Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401
Telephone (612) 330-5500

July 7, 1982

Director
Office of Nuclear Reactor Regulation
U S Nuclear Regulatory Commission
Washington, DC 20555

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

Control of Heavy Loads (Revised Six Month Submittal)

Following discussions with the NRC staff the six month submittal dated September 30, 1981 has been revised and is attached. The September 30, 1981 letter was submitted in response to Mr Eisenhut's letter dated December 22, 1980, titled Control of Heavy Loads (Generic Letter 81-07).

The attached revised report replaces the September 30, 1981 (six month report) letter in its entirety and incorporates the item pertaining to the six month report included in the March 12, 1982 submittal concerning code comparisons.

The analysis of the special lifting devices (part of 2.1.3d) is not complete. In order to do these analyses information must be received from their manufacturer. Following the receipt of this information a detailed analysis must be completed. The target date for completion of this analysis is October 1, 1982.

This revision of the six month report necessitates the revision of the nine month report. The target date for the completion of this is also October 1, 1982.

David Musolf

David Musolf
Acting Head-Nuclear Support Services

DMM/TMP/bd

cc: Regional Administrator-III
NRR Project Manager, NRC
NRC Resident Inspector
G Charnoff

Attachment

A033

# CONTROL OF HEAVY LOADS

# NRC GENERIC LETTER 81-07

# REVISED SIX MONTH REPORT

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

JULY 7, 1982

## Table of Contents

RESPONSE TO REQUEST FOR
INFORMATION IN SECTION 2.1
GENERIC LETTER 81-07

Item 1 (NRC Question 2.1.1)

Report the results of your review of plant arrangements to identify all over-head handling system 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

A survey of the Monticello Plant was performed to identify the overhead handling systems that fall in the category referred to in Question 2.1.1. These handling systems are listed below:

| Location | Handling System | Main/Auxiliary | ID No.* |
|---|---|---|---|
| Turbine Building | Turbine Building Crane | 125/5 | 1 |
| Reactor Building | Reactor Building Crane | 85/5 | 2 |
| Drywell | SRV Drywell Monorail | 5 | 14 |
| Torus | Torus Monorail | 5 | 15 |
| Reactor Building | Torus Access Hatch Hoist & Lifting Lug | 2 | 28 |
| Intake Structure | Chlorine Container Monorail & Cylinder Grab | 2 | 31 |
| Reactor Building | Radwaste & Fuel Pool Shield Blocks Monorails | 5 | 36 |
| Reactor Building | Reactor Building Floor/ Equipment Drain Tank Hatch Lifting Device | 4 | 45 |
| Reactor Building | RCIC Pump Room Access Hatch Lifting Device | 4 | 53 |
| Reactor Building | Drott Mobile Crane | 3.5 | 62 |

* Identification number (ID No) used to identify overhead handling systems in attached tables and figures.

Item 2 (NRC Question 2.1.2)

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 decay heat removal.

Response

Table I lists the overhead handling systems which have been excluded from further consideration because of capacity or physical separation from any system or component required for plant shutdown or decay heat removal. In addition the following handling systems have been eliminated from consideration for the following reasons:

1. Reactor Recirc Pumps Monorail Motor Hoist (Capacity 32,000 lbs) ID No. 6

   The function of this load handling device is to assist in the assembly and disassembly of the Reactor Recirculation Pumps druing plant shutdown. This device is located in the drywell. The items handled by this handling device would typically consist of the Rx Recirc Pump Drive Motor and the individual parts of the Rx Recirc Pump as it is disassembled. The potential impact item of concern is the applicable loop of the Rx Recirc System. It is possible, but highly unlikely, that dropping the Rx Recirc drive motor could rupture the recirc system piping of the loop being repaired. When this device is used to disassemble a Rx Recirc Pump the applicable pump will be isolated. It is physically impossible to drop this heavy load and disable both Rx Recirc loops. Therefore this load handling device is eliminated because of system redundancy and sole purpose use.

2. HPCI Turbine Monorail (Capacity 8,000 lbs) ID No. 17

   The function of this load handling device is to assist in the assembly and disassembly of the HPCI turbine. This device would only be used when the HPCI system is not required to be operable per plant technical specifications. Any load handled by this load handling device could not impact on the redundant system to the HPCI system. The RCIC system would be available to makeup water to the Rx. Therefore this load handling device has been eliminated because of system redundancy and sole purpose use.

3. "A" Turbine Floor Portable A-Frame & Monorail (Cap. 10,000 lbs) ID No. 44

   The function of this load handling device is to assist in the assembly and disassembly of the turbine generator. This device is normally used to assemble and disassemble the turbine governor, bypass valves and the stop and control valves. This load handling device will only be used for this purpose when the plant is shutdown.

4. "A" RHR Pump Room Access Hatch Lifting Lugs(4) (Cap. 7,500 lbs ea) ID No. 54

These lifting lugs were installed during construction of the plant. They were used for various purposes during the construction phase. They have not been used for removal of the associated shield blocks or for RHR or Core Spray System equipment maintenance since the plant became operational. These lifting lugs are being removed.

5. "B" RHR Pump Room Access Hatch Lifting Lugs(4) (Cap. 7500 lbs ea) ID No. 55

These lifting lugs were installed during construction of the plant. They were used for various purposes during this construction phase. They have not been used for removal of the associated shield blocks or for RHR or Core Spray System equipment maintenance since the plant became operational. These lifting lugs are being removed.

6. "B" Turbine Building Portable A-Frame & Monorail (Cap. 10,000 lbs) ID No.61

The function of this load handling device is to assist in the assembly and disassembly of the turbine generator. This device is normally used to assemble and disassemble the turbine governor, bypass valves and the stop and control valves. This load handling device will only be used for this purpose when the plant is shutdown.

Item 3 (NRC Question 2.1.3)

With respect to the design and operation of heavy load handling systems in the reactor building and those load handling systems identified in the response to Question 1 above, provide your evaluation concerning compliance with the guide-lines of NUREG 0612, Section 5.1.1. The following specific information should be included in the reply:

Sub Question 2.1.3a

Drawings or sketches sufficient to clearly identify the locations of safe load paths, spent fuel and safe shutdown equipment.

Response

Drawings are attached that show the location of the reactor core, the spent fuel pool, safe shutdown equipment, and safe load paths.

Sub Question 2.1.3b

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

Response

Procedures are used to control the handling of loads by the Reactor Building Crane and the Turbine Building Crane. These procedures define the path of movement that is to be followed for each load handled by these cranes. As a part of the interim work for the control of heavy loads, (enclosure 2 of Nuclear Regulatory Commission letter dated 22 December 1980), these procedures were reviewed and revised, as necessary, to ensure that the load paths defined in the procedure were safe load paths. These procedures require prior approval by the Operations Committee of any deviations from the designated load path.

Designated safe load paths have not been marked on the floor for the reactor and turbine building cranes for the following reasons:

1. As part of the AIARA program at Monticello the reactor building floor at elevation 1027' is covered with a protective covering to minimize the spread of contamination and to speed up the decontamination process. Successive layers of protective covering are added as necessary during reactor maintenance activities. This covering would obscure marked load paths.

2. The dimensions of most heavy loads handled in the reactor building are such that they span or nearly span the distance between the reactor building floor beams.

3. All or a major portion of the load paths for the reactor vessel head and the reactor vessel internals are through the equipment storage pool where the load path is physically restricted by the dimensions of the equipment storage pool.

4. The physical dimensions and the space available for laydown of major heavy loads on the 1027' elevation of the reactor building does not allow major deviations from load paths identified in the procedures for handling heavy loads in the reactor building.

5. In the turbine building, safe load paths have not been identified in procedures or marked on the floor for the following reasons:

   a. There are many combinations of circumstances that make it impossible to identify specific laydown areas and load paths for each heavy load.

   b. In lieu of safe load paths, two areas have been established which control the movement of heavy loads. In the exclusion area, as identified in the procedure for handling heavy loads in the turbine building and as identified by painted lines on the turbine building floor at elevation 951', certain specifically identified loads are excluded. All other identified heavy loads may be transported via any load path provided they are transported as specified by procedure. In all areas not identified as an exclusion area there are no restrictions on the movement of any loads.

c. The basis for not identifying safe load paths and specific laydown areas is a review performed of heavy loads transported on the turbine floor and an analysis performed of the consequence of dropping any of these identified loads. This analysis revealed that with the exception of the genetor field and the high and low pressure turbine spindles, these loads can be safely transported over any area of the turbine floor if the maximum distance between the load and the floor is limited to 6 inches. This analysis revealed that if a load that is permitted by procedure is transported by procedure over the exclusion area and is dropped, the load will not penetrate the floor and no spalling of the underside of the floor will occur.

6. With the exception of the turbine and reactor building cranes, all other lifting devices identified in this report have a fixed load path as determined by the length of the associated monorail or they have no load path because they have a fixed lifting point.

7. Only trained, permanent Northern States Power (NSP) Company employees are permitted to operate the turbine and reactor building cranes.

Sub Question 2.1.3c

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 loads are governed by a written procedure containing, as a minimum, the information identified in NUREG 0612, Section 5.1.1(2).

Response

See Table II.

Procedures were prepared and/or revised to meet the requirements of NUREG 0612 Section 5.1.1(2) as part of the interim actions for the control of heavy loads, (Nuclear Regulatory Commission letter dated 22 December 1980).

Sub Question 2.1.3d

Verification that the lifting devices identified in the response to Question 2.1.3c comply with the requirements of ANSI N14.6-1978 or ANSI B30.9-1971 as appropriate. For lifting devices where these standard, 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

1. Slings ANSI B30.9-1971

   The slings used for handling heavy loads by lifting devices identified in this report comply with the design and inspection requirements of ANSI B30.9-1971. The slings have a minimum factor of safety of five (5) and the

rated capacity of the slings used for handling heavy loads shall be taken as those listed in tables 3 through 14 of ANSI B30.9. The Wire Rope Technical Board was contacted regarding the basis for the safety factor of five (5) in the design and manufacture of nylon and wire rope slings. The Wire Rope Technical Board is made up of design engineer representatives from sling manufacturers. The Wire Rope Technical Board is the major source of technical information used to establish the ANSI B30.9 code by the ANSI B30.9 Code Committee. Information received from this source revealed that the basis for a safety factor in the design and manufacture of slings is to account for service factors including deterioration of slings from use and dynamic loads associated with transporting any load. Since dynamic load is accounted for in the sling rating, no additional derating is believed necessary.

Only trained, permanent Northern States Power (NSP) Company employees are permitted to operate the turbine reactor and building cranes. Additional assurance is thus provided that sling ratings will not be exceeded.

2. Special Lifting Devices ANSI N14.6-1978

Retrieval of information regarding the design and manufacture of special lifting devices supplied to the Monticello Nuclear Generating Plant is in progress. When this tion is received a determination will be made as to their complian ANSI B14.6-1978.

Sub Question 2.1.3e

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

Procedures for inspection, testing and maintenance of the cranes were reviewed and revised as appropriate as part of the Interim Actions for Control of Heavy Loads, enclosure 2 of Nuclear Regulatory letter dated 22 December 1980, to comply with the standard of ANSI B30.2-1976, Chapter 2-2. No exception to the standards is taken.

Sub Question 2.1.3f

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 compliances with these standards is not provided.

Response

These guidelines apply to overhead and gantry type, top running, multiple girder, electric, traveling cranes. The reactor building and turbine building cranes were both manufactured prior to the issuance of these guidelines. The reactor building crane has been modified to provide redundant lifting features for Monticello based on Regulatory Guide 1.13. The modification takes into consideration the ANSI B30.2, CMAA Specification 70 requirements and Regulatory Guide 1.104 (subsequently withdrawn.). The modifications made were found acceptable with provisions by the NRC as described in the NRC letter of May 19, 1977.

A comparison between the design of the Reactor and Turbine Building Cranes and the CMAA-70 and ANSI B30.2-1976 codes is shown in attachment 1. These codes are not applicable to the other lifting devices listed in 2.1.1 of this report.

Sub Question 2.1.3q

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

Response

Operator training, qualification and conduct was reviewed as apart of the interim actions for the control of heavy loads, enclosure 2 of Nuclear Regulatory letter dated 22 December 1980. No exception is taken to ANSI B30.2-1976 in this respect.

Enclosures:

Attachment 1
Table I
Table II

Table I

List of Overhead Load Handling Devices Not Considered Because of Physical Separation or Capacity

| Location | Handling Device | Capacity* | ID No. |
|---|---|---|---|
| RX Building | Refueling Facilities Channel Handling Jib Boom | 50 lbs | 3 |
| Rx Building | Refueling Facilities Motor Drive Jil Crane A | 1500 lbs | 4 |
| Rx Building | Refueling Facilities Motor Drive Jib Crane B | 1500 lbs | 5 |
| Rx Building | Channel Handling Overhead Rigging | 50 lbs | 7 |
| R.W. Building | Radwaste Conveyor Load-Out Monorail | 12000 lbs | 8 |
| R.W. Building | Radwaste Centrifuge Hoist A | 4000 lbs | 9 |
| R. W. Building | Radwaste Centrifuge Hoist B | 4000 lbs | 10 |
| R.W. Building | Radwaste Building Monorail | 6000 lbs | 11 |
| O.G. Stack | Off Gas Stack Monorail | 6000 lbs | 12 |
| R.W. Building | Padwaste Building Sump Monorail | 6000 lbs | 13 |
| Turbine Building | C Turbine Building Portable A Frame Monorail C | 1500 lbs | 16 |
| Drywell | MSIV Area Lifting Lug | 1000 lbs | 18 |

* A Heavy Load has been defined (per NUREG 0612) as, any load carried in a a given area after a plant becomes operational, that weighs more than the combined weight of a single spent fuel assembly and its associated handling tool for the specific plant in question. At Monticello Nuclear Plant this weight has been conservatively calculated to be 1500 lbs.

Table I (Cont'd)

| Location | Handling Device | Capacity | I.D. No. |
|---|---|---|---|
| Drywell | MSIV Area Lifting Lug | 1000 lbs | 19 |
| Steam Chase | MSIV Area Monorail | 6000 lbs | 20 |
| Steam Chase | MSIV Area Monorail | 6000 lbs | 21 |
| D. G. Building | Diesel Generator A Monorail, A & B Lifting Lugs | 470 lbs | 22 |
| D. G. Building | Diesel Generator B Monorail, A & B Lifting Lugs | 470 lbs | 23 |
| Turbine Building | Electric Breakers Bridge Hoist Room A | 1000 lbs | 24 |
| Turbine Building | Electric Breakers Bridge Hoist Room B | 1000 lbs | 25 |
| R.W. Building | Radwaste Storage Bridge Crane | 20000 lbs | 26 |
| Hot Machine Shop | Hot Machine Shop Monorail | 4000 lbs | 27 |
| $H_2$ Storage Building | $CO_2$ & $H_2$ Monorail | 4000 lbs | 29 |
| Intake Structure | Screen House Bridge Crane | 10000 lbs | 30 |
| Intake Structure | Trash Basket Jib Crane | 4000 lbs | 32 |
| Turbine Building | Condenser Tube Pulling Pit Monorail & Lifting Lug | 2000 lbs | 33 |
| R.W. Building | Radwaste Capping Station Monorail | 1000 lbs | 34 |
| Rx Building | RWCU Filter Shield Block Monorail | 10000 lbs | 35 |
| Turbine Building | Condensate Demin Holding Pump A Hatch Monorail | 6400 lbs | 37 |
| Turbine Building | Condensate Demin Holding Pump B Hatch Monorail | 6400 lbs | 38 |

Table I (Cont'd)

| Location | Handling Device | Capacity | I.D. No. |
|---|---|---|---|
| Turbine Building | Condensate Demin Holding Pump C Hatch Monorail | 6400 lbs | 39 |
| Turbine Building | Condensate Demin Holding Pump D Hatch Monorail | 6400 lbs | 40 |
| Turbine Building | Condensate Demin Holding Pump E Hatch Monorail | 6400 lbs | 41 |
| R.W. Storage Building | New Shipping Building Crane | 20000 lbs | 42 |
| Rx Building | Rx Refueling Platform Handling Device | 1000 lbs | 43 |
| Rx Building | Reactor Vessel Service Platform | 1500 lbs | 46 |
| R.W. Building | Radwaste Devices Entrance Monorail | 2000 lbs | 47 |
| R.W. Building | Hot Machine Shop Jib Crane and Lifting Lug | 2000 lbs | 48 |
| O.G. Storage Building | Off Gas Storage Building Jib Crane | 15000 lbs | 49 |
| O. G. Storage Building | Off Gas Storage Building Monorails | 1000 lbs | 50 |
| Rx Building | CRD Rebuild Area Monorail | 1000 lbs | 51 |
| Rx Building | Drywell Equipment Hatch Monorail & Lifting Device | 3000 lbs | 52 |
| Rx Building | Low Level Contamination Work Area Monorail | 1000 lbs | 56 |
| Rx Building | Rx Building Closed Cooling Water Heat Exchanger Lifting Lugs | 6000 lbs | 57 |
| Turbine Building | Rx Feedwater Pump A Monorail | 2000 lbs | 58 |
| Turbine Building | Rx Feedwater Pump B Monorail | 2000 lbs | 59 |
| Turbine Building | Miscellaneous Lifting Lugs | 6000 lbs | 60 |

Table II

Heavy Loads Handled by the Overhead Load Handling Device
Identified in Section 2.1.1

| Crane | Load | Weight | Lifting Device | Procedure |
|---|---|---|---|---|
| ID #1 | Turbine H.P. Hood | 108,420 lbs | Slings | Yes |
| | Turbine L.P. Hood A | 60,515 lbs | Slings | Yes |
| | Turbine L.P. Hood B | 60,515 lbs | Slings | Yes |
| | L.P. Inner Casing A | 103,280 lbs | Slings | Yes |
| | L.P. Inner Casing B | 103,280 lbs | Slings | Yes |
| | L.P. Rotor A & B | 226,000 lbs | Strongback & Slings | Yes |
| | H.P. Rotor | 82,583 | Strongback & Slings | Yes |
| | L.P. Turbine Diaphragms | 9000-12000 lbs | Slings | Yes |
| | L.P. Turbine Diaphragms | 12000-18000 lbs | Slings | Yes |
| | Bypass Valves Shield Block | 2,700 lbs | Slings | Yes |
| | Generator Rotor | 281,832 lbs | Slings | Yes |
| | Generator Endbells | 12,000 lbs | Slings | Yes |
| | Exciter Hood | 22,000 lbs | Slings | Yes |
| | Exciter Rotor | 35,000 lbs | Slings | Yes |
| | R.F.P. Motor | 35,000 lbs | Slings | Yes |
| | Condensate Pump Shield Block | 10,800 lbs | Slings | Yes |
| | Condensate Pump | 18,600 lbs | Slings | Yes |
| | Condensate Pump Motor | 12,900 lbs | Slings | Yes |
| | HIP Heaters | 45,100 lbs | Slings | Yes |
| | HP Heaters | 46,900 lbs | Slings | Yes |
| | Turbine Gen Bearing Diaphragms | 5,580 lbs | Slings | Yes |
| | Pallets & Miscellaneous Material | 2,000 lbs | Pallet Lifting Device | Yes |
| | Turbine Rotor Stands | 22,400 lbs | Slings | Yes |
| ID #2 | Vessel Service Platform | 6,000 lbs | Slings | Yes |
| | Stud Detentioner Carousel | 20,000 lbs | RPV Head Strongback | Yes |
| | Fuel Pool Shield Blocks (3) | 10,000 lbs | Slings | Yes |
| | RPV Head | 90,000 lbs | RPV Head Strongback | Yes |
| | Drywell Head | 80,000 lbs | DW Head Strongback | Yes |
| | Fuel Pool Skimmer Tank Shield Blocks (3) | 6,000 lbs | Slings | No[1] |

Table II (Cont'd)

| Crane | | | | |
|---|---|---|---|---|
| | Steam Separator | 66,000 lbs | Dryer Separator Strongback & Slings | Yes |
| | Steam Dryer | 44,000 lbs | Dryer Separator Strongback & Slings | Yes |
| | Rx Head Insulation | 9,000 lbs | Slings | Yes |
| | Refueling Canal Shield | 30,000 lbs | Slings | Yes |
| | Spent Fuel Shipping Cask | 49,464 lbs | Special Device | No[1] |
| | New Fuel Storage Shield Block (3) | 6,000 lbs | Slings | No[1] |
| | GE Model 1600 Cask | 25,950 lbs | Special Device | Yes |
| | Equip Storage Pool Shield Block(3) | 87,000 lbs | Slings | Yes |
| | Rx Cavity Shield Block (6) | 100,000 lbs | Slings | Yes |
| | Fuel Pool Shield Blocks | 10,000 lbs | Slings | Yes |
| | New Fuel Shipping Container | 2,000 lbs | Slings | Yes |
| | RPV Head Piping | 2,000 lbs | Slings | Yes |
| | Fuel Preparation Machine | 10,000 lbs | Slings | Yes |
| | RPV Invessel Work Platform | 100,000 lbs | Slings | No[2] |
| ID #14 | Miscellaneous Loads | 10,000 lbs | Slings | No |
| ID #15 | Miscellaneous Loads | 10,000 lbs | Slings | No |
| ID #28 | Miscellaneous Loads | 4,000 lbs | Slings | No |
| ID #31 | Chlorine Container | 3,580 lbs | Strongback | No |
| ID #36 | Radwaste & Fuel Pool Filter Demin Shield Blocks (5) | 7,600 lbs | Slings | No |
| ID #45 | Miscellaneous Loads | 8,000 lbs | Slings | No |
| ID #53 | RCIC Pump Room Shield Block | 8,000 lbs | Slings | No |
| ED #62 | Miscellaneous Loads | 7,000 lbs | Slings | No |

1. Procedures will be written prior to the handling of these heavy loads.

2. Procedures have been prepared for each use of the RPV invessel work platform.

Attachment 1

# REACTOR BUILDING AND TURBINE BUILDING CRANE DESIGN REVIEW

CMAA Specification 70 and ASNI B30.2-1976 apply to the Reactor Building and Turbine Building Cranes.

The Reactor Building and Turbine Building Cranes were designed to comply with EOCI Specification 61, which was superceded by CMAA Specification 70. The difference between these two specifications which impact the evaluation of the safe handling of heavy loads are addressed below with respect to the Reactor Building and Turbine Building Cranes: The evaluation will take into consideration the requirements of CMAA specification 70, ANSI B30.2-1976 and the guidance of Regulatory Guide 1.13.

It is to be noted that the Franklin Research Center, a division of the Franklin Institute, conducted a comparison of the recommendations of CMAA-70 with those contained in EOCI-61. Generally, the requirements of CMAA-70 represent the codification of good engineering practice which should have been incorporated in cranes built to EOCI-61 specification although specific requirements were not contained in EOCI-61. The Franklin Research Center study is addressed in "Technical Evaluation Report", NRC Docket No. 50-334, dated September 24, 1981 performed under NRC Contract No. NRC-03-79-18.

The following generally tracks those points of concern addressed in the referenced Franklin Institute comparison for the NRC.

## Hoist Rope Safety Factor

CMAA-70 requires the hoist rope safety factor be calculated on the combined weight of the bottom block assembly and the rated load. This requirement is met by the Reactor Building and Turbine Building Cranes.

## Structural Steel

CMAA-70 requires ASTM A36 structural steel. The ordinary structural steel for Reactor Building and Turbine Building cranes conforms with ASTM A36 and low alloy structural steel conforms to ASTM A 242.

## Stress Requirements

Although the specification requirements differ, the stress requirements of CMAA-70 for bridge girders, end trucks and trolley frames are met by the Reactor Building and Turbine Building Cranes.

## Crane Hook Latches

ANSI B30.2-1976 adds the additional requirements, applicable to safe heavy load handling, that crane hooks have latches, if practical, in that application. This requirement is met by the Reactor Building and Turbine Building Cranes.

Impact Allowance

CMAA-70, Article 3.3.2.1.1.3 requires that crane design calculations include an impact allowance of 0.5% of the load per foot per minute of hoisting speed but not less than 15%. EOCI-61 specifies only a maximum allowance of 15%. Consequently, for cranes with hoist speeds in excess of 30 feet per minute, it is possible that the impact allowance applied under EOCI-61 will be less than that required by CMAA-70. The overhead cranes subject to this review operate at hoist speeds not in excess of 30 fpm.

Torsional Forces

CMAA-70, Article 3.3.2.1.3 requires that twisting moments due to overhanging loads and lateral forces acting eccentric to the horizontal neutral axis of a girder be calculated on the basis of the distance between the center of gravity of the load, or force center line, and the girder shear center measured normal to the force vector. EOCI-61 states that such moments are to be calculated with reference to girder center of gravity. For girder sections symmetrical about each principal central axis, e.g., box section or I-beam girders, the shear center coincides with the centroid of the girder section and there is no difference between the two requirements. Box section girders are used for the Reactor Building and Turbine Building Cranes.

Bending Stress

CMAA-70, Article 3.3.2.2 requires that bending stress calculations include a wind load of 5 pounds per square foot in design stress calculations based on the sum of dead and live loads. EOCI-61 requires that the design of outdoor cranes include a wind load of 10 pounds per square foot of projected area but is not specific concerning the combination of wind loads with other dead and live loads. Although the combination of a wind load with other design loading calculations constitutes a codification of the same good engineering practice that would have been used in the cranes built to EOCI-61 specifications, the Reactor Building and Turbine Cranes are installed indoors and therefore are not subject to wind loading.

