'-3"
22'-9"
W
L
B
K
S
G
T
U
D
C

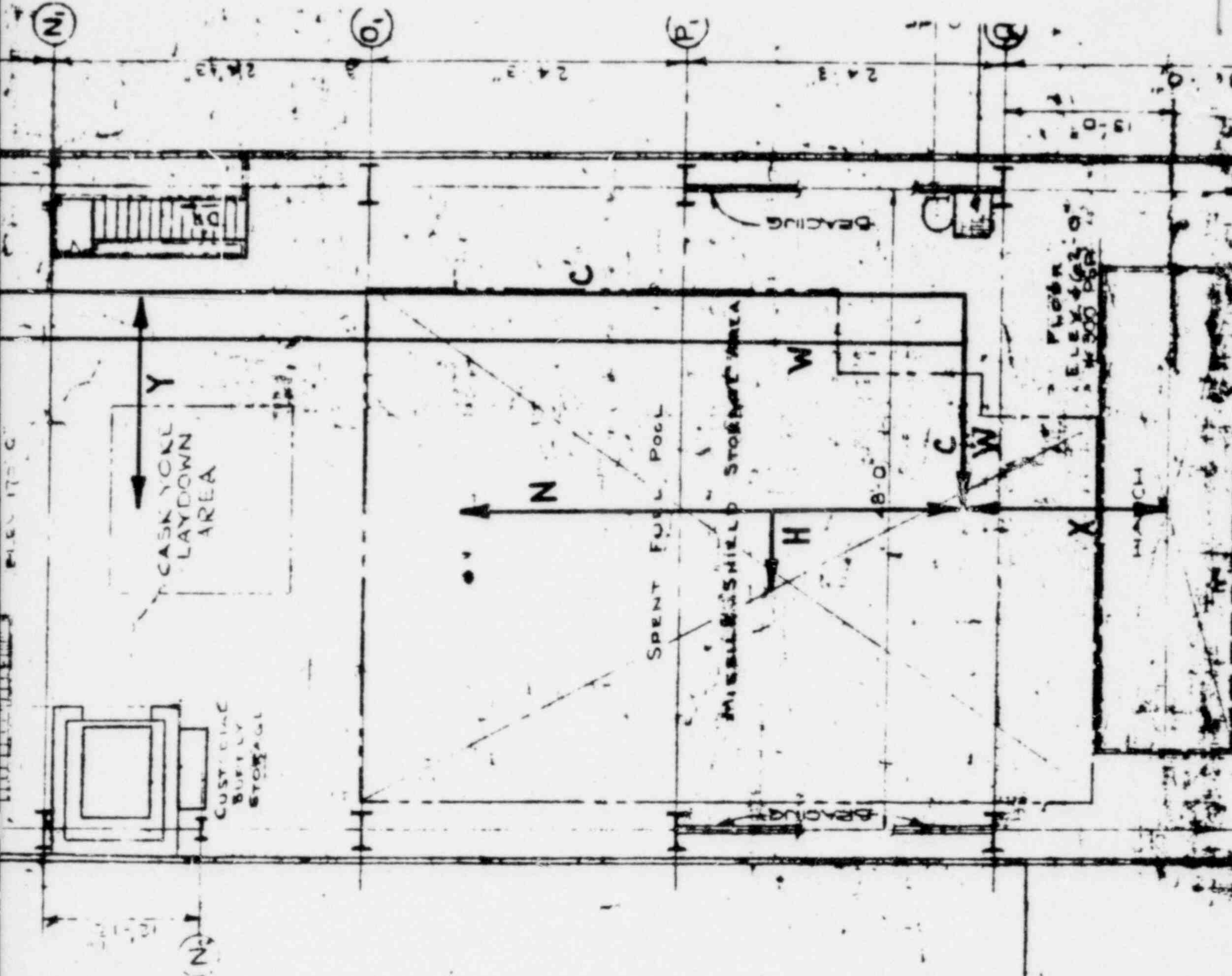
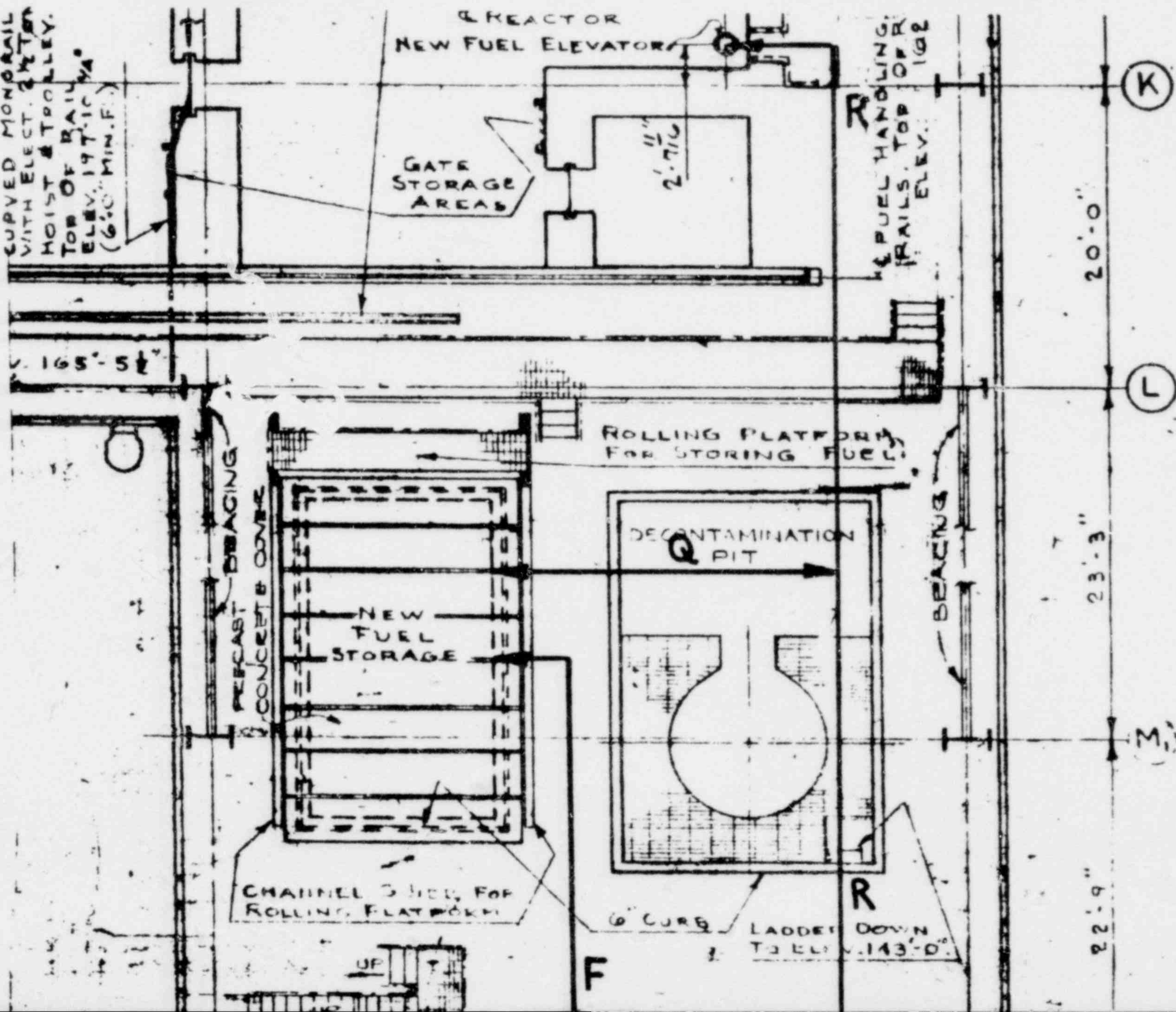


FIGURE 4-12 AUXILIARY BUILDING
LOAD PATH COMPOSITE,
ELEVATION 162' SHEET 1 of 2



K
L
M
20'-0"
23'-3"
22'-9"
℄ REACTOR
NEW FUEL ELEVATOR
GATE STORAGE AREAS
2'-7½"
CURVED MONORAIL WITH ELECT. 2½ TON HOIST & TROLLEY. TOP OF RAIL ELEV. 197'-10¼" (6'-0" MIN. F.)
℄ FUEL HANDLING RAILS. TOP OF ℞ ELEV. 192
R
165'-5½"
ROLLING PLATFORM FOR STORING FUEL
BRACING
PRECAST CONCRETE COVER
NEW FUEL STORAGE
DECONTAMINATION PIT
Q
CHANNEL SILLS FOR ROLLING PLATFORM
6" CURB
LADDER DOWN TO ELEV. 143'-0"
F
UP

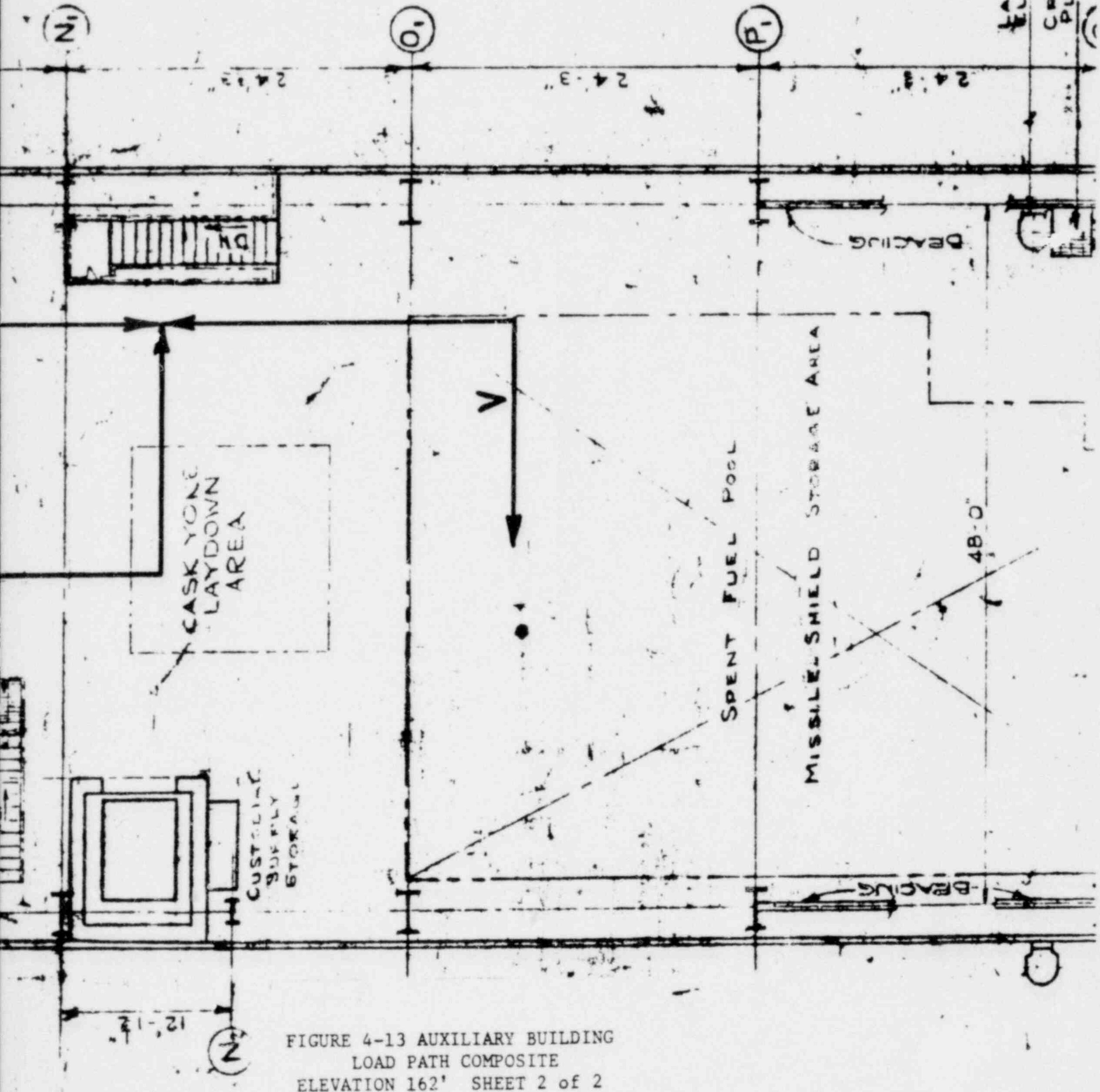
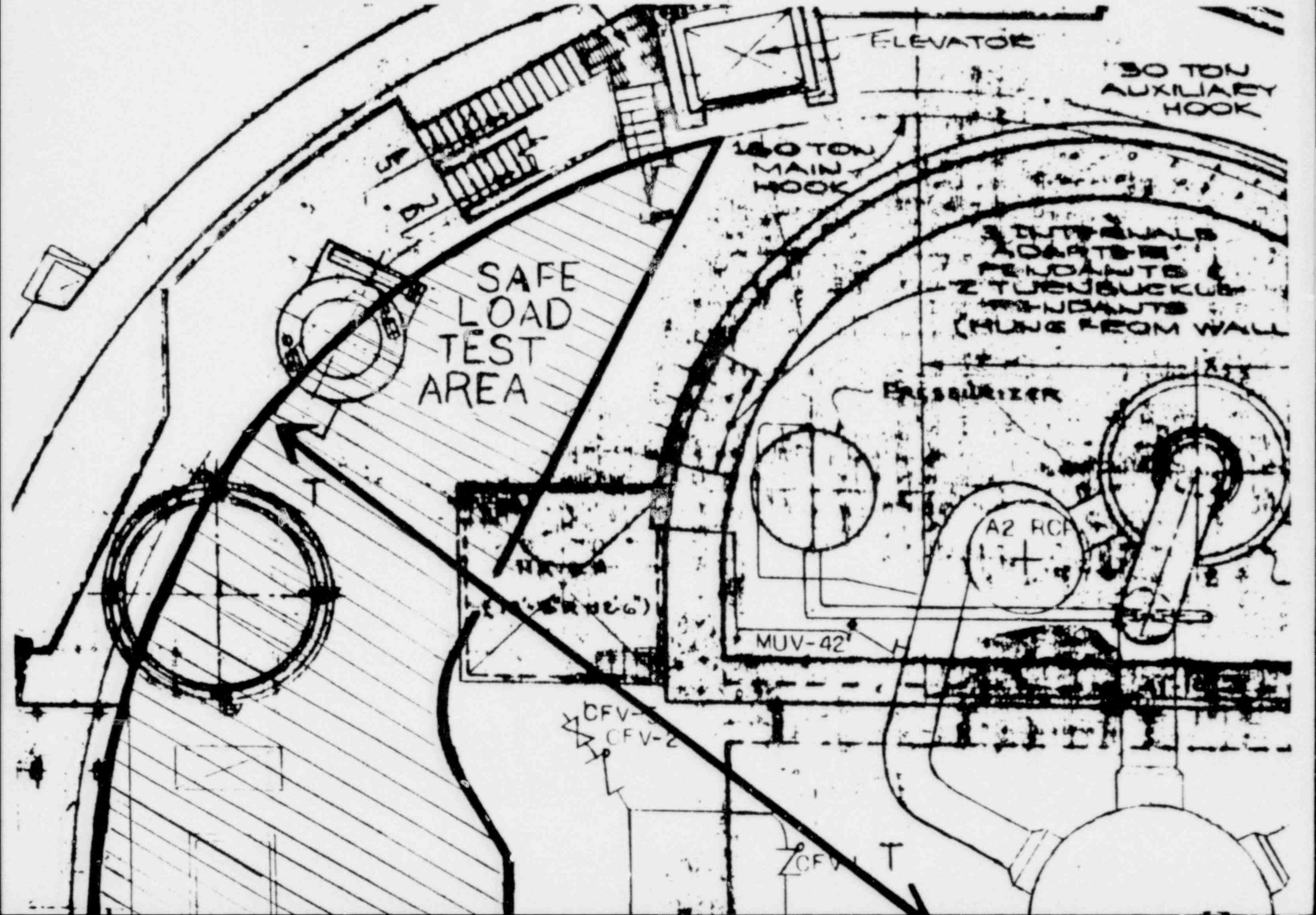