Longitudinal Stiffeners

CMAA-70, Article 3.3.3.1 specifies the maximum allowable web depth/thickness (h/t) ratio for box girders using longitudinal stiffeners and requirements concerning the location and minimum moment of inertia for such stiffeners. EOCI-61 allows the use of longitudinal stiffeners but provides no similar guidance. Requirements of CMAA-70 represent a codification of the girder design practice and the design standards employed in the Reactor Building and Turbine Building Cranes built to EOCI-61 specifications.

Allowable Compressive Strength

CMAA-70, Article 3.3.3.1.3 identifies allowable compressive stresses to be approximately 50% of yield strength of the recommended structural material (A-36) for girders, where the ratio of the distance between web plates to the thickness of the top cover plate (b/c ratio) is less than or equal to 38.

Allowable compressive stresses decrease linearly for b/c ratios in excess of 38. EOCI-61 provides a similar method for calculating allowable compressive stresses except that the allowable stress decreases from approximatley 50% of yield only after the b/c ratio exceeds 41. Consequently, structural members with b/c ratios in the general range of 38 to 52 designed under EOCI-61 will allow a slightly higher compressive stress than those designed under CMAA-70. This variation is not of consequence since the b/c ratios of structural members for the Reactor Building and Turbine Building Cranes are 13.5 and 17.5, respectively.

Fatigue Considerations

CMAA-70, Article 3.3.3.1.3 provides substantial guidance with respect to fatigue failure by indicating allowable stress ranges for various structural members in joints under repeated loads. EOCI-61 does not address fatigue failure. The requirements of CMAA-70 are not of consequence for the Reactor Building and Turbine Building Cranes since these cranes are not generally subjected to frequent loads at or near design conditions (CMAA-70 provides allowable stress ranges for loading cycles in excess of 20,000) and are not generally subjected to stress reversal (CMAA-70 allowable stress range is reduced to below the basic allowable stress for only a limited number of joint configurations).

Hoist Rope Requirements

CMAA-70, Article 4.2.1 requires that the capacity load, plus the bottom block, divided by the number of parts of rope, not exceed 20% of the published rope breaking strength. EOCI-61 requires that the rated capacity load divided by the number of parts of rope, not exceed 20% of the published rope breaking strength. The capacity load plus the bottom block, divided by the number of parts of rope yields 4.36 tons and 7.97 tons for the Reactor Building and Turbine Building Cranes, respectively. These values are less than 20 percent of the published breaking strengths of 39.3 tons and 44.9 tons, for 7/8 inch and one inch 6 x 37 Improved Plow Steel Fiber Core Wire Rope, for the Reactor Building and Turbine Building Cranes, respectively.

Drum Design Crushing and Bending Loads

CMAA-70, Article 4.4.1 requires that the drum be designed to withstand combined crushing and bending loads. EOCI-61 requires only that the drum be designed to withstand maximum load bending and crushing loads with no stipulation that these loads be combined. This variation is not expected to be of consequence

since the requirements of CMAA-70 represent the codification of good engineering practice which has been incorporated in the Reactor Building Crane built to CMAA-70, and Turbine Building Cranes built to EOCI-61 specification, although a specific requirement was not contained in EOCI-61.

Drum Design Groove Depth and Pitch

CMAA-70, Article 4.4.3 provides recommended drum grove depth and pitch. The Reactor Building Crane drum groove depth and pitch was designed in accordance with CMAA-70. EOCI-61 provides no similar guidance. The recommendations in CMAA-70 constitute a codification of good engineering practice with regard to reeving stability and reduction of rope wear and are not expected to differ substantially from practices employed in the design of the Turbine Building Crane built to EOCI-61 specification.

Gear Design

CMAA-70, Article 4.5 requires that gearing horsepower rating be based on certain American Gear Manufacturers Association (AGMA) Standards and provides a method for determining allowable horsepower. EOCI-61 provides no similar guidance. The recommendations in CMAA-70 constitute a codification of good engineering practice for gear design and do not differ substantially from the practices employed in the design of the Reactor Building and Turbine Building cranes built to EOCI-61 specifications.

Bridge Brake Design

CMAA-70, Article 4.7.2.2 requires that bridge brakes, for cranes with cab control and the cab-on-the-trolley, be rated at least 75% of bridge motor torque. EOCI-61 requires a brake rating of 50% of bridge motor torque for similar configurations. A cab-on-trolley control arrangement is not used for the Reactor Building and Turbine Cranes subject to this review. The Reactor Building Crane bridge brakes are rated at 150 percent of the motor full load torque. The Turbine Building Crane bridge and trolley brakes are rated at 100 percent of the motor full load torque. The Reactor Building Crane trolley brakes are rated at 125 percent of the motor full load torque.

Hoist Brake Design

CMAA-70, Article 4.7.4.2 requires that hoist holding brakes, when used with a method of control breaking other than mechanical, have torque ratings no less than 125% of the hoist motor torque. EOCI-61 requires a hoist holding brake torque without regard to the type of control brake employed. The Reactor Building crane main and auxiliary hoist brakes are rated at 125 percent of the hoist motor full load torque with electrical control braking systems. The Turbine Building main and auxiliary hoist brakes are rated at 125 percent of the hoist motor full load torque with electrical control braking systems.

Bumpers and Stops

CMAA-70, Article 4.12 provides substantial guidance for the design and installation of bridge and trolley bumpers and stops for cranes which operate near the ends of bridge and trolley travel. No similar guidance is provided in EOCI-61. This variation is not expected to be significant for the Reactor Building and Turbine Building Cranes since these cranes are not expected to be operated under load at substantial bridge or trolley speed near the end of travel. Further, guidance of CMAA-70 constitutes the codification of good engineering practice and will be expected to be satisfied by equivalent requirements for cranes produced according to EOCI-61.

Static Control Systems

CMAA-70, Article 5.4.6 provides substantial guidance for the use of static control systems. EOCI-61 provides guidance for magnetic control systems only. This variation is not an issue of consequence because magnetic control systems were generally employed in cranes designed when EOCI-61 was in effect and the static control requirements identified in CMAA-70 constitute a codification of the same good engineering practice that was used in the design of static control systems in the Reactor Building and Turbine Cranes built to EOCI-61 specifications.

Restart Protection

CMAA-70, Article 5.6.2 requires that cranes not equipped with spring return controllers or momentrary-contact push buttons be provided with a device that will disconnect all motors upon power failure and will not permit any motor to be restarted until the controller handle is brought to the off position. No similar guidance is provided in EOCI-61.

The variation is not of consequence for the Turbine Building Crane since the lever type controller is provided with a spring return to the "OFF" position and the crane is also provided with a spring return "dead man" switch (to the "OFF" position) that interrupts all power to move the crane, the trolley or any hoists. The Reactor Building Crane, although not provided with spring return controllers, is provided with momentary contact push buttons for pendant control and a spring return "dead man" switch (to the "OFF" position) that interrupts all power to move the crane, the trolley or any hoists.

# FIGURES

FIG. 1
Designated Safe Load Path for
GE Model 1600 Cask
Procedure 8111 Rev. 1

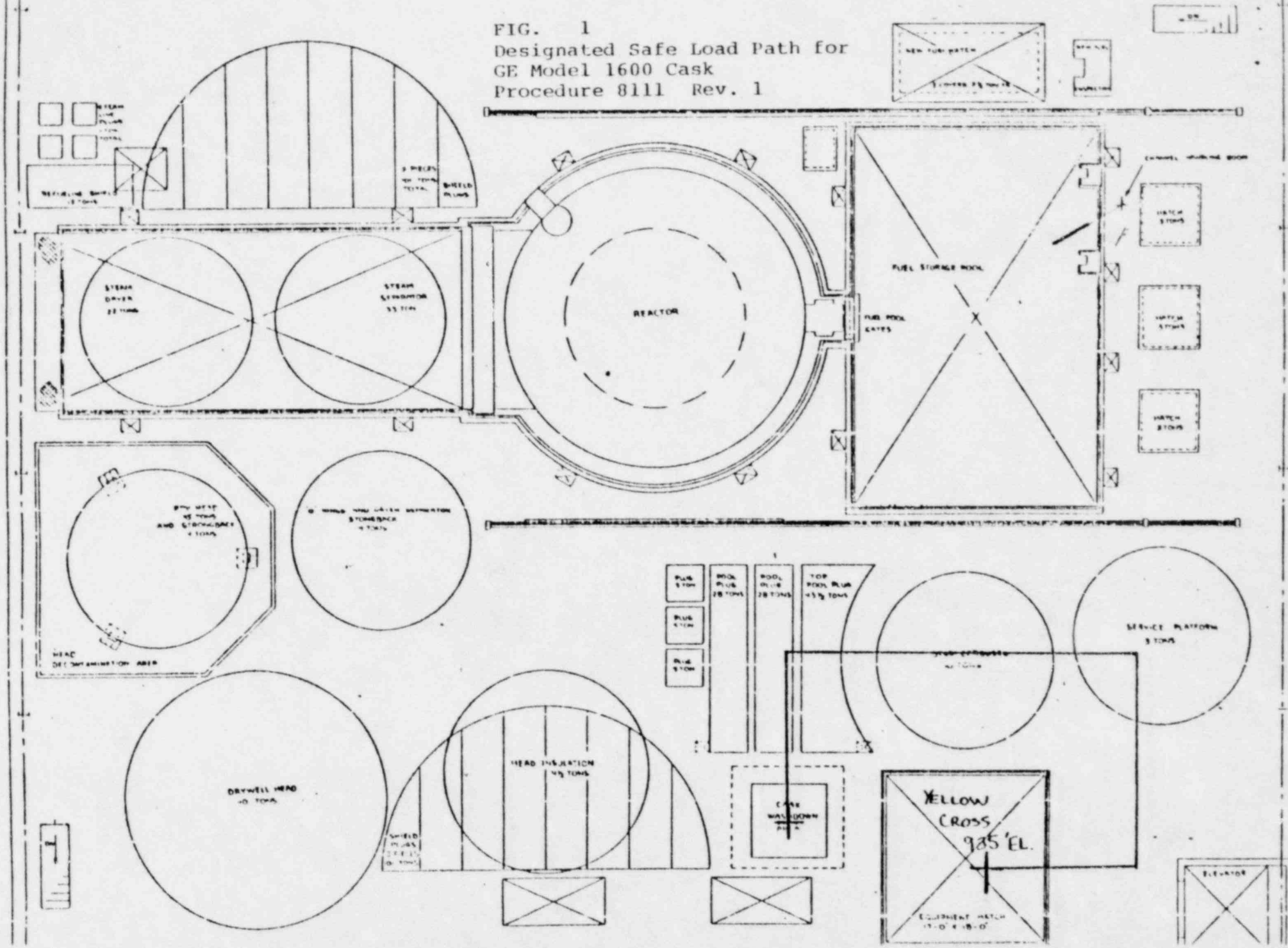


Fig. 2
Designated Safe Load Path for the
Removal of the Reactor Well Shield
Block 5 Procedure No. 9203 Rev.4

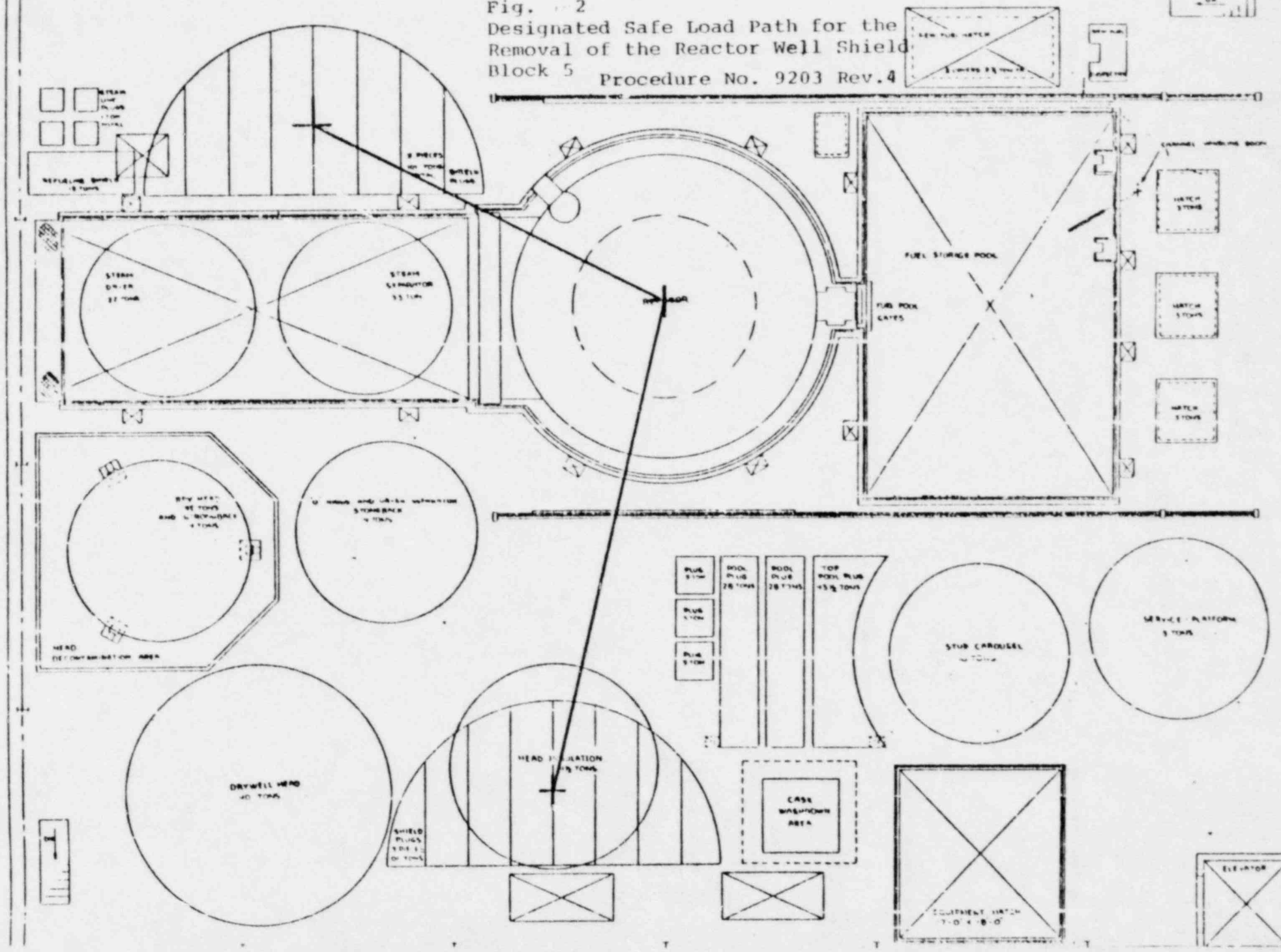


Fig. 3
Designated Safe Load Path for the
Removal of the Drywell Head
Procedure 9207 Rev. 4

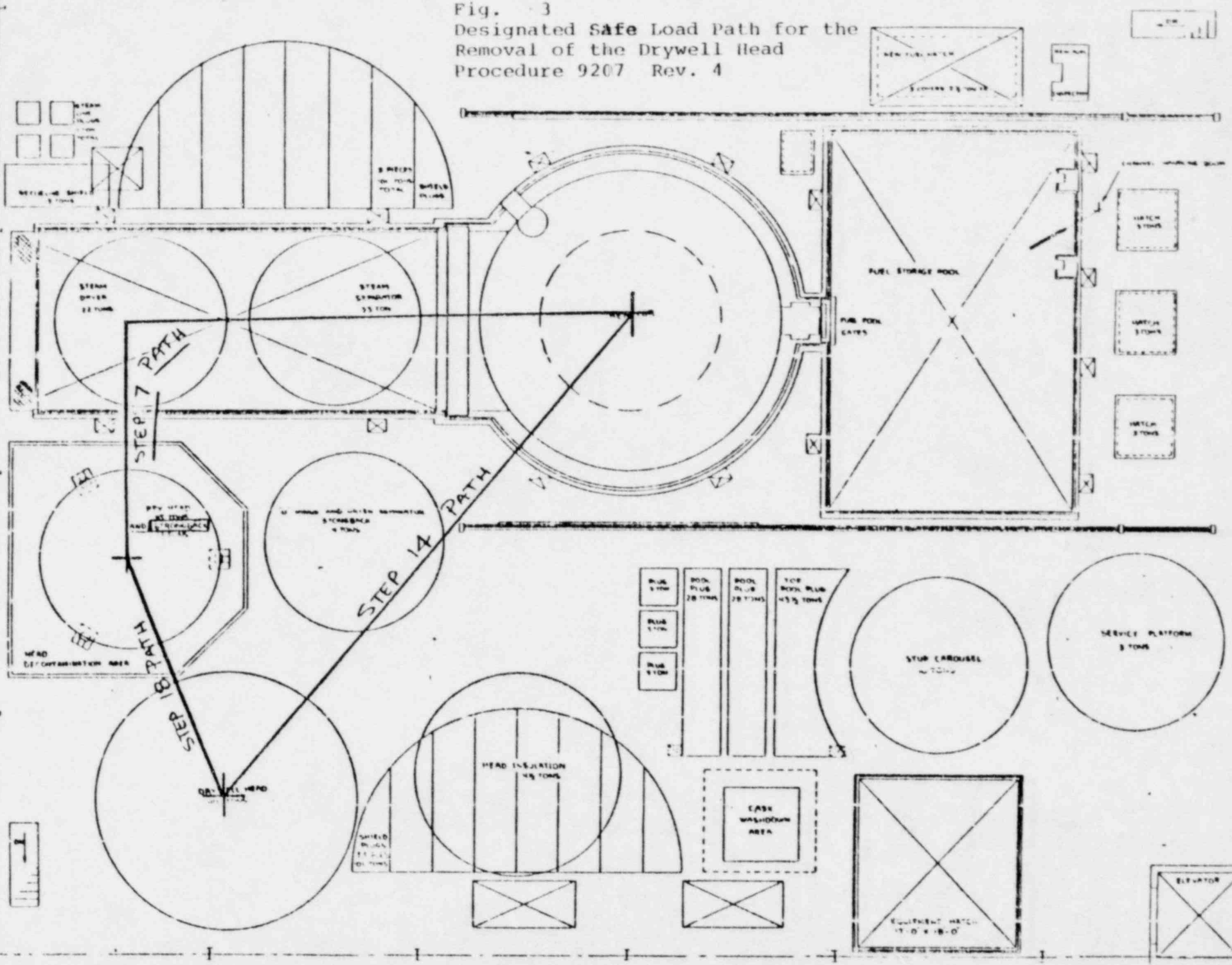


Fig. 4
Designated Safe Load Path for the Removal of 7 Shield Blocks on the Refueling Floor
Procedure 9209 Rev. 5

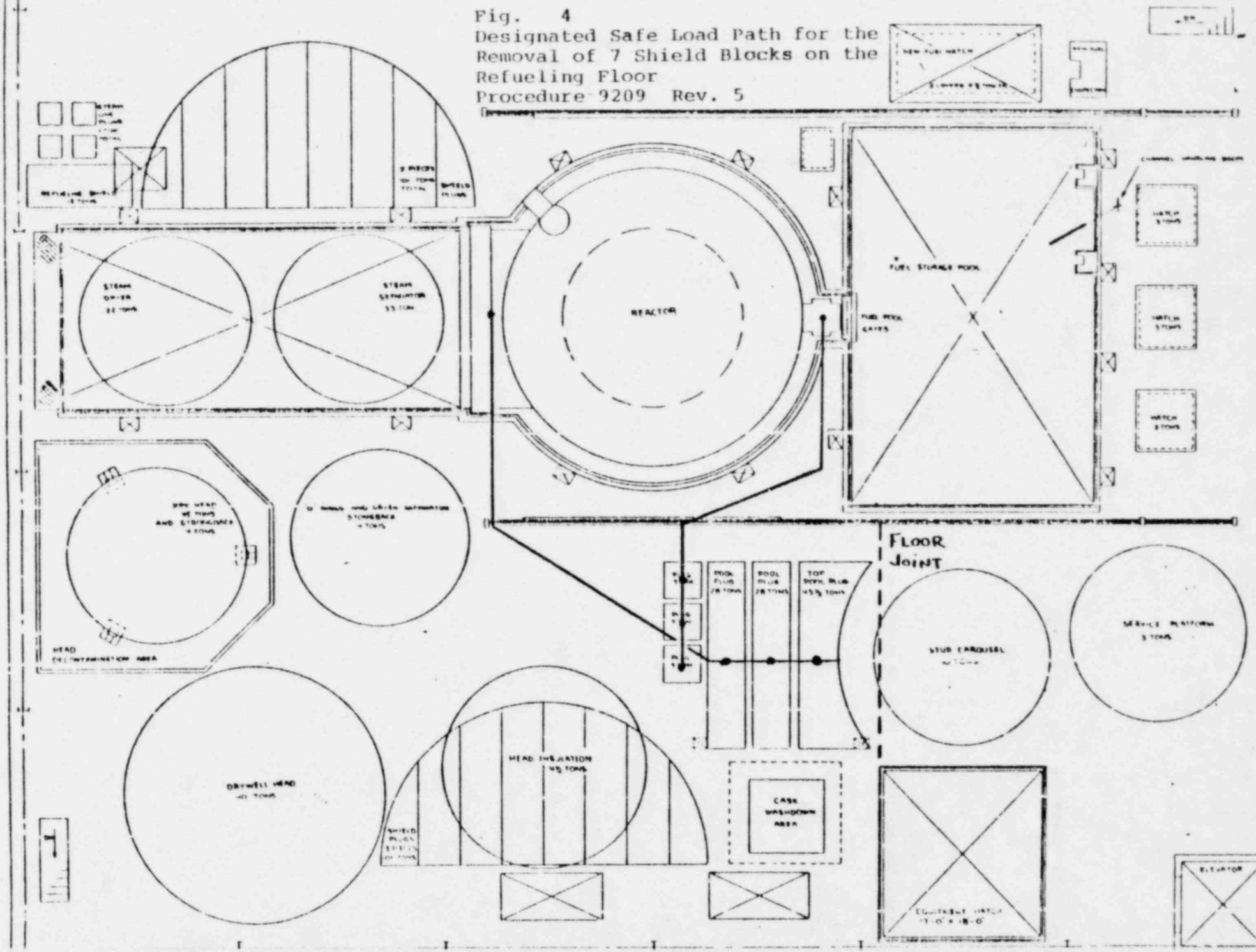


Fig. 5
Designated Safe Load Path for the
Removal of the RPV Head Insulation
Procedure No. 9213 Rev. 4

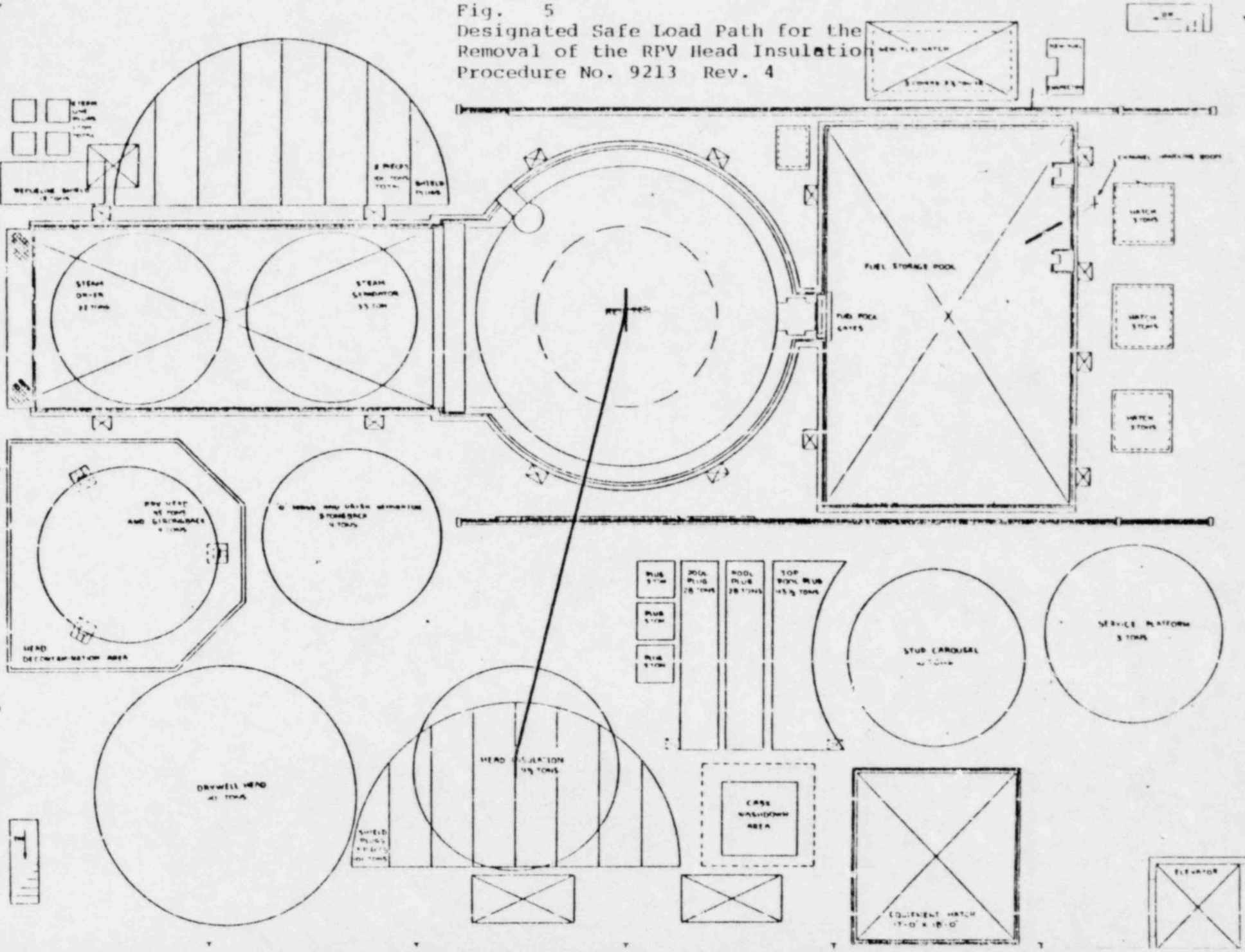


Fig. 6
Designated Safe Load Path for the Installation of the Carousel and Detension RPV Head Bolts
Procedure No. 9214 Rev. 4

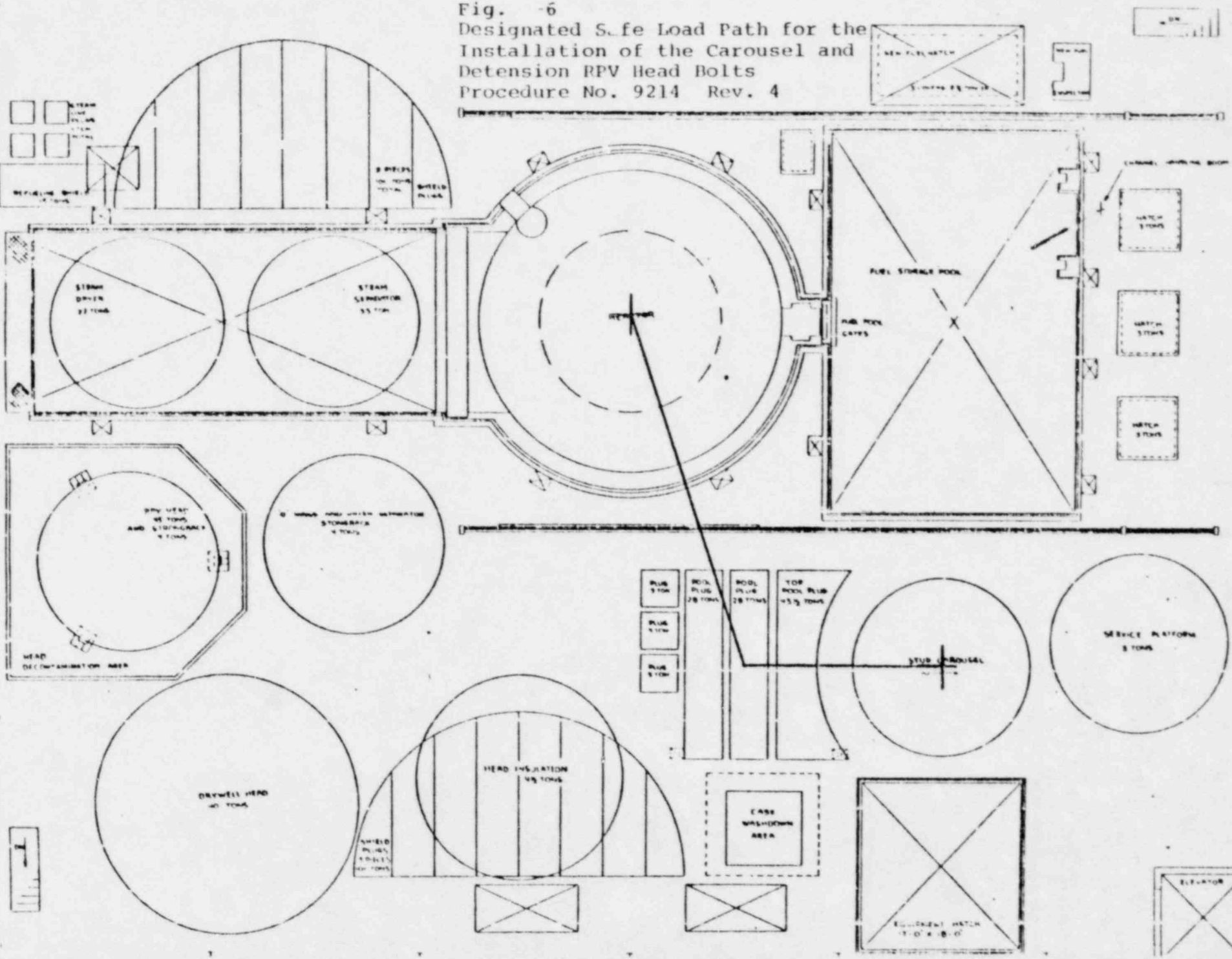


Fig. 4-7
Designated Safe Load Path for the Removal of the Carousel and Sling Head
Procedure No. 9218 Rev. 3

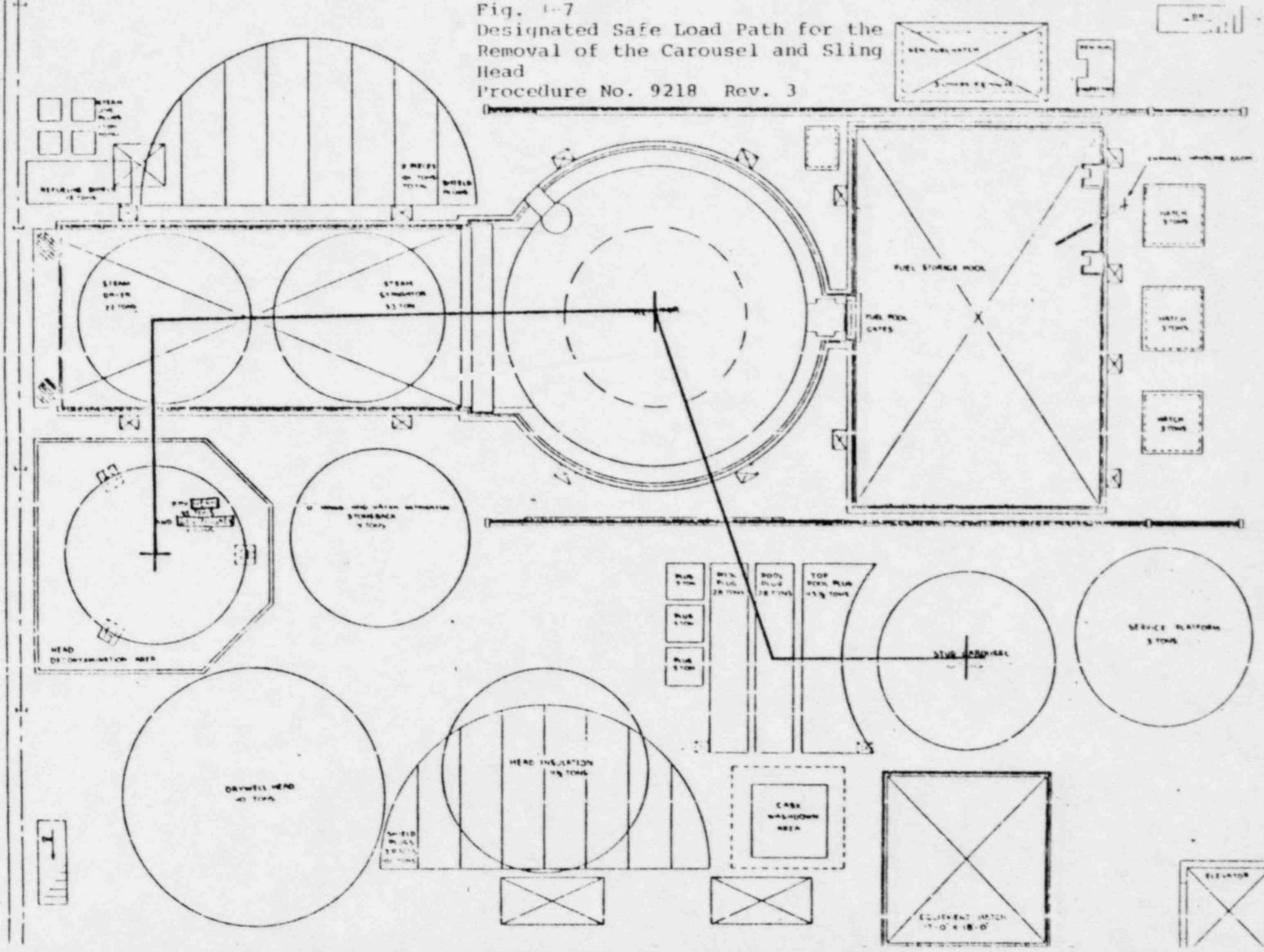


Fig. 8
Designated Safe Load Path for the
Removal of the RPV Head
Procedure No. 9220 Rev. 4

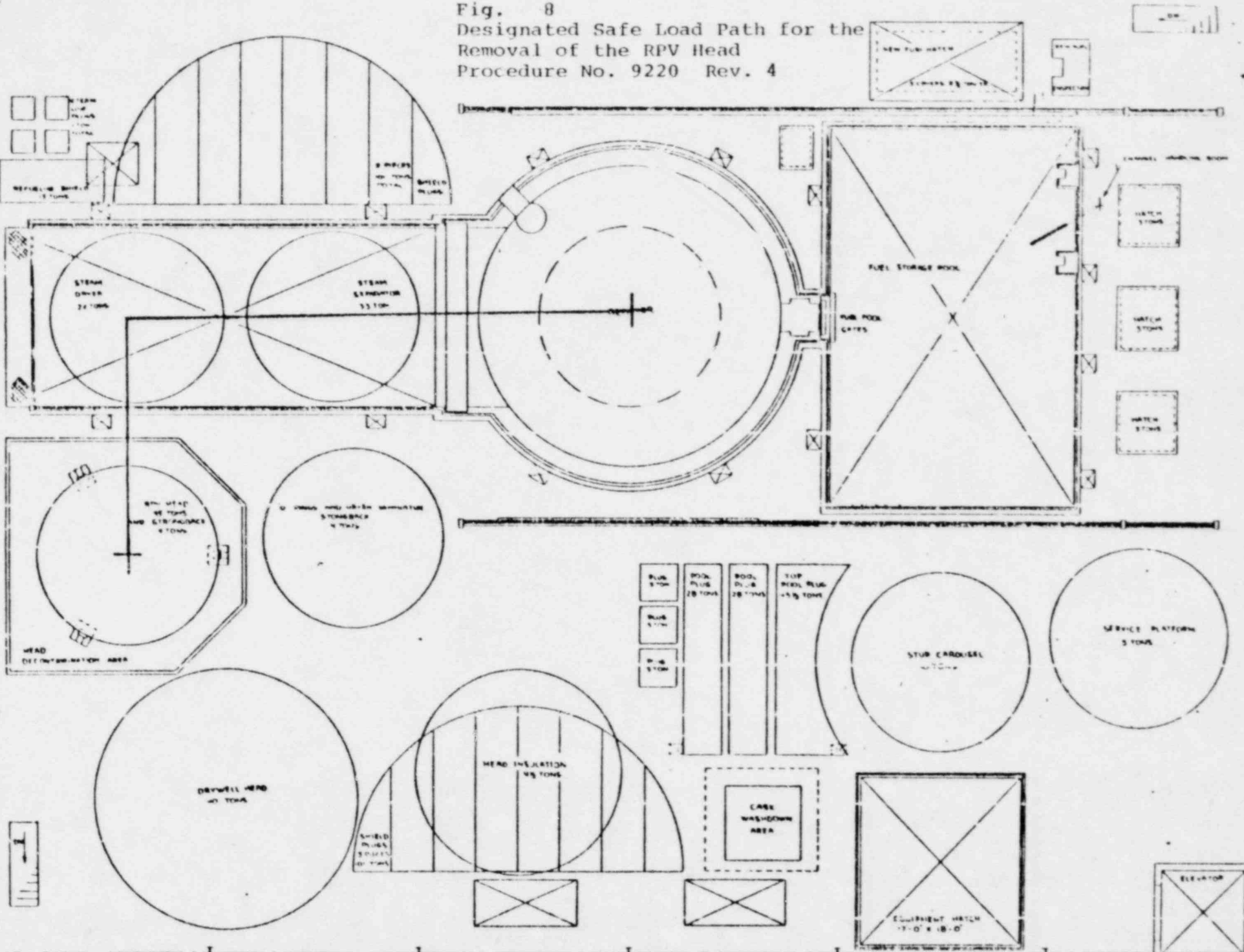


Fig. 9
Designated Safe Load Path for the
Removal of the Steam Dryer
Procedure No. 9224 Rev. 3

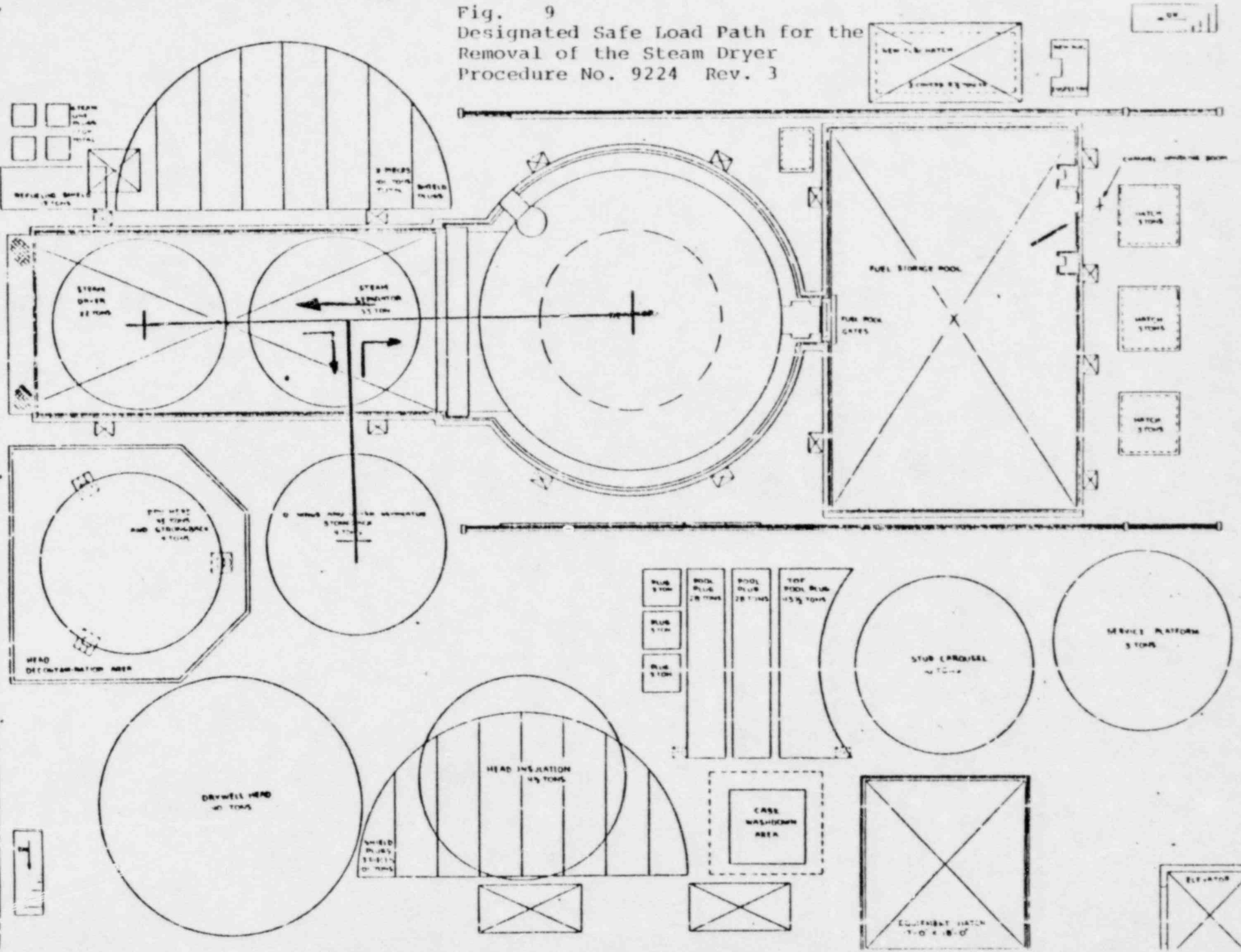


Fig. 1-10
Designated Safe Load Path for the Installation of the Drywell Radiation Shield
Procedure No. 9226 Rev. 6

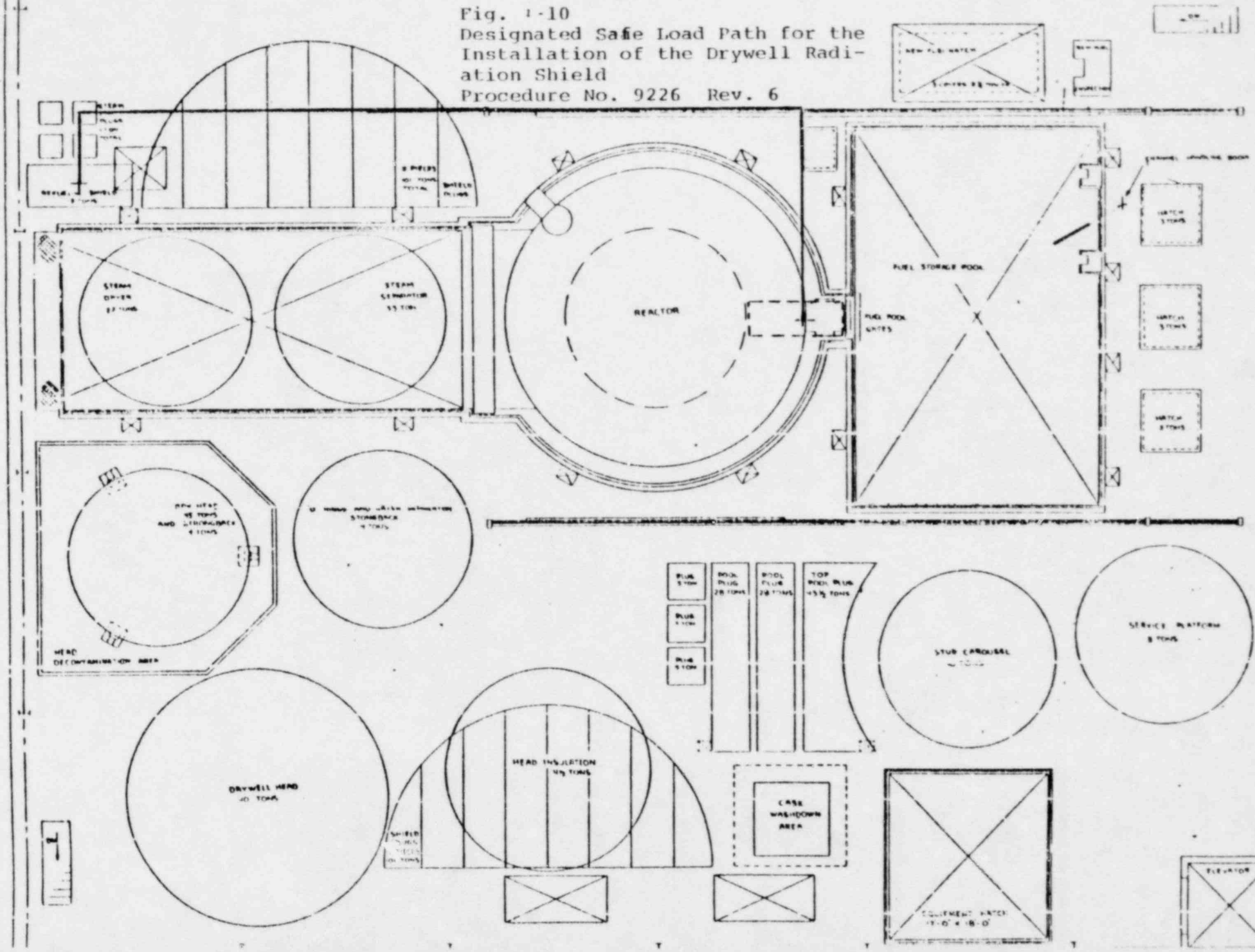


Fig. 11
Designated Safe Load Path for the
Removal of the Steam Separator
Procedure No. 9228 Rev. 4

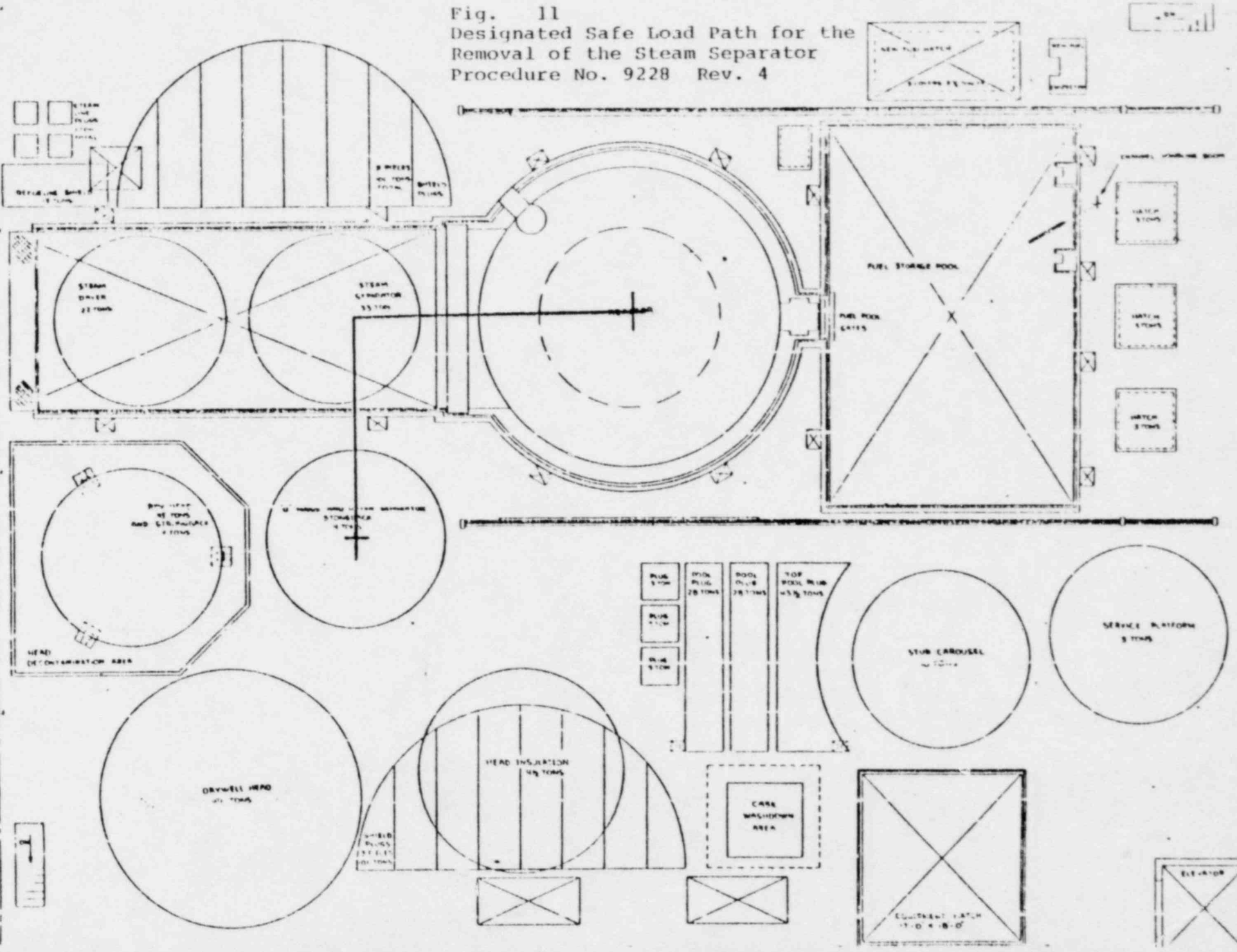


Fig. 12
Designated Safe Load Paths for the
Removal of the Fuel Pool Gates
Procedure No. 9229, Rev. 0