FIGURE 4-13 AUXILIARY BUILDING
LOAD PATH COMPOSITE
ELEVATION 162' SHEET 2 of 2


ELEVATOR
30 TON AUXILIARY HOOK
180 TON MAIN HOOK
SAFE LOAD TEST AREA
PRESSURIZER
A2 RCP
MUV-42
UP
DN

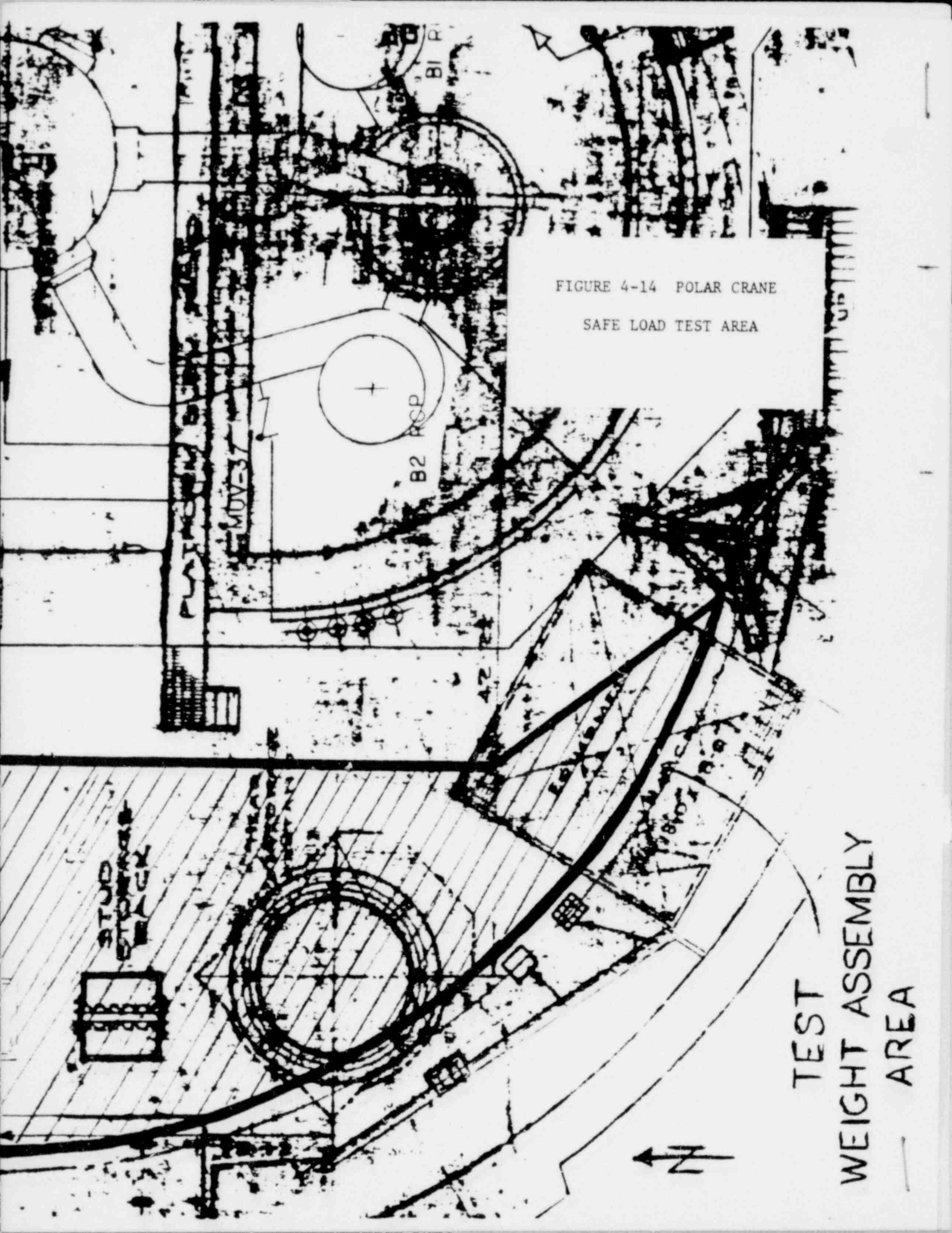
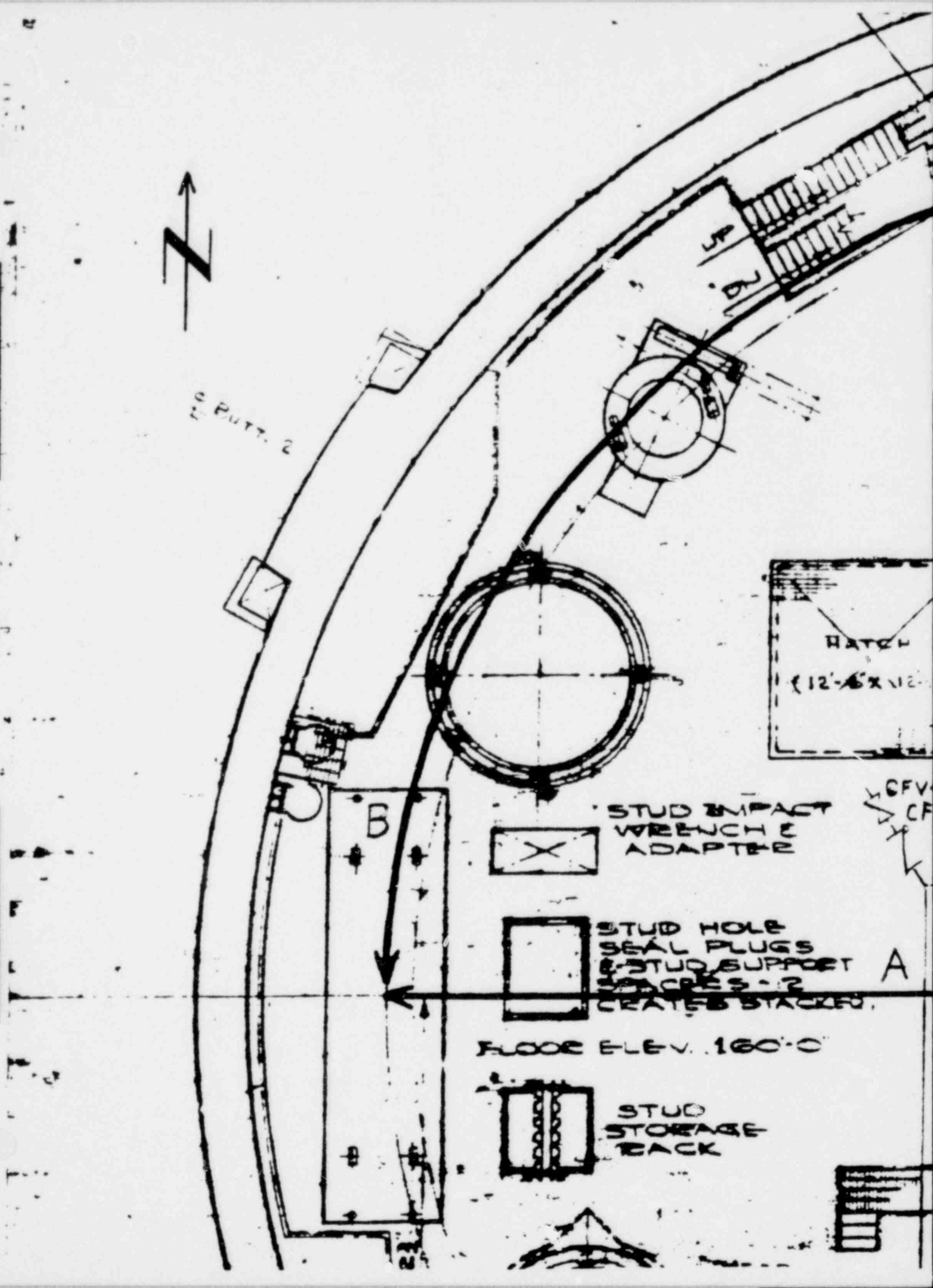


FIGURE 4-14 POLAR CRANE SAFE LOAD TEST AREA



N
UP
DN
HATCH
B
STUD IMPACT WRENCH & ADAPTER
STUD HOLE SEAL PLUGS
A
FLOOR ELEV. 160'-0"
STUD STORAGE RACK

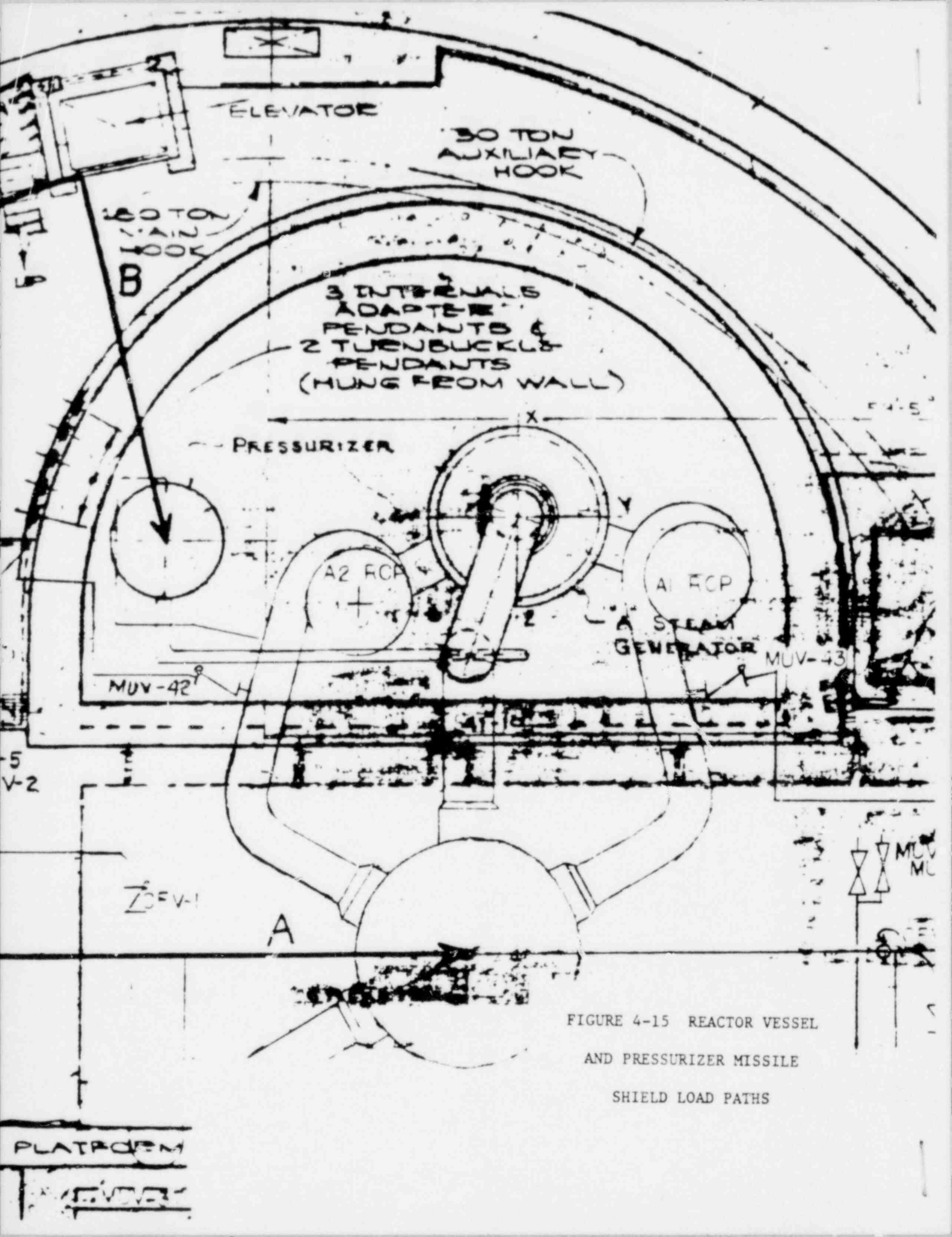
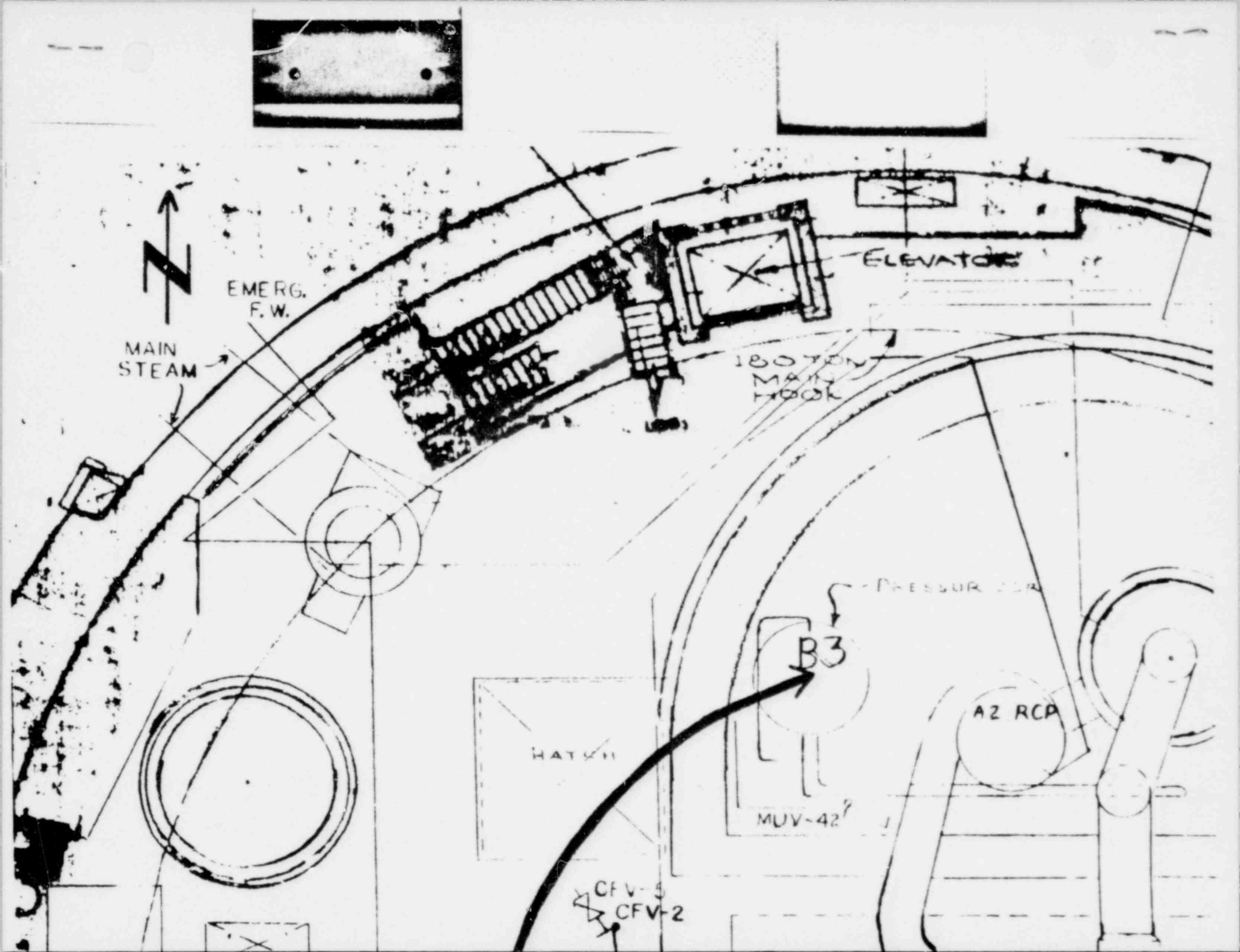


FIGURE 4-15 REACTOR VESSEL AND PRESSURIZER MISSILE SHIELD LOAD PATHS


EMERG.
F. W.
MAIN
STEAM
ELEVATOR
180 TON
MAIN
HOOK
B3
A2 RCP
HATCH
MUV-42
CFV-5
CFV-2

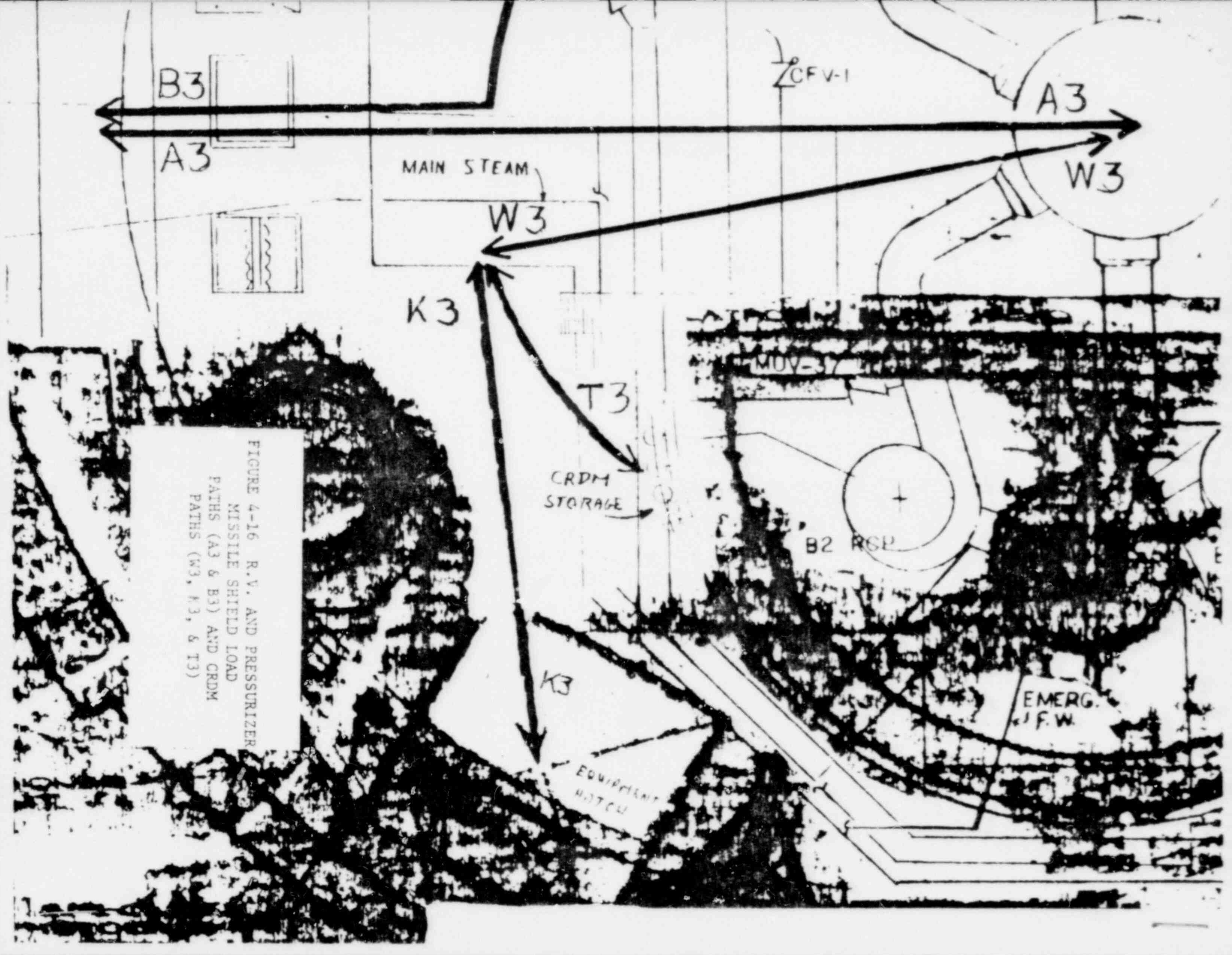
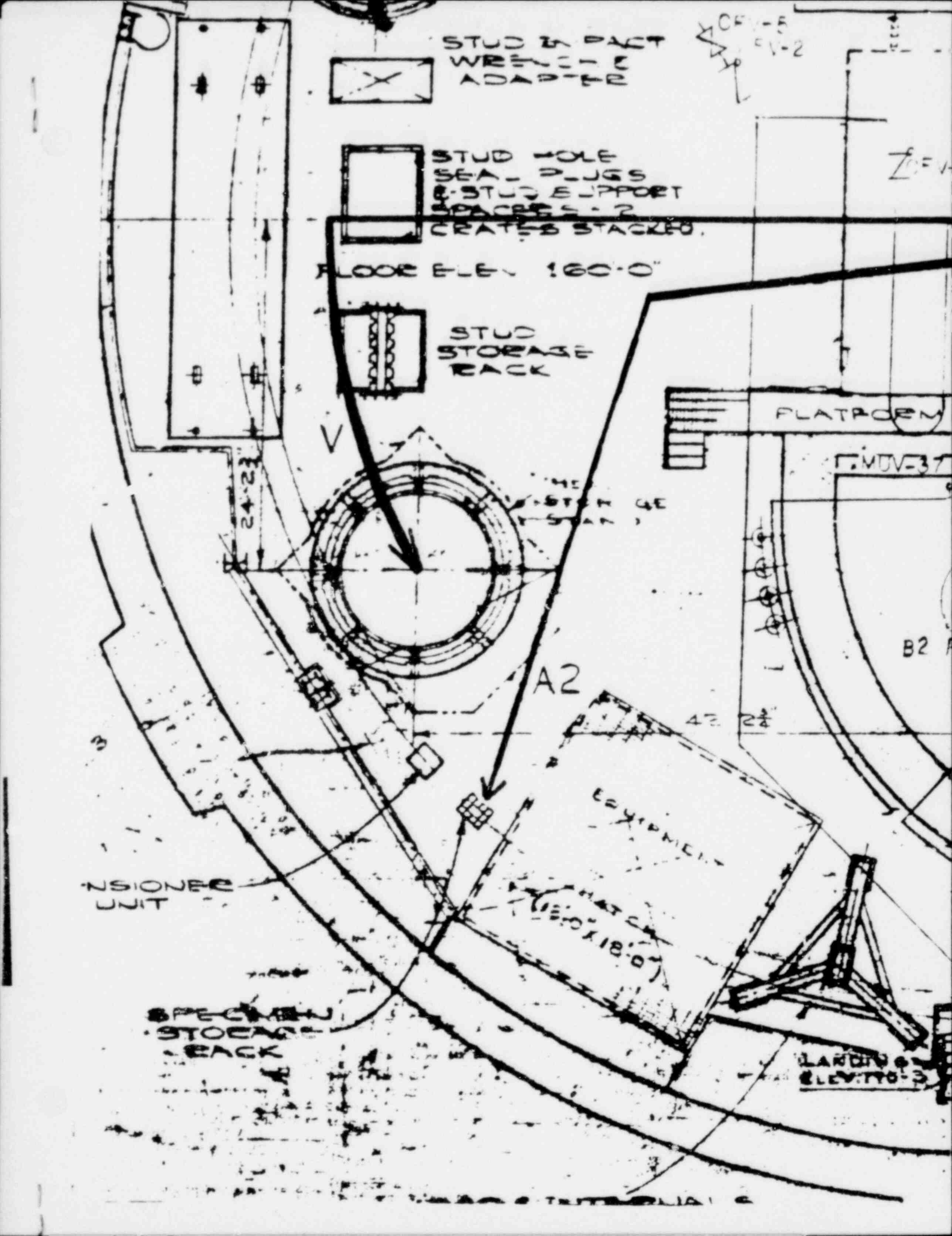