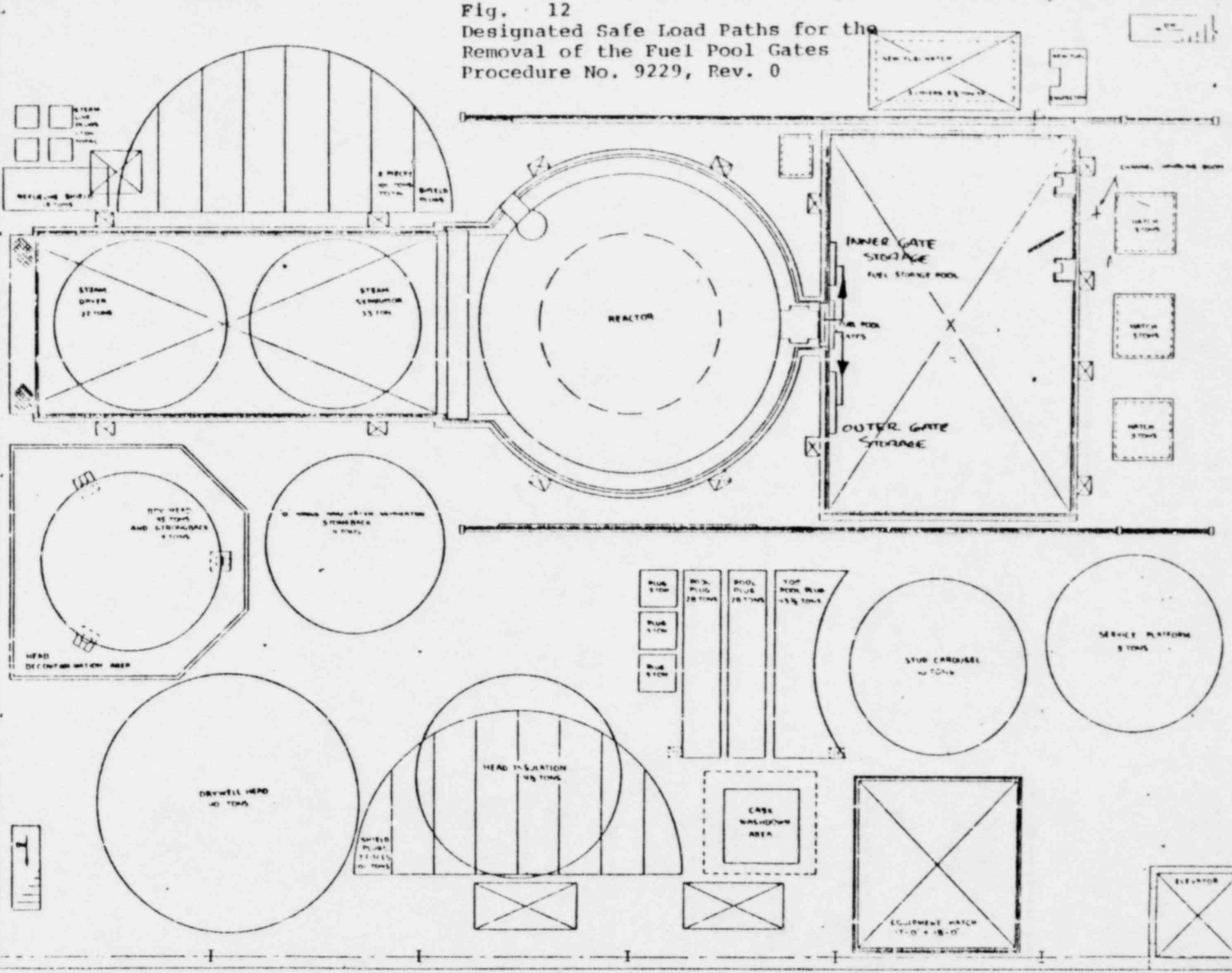


Fig. 13
Designated Safe Load for the Wet Transfer of the Steam Separator
Procedure No. 9231, Rev. 3

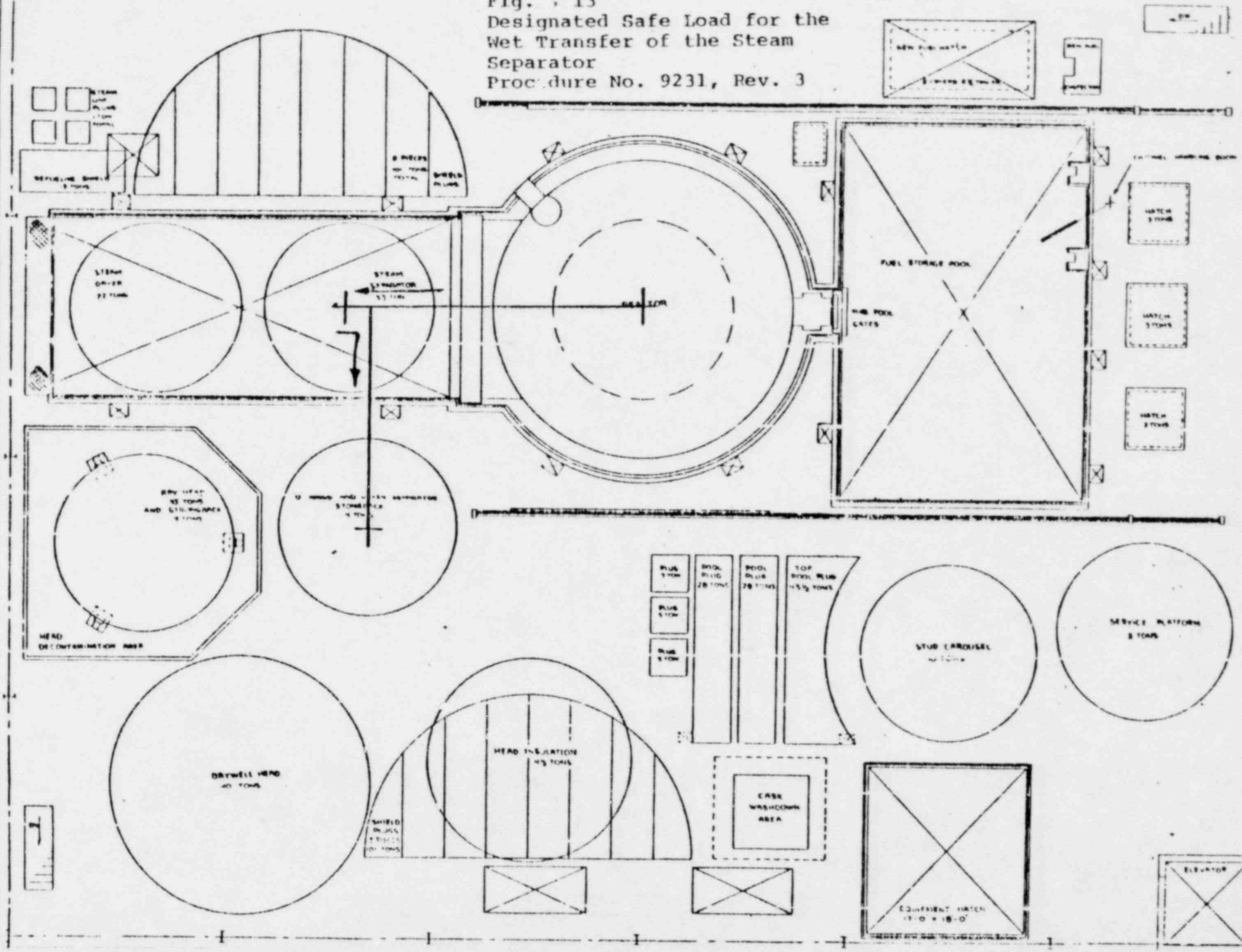


Fig. 14
Designated Safe Load Path for the Installation of the Service Platform
Procedure No. 9243, Rev. 3

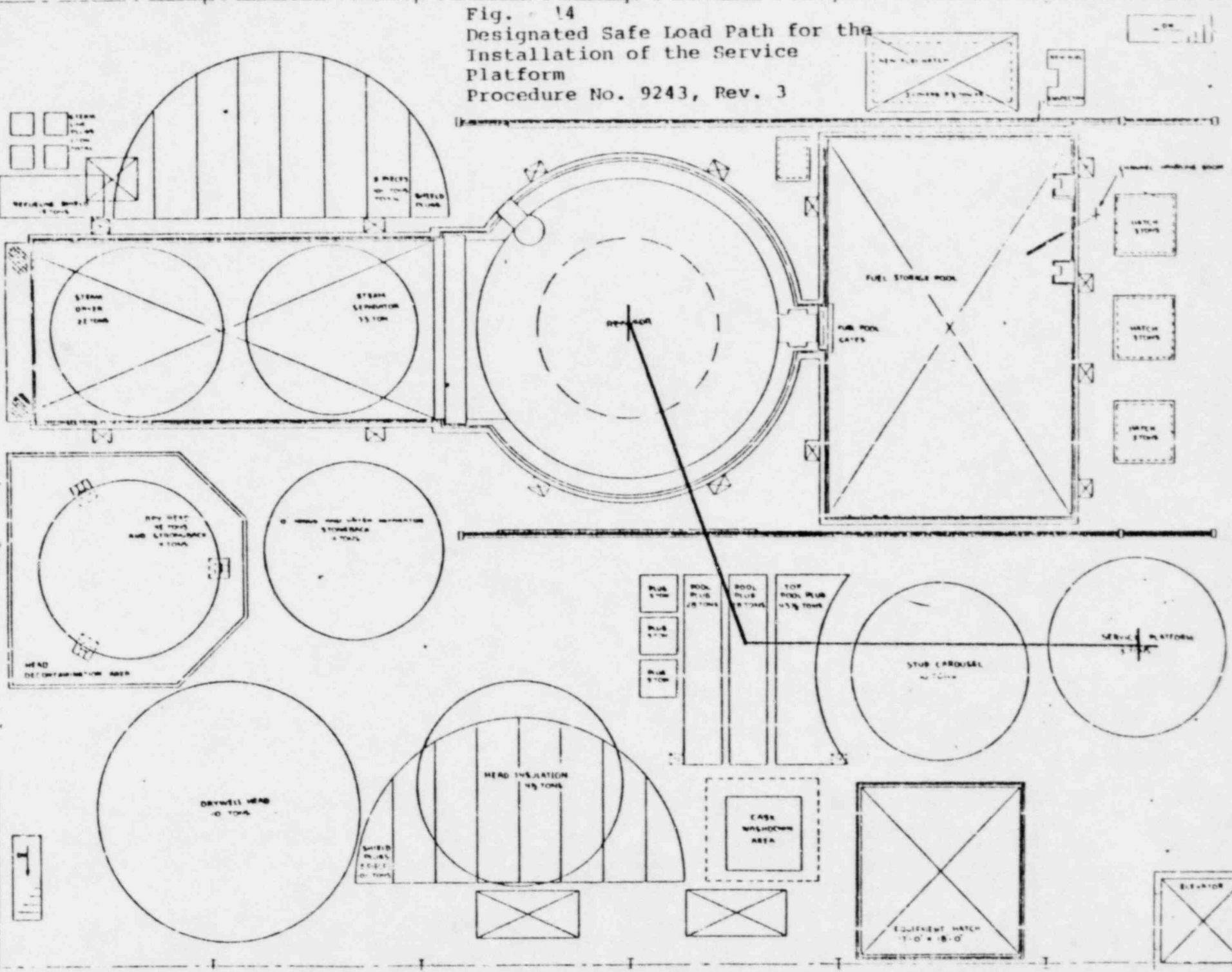


Fig. 15
Designated Safe Load Path for the
Removal of the Service Platform
Procedure No. 9245, Rev. 3

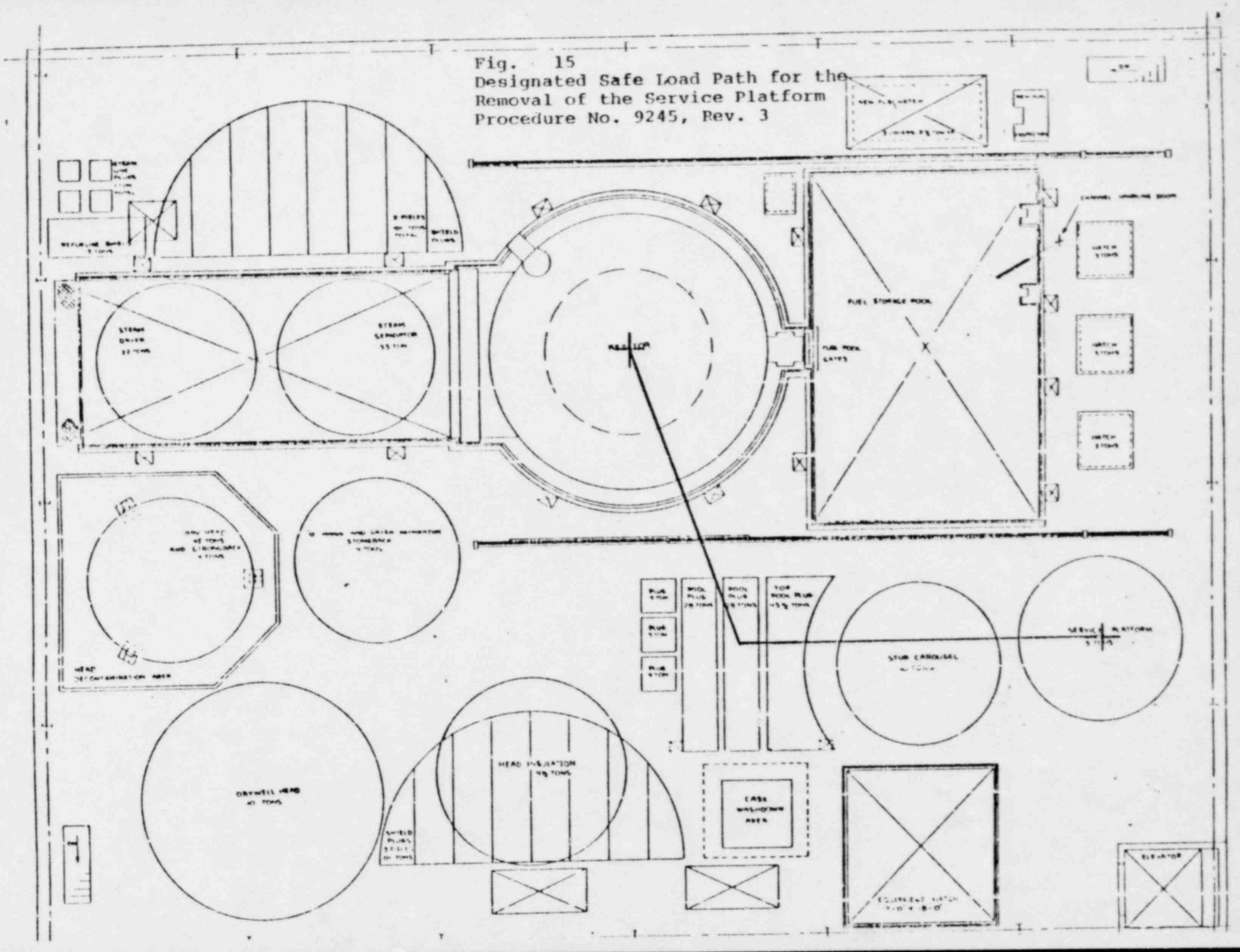


Fig. 16
Designated Safe Load Paths for the Installation of the Fuel Pool Gates
Procedure No. 9250, Rev. 0

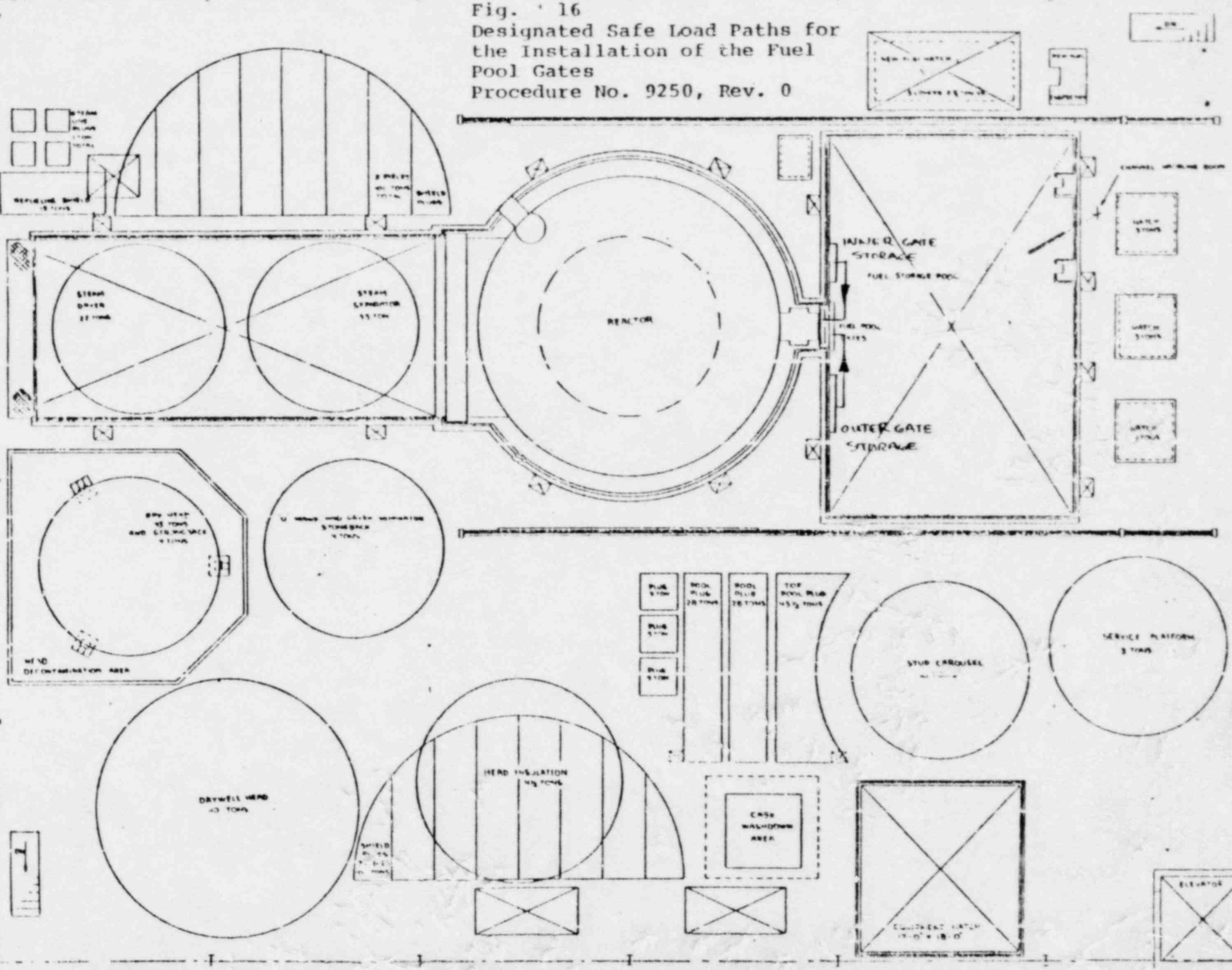


Fig. 4-17
Designated Safe Load Path for the Installation of the Steam Separator
Procedure No. 9253 Rev. 4

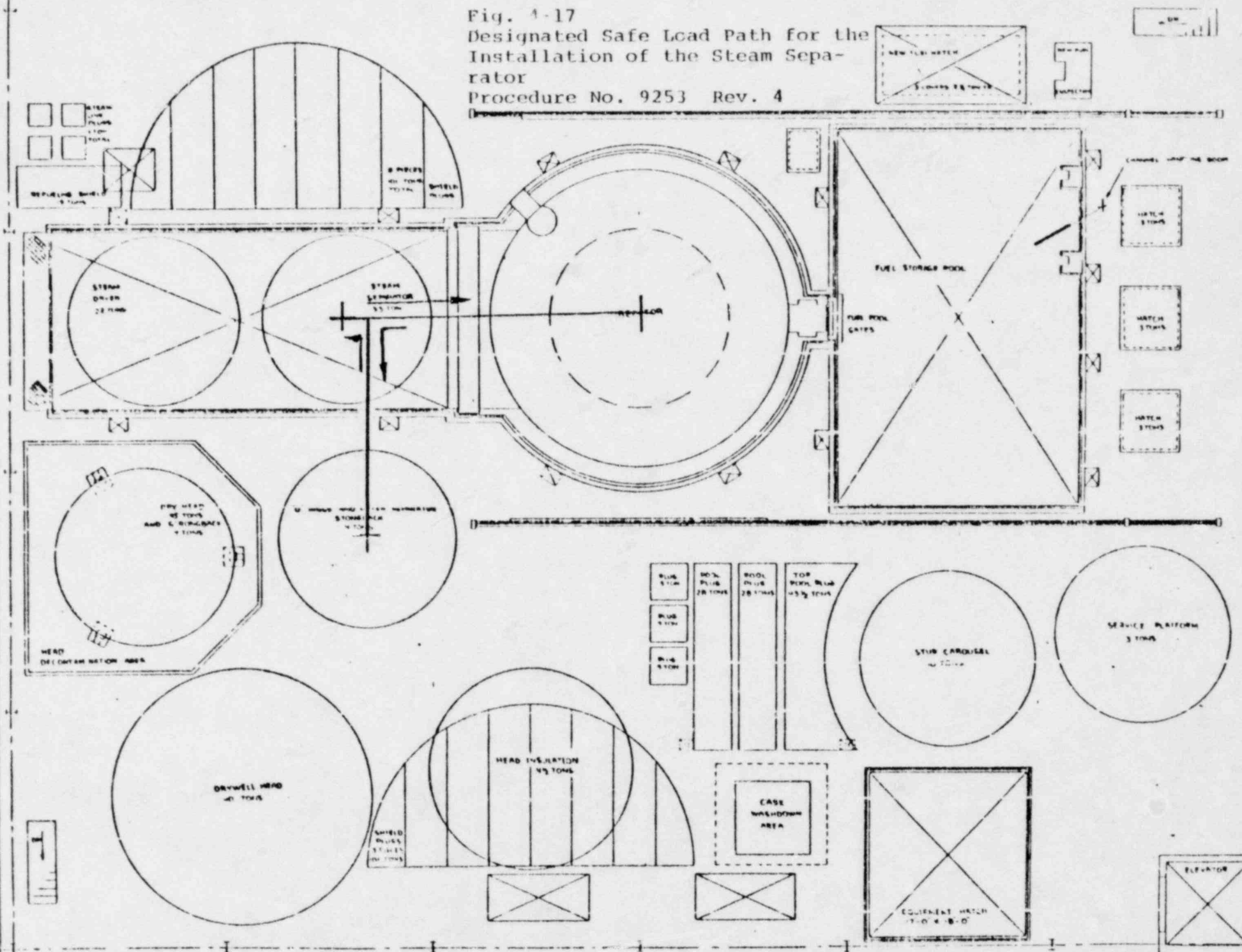


Fig. 18
Designated Safe Load Path for the Removal of the Drywell Radiation Shield.
Procedure No. 9256, Rev. 3

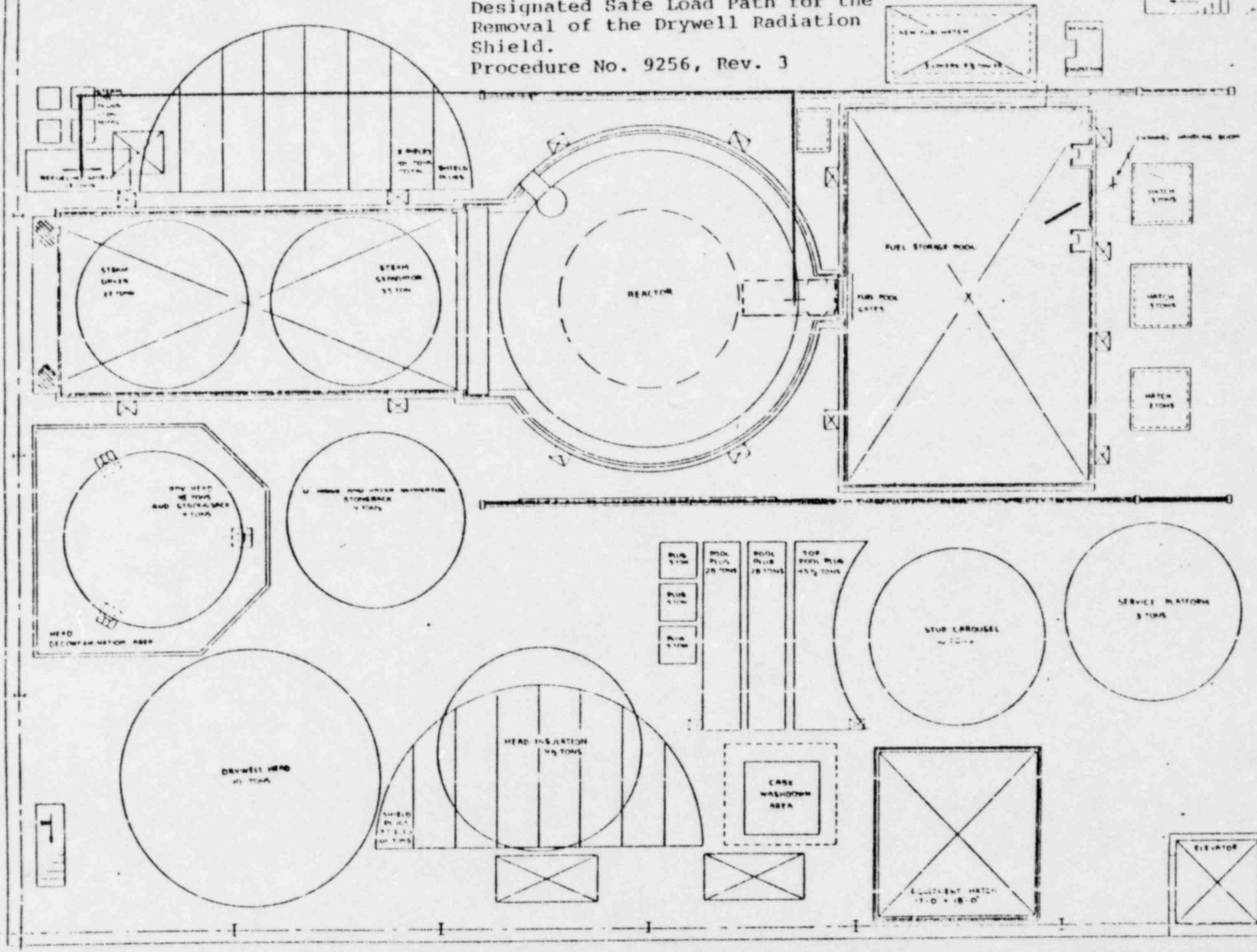


Fig. 19
Designated Safe Load Path for the Installation of the Steam Dryer
Procedure No. 9259, Rev. 3