FIGURE 4-16 R.V. AND PRESSURIZER MISSILE SHIELD LOAD PATHS (A3 & B3) AND CRDM PATHS (W3, K3, & T3)



STUD IMPACT
WRENCH E
ADAPTER
STUD HOLE
SEAL PLUGS
& STUD SUPPORT
CRATES STACKED.
FLOOR ELEV. 160'-0"
STUD
STORAGE
RACK
PLATFORM
MUV-37
V
A2
B2
24'-2"
42'-2¾"
18'-0"X18'-0"
NSIONER
UNIT
SPECIMEN
STORAGE
RACK

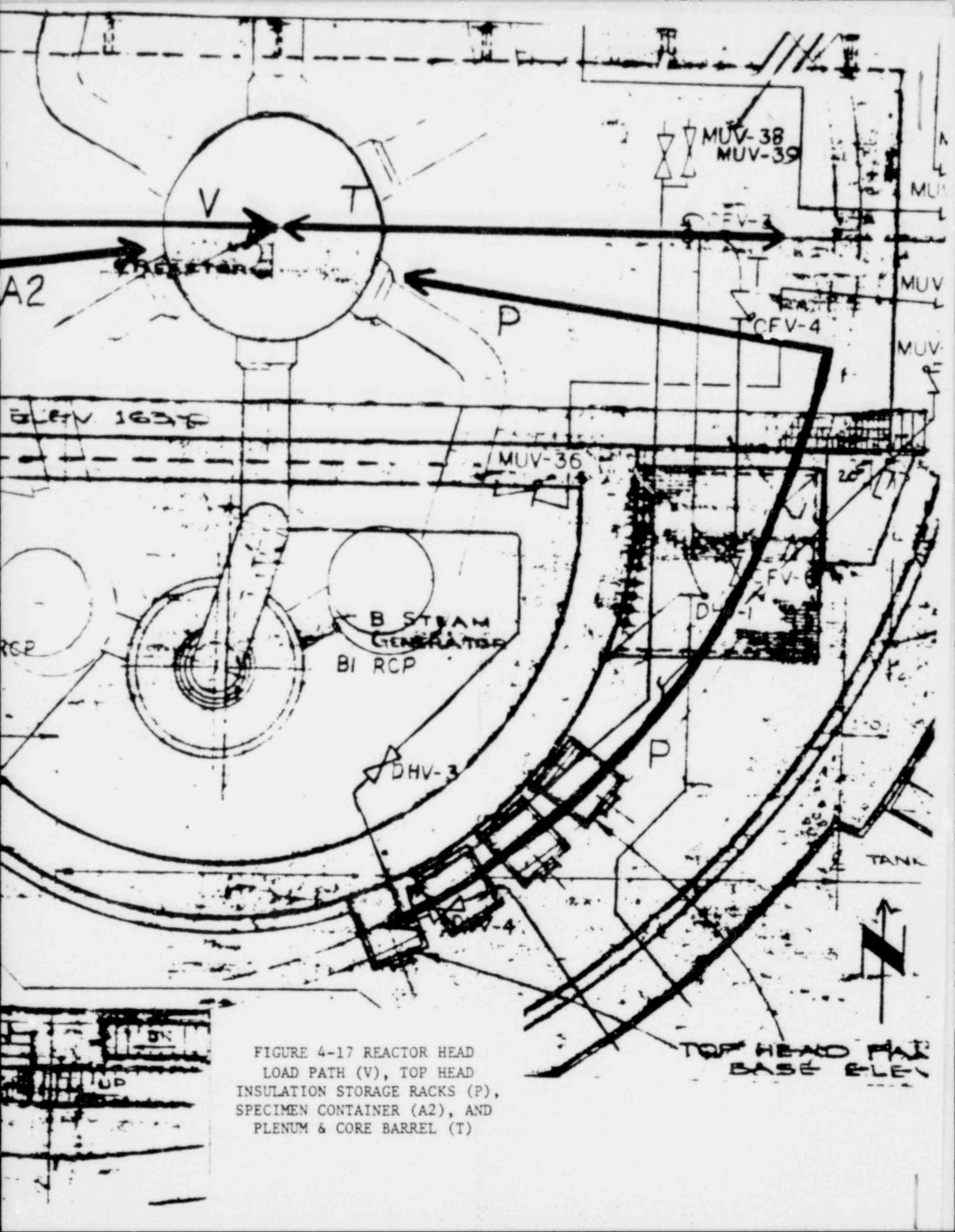
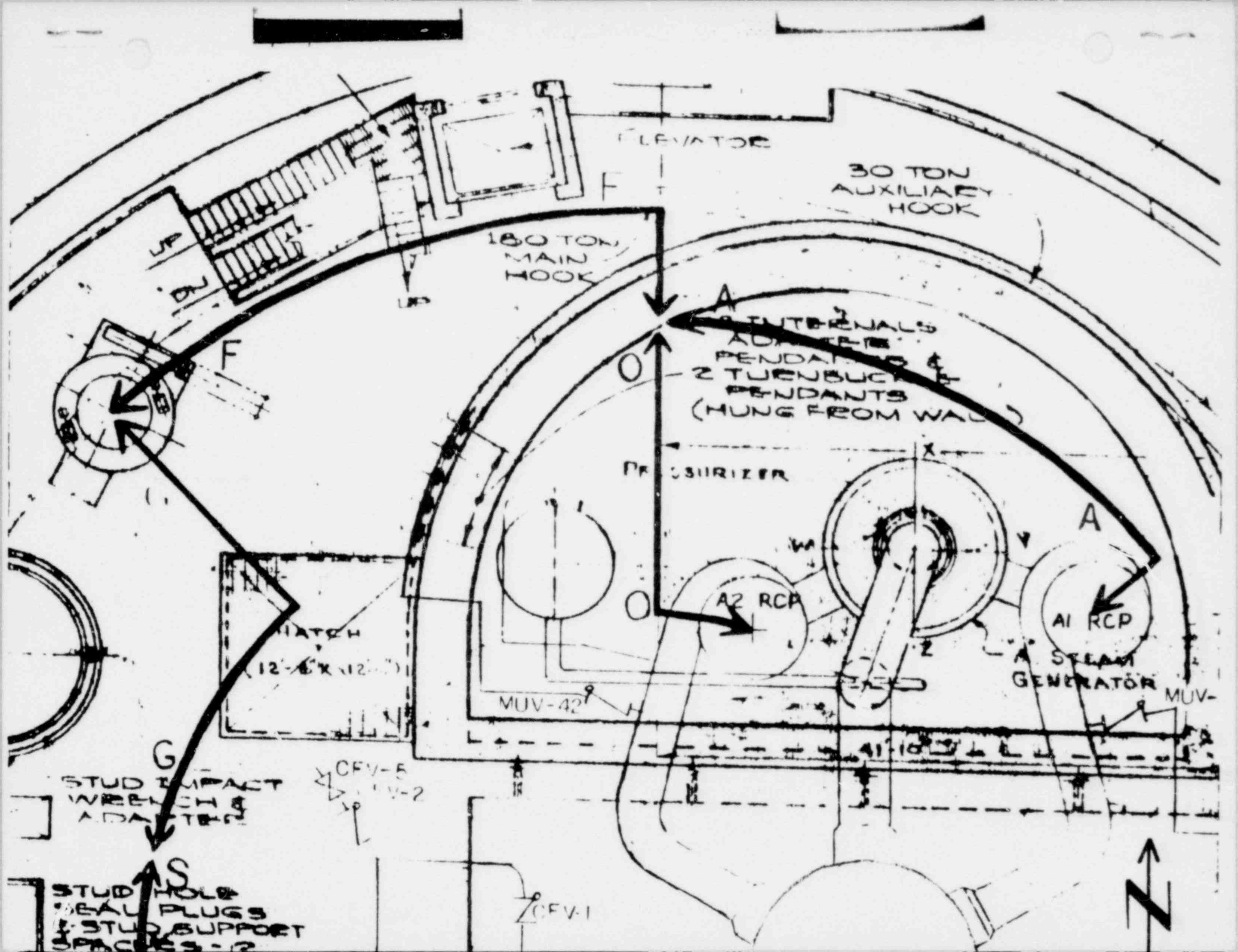


FIGURE 4-17 REACTOR HEAD LOAD PATH (V), TOP HEAD INSULATION STORAGE RACKS (P), SPECIMEN CONTAINER (A2), AND PLENUM & CORE BARREL (T)


ELEVATOR
30 TON
AUXILIARY
HOOK
180 TON
MAIN
HOOK
F
UP
DN
UP
A
O
PRESSURIZER
A
A2 RCP
A1 RCP
STEAM
GENERATOR
MUV-
MUV-42
HATCH
G
CFV-5
CFV-2
CFV-1
STUD IMPACT
WRENCH &
ADAPTER
S
STUD HOLE
SEAL PLUGS
& STUD SUPPORT
N

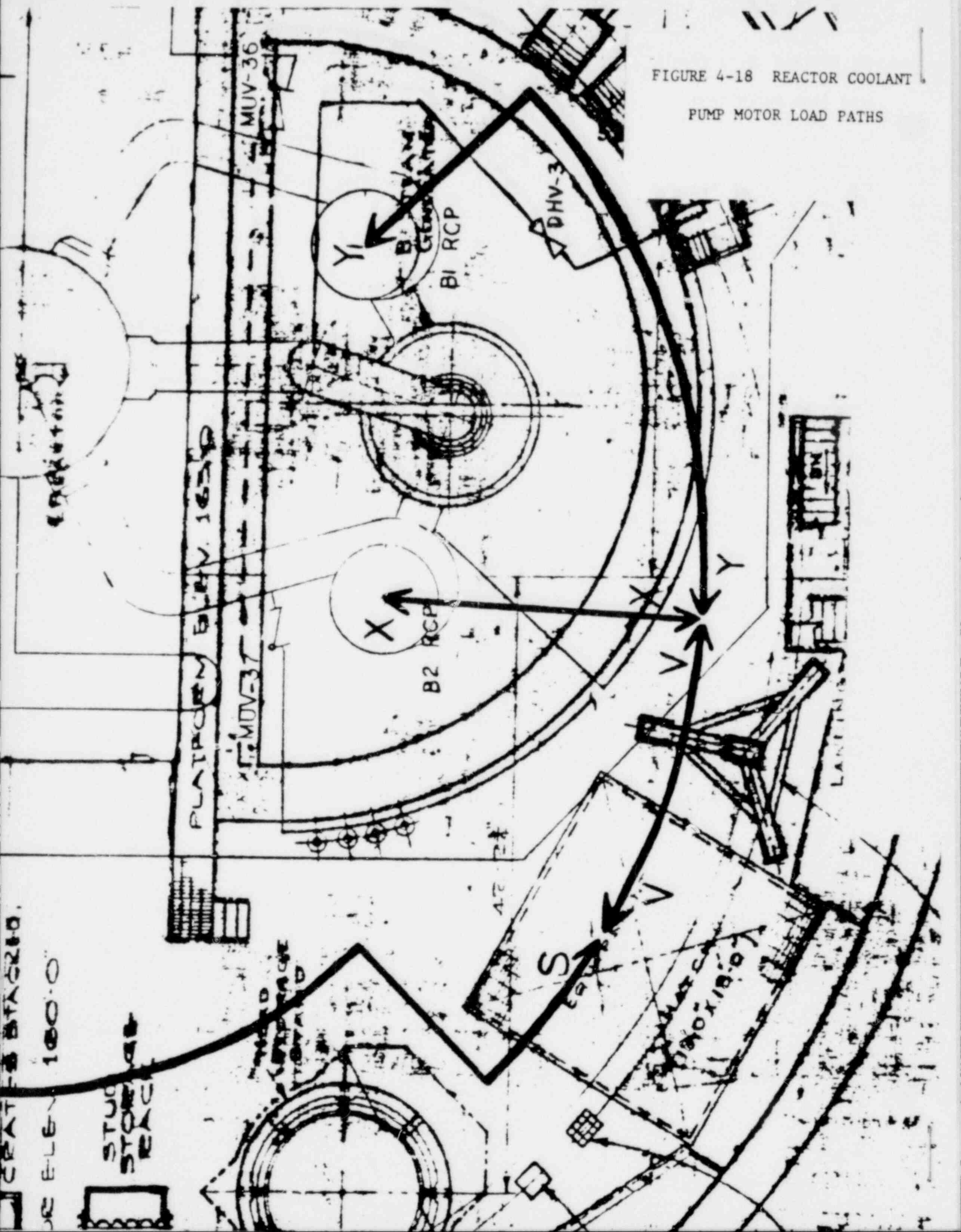
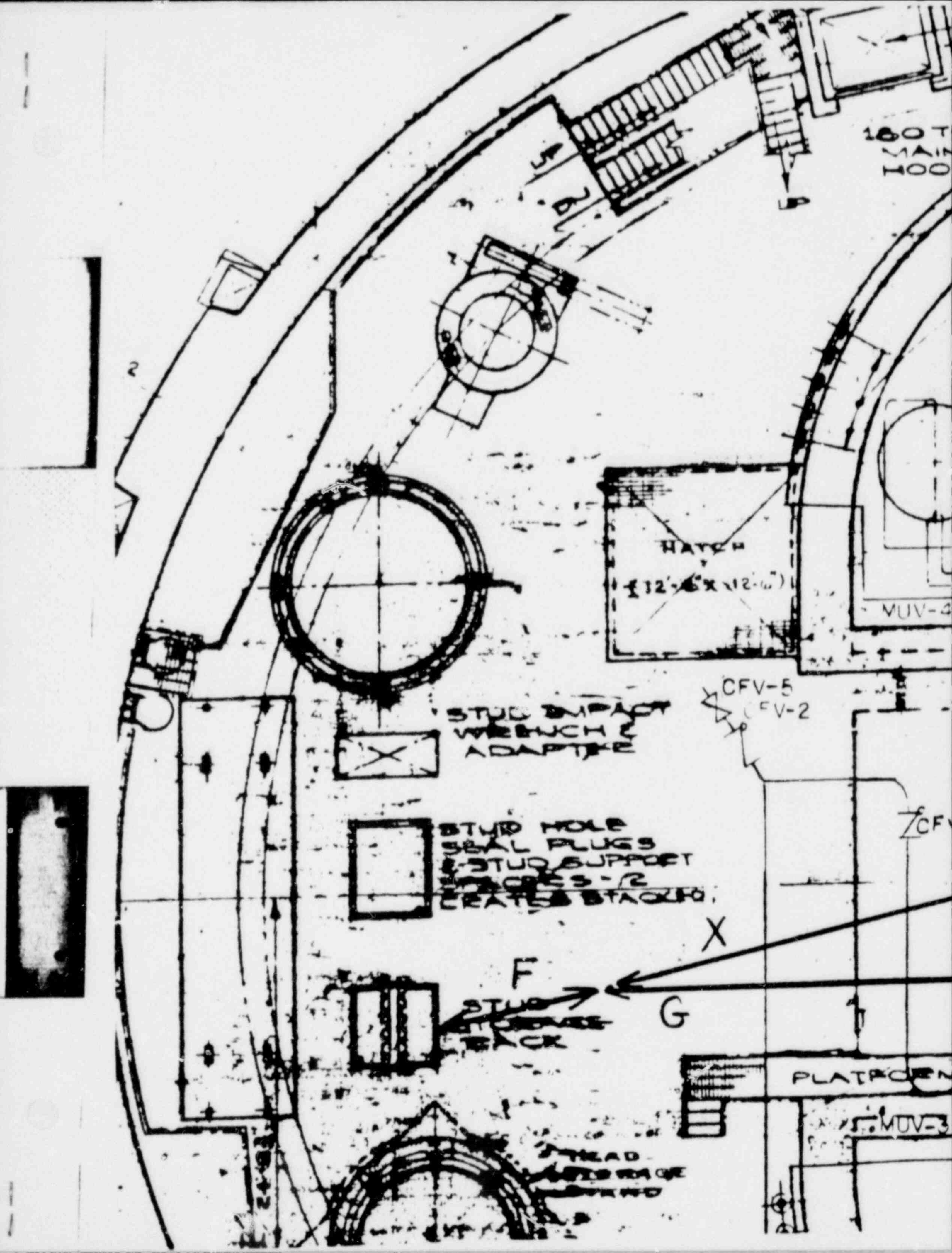