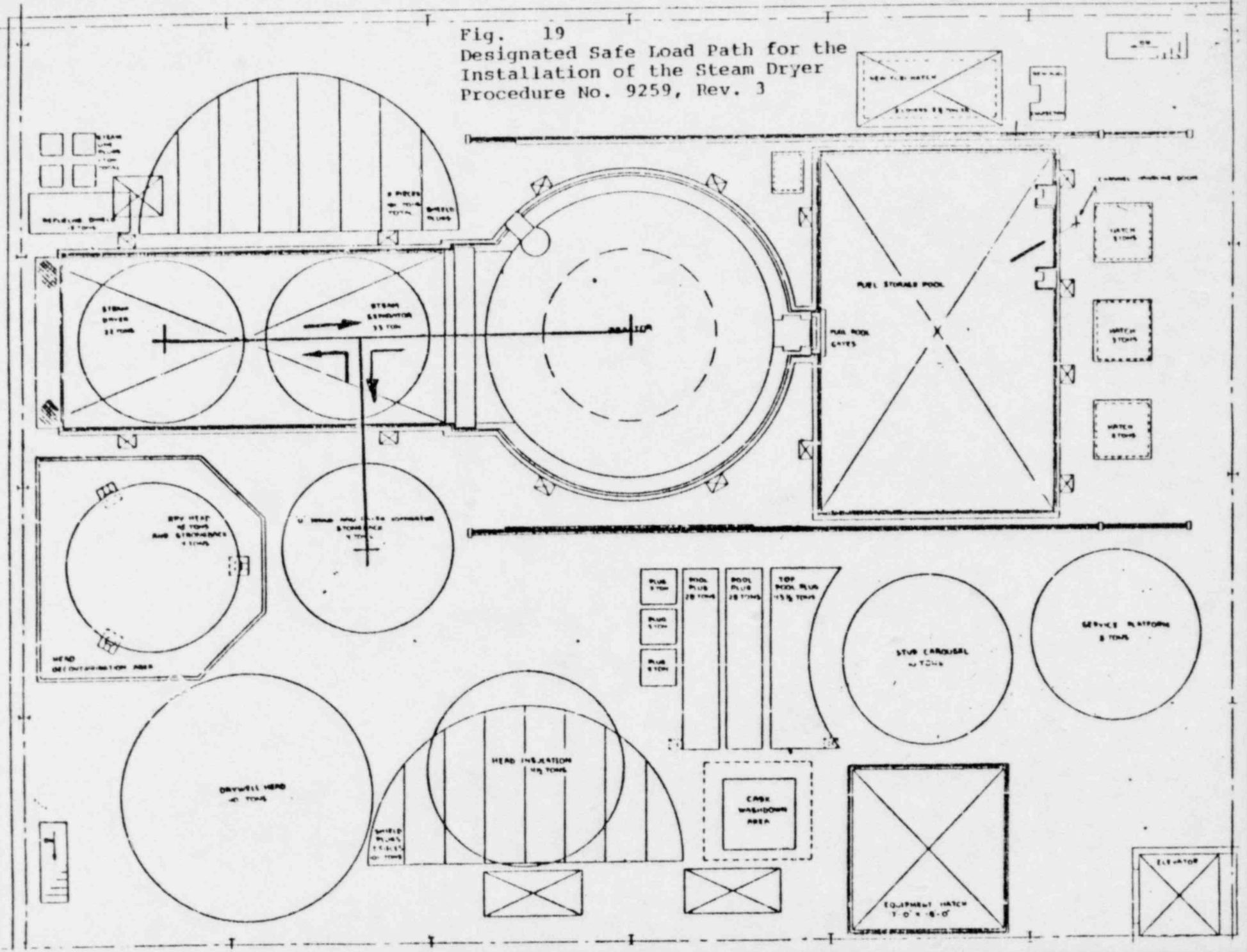


Fig. ' 20
Designated Safe Load Path for the
Installation of the RPV Head
Procedure No. 9262 Rev. 4

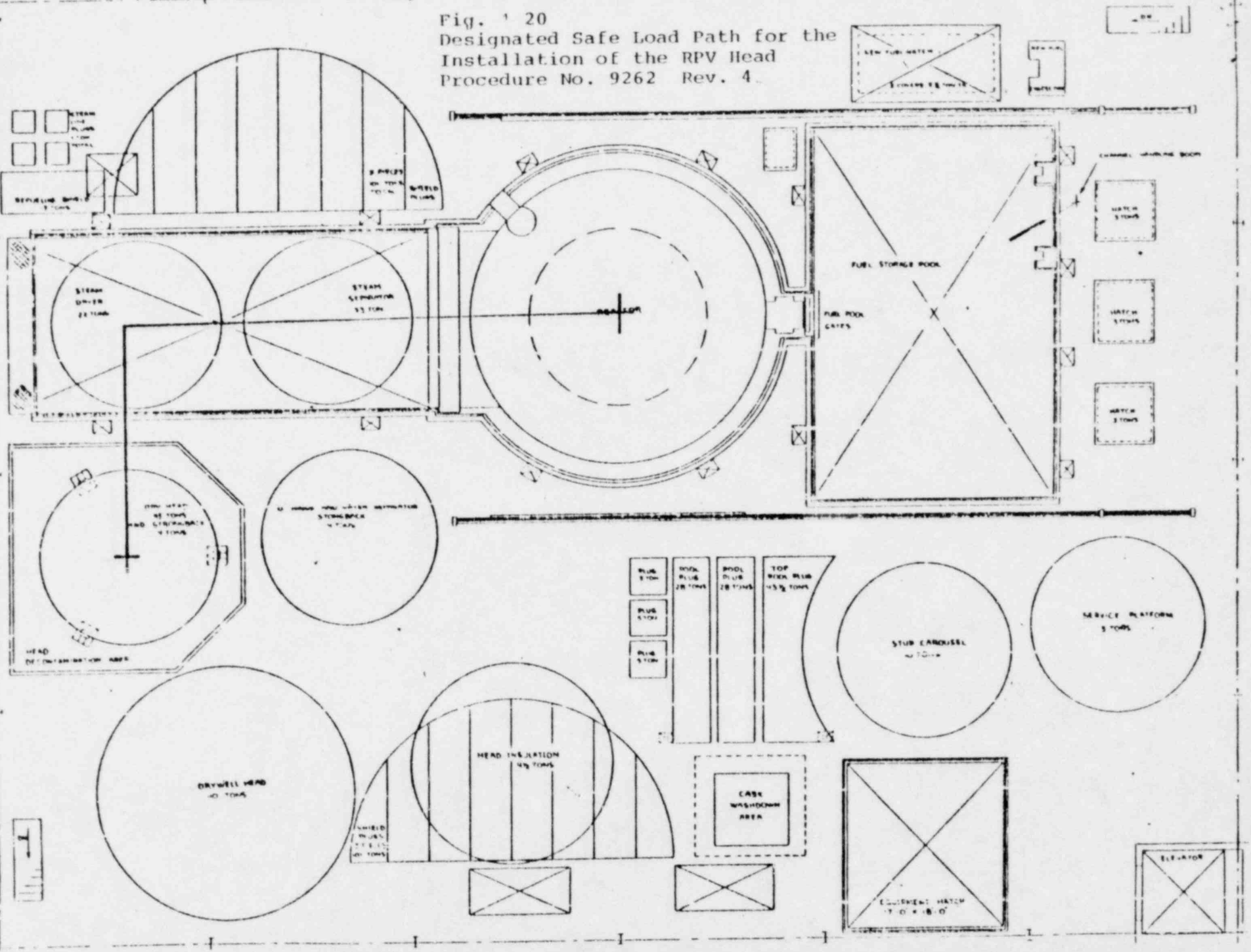


Fig. 21
Designated Safe Load Path for the Installation of the RPV Stud Tensioner
Procedure No. 9267, Rev. 6

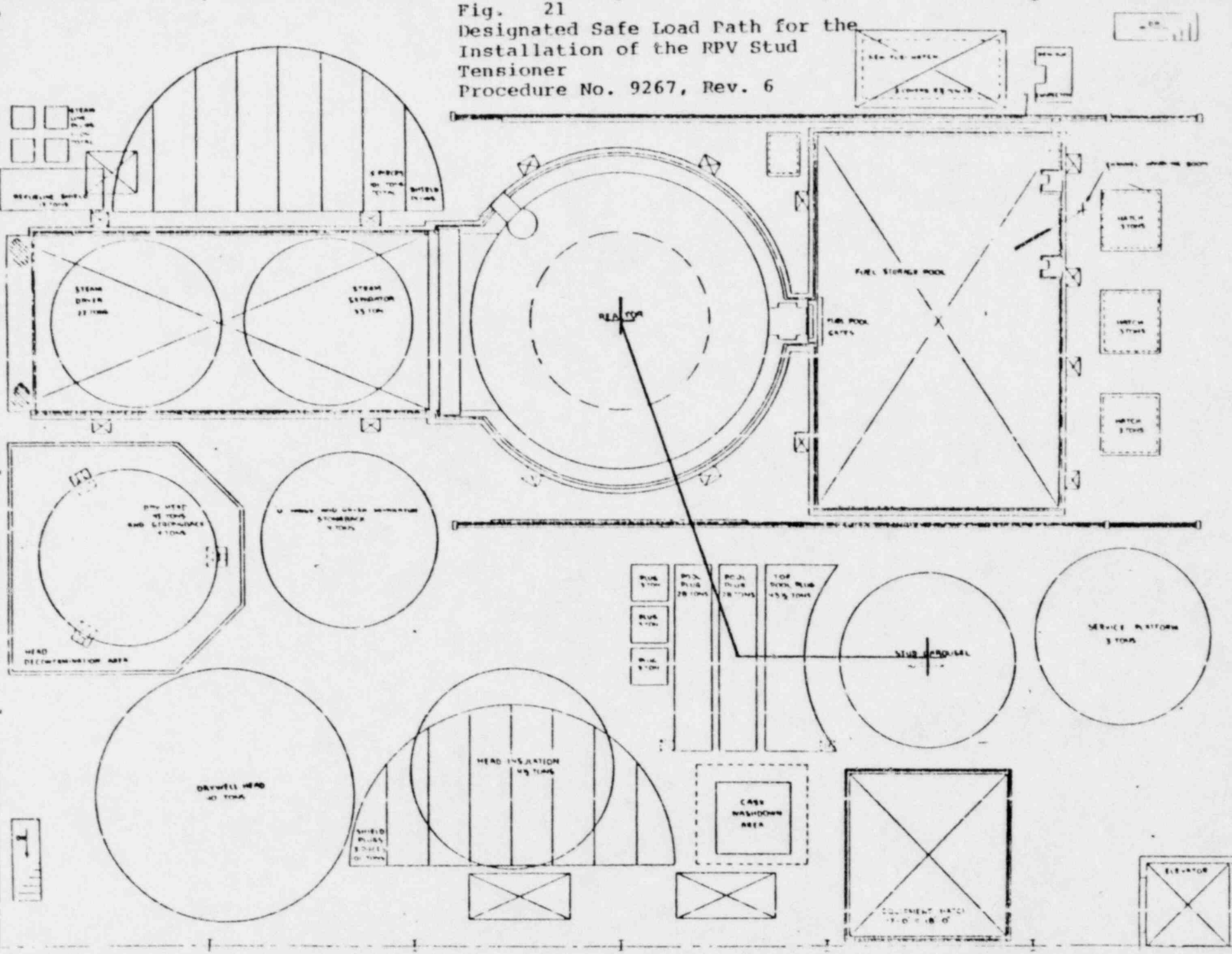


Fig. 22
Designated Safe Load Path for the Installation of the RPV Head Insulation
Procedure No. 9269, Rev. 3

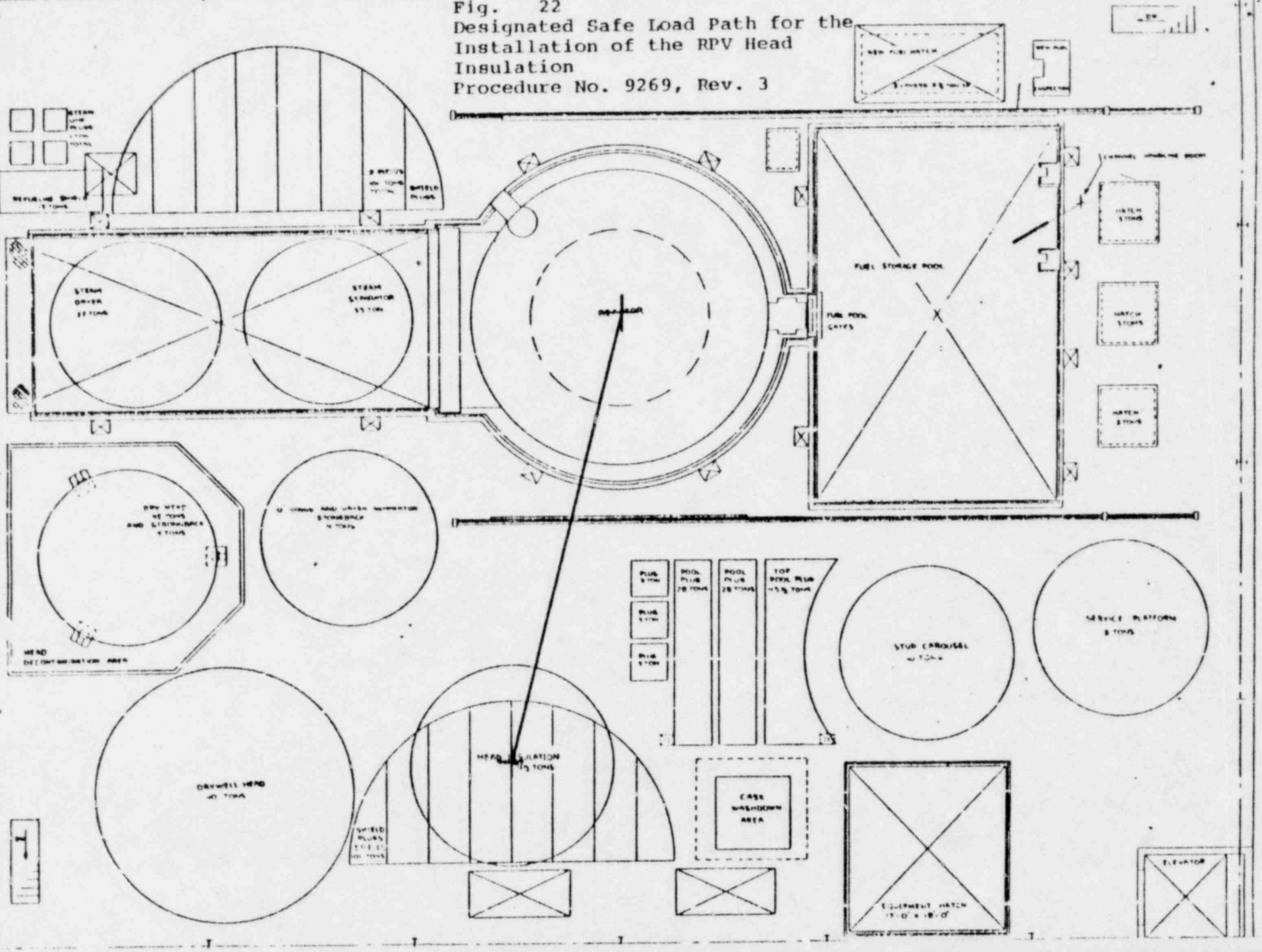


Fig. 23
Designated Sfae Load Path for the Installation of the Drywell Head
Procedure No. 9275 Rev. 4

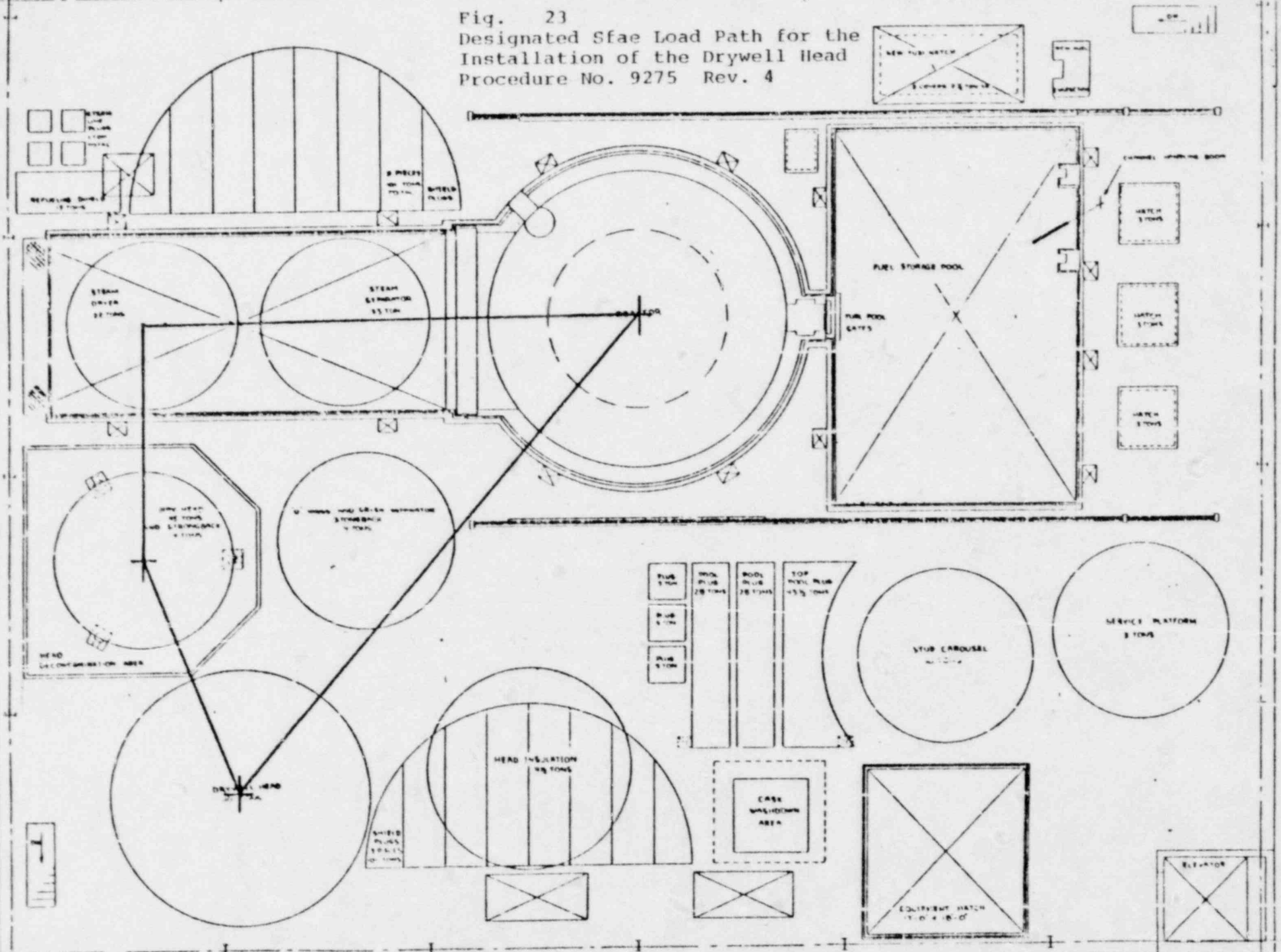


Fig. 24
Designated Safe Load Path for the Installation of the Dryer/ Separator Pit Shield Blocks
Procedure No. 9279, Rev. 4

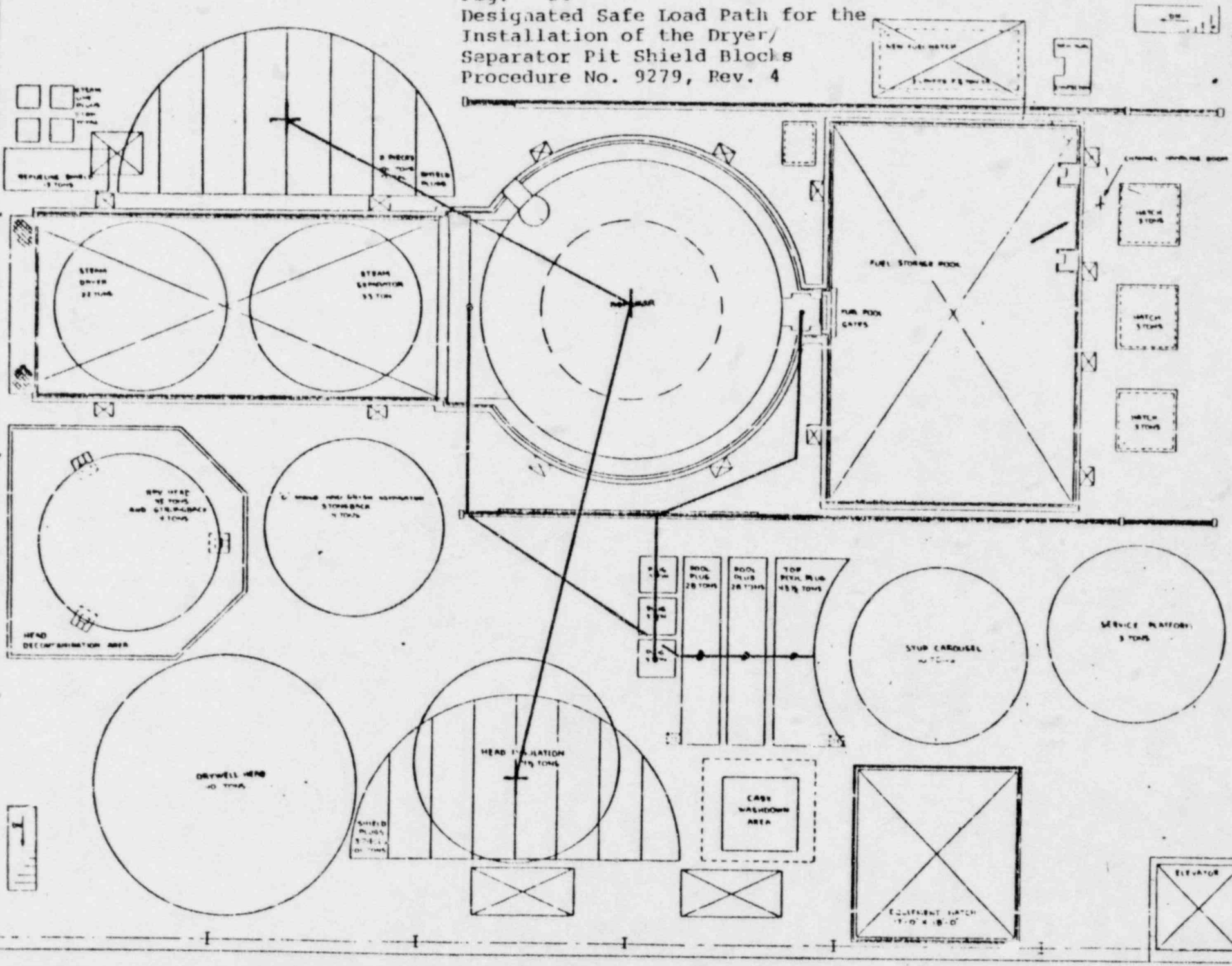
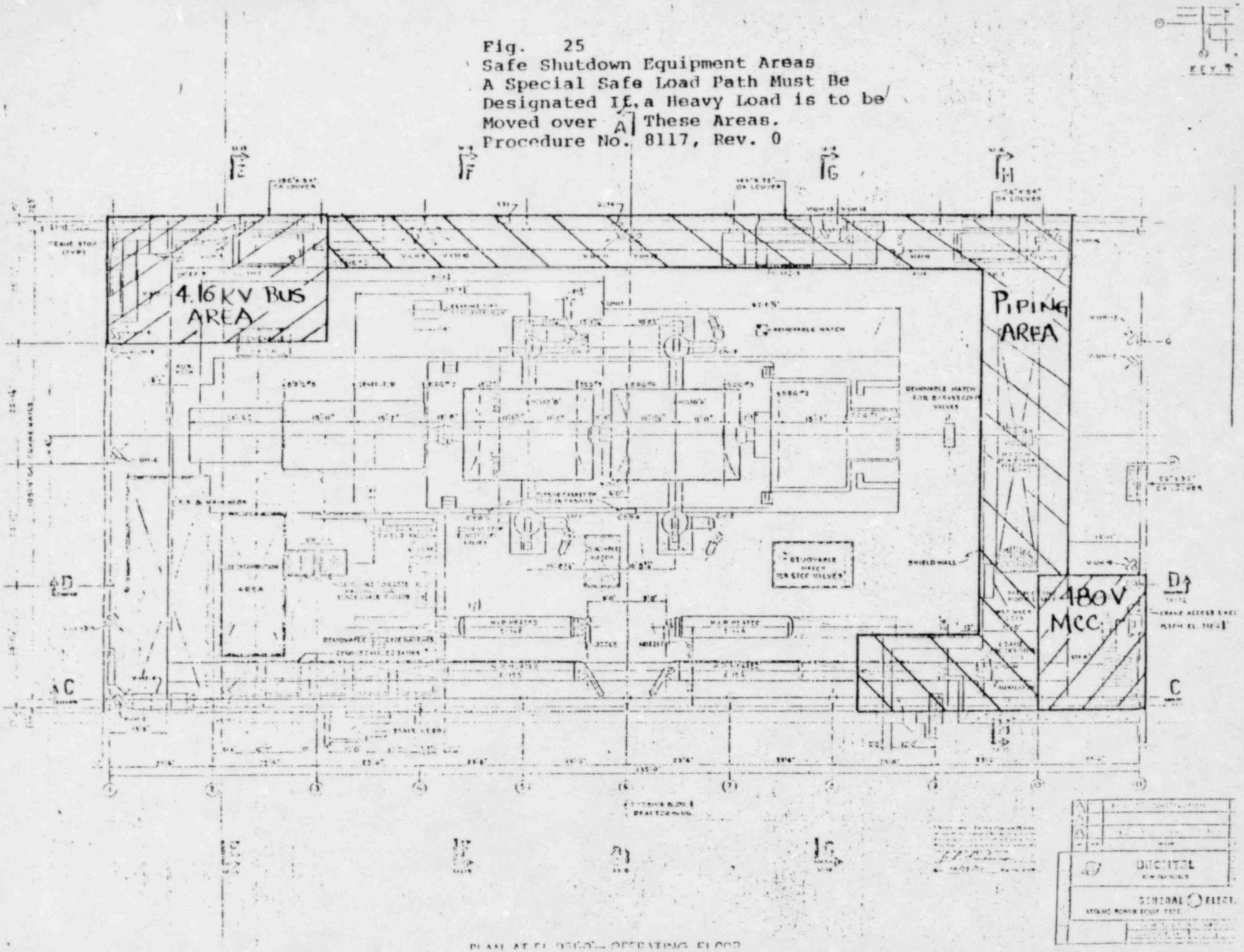
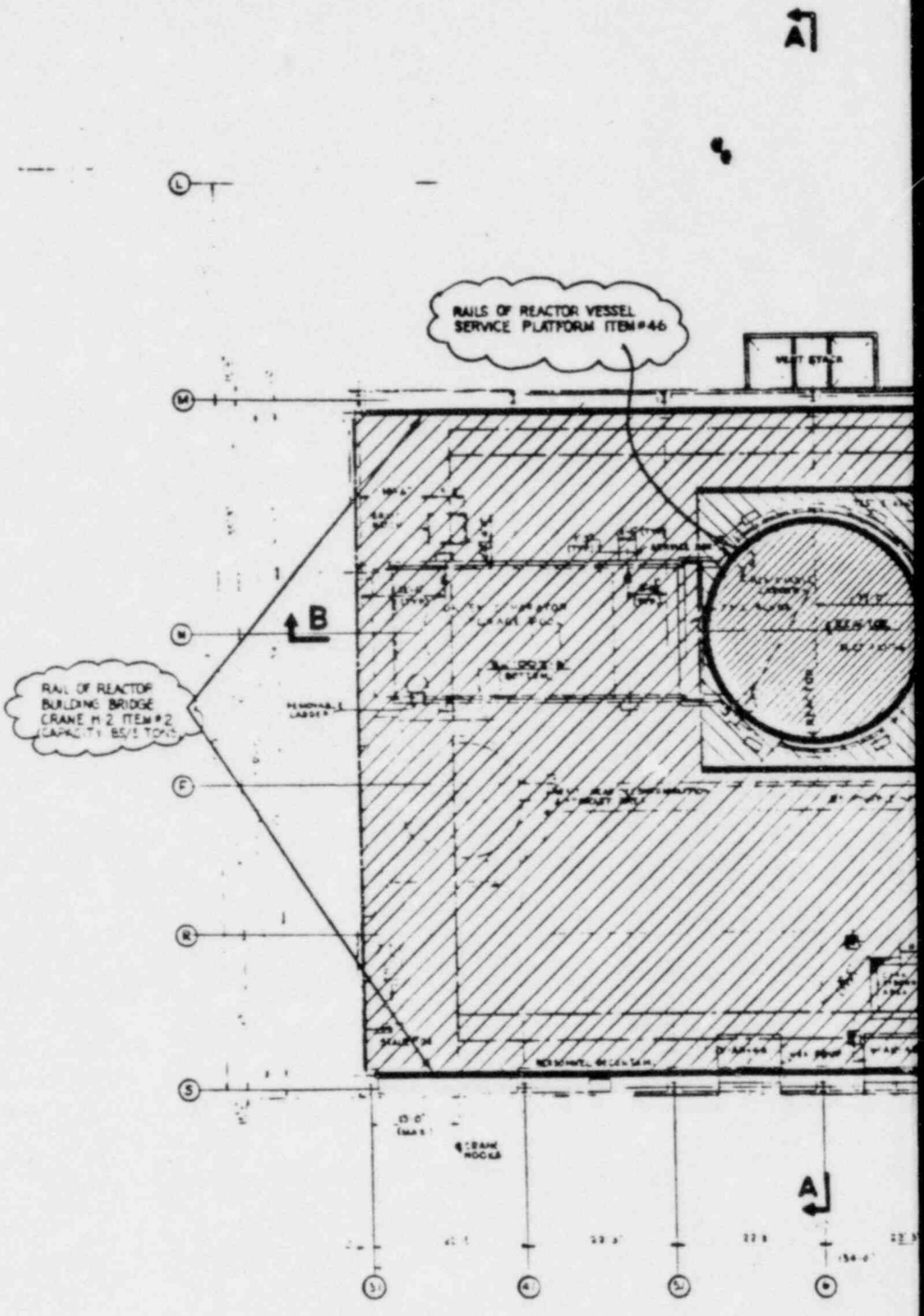