FIGURE 4-18 REACTOR COOLANT PUMP MOTOR LOAD PATHS


UP
DN
UP
HATCH
CFV-5
CFV-2
STUD IMPACT
WRENCH &
ADAPTER
STUD HOLE
SEAL PLUGS
& STUD SUPPORT
CRATES STACKED
X
F
G

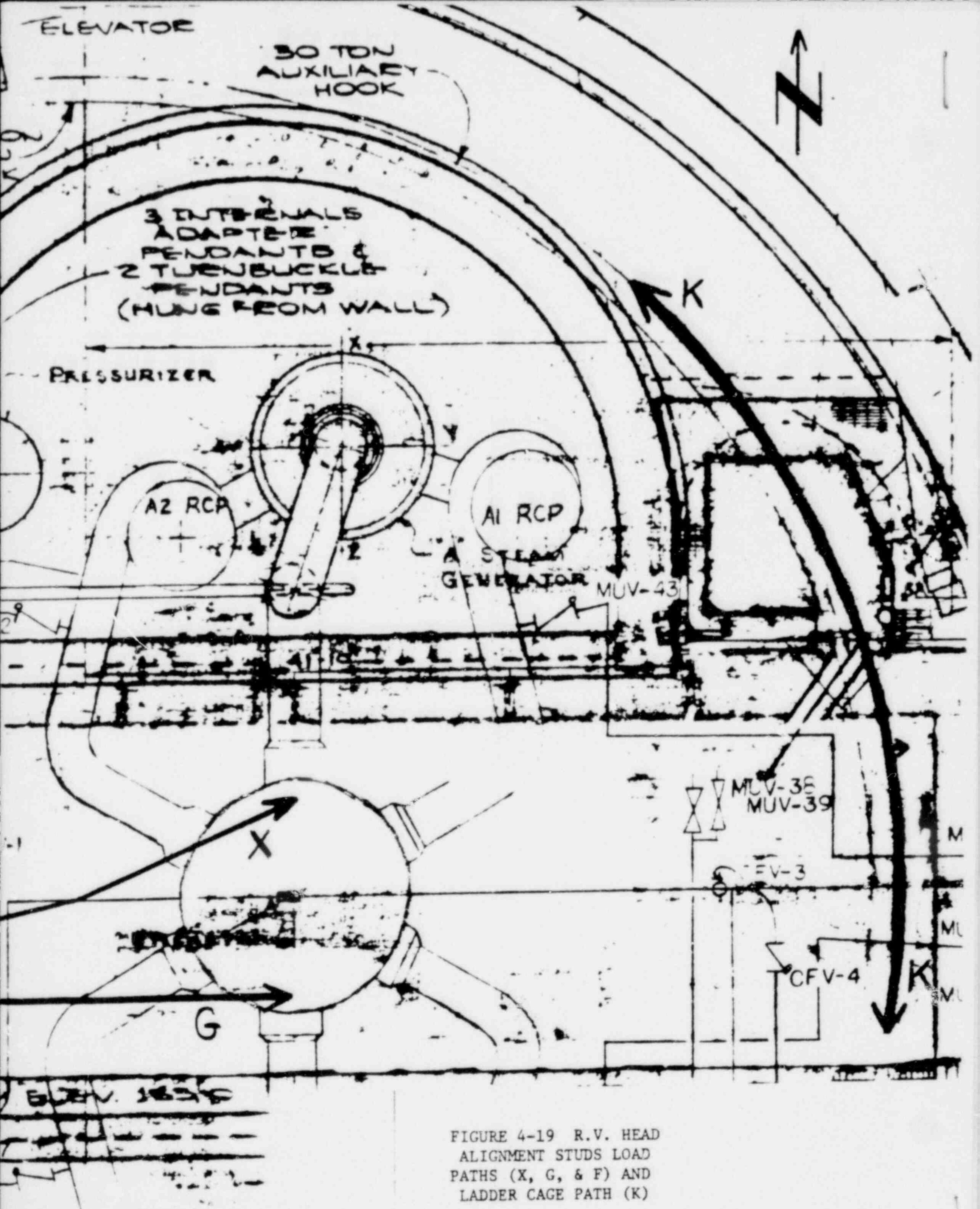
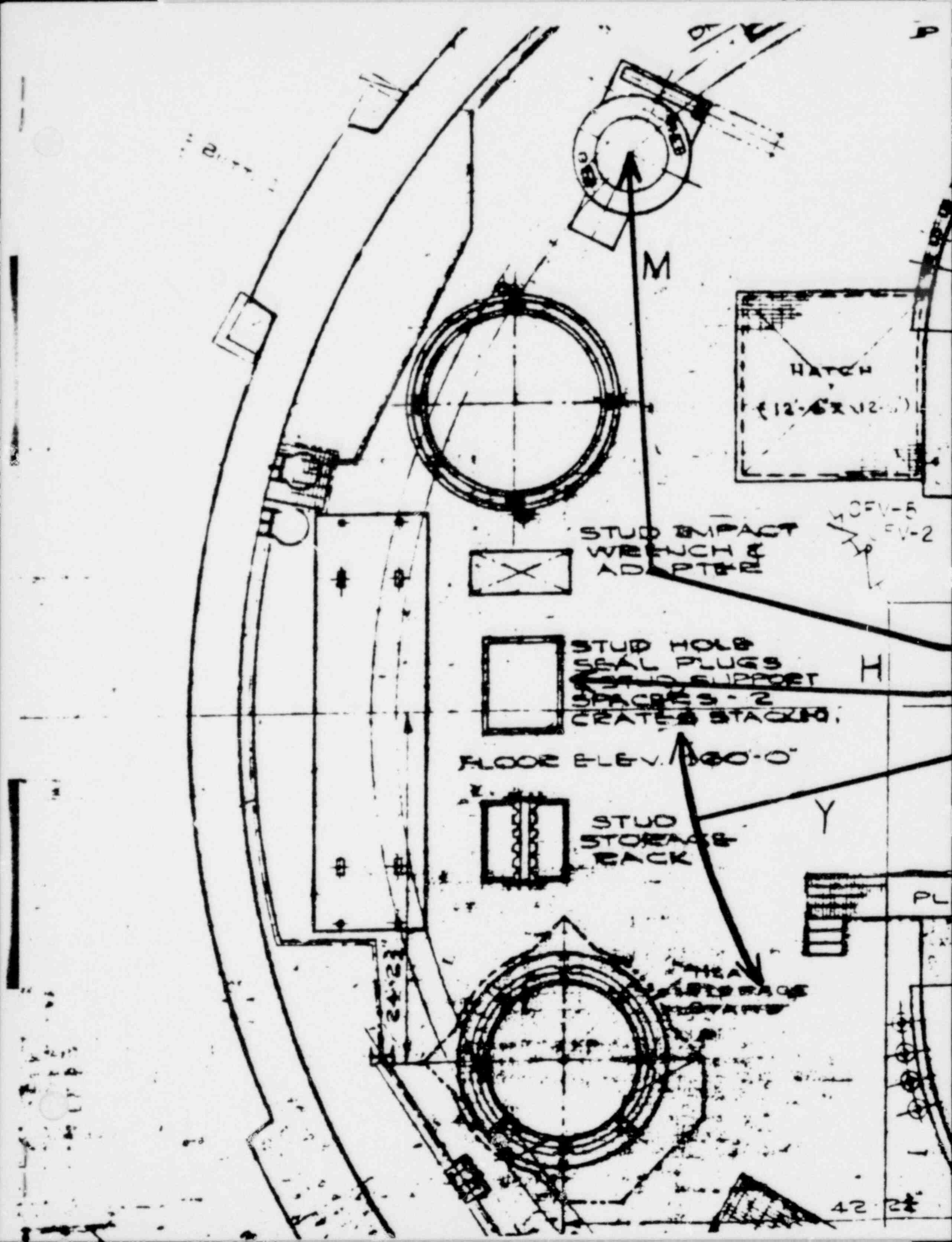


FIGURE 4-19 R.V. HEAD ALIGNMENT STUDS LOAD PATHS (X, G, & F) AND LADDER CAGE PATH (K)



M
HATCH
CFV-5
STUD IMPACT
WRENCH &
STUD HOLE
SEAL PLUGS
H
FLOOR ELEV.
STUD
Y
RACK

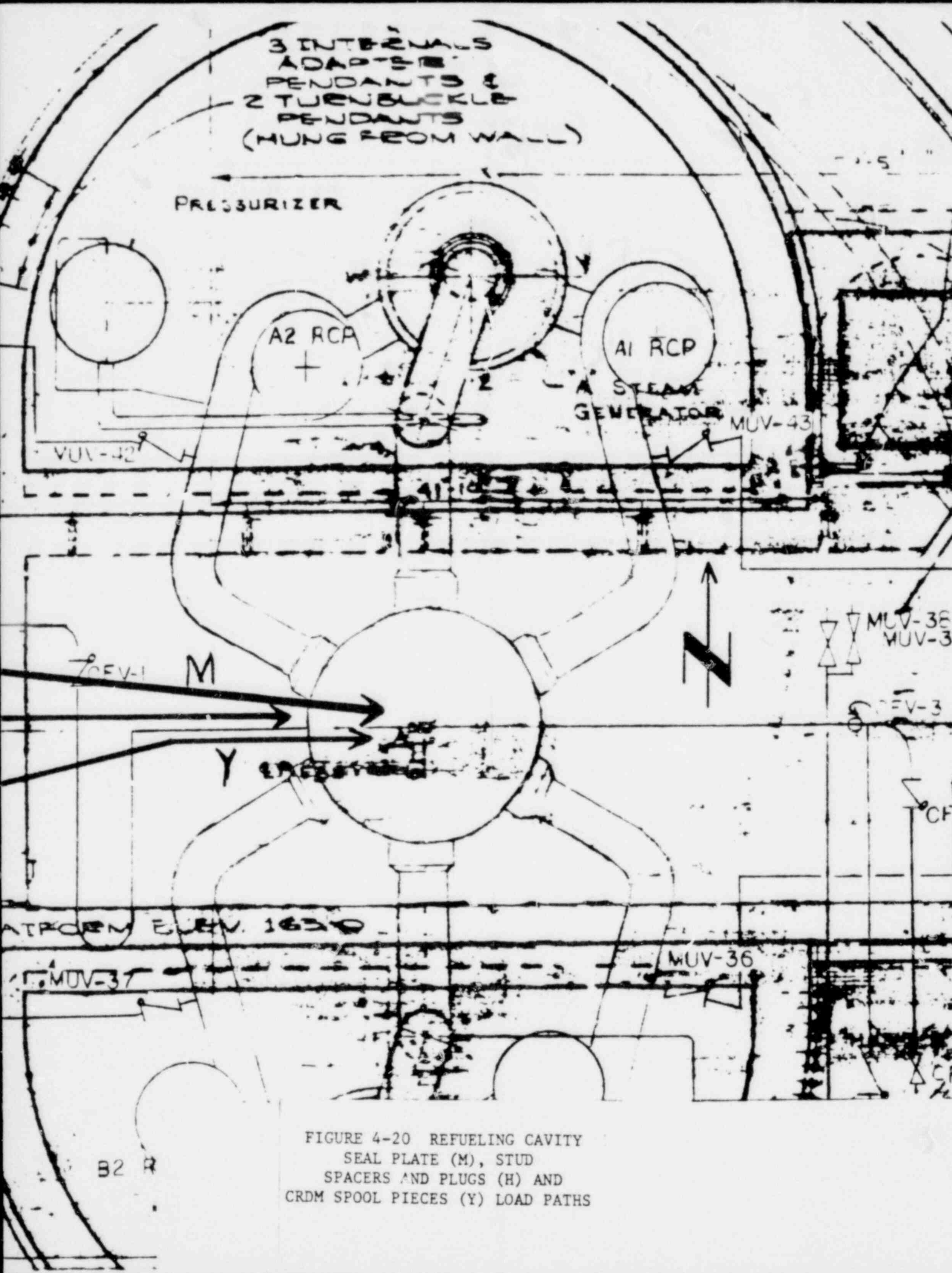
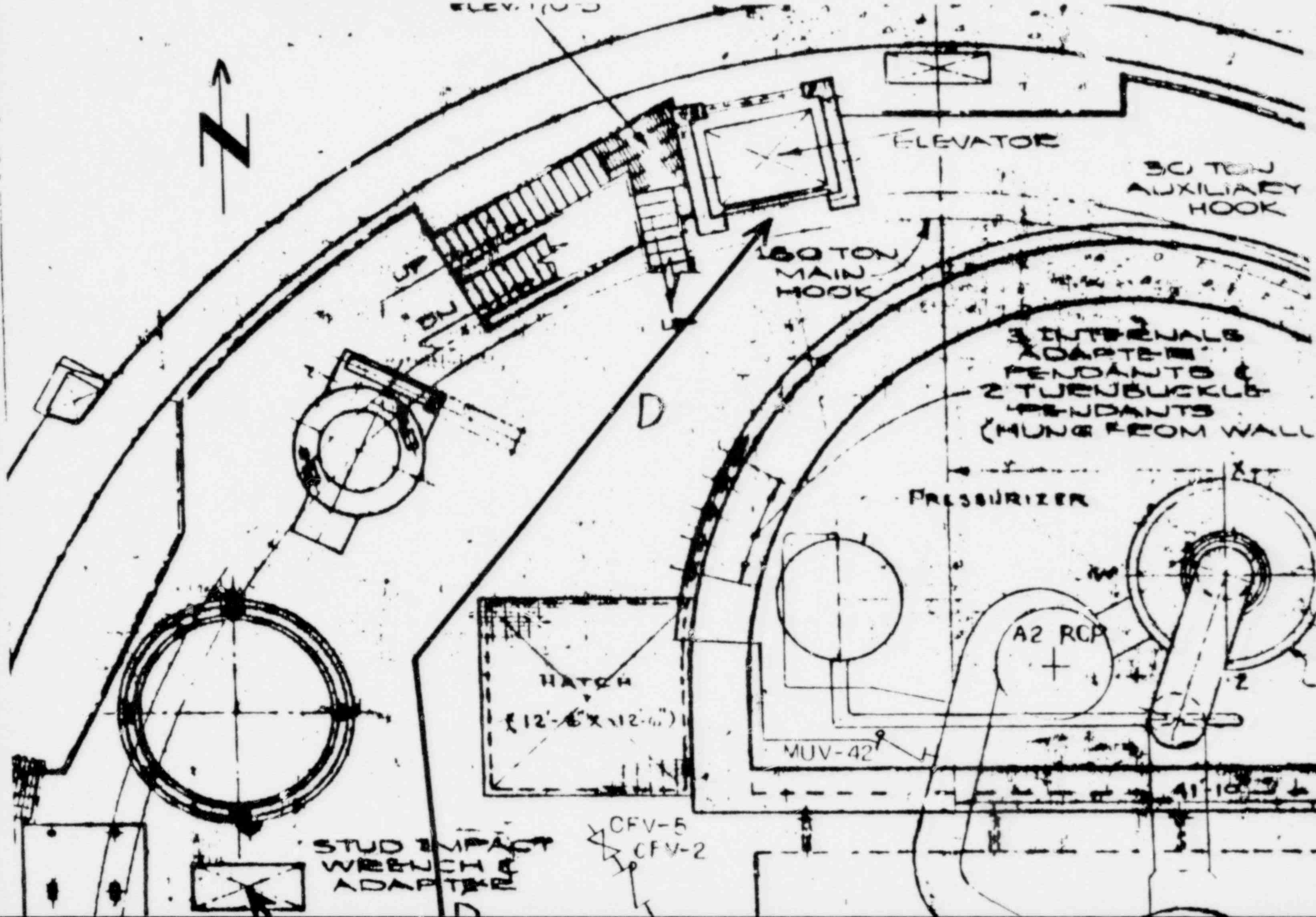


FIGURE 4-20 REFUELING CAVITY SEAL PLATE (M), STUD SPACERS AND PLUGS (H) AND CRDM SPOOL PIECES (Y) LOAD PATHS


N
ELEVATOR
30 TON AUXILIARY HOOK
160 TON MAIN HOOK
UP
DN
D
3 INTERNALS ADAPTER PENDANTS &
2 TURNBUCKLE PENDANTS
(HUNG FROM WALL
PRESSURIZER
A2 RCP
HATCH
(12'-6" X 12'-6")
MUV-42
CFV-5
CFV-2
STUD IMPACT WRENCH & ADAPTER

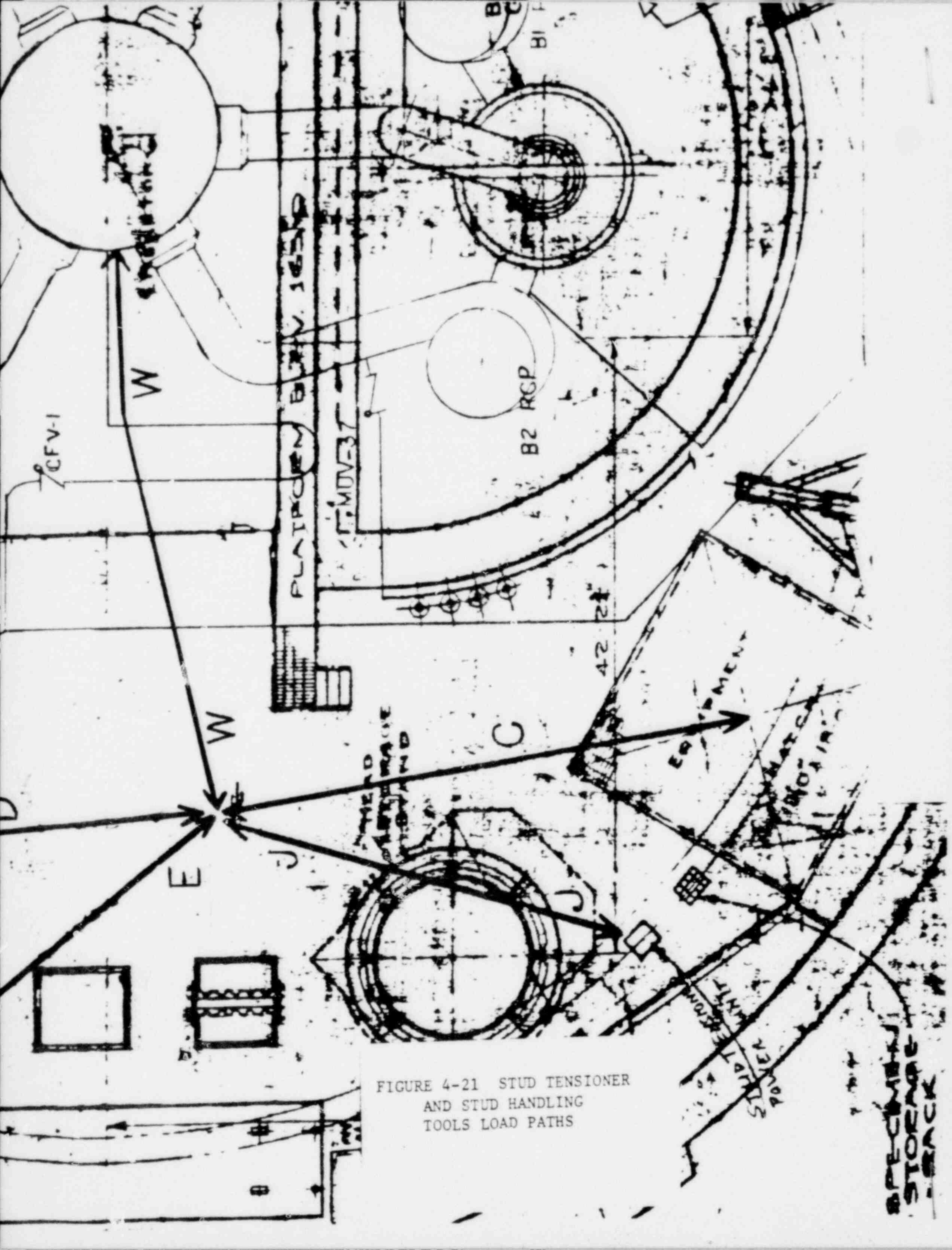
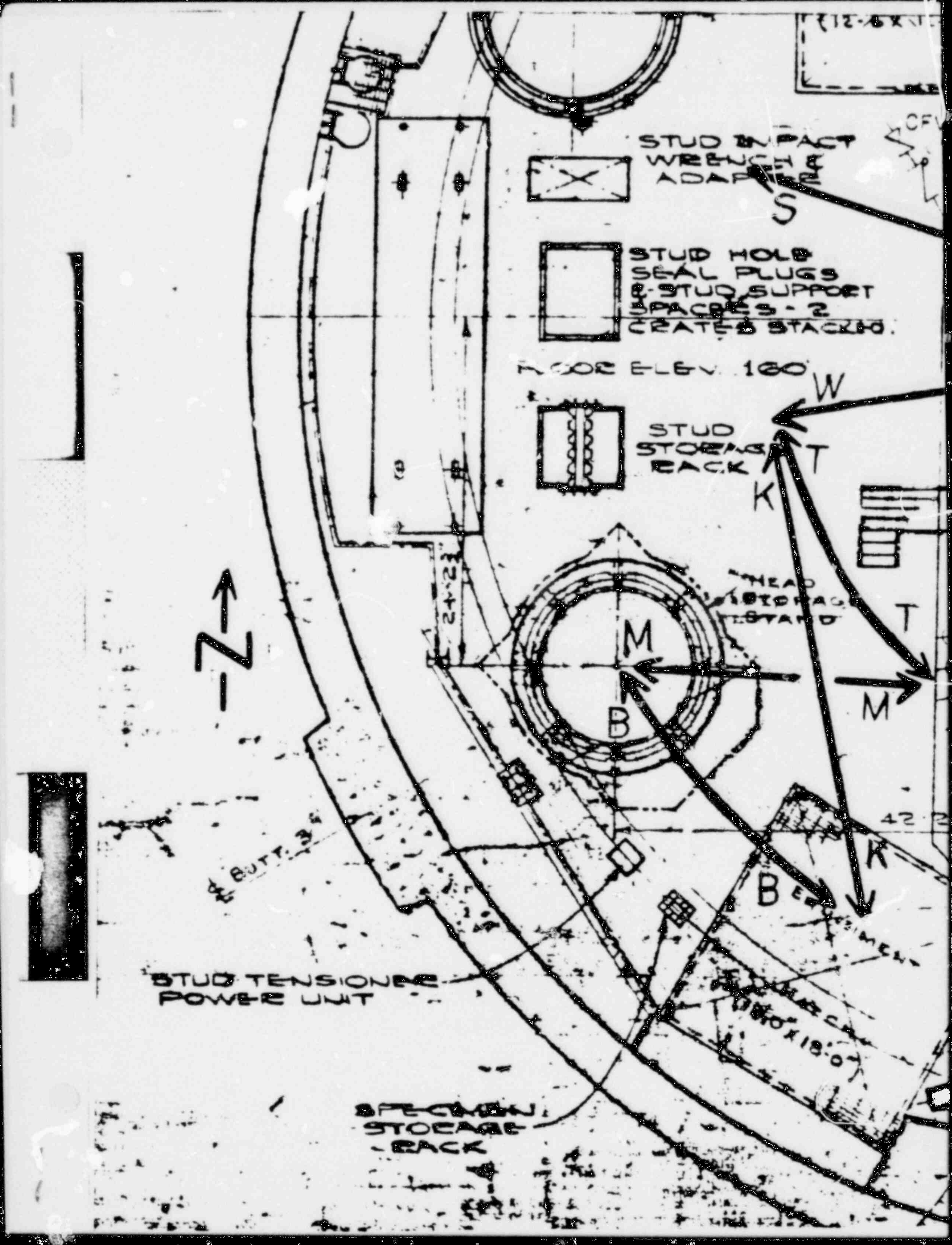


FIGURE 4-21 STUD TENSIONER AND STUD HANDLING TOOLS LOAD PATHS



STUD IMPACT WRENCH & ADAPTER
S
STUD HOLE SEAL PLUGS & STUD SUPPORT SPACERS - 2 CRATED STACKED
FLOOR ELEV. 160'
W
STUD STORAGE RACK
T
K
HEAD STORAGE STAND
M
B
N
STUD TENSIONER POWER UNIT
SPECIMEN STORAGE RACK

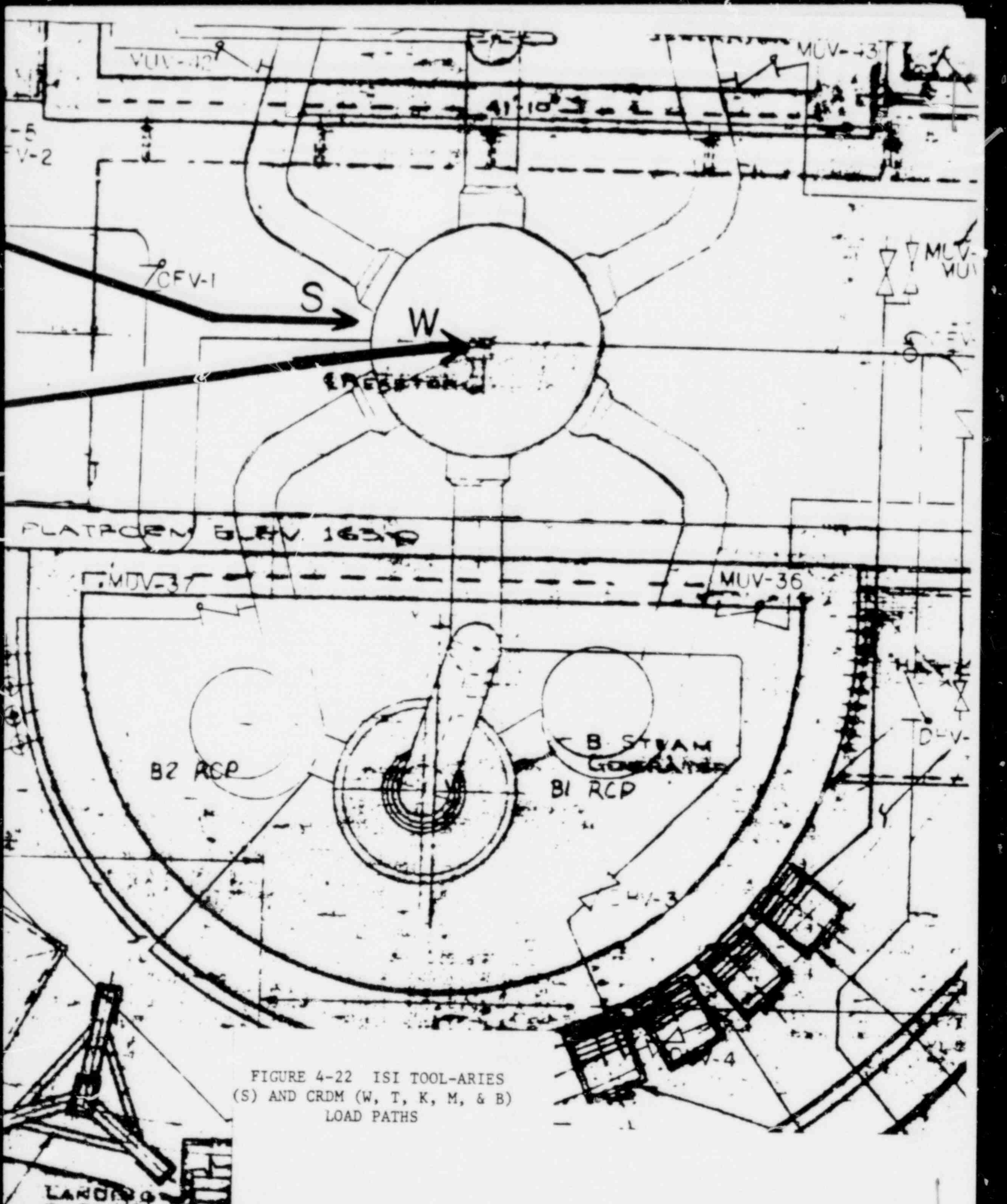
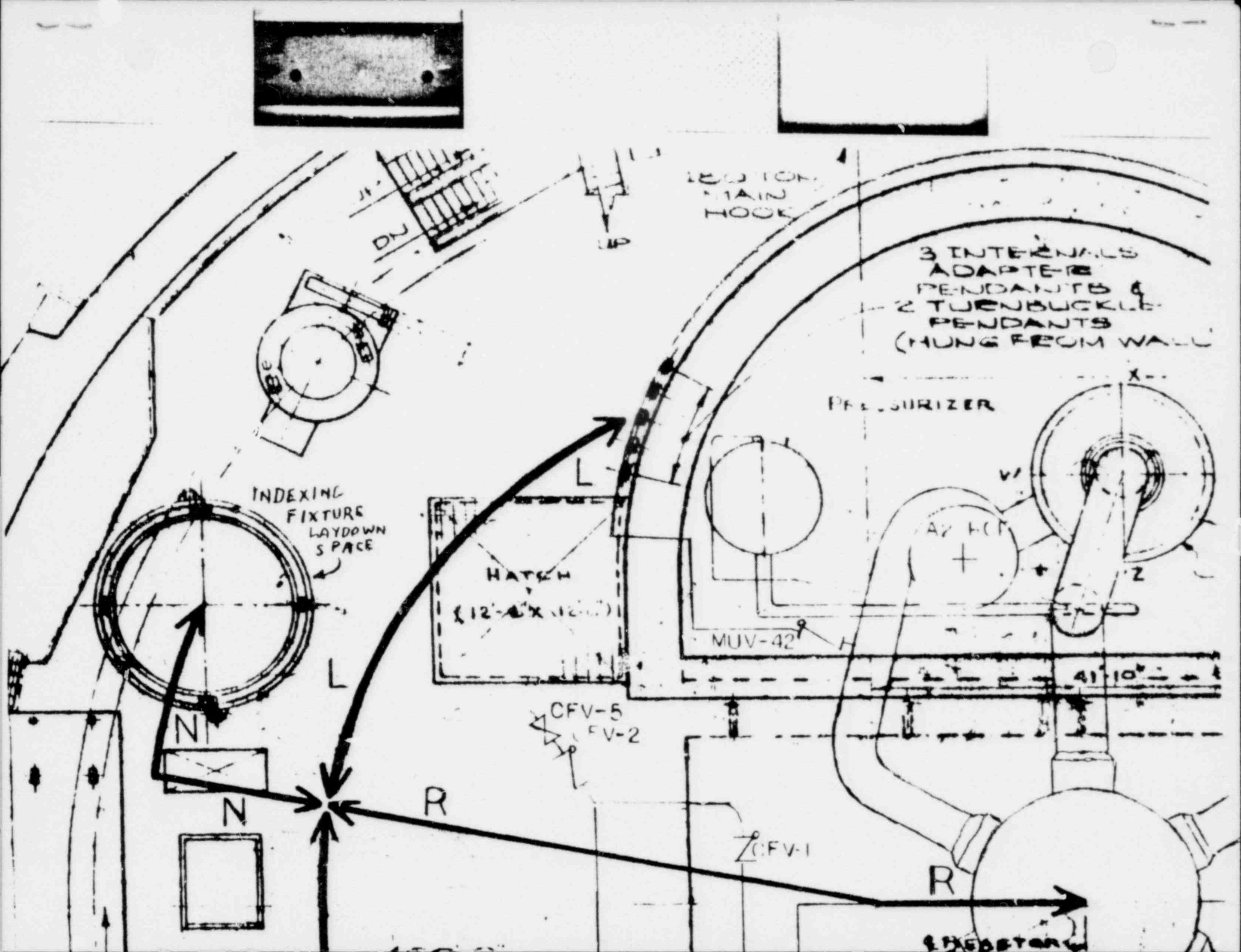


FIGURE 4-22 ISI TOOL-ARIES (S) AND CRDM (W, T, K, M, & B) LOAD PATHS



MAIN
HOOK
DN
UP
3 INTERNALS
ADAPTER
PENDANTS &
2 TURNBUCKLE
PENDANTS
(HUNG FROM WALL
PRESSURIZER
INDEXING
FIXTURE
LAYDOWN
SPACE
HATCH
MUV-42
41'-10"
CFV-5
CFV-2
CFV-1
L
L
N
N
R
R

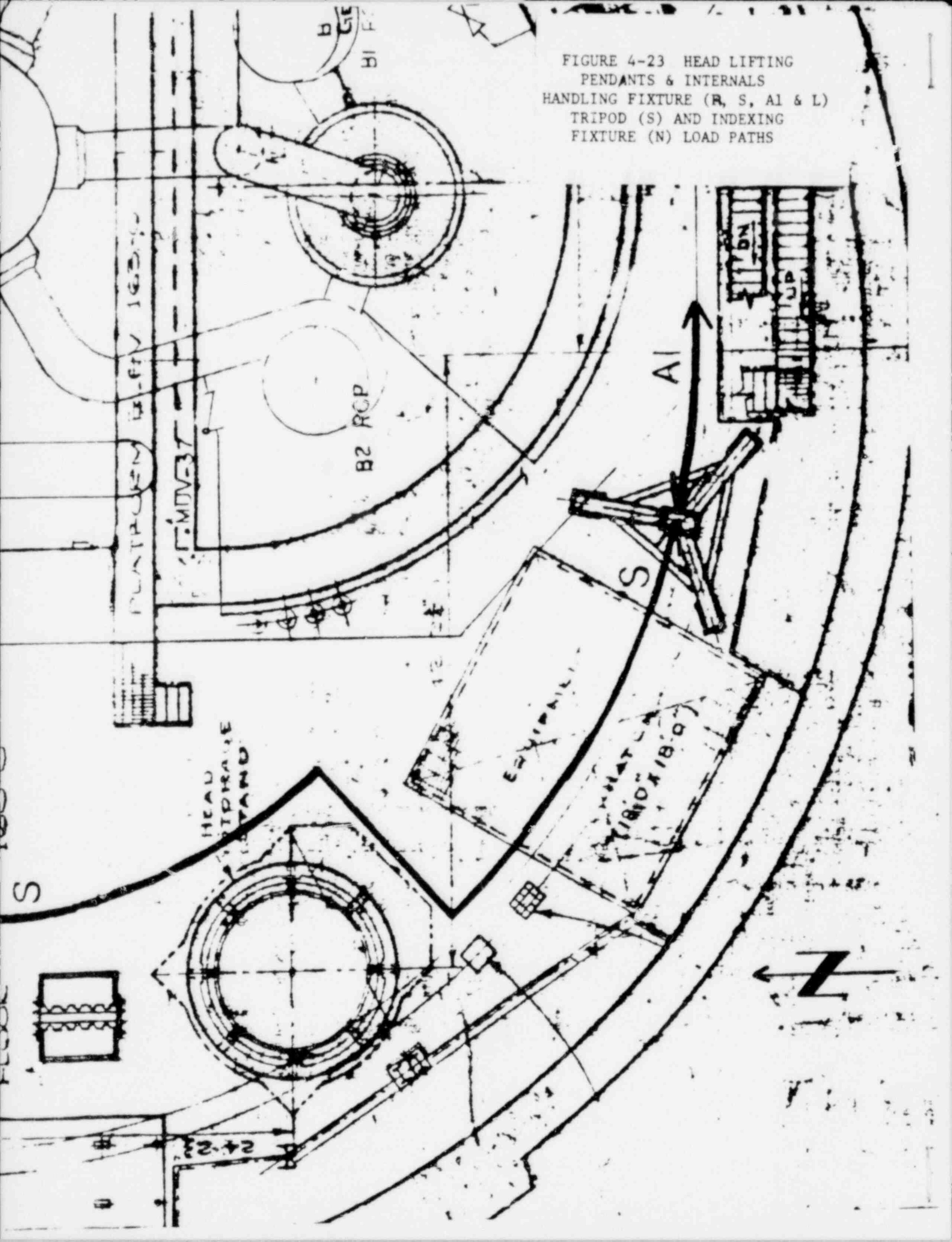
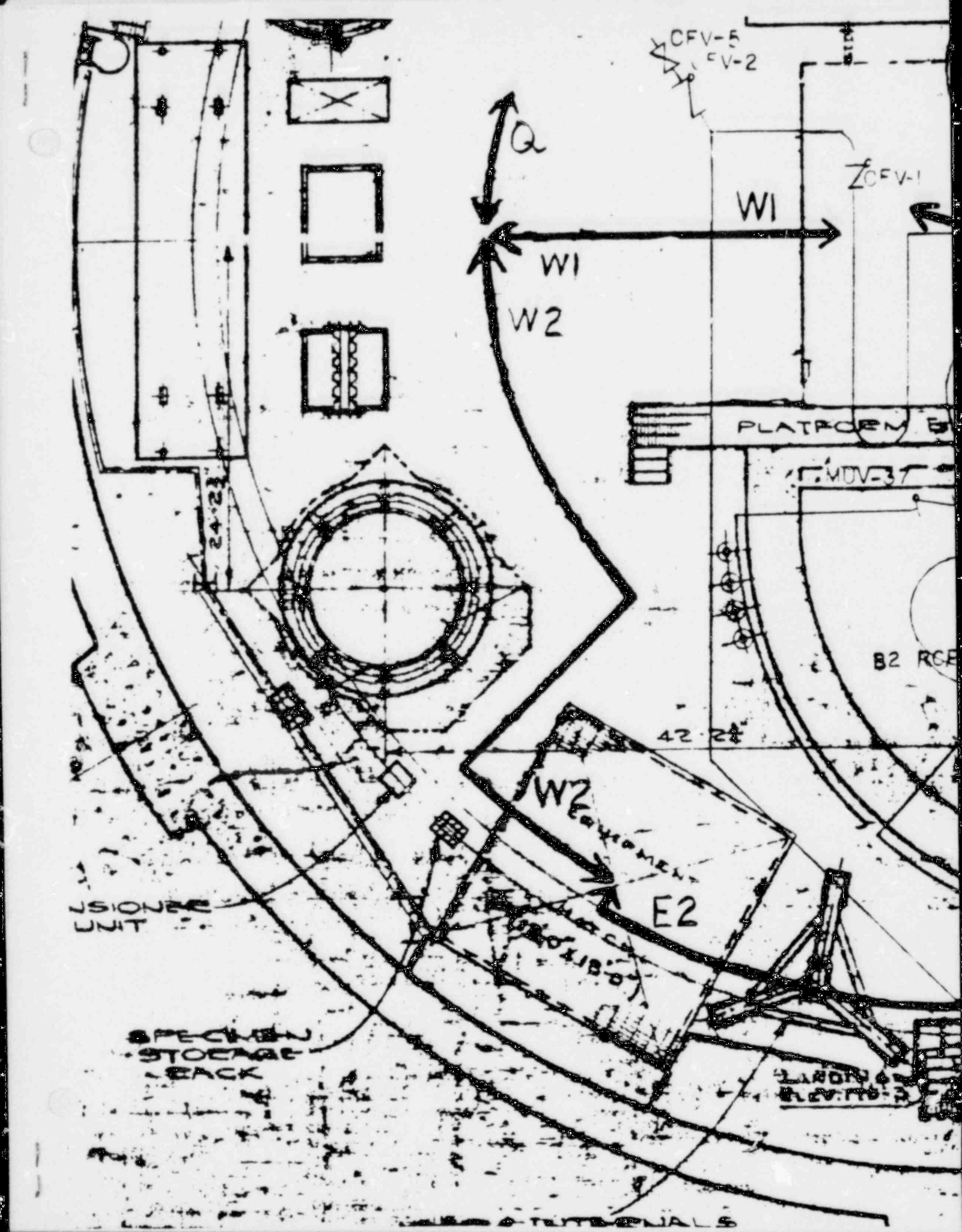


FIGURE 4-23 HEAD LIFTING PENDANTS & INTERNALS HANDLING FIXTURE (R, S, A1 & L) TRIPOD (S) AND INDEXING FIXTURE (N) LOAD PATHS


CFV-5
Q
W1
W1
W2
CFV-1
PLATFORM
MDV-37
W2
E2
UNIT

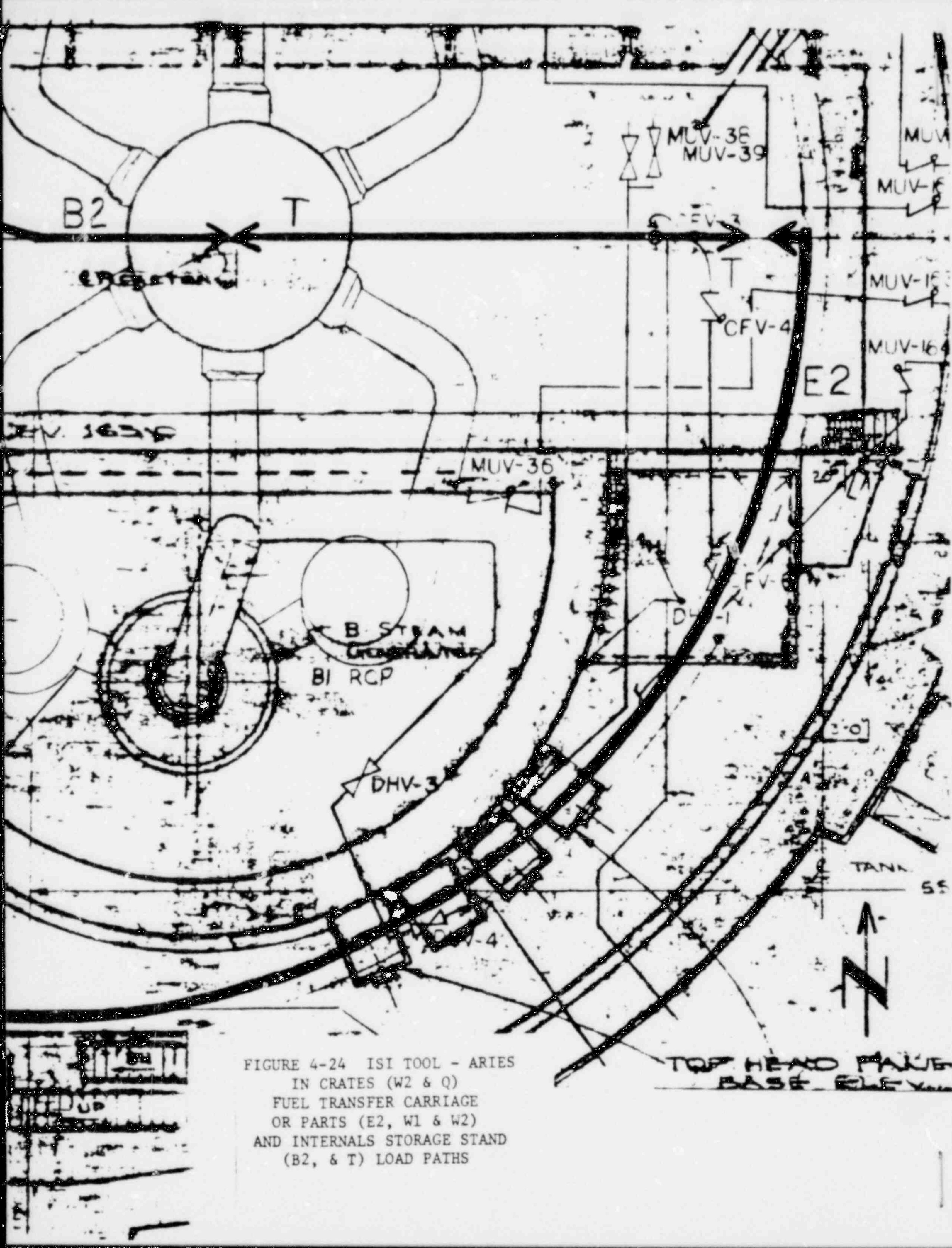


FIGURE 4-24 ISI TOOL - ARIES
IN CRATES (W2 & Q)
FUEL TRANSFER CARRIAGE
OR PARTS (E2, W1 & W2)
AND INTERNALS STORAGE STAND
(B2, & T) LOAD PATHS