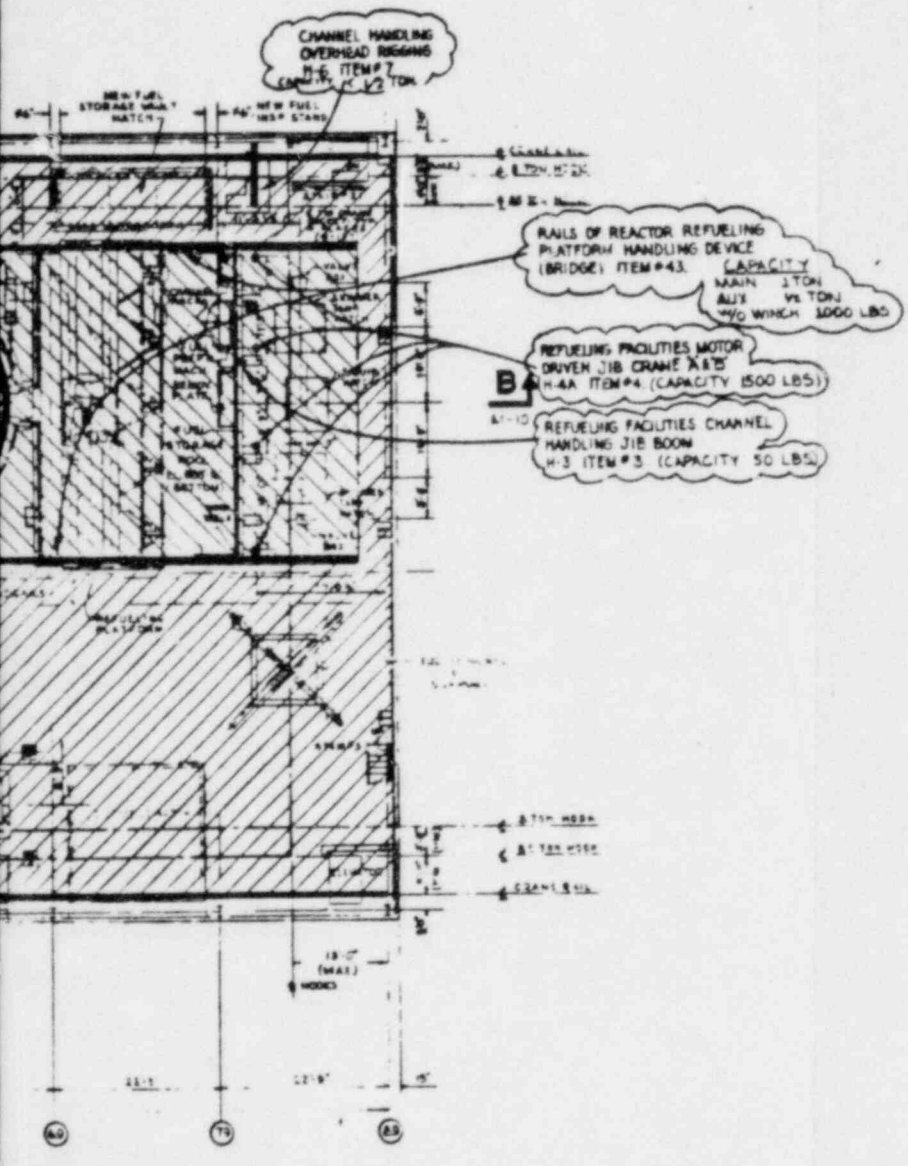
Fig. 25
Safe Shutdown Equipment Areas
A Special Safe Load Path Must Be
Designated If a Heavy Load is to be
Moved over A These Areas.
Procedure No. 8117, Rev. 0

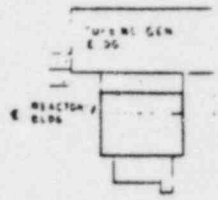



PLAN AT EL 755'-0" OPERATING FLOOR




PLAN AT EL. 1027'-6"



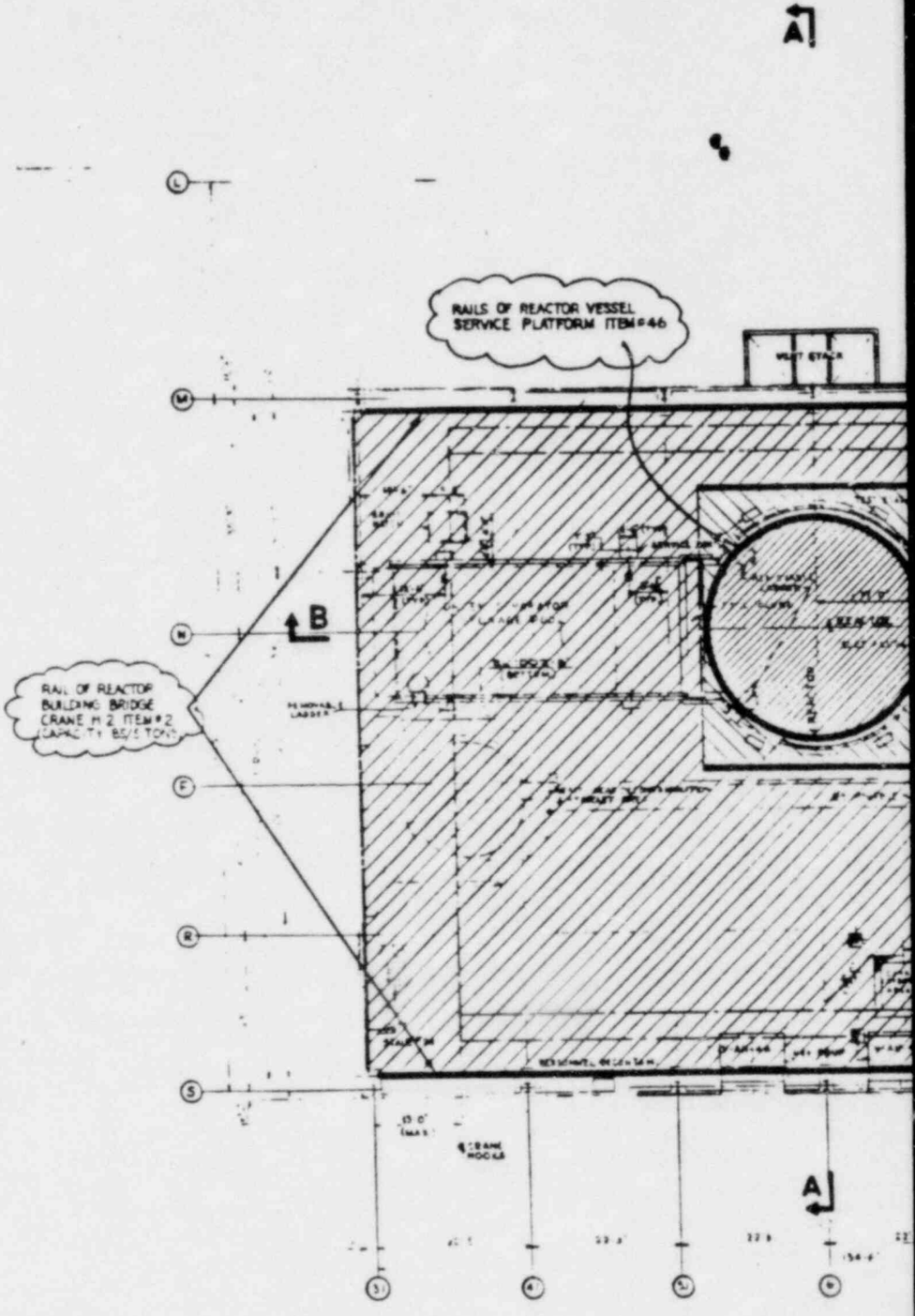
KEY PLAN

TYPICAL SYMBOL

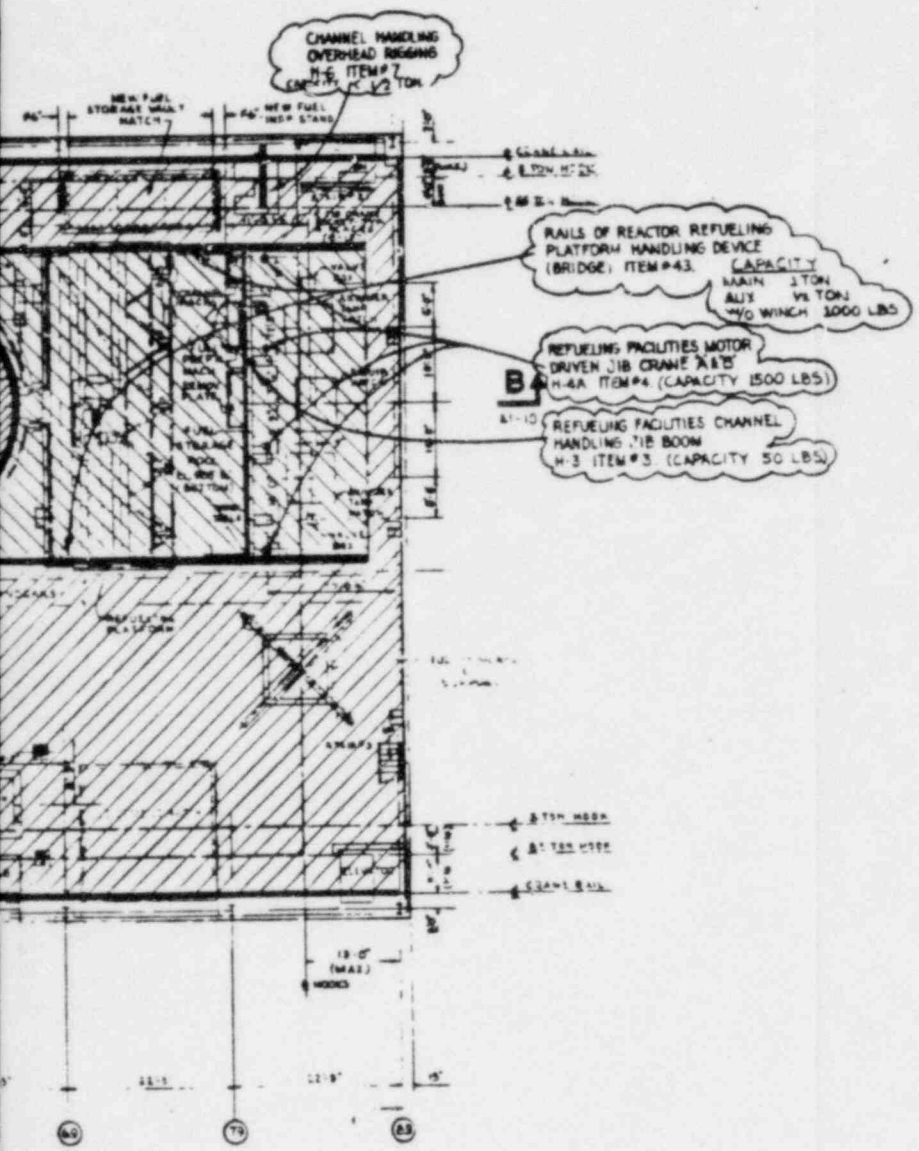
ENLARGED COVERAGE ENVELOPE

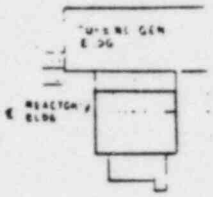
OR

| | | |
|---|---|---|
| AUGUST '68 | [illegible] NUCLEAR POWER GENERATING PLANT, UNIT 1 | |
| FIG 26 | LOAD HANDLING DEVICES - REACTOR BLDG PLAN AT EL 1027'-8" | |
| | [illegible] POWER COMPANY | |



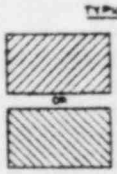

PLAN AT EL. 1027'-6"



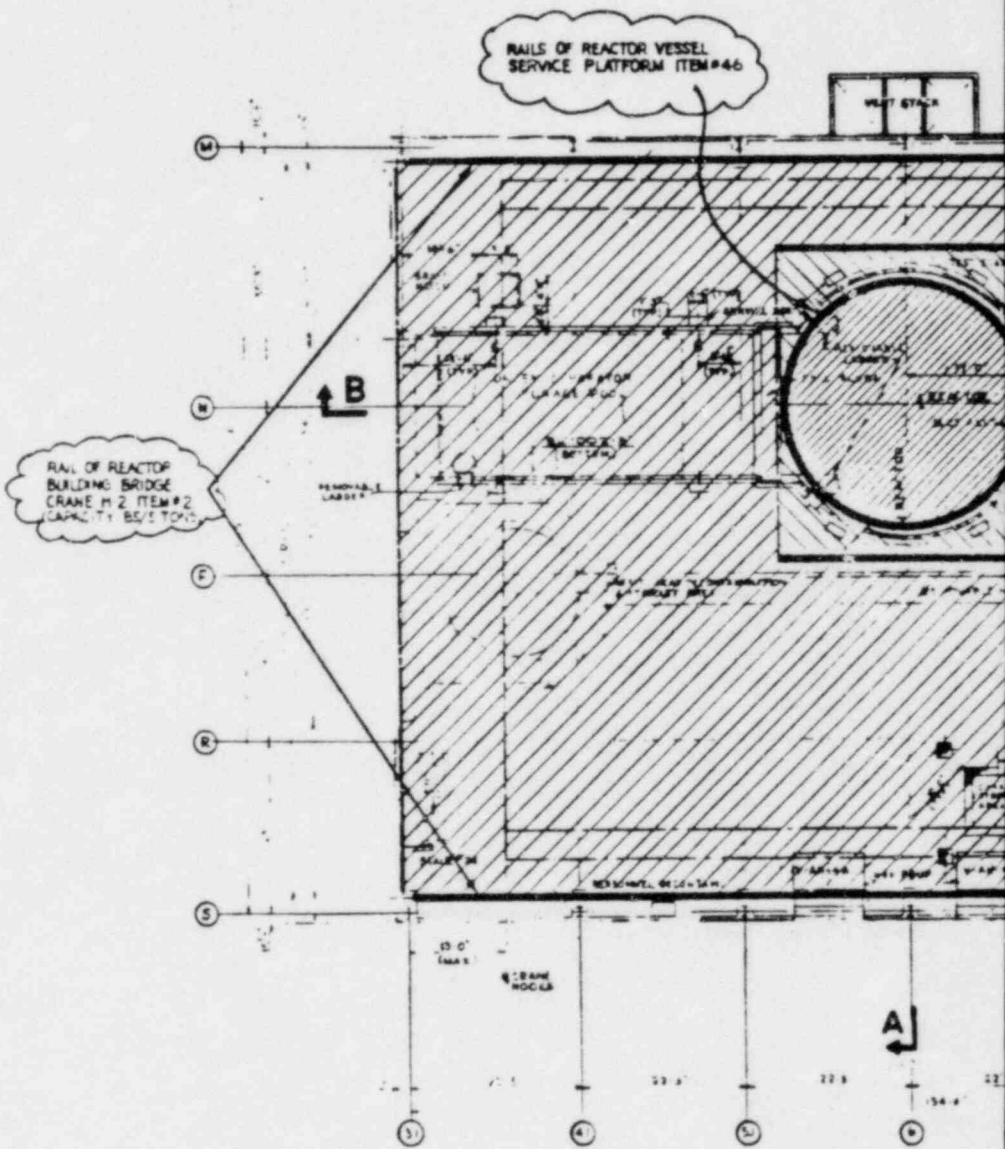
KEY PLAN

TYPICAL SYMBOL

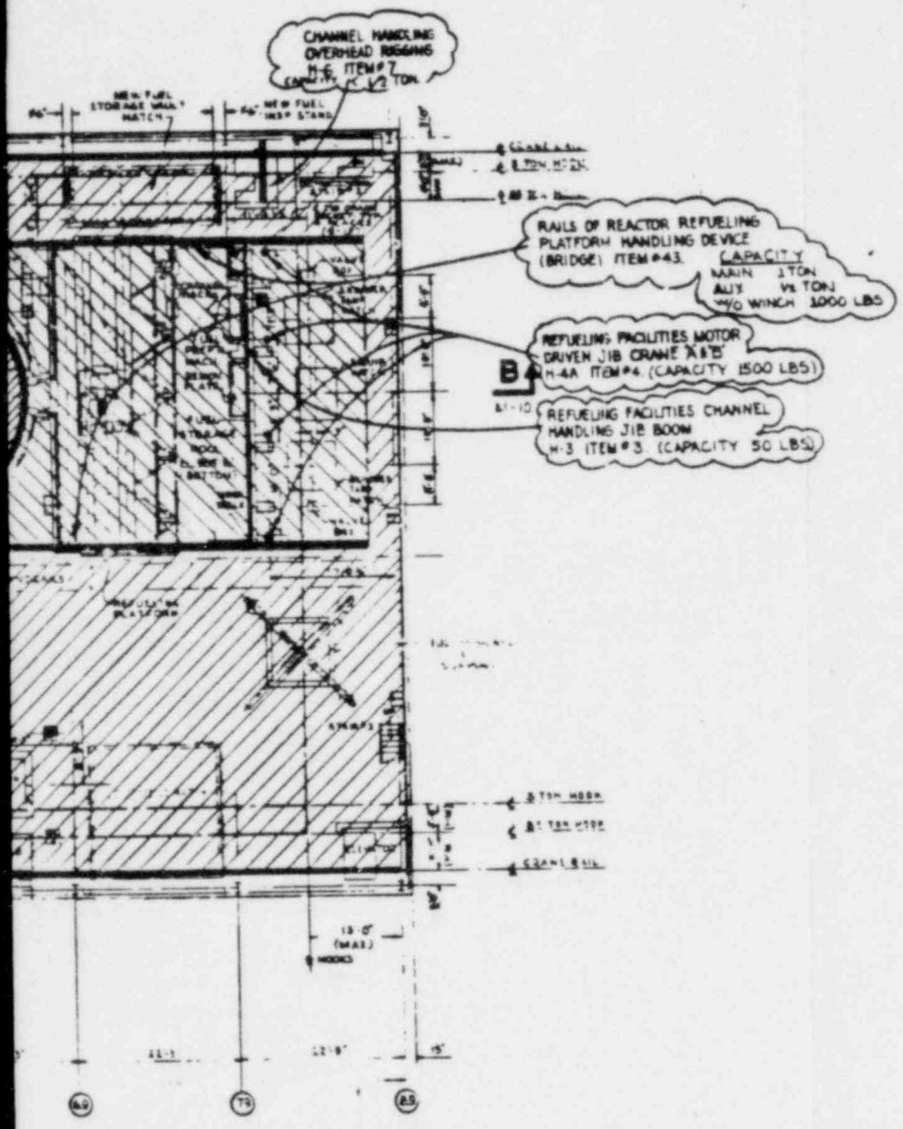


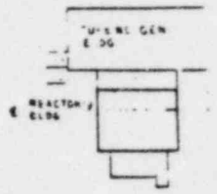
ENLARGED COVERAGE ENVELOPE

| | | |
|---|---|---|
| AUGUST 1981 | CRITICAL NUCLEAR GENERATING PLANT, UNIT 1 | |
| FIG 26 | LOAC HANDLING DEVICES - REACTOR BLDG PLAN AT EL 1027'-8" | |
| | NORTHERN STATES POWER COMPANY | |



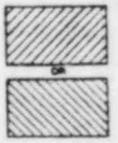

PLAN AT EL. 1027'-6"