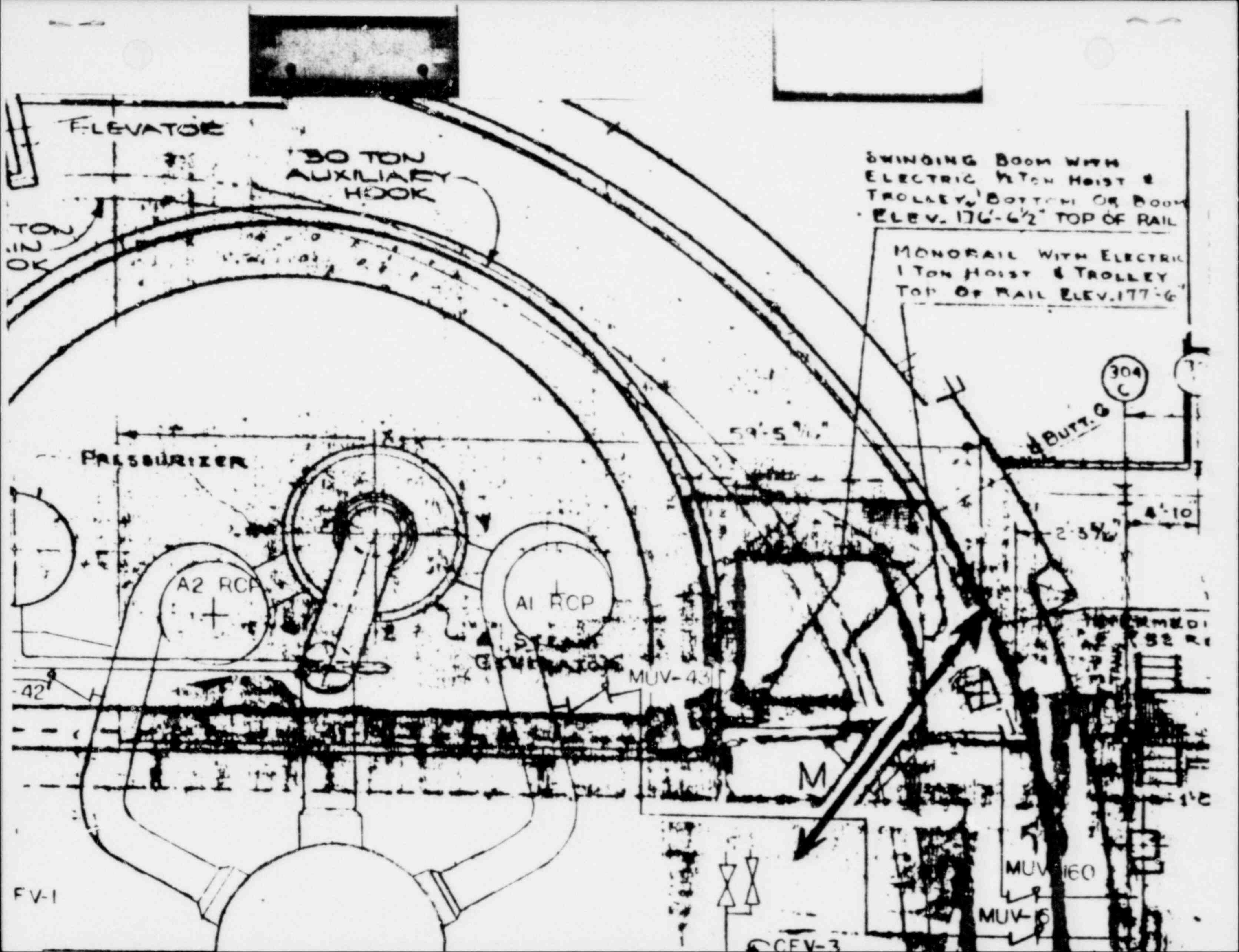
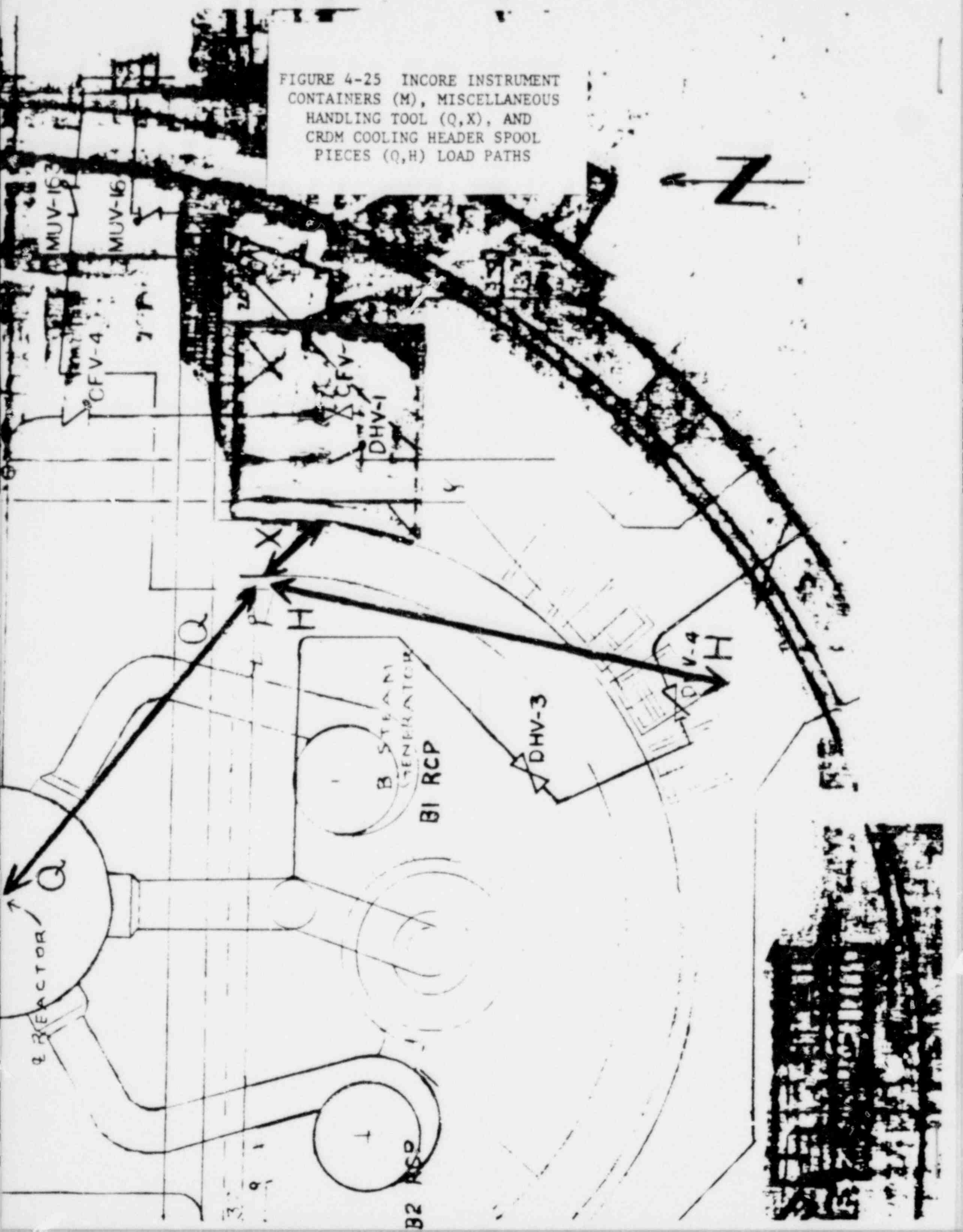
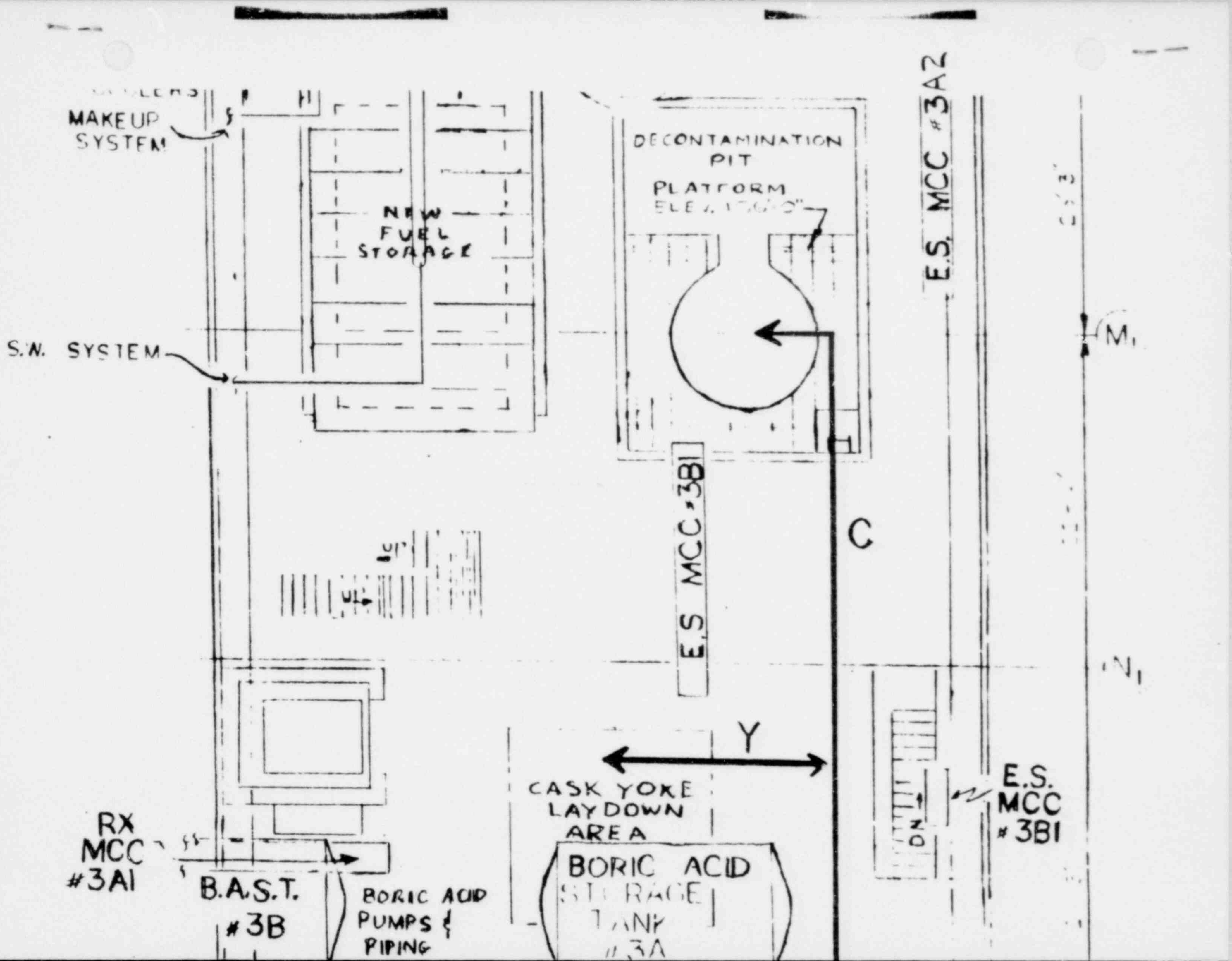

ELEVATOR
30 TON AUXILIARY HOOK
SWINGING BOOM WITH ELECTRIC ½ TON HOIST & TROLLEY
ELEV. 176'-6½" TOP OF RAIL
MONORAIL WITH ELECTRIC 1 TON HOIST & TROLLEY
TOP OF RAIL ELEV. 177'-6"
304 C
BUTT. G
59'-5
PRESSURIZER
4'-10
A2 RCP
A1 RCP
MUV-43
M
MUV-160
MUV-16
FV-1

FIGURE 4-25 INCORE INSTRUMENT CONTAINERS (M), MISCELLANEOUS HANDLING TOOL (Q,X), AND CRDM COOLING HEADER SPOOL PIECES (Q,H) LOAD PATHS




MAKEUP SYSTEM
NEW FUEL STORAGE
DECONTAMINATION PIT
PLATFORM
E.S. MCC #3A2
S.W. SYSTEM
M1
E.S MCC #3B1
C
UP
N1
Y
CASK YOKE LAYDOWN AREA
E.S. MCC #3B1
DN
RX MCC #3A1
B.A.S.T. #3B
BORIC ACID PUMPS & PIPING
BORIC ACID STORAGE TANK #3A

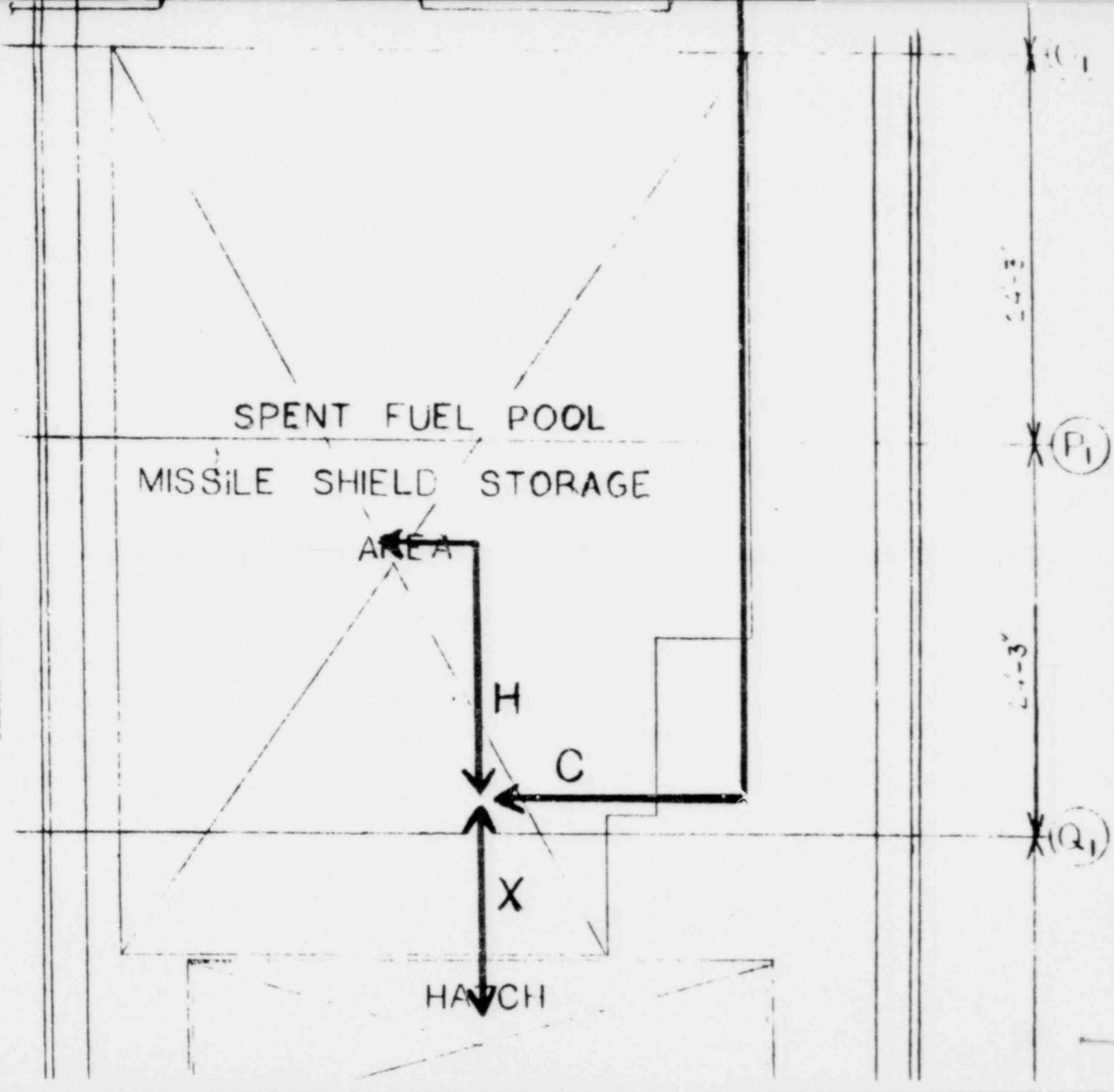
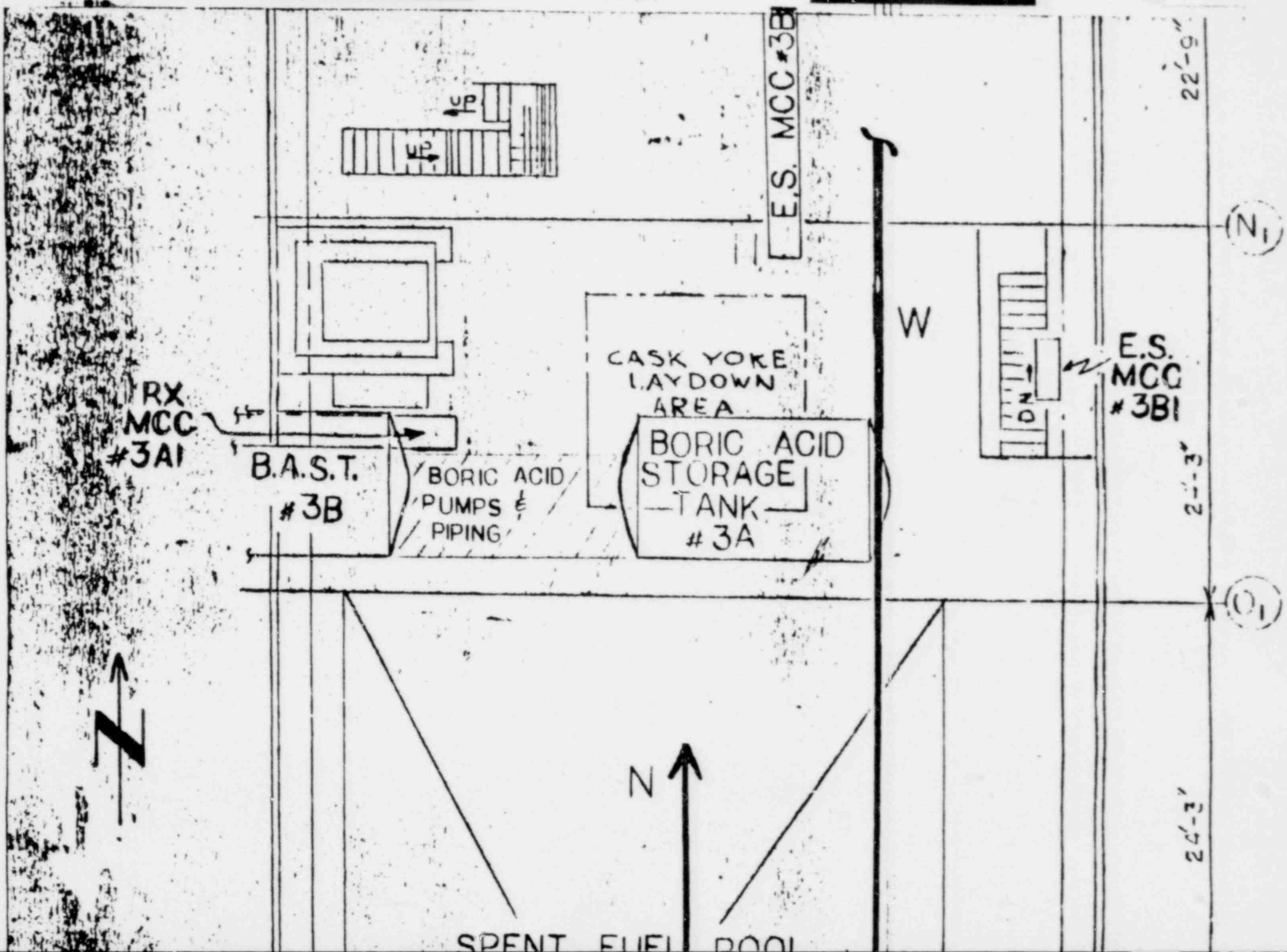


FIGURE 4-26 HATCH COVERS (X,H), CASK YOKE (Y,C,& X), AND SPENT FUEL CASK (X,C) LOAD PATHS


UP
UP
E.S. MCC #3B
W
N1
22'-9"
CASK YOKE LAYDOWN AREA
E.S. MCC #3B1
DN
RX MCC #3A1
B.A.S.T. #3B
BORIC ACID PUMPS & PIPING
BORIC ACID STORAGE TANK #3A
2'-3"
O1
N
24'-3"
SPENT FUEL POOL

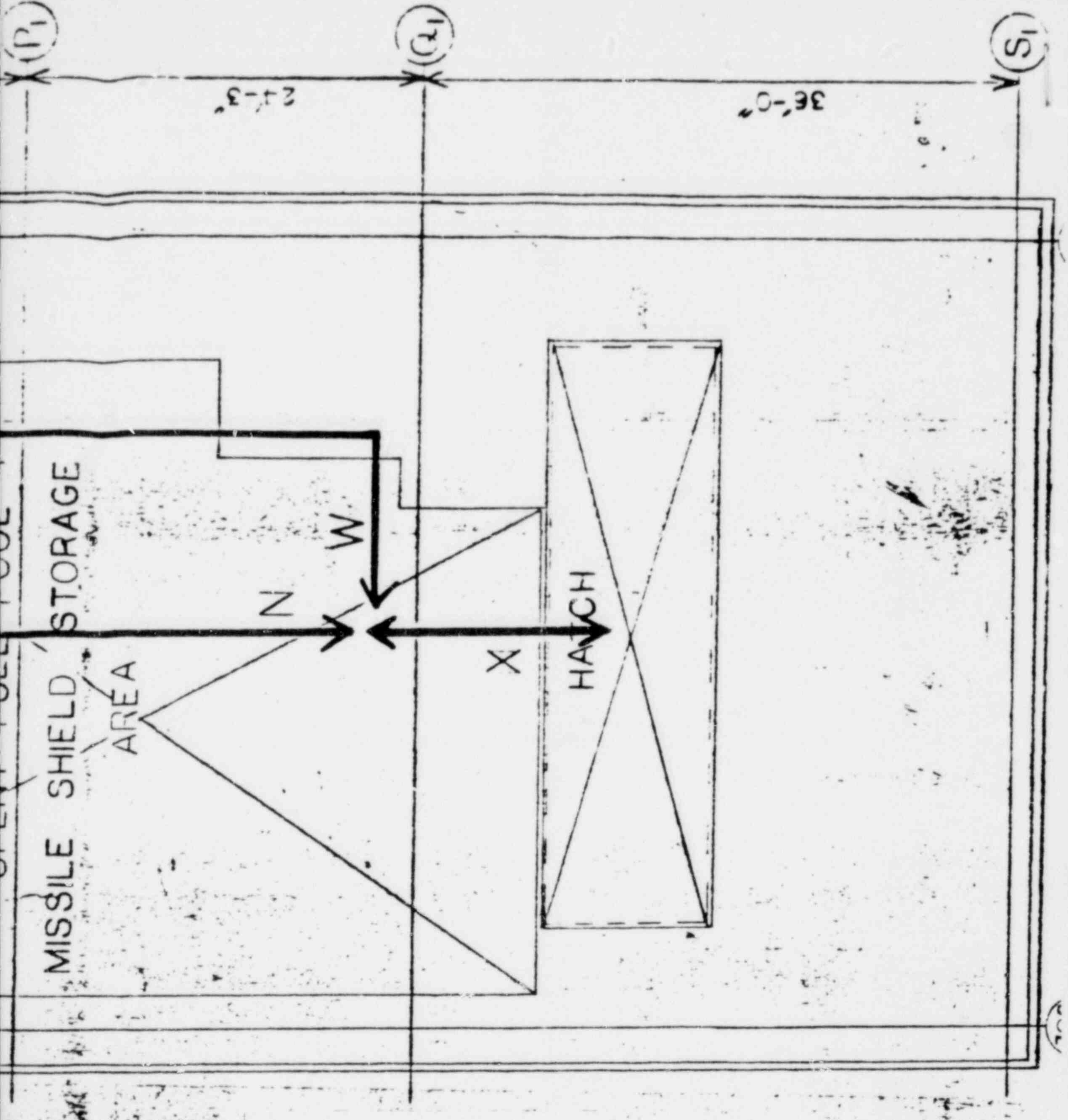
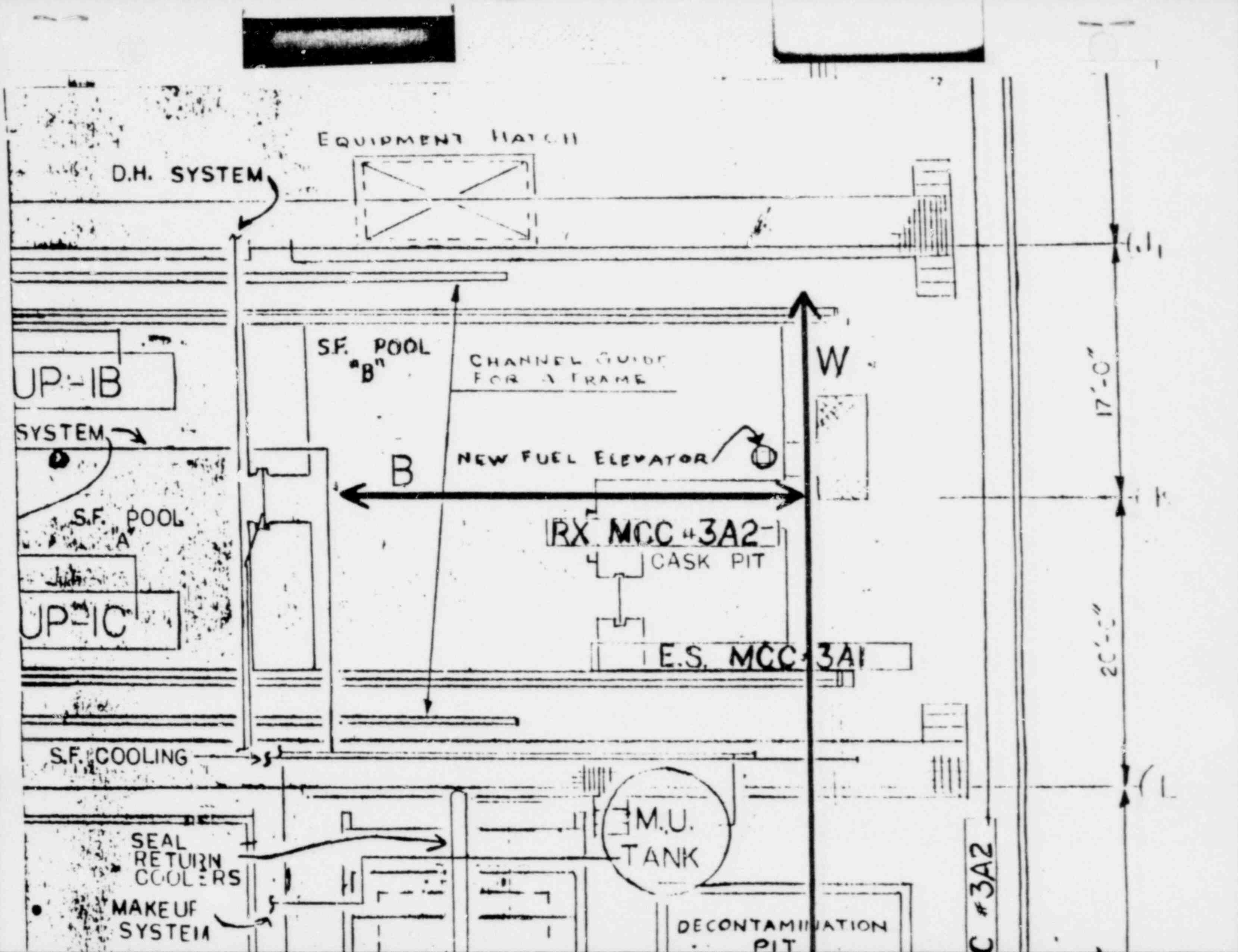


FIGURE 4-27 NEW FUEL SHIPPING
CASK (X,N) AND VARIOUS
MAINTENANCE LOADS TO
FUEL POOL (W,X) LOAD
PATHS


EQUIPMENT HATCH
D.H. SYSTEM
S.F. POOL "B"
CHANNEL GUIDE FOR A FRAME
W
UP-1B
SYSTEM
NEW FUEL ELEVATOR
B
S.F. POOL "A"
RX MCC #3A2
CASK PIT
UP-1C
E.S. MCC-3A1
17'-0"
S.F. COOLING
M.U. TANK
SEAL RETURN COOLERS
MAKEUP SYSTEM
DECONTAMINATION PIT
#3A2

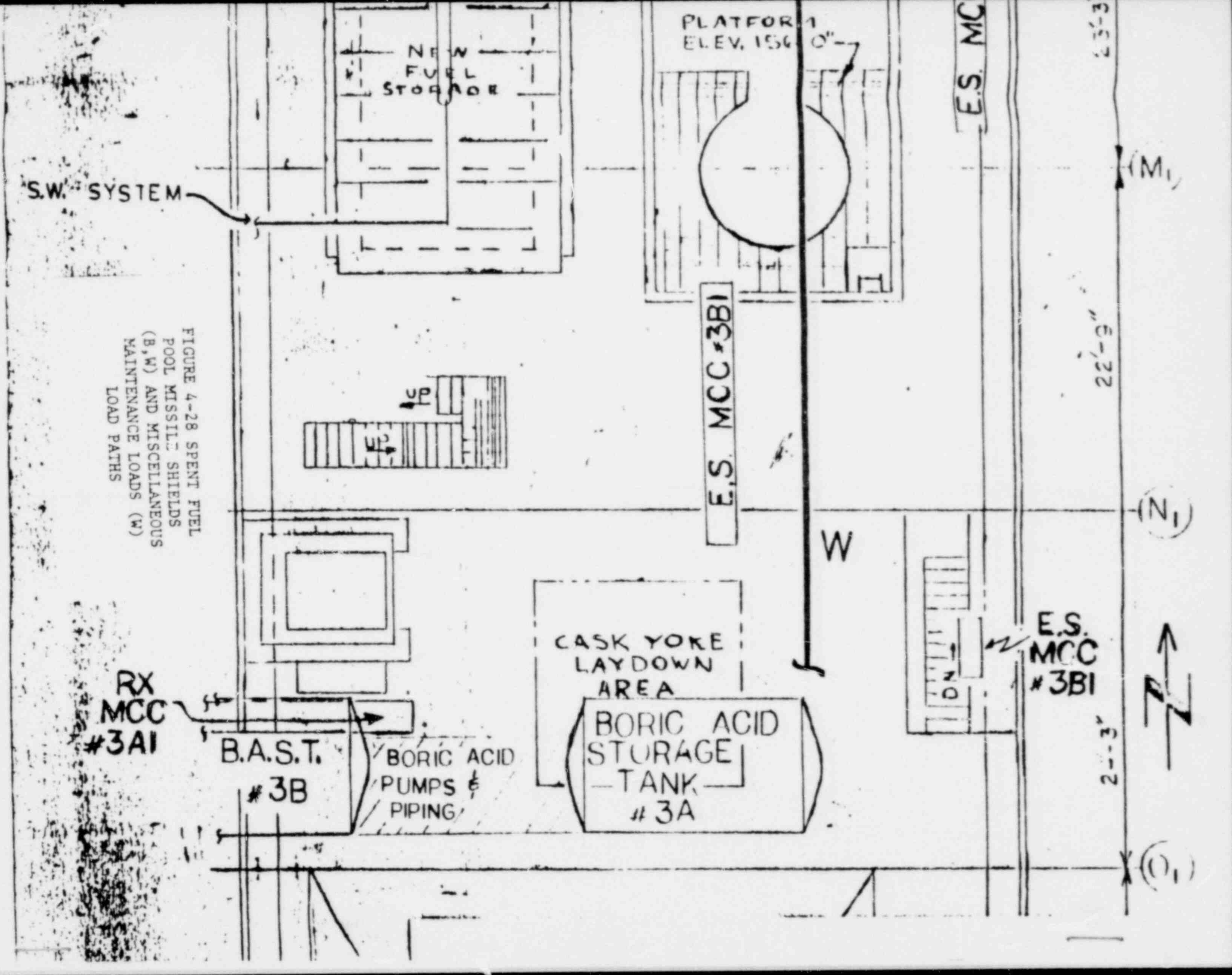
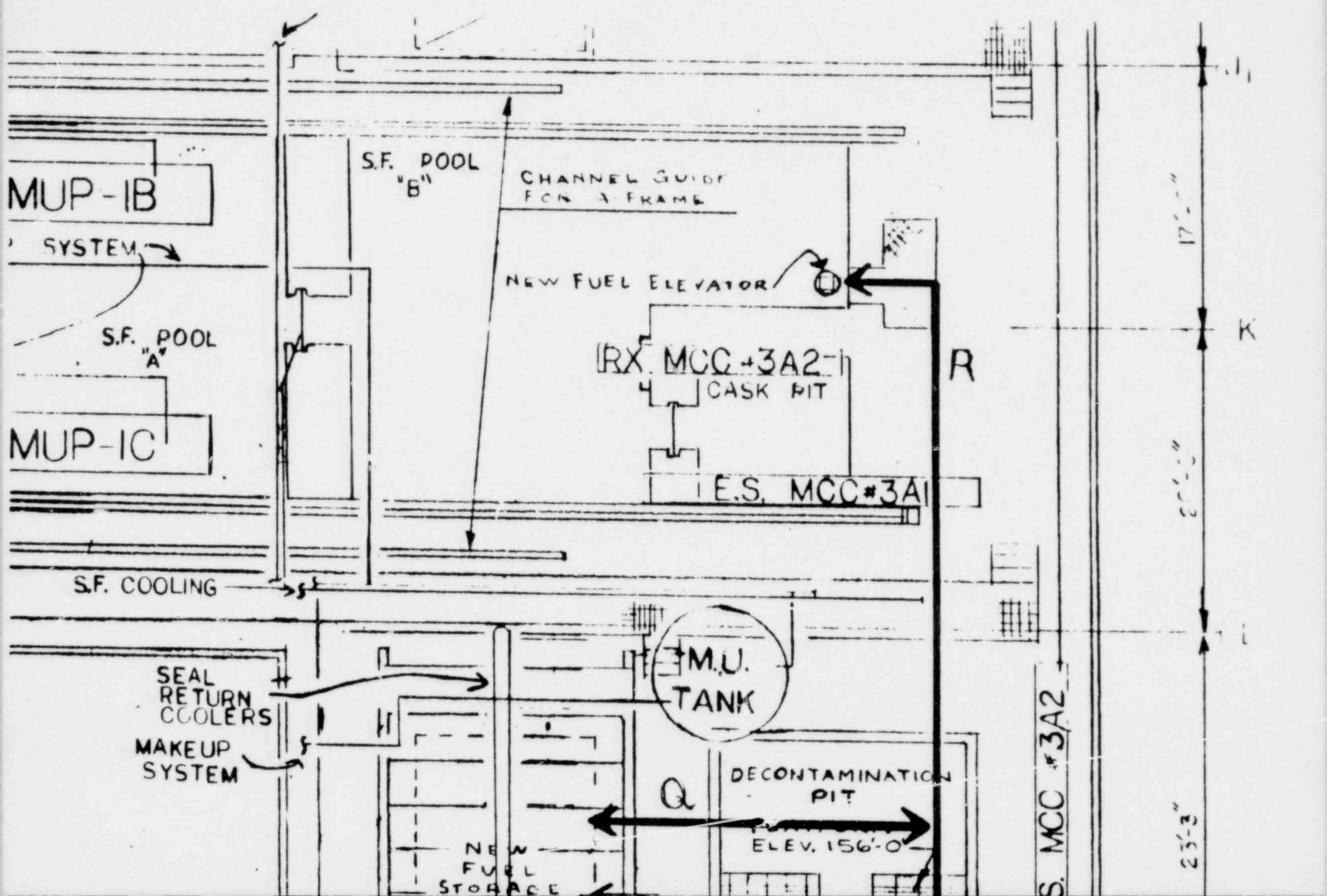


FIGURE 4-28 SPENT FUEL POOL MISSILE SHIELDS (B,W) AND MISCELLANEOUS MAINTENANCE LOADS (W) LOAD PATHS



S.F. POOL "B"
CHANNEL GUIDE FOR A-FRAME
MUP-IB
SYSTEM
NEW FUEL ELEVATOR
S.F. POOL "A"
K
RX. MCC #3A2-1
CASK PIT
R
MUP-IC
E.S. MCC #3A1
S.F. COOLING
M.U. TANK
SEAL RETURN COOLERS
MAKEUP SYSTEM
DECONTAMINATION PIT
Q
ELEV. 156'-0"
NEW FUEL STORAGE
S. MCC #3A2
17'-0"
23'-3"