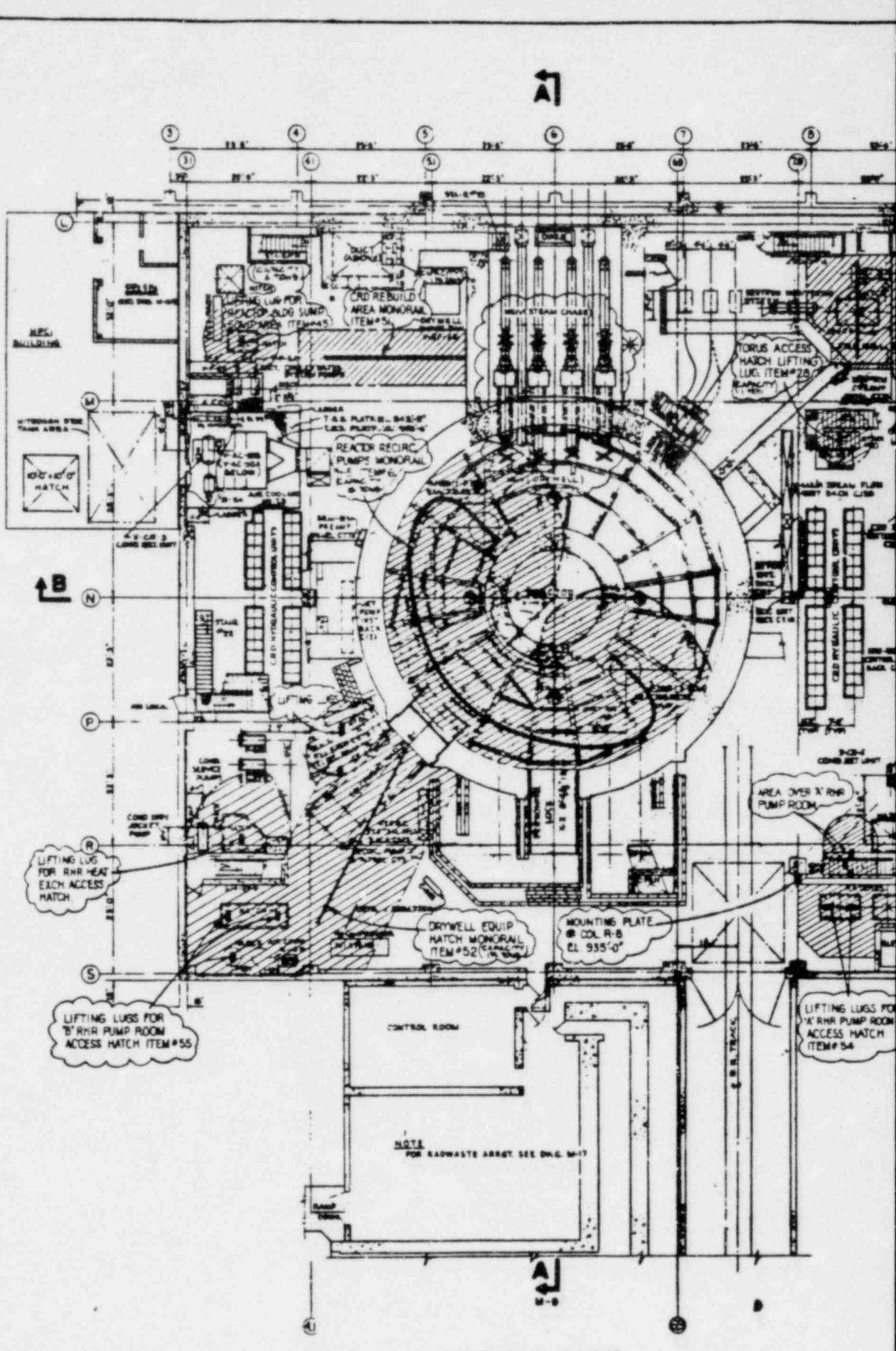

KEY PLAN

TYPICAL SYMBOL

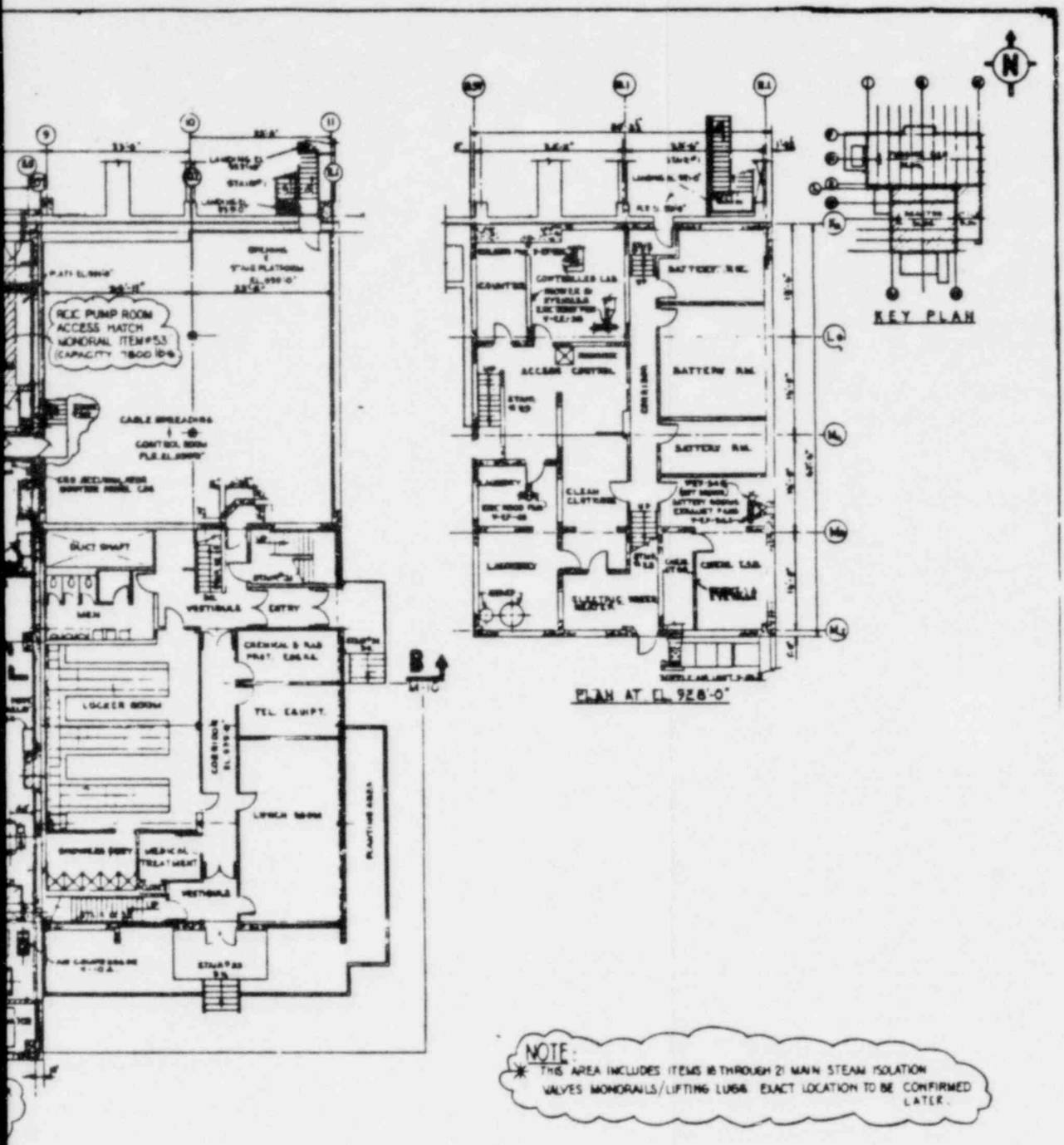


ENLARGED COVERAGE ENVELOPE

| | |
|---|---|
| AUGUST 1969 | WORTHING NUCLEAR GENERATING PLANT UNIT 1 |
| FIG. 26 | LOAD HANDLING DEVICES - REACTOR BLDG PLAN AT EL. 1027'-8" |
| | NORTHERN STATES POWER COMPANY |




PLAN AT EL. 935'-0"



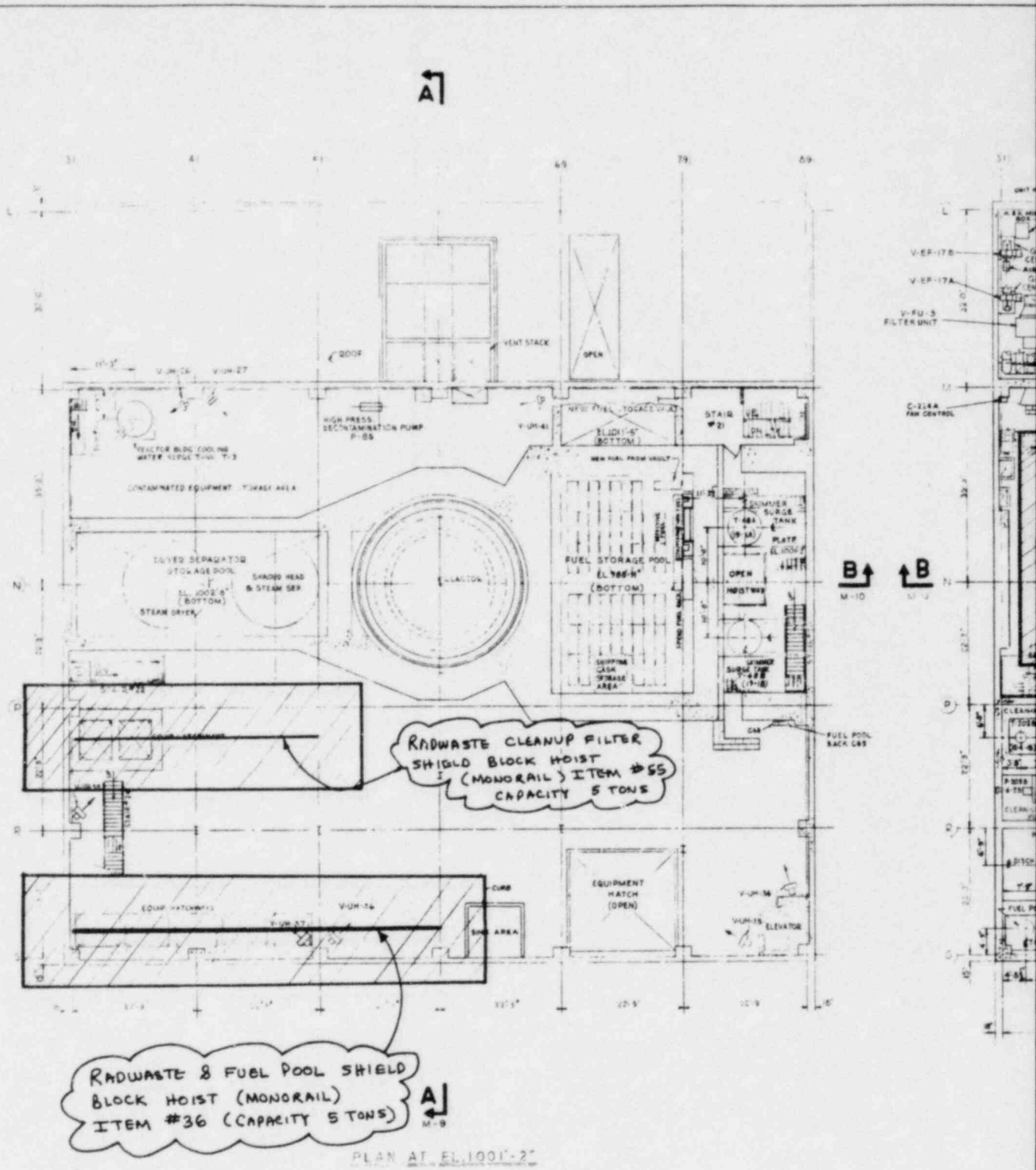

NOTE:
* THIS AREA INCLUDES ITEMS 18 THROUGH 21 MAIN STEAM ISOLATION VALVES MONORAILS/LIFTING LUGS. EXACT LOCATION TO BE CONFIRMED LATER.

NOTE:
FOR RADWASTE AREAS SEE DWG. M-17

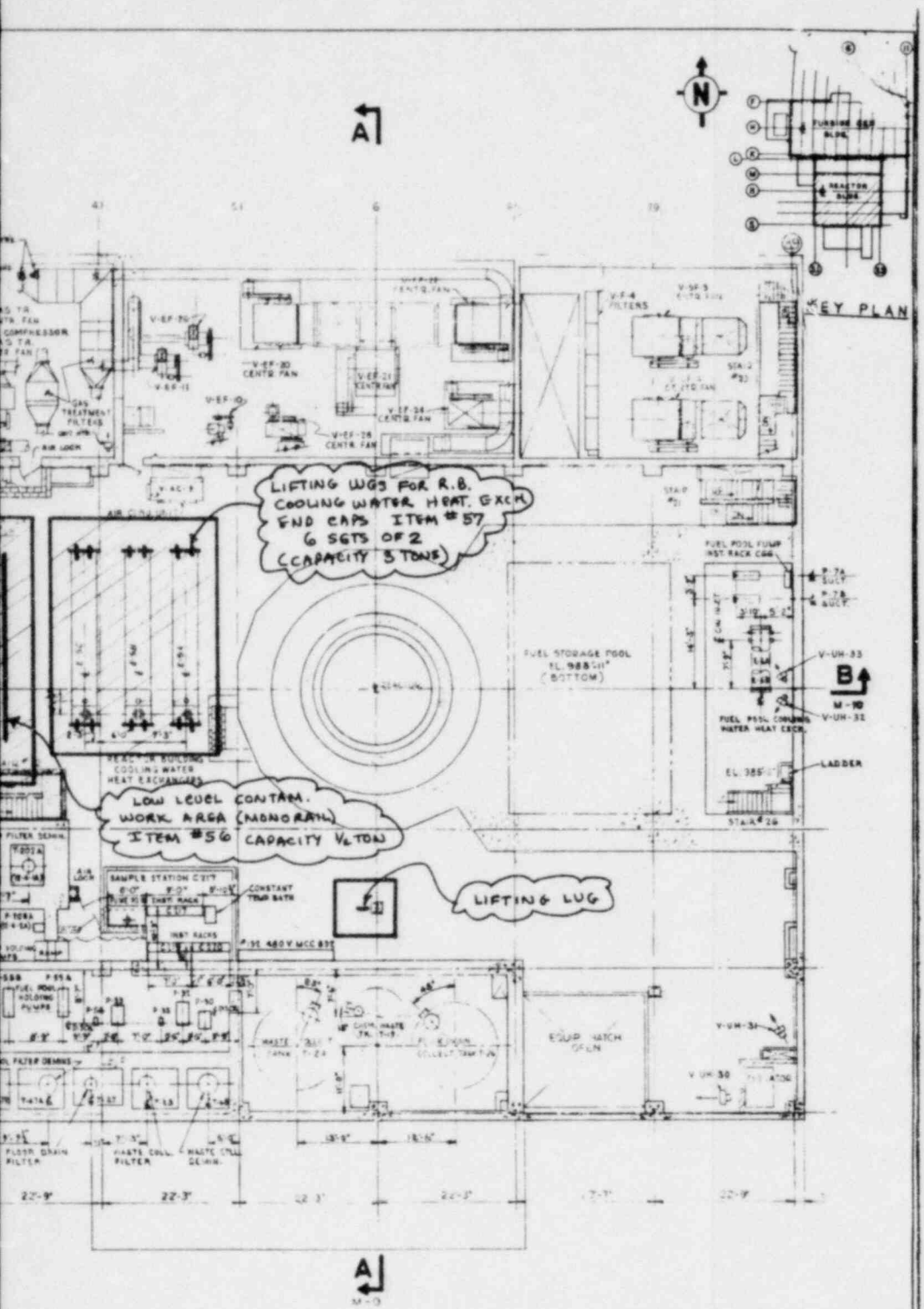
TYPICAL SYMBOLS

ENLARGED COVERAGE ENVELOPE

| | |
|---|---|
| AUGUST 1981 | NORTHEAST NUCLEAR GENERATING PLANT - UNIT 1 |
| FIG. 27 | LOAD HANDLING DEVICES REACTOR BLDG. PLAN AT EL 935'-0" & OFFICE BLDG. PLANS AT EL 928'-0" & EL 939'-0" |




PLAN AT EL. 1001'-2"




PLAN AT EL. 985'-6"

ENLARGED COVERAGE ENVELOPE

| | | | | | |
|---|---|---|---|---|---|
| 3 | REVISED TO AS BUILT CONDITIONS | | | | |
| 2 | REVISED AS INDICATED | | | | |
| 1 | ISSUED FOR CONSTRUCTION | | | | |

BECHTEL SAN FRANCISCO — JOB NO. 5828 — DWG. NO. M-4 — REV. RD

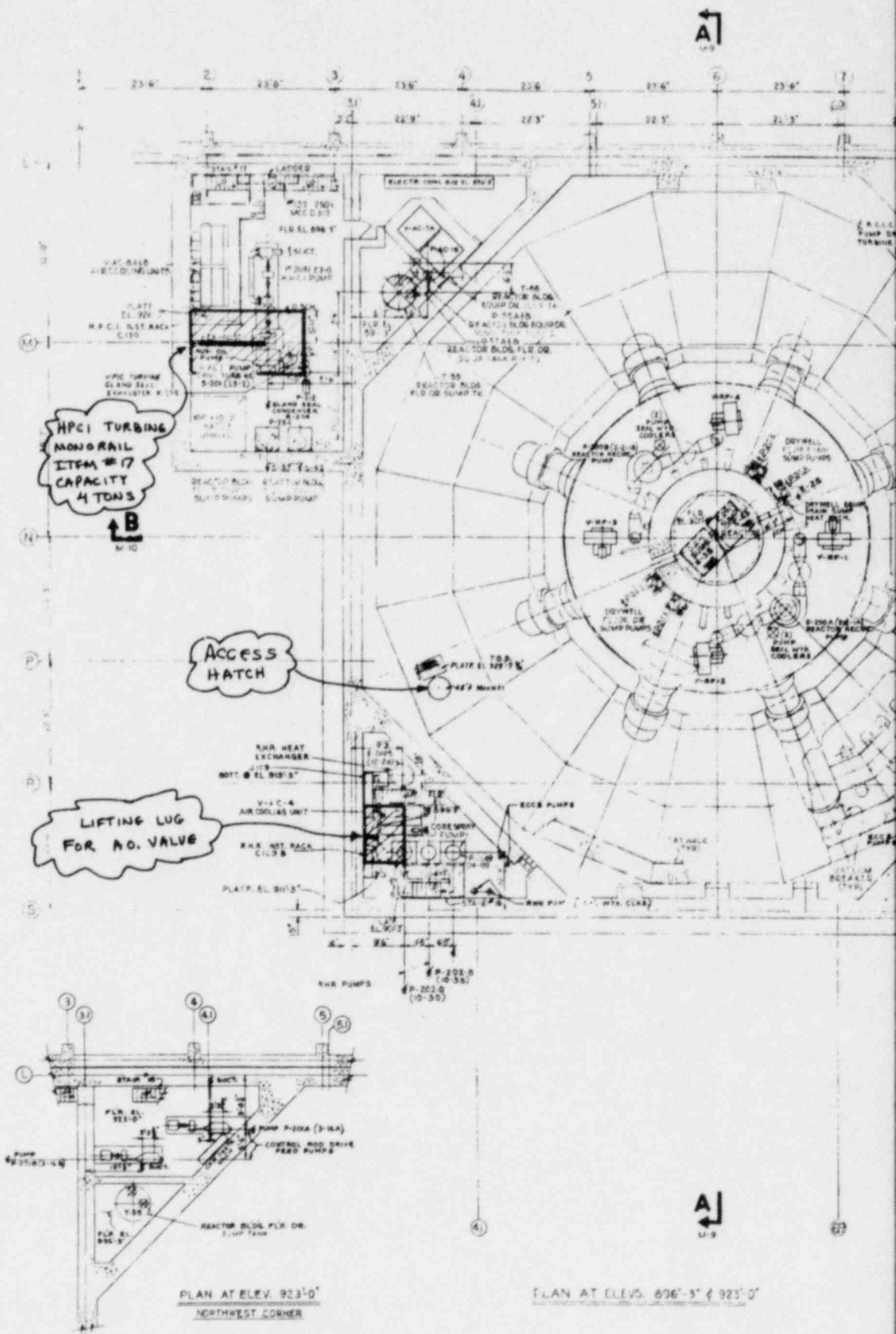
GENERAL ELECTRIC ATOMIC POWER EQUIP. DEPT. SAN JOSE, CALIF.

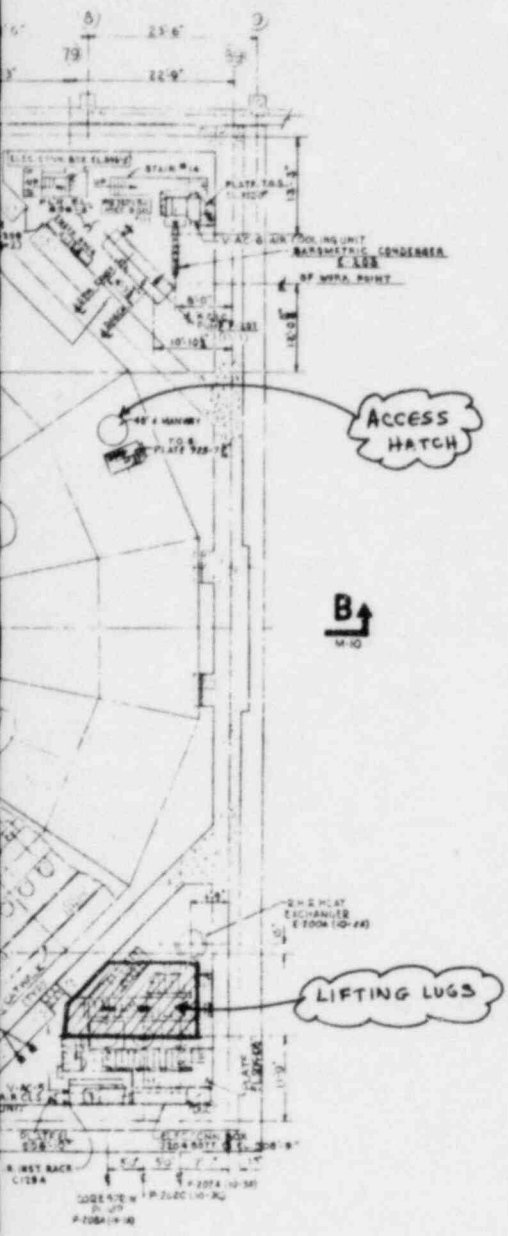
FIG 28

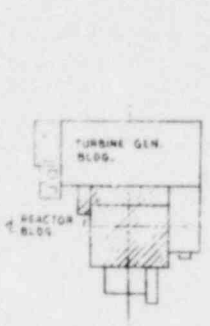
NORTHERN STATES POWER COMPANY

EQUIPMENT LOCATION - REACTOR BLDG. PLANS AT EL. 985'6" & 1001'2"

NF-3605TC


HPCI TURBINE MONORAIL ITEM #17 CAPACITY 4 TONS
ACCESS HATCH
LIFTING LUG FOR A.O. VALVE
RHR HEAT EXCHANGER
RHR PUMPS
PLAN AT ELEV. 923'-0"
NORTHWEST CORNER
PLAN AT ELEVS. 836'-3" & 923'-0"




KEY PLAN
1" = 100'-0"

| REVISIONS |
|---|
| A/1 AS BUILT SECURITY SYSTEM REVISIONS PER DWG TURNOVER PER OTHER MOD'S. ANSB |
| DWN BK DATE 8-6-79 |
| CHK'D KMC |
| PROJ. D.C. 7780.60 |
| FILMED 8-12-79 |

ENLARGED COVERAGE ENVOLOPE

| | | | |
|---|---|---|---|
| A/1 | REVISED TO AS BUILT CONDITIONS | | |
| | REVISED AS INDICATED | | |
| | ISSUED FOR CONSTRUCTION | | |
| | ISSUED FOR INFORMATION | | |