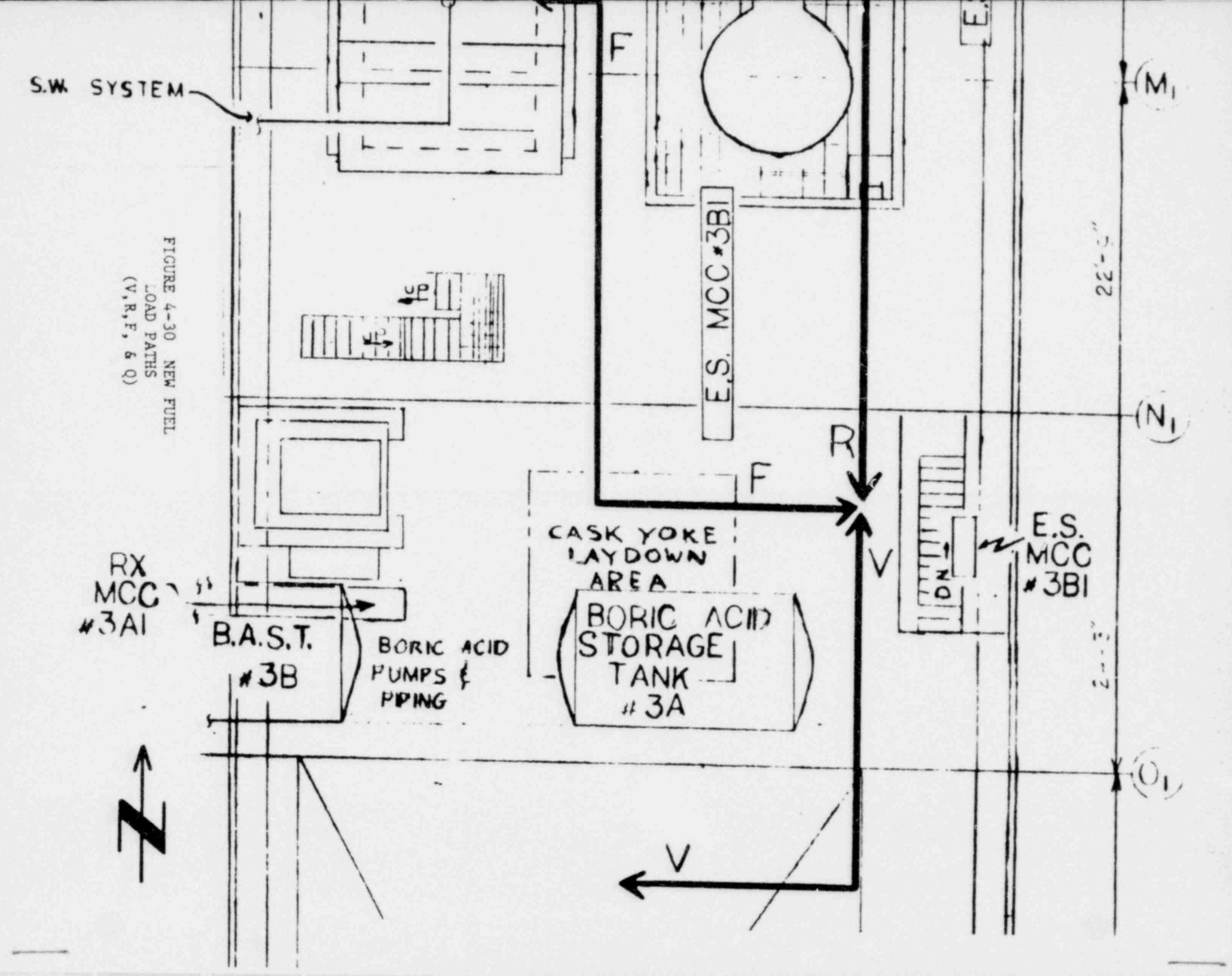


FIGURE 4-30 NEW FUEL LOAD PATHS (V,R,F, & Q)

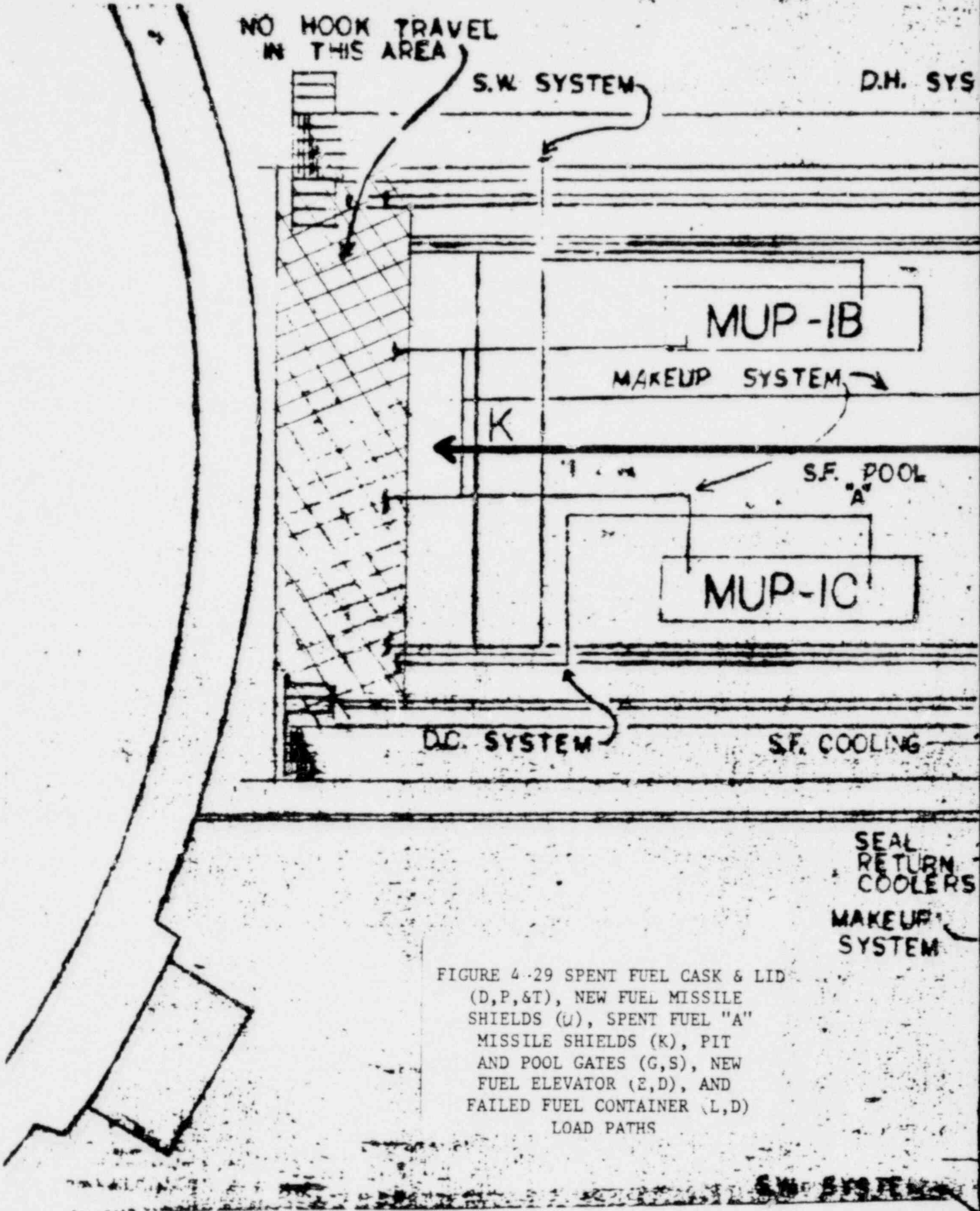
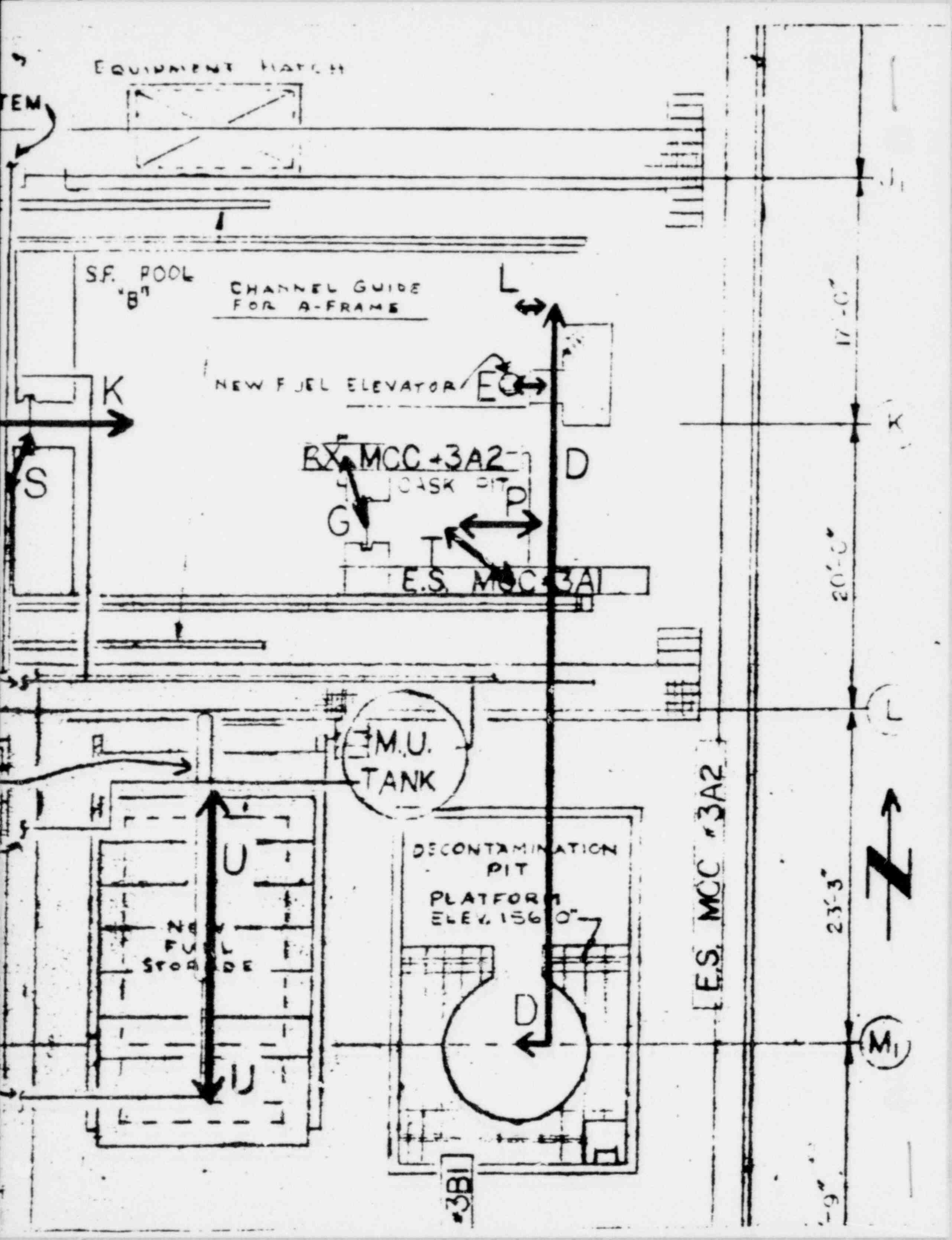


FIGURE 4-29 SPENT FUEL CASK & LID (D,P,&T), NEW FUEL MISSILE SHIELDS (U), SPENT FUEL "A" MISSILE SHIELDS (K), PIT AND POOL GATES (G,S), NEW FUEL ELEVATOR (E,D), AND FAILED FUEL CONTAINER (L,D) LOAD PATHS


EQUIPMENT HATCH
S.F. POOL "B"
CHANNEL GUIDE FOR A-FRAME
NEW FUEL ELEVATOR
L
K
E
D
S
MCC #3A2
CASK PIT
G
P
T
E.S. MCC #3A1
M.U. TANK
U
DECONTAMINATION PIT
PLATFORM ELEV. 156'0"
NEW FUEL STORAGE
D
E.S. MCC #3A2
#3B1
17'-0"
20'-0"
23'-3"
M1

Section 5

Lifting Device Compliance with ANSI N14.6-1978 and ANSI B30.9-1971

REQUESTED INFORMATION:

Verification that lifting devices identified in Section 4, comply with the requirements of ANSI N14.6-1978, or ANSI B30.9-1971 as appropriate. For lifting devices where these standards, as supplemented by NUREG 0612, Section 5.1.1(4) or 5.1.1(5), are not met, describe any proposed alternatives and demonstrate their equivalency in terms of load-handling reliability.

RESPONSE:

For the loads listed in the tables in Section 4 which utilize slings, the plant procedure governing the testing and use of slings is being revised to be in accordance with the requirements of ANSI B30.9-1971.

Only two lifting devices have been identified in the tables in Section 4. These are:

1. The reactor vessel head and internals lifting device.

2. The spent fuel pool missile shield lifting beam.

The requirements of ANSI N14.6 are not considered applicable to the spent fuel pool missile shield lifting device in that if the handled load, ie. a spent fuel pool missile shield, is dropped it will float in the spent fuel pool and it can not sink to a pool depth where it could impact the spent fuel (Section 9.6.1.5 of the Crystal River FSAR).

The reactor vessel head and internals lifting device was designed and fabricated by the Babcock and Wilcox Company (B&W) using the B&W engineering practices in effect at the time. Since this preceded ANSI N-14.6-1978, it is difficult to make a strict interpretation of compliance with the standard in light of the fact that the lifting device is in use and that the existing documentation was not originally intended to meet the requirements of the ANSI standard.

Since the intent of NUREG-0612 is to verify the load handling reliability of the lifting device, our review of the lifting device's compliance to ANSI 14.6-1978 has been limited to specifically addressing those sections of the standard which have a direct bearing on the issue of load handling reliability. The following paragraphs discuss compliance with Sections 3 through 6 of ANSI 14.6.

Section 3 of ANSI N14.6, "Design", addresses the considerations made in for designing a new lifting device. The reactor vessel head and internals lifting device was designed to standard industry and B&W engineering and fabrication practices in effect at the time. Although no specific design specification was prepared and quality assurance requirements were not placed upon the design and fabrication of the device, B&W standard engineering and design practices plus B&W's knowledge of how the device would be used should adequately fulfill these requirements.

B&W has stated that the tripod, handling extensions and load slings were all designed to be capable of lifting three times the design capacity of the lifting device, 180 tons, without exceeding the yield strength of the materials used. Dynamic loading was not considered in the original design, however the excess design margin in static loading should account for any dynamic loading. The stress design factors are therefore in compliance with the ANSI 14.6 standard as supplemented by NUREG 0612. The lifting device slings are in accordance with ANSI B30.9-1971. With regards to Section 3.2.6 of ANSI N14.6, we have been unable to retrieve any information on materials testing from the files. The reactor vessel head and internals lifting device was designed specifically for handling the reactor vessel head and internals, therefore the design considerations of Sections 3.3, 3.4, 3.5 and 3.6 of ANSI N14.6 were all considered in the context of the design practices in use when the device was built.

Section 4 of ANSI N14.6, Fabrication, is directed at new fabrication. Reviewing this section in retrospect to the standard B&W manufacturing practices is not considered practical.

With regards to the owner's responsibilities in Section 5, "Acceptance Testing, Maintenance, and Assurance of Continued Compliance", the refueling and surveillance procedures address proper use and maintenance of the reactor head and internals device. Current inspection practices are carried out each refueling outage.

The tripod, handling extensions and load slings were initially subjected to an acceptance test of 255 tons. Considering that the critical lifts as defined by NUREG 0612 are the lift of the reactor head and lifting fixture (160 tons) and the lift of the core plenum and handling fixture (58 tons), the acceptance test initially performed greatly exceeded ANSI N14.6 requirements. All load bearing welds were also subjected to nondestructive examination.

Florida Power Corporation complies with Section 5.3, "Testing to Verify Continuing Compliance". Annual load testing to 150% of the maximum load is not practical; NDE testing of the lifting device is required prior to use in accordance with Section 5.1.3(2) of ANSI 14.6. Additionally, plant procedures specify that when initially lifting the head from the vessel, the load is held suspended 1 to 2 inches above the flange for several minutes while the rigging, the crane and the disconnection of control rod drives is checked. Following this, the reactor head is moved to its laydown area. Due to the inaccessability of containment, where the head and internals handling device is stored, inspections and testing requirements addressed in this section of the standard are interpreted as either a prior to use or refueling outage frequency and, not a specified number of months.

The applicability of Section 6, "Special Lifting Devices for Critical Loads" can not be determined at this time. ANSI N14.6 defines a critical load as:

> "Any lifted load whose uncontrolled movement or release could adversely affect any safety related system when such system is required for unit safety or could result in potential off site exposures comparable to the guidelines exposures outlined in Code of Federal Regulations, Title 10, Part 100".

The structural, impact, etc. analyses required to make such a determination are scheduled to be completed for the 9 month report.

In reviewing Section 6 against the reactor vessel head and internals lifting device, two problem areas are noted. Section 6.2.1 states that load-bearing members be designed with at least twice the normal stress design factor for handling a critical load. If this is interpreted to mean twice the requirements stated in Section 3.2.1.1, the reactor head and internals lifting device does not comply. Additionally, it would be extremely difficult to comply with the annual testing requirements stated in Section 6.3.1.

Section 6

Verification of Testing and Inspection

REQUESTED INFORMATION:

Verification that ANSI B30.2-1976, Chapter 2-2, has been invoked with respect to crane inspection, testing, and maintenance. Where any exception is taken to this standard, sufficient information should be provided to demonstrate the equivalency of proposed alternatives.

RESPONSE:

The Florida Power Corporation is currently in the process of upgrading the crane inspection, testing and maintenance procedures to meet the intent of ANSI B30.2-1976, Chapter 2-2. It is anticipated that these procedures will be in effect prior to the third refueling outage.(Reference letter from Baynard to Eisenhut dated May 14, 1981).

Section 7

Verification of Crane Design

REQUESTED INFORMATION:

Verification that crane design complies with the guidelines of CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976, including the demonstration of equivalency of actual design requirements for instances where specific compliance with these standards is not provided.

RESPONSE:

The design of the Reactor Building Polar Crane (RCCR-1), the Auxiliary Building Crane (FHCR-5) and the Intake Gantry Crane (CWCR-1) were reviewed with respect to the guidelines set forth in CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976. All three cranes were built in 1969 prior to the issuance of the CMAA and ANSI standards in accordance with the governing industry standard and practices in effect at that time, the "Specifications of the Electric Overhead Crane Institute" (E.O.C.I), and the detailed crane procurement specification prepared by Gilbert Associates, Inc. From these specifications it has been determined that the cranes are in compliance with CMAA Specifications 70 and ANSI B30.2 with the following qualifications.

Both ANSI and CMAA require that welding be performed in accordance with the latest edition of AWS D.1.1, "Structural Welding Code" and AWS D14.1, "Specifications for Welding Industrial and Mill Cranes". These current standards are more recent and were not available at the time of construction of these cranes. However the Whiting practices and procedures for the welding were in accordance with AWS standards in effect at the time of construction and are considered equivalent to the current standards.

The cranes structural members were fabricated from A-36 structural steel. The E.O.C.I specifications to which the crane was built allowed the crane manufacturer to use a higher stress design factor than 16,000 psi for A-36 steel. In recent discussions with the Whiting Corporation, we have not been able to determine if the 16,000 psi design stress was used, which would make the cranes conservatively designed under CMAA standards, or whether a higher stress factor was used, which could possibly not be in full compliance with CMAA Specification 70. The Whiting Corporation has been contracted to review this aspect of the crane design. The results of their review will be incorporated into the 9-month report. Since the cranes were all load tested to 125% of the rated capacity prior to use and since the heaviest load of concern, the 160 ton reactor vessel head lift, is less than rated crane capacity, the resolution of this matter will not adversely affect the load handling reliability of the cranes.

Section 8

Operator Training, Qualification and Conduct

REQUESTED INFORMATION:

Exceptions, if any, taken to ANSI B30.2-1976 with respect to operator training, qualification, and conduct.

RESPONSE:

Procedures and the training program for crane operators are being upgraded to meet the intent of ANSI B30.2-1976. It is anticipated that these procedures will be in effect prior to the third refueling outage (Reference letter from Baynard to Eisenhut dated May 14, 1981).