BECHTEL SAN FRANCISCO — JOB NO. 5828 — DWG. NO. M-1 — REV. 1

GENERAL ELECTRIC — ATOMIC POWER EQUIP. DEPT. — RD

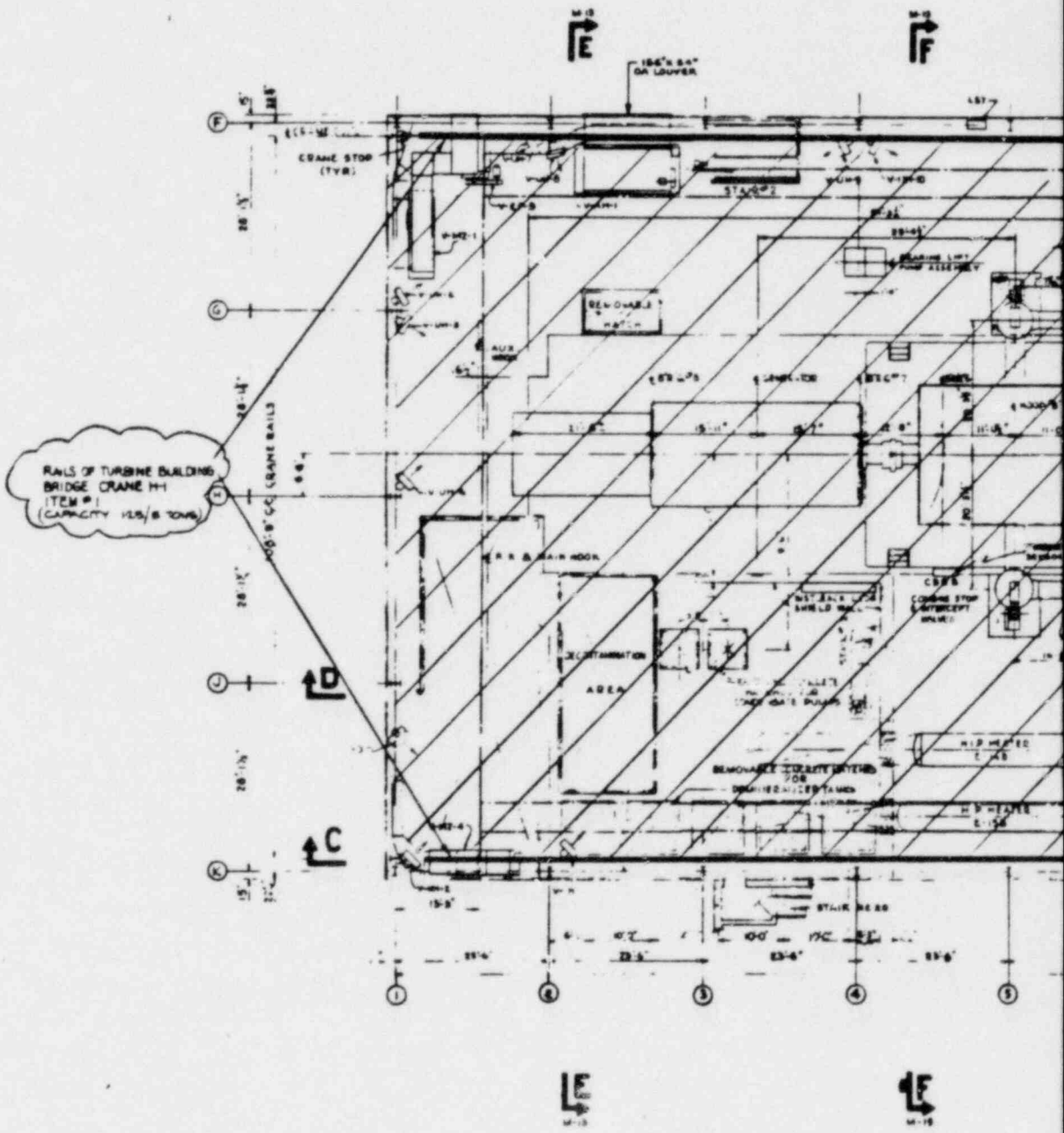
NF

FIG 29

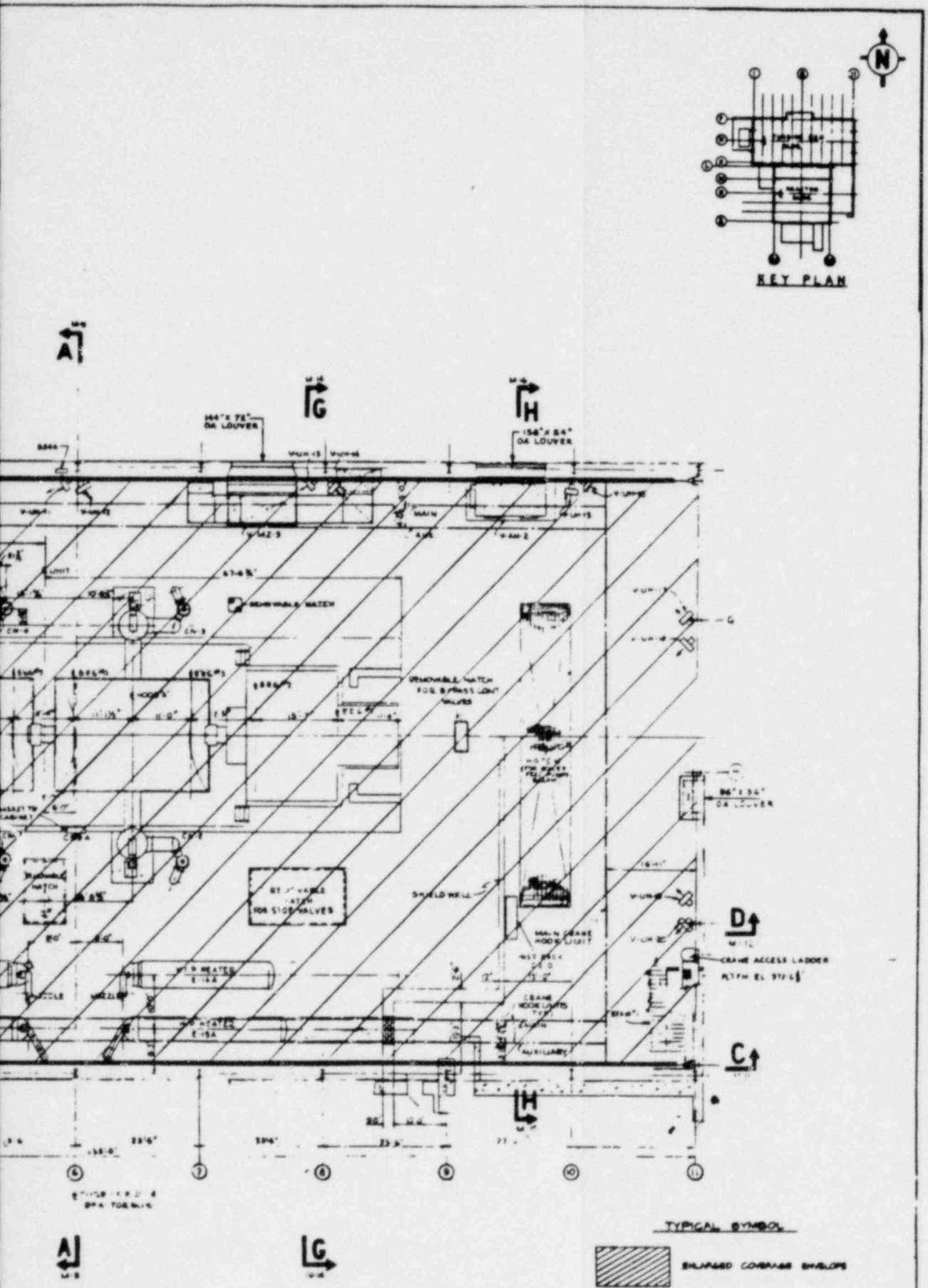
MONTICELLO NUCLEAR GENERATING PLANT — NSP

EQUIPMENT LOCATION - REACT. & PLUG. PLAN AT EL. 986'-5" & 994'-0"

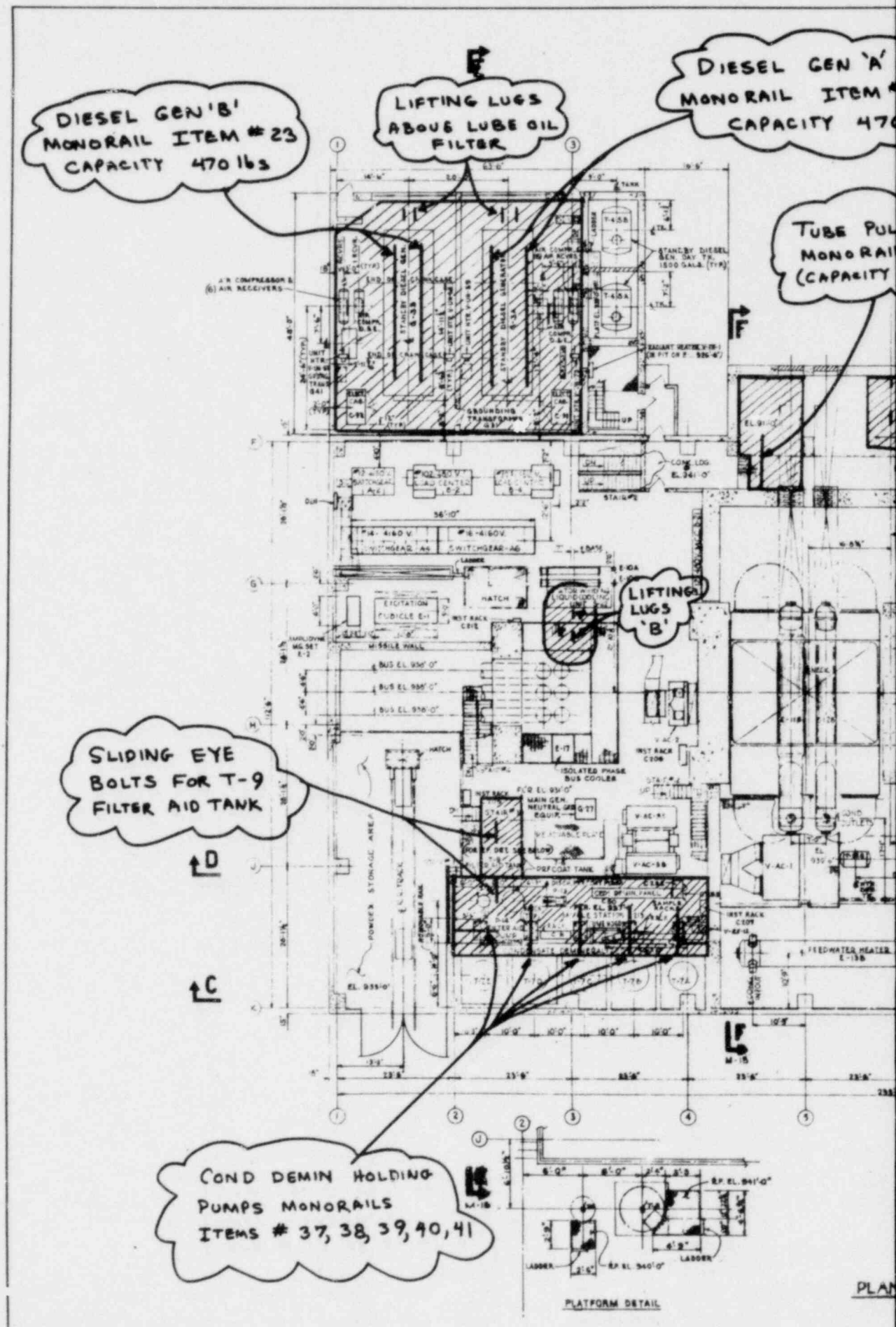
NORTHERN STATES POWER COMPANY — DWG. NO. NF-4360-4 — REV. C

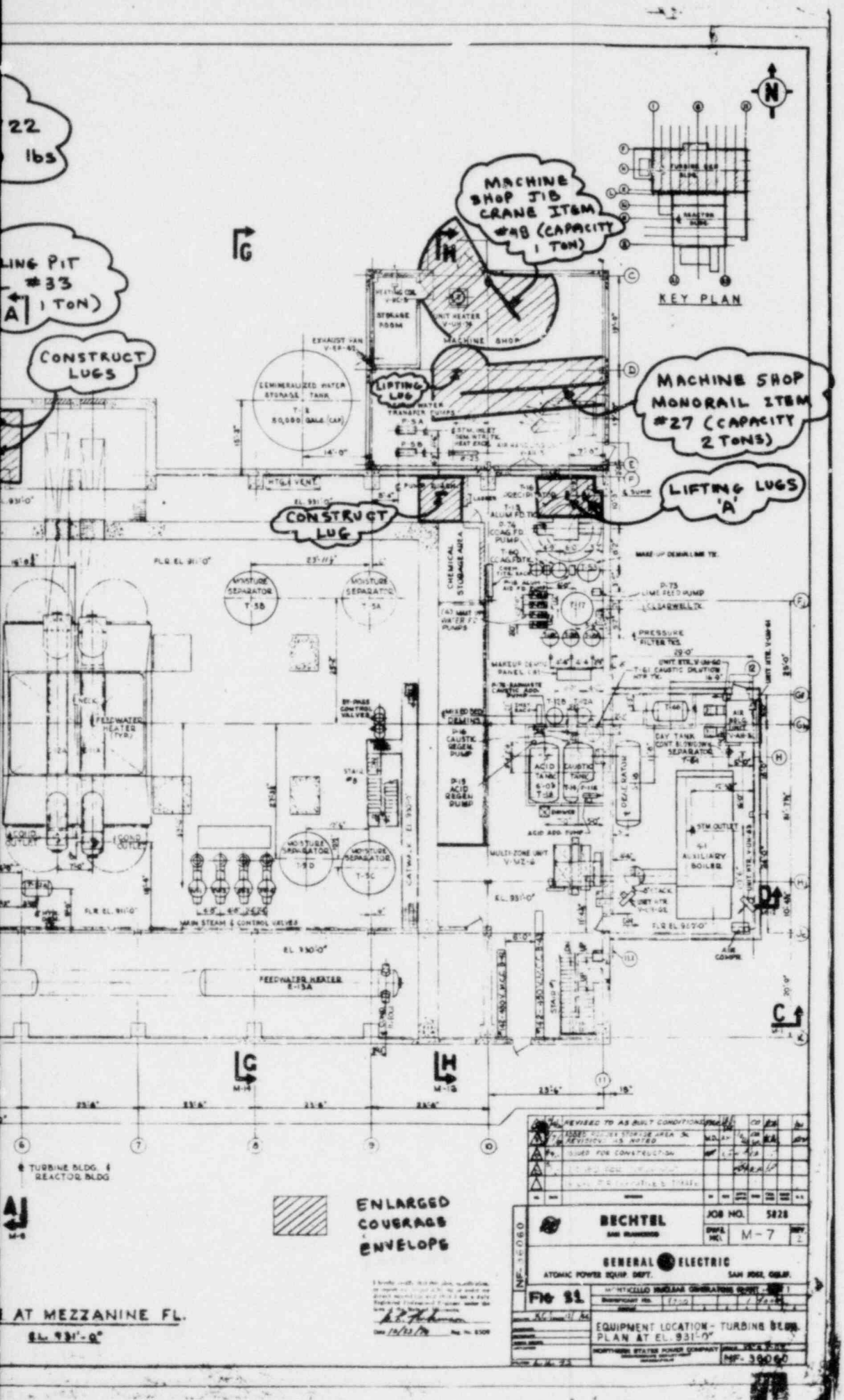

RAILS OF TURBINE BUILDING BRIDGE CRANE M-1 (ITEM #1 (CAPACITY 125/8 TONS)
CRANE STOP (TYP.)
CONTAMINATION AREA
E
F
D
C

PLAN AT EL




951'-0"— OPERATING FLOOR


DIESEL GEN 'B'
MONORAIL ITEM # 23
CAPACITY 470 lbs
LIFTING LUGS
ABOVE LUBE OIL
FILTER
DIESEL GEN 'A'
MONORAIL ITEM
CAPACITY 47
TUBE PUL
MONORAI
(CAPACITY
LIFTING
LUGS
'B'
SLIDING EYE
BOLTS FOR T-9
FILTER AID TANK
COND DEMIN HOLDING
PUMPS MONORAILS
ITEMS # 37, 38, 39, 40, 41
PLATFORM DETAIL
PLAN




REVISED TO AS BUILT CONDITIONS

BECHTEL SAN FRANCISCO

JOB NO. 5828

DWG. NO. M-7

GENERAL ELECTRIC ATOMIC POWER EQUIP. DEPT. SAN JOSE, CALIF.

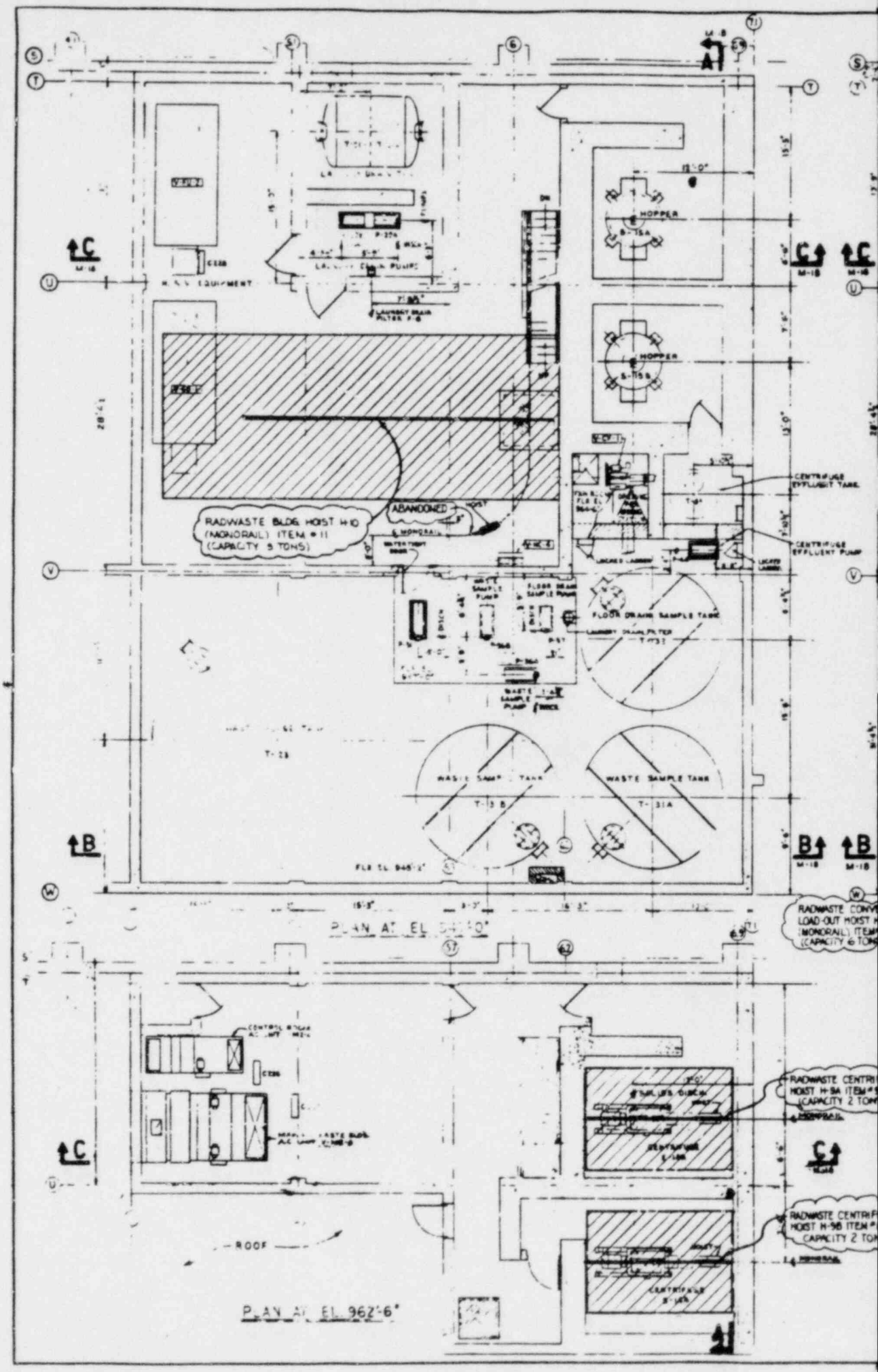
FIG 8.1

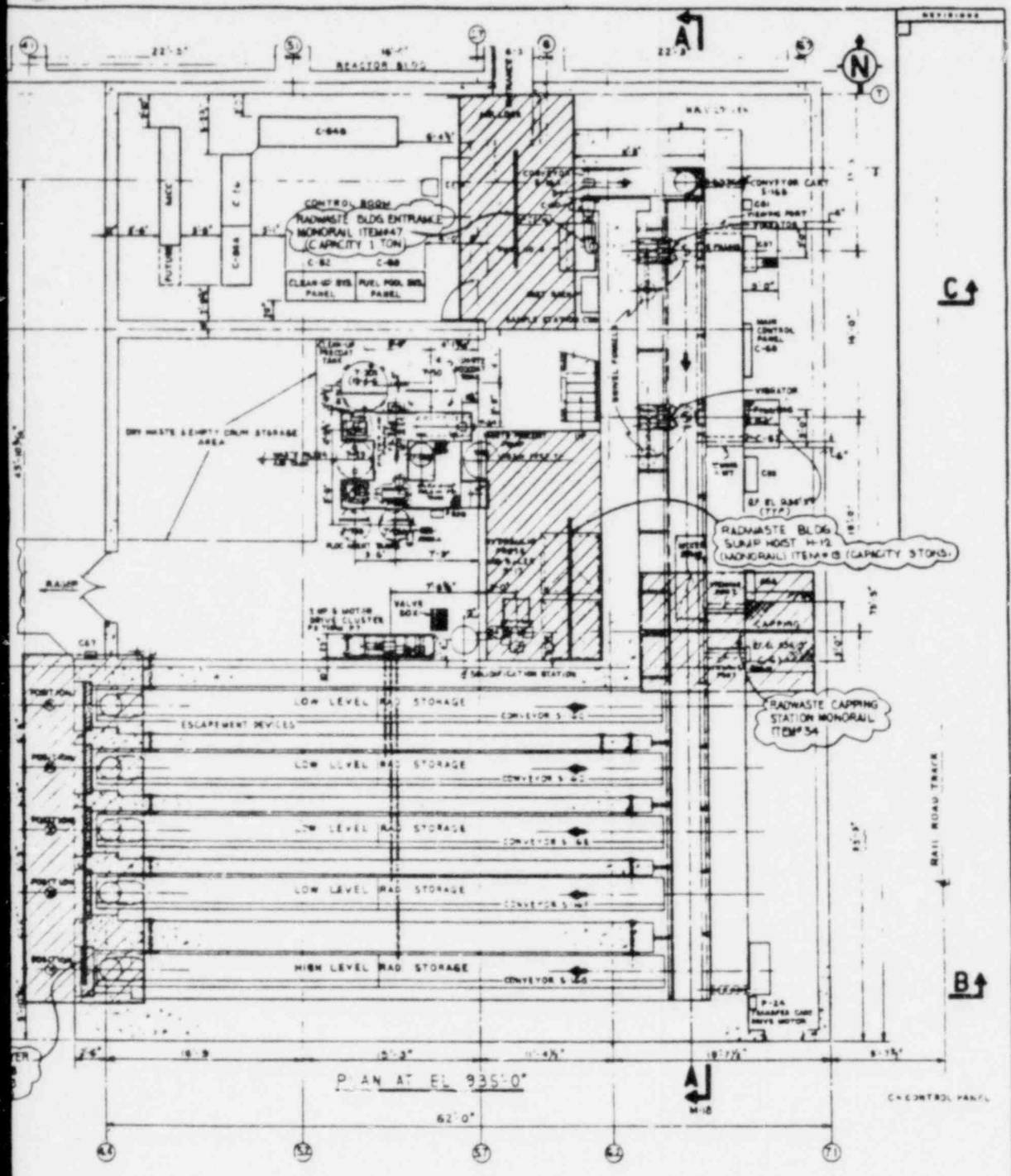
EQUIPMENT LOCATION - TURBINE BLDG. PLAN AT EL. 931'-0"

NORTHERN STATES POWER COMPANY

NF-39060

NF-10060

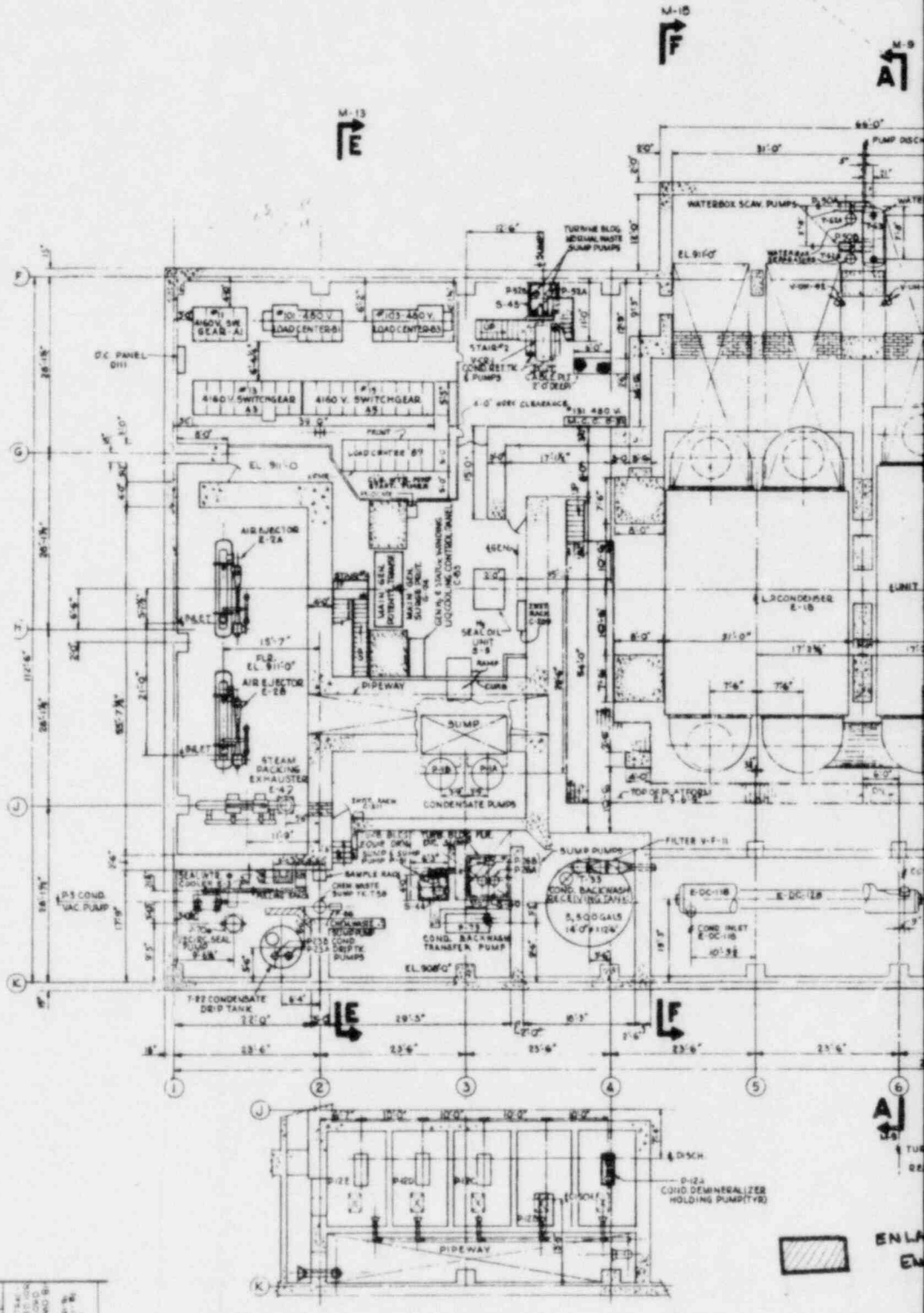

RADWASTE BLDG HOIST H-10
(MONORAIL) ITEM # 11
(CAPACITY 5 TONS)
ABANDONED
HOPPER
HOPPER
CENTRIFUGE EFFLUENT TANK
CENTRIFUGE EFFLUENT PUMP
FLOOR DRAIN SAMPLE TANK
WASTE SAMPLE TANK
WASTE SAMPLE TANK
PLAN AT EL 985'-0"
ROOF
PLAN AT EL 962'-6"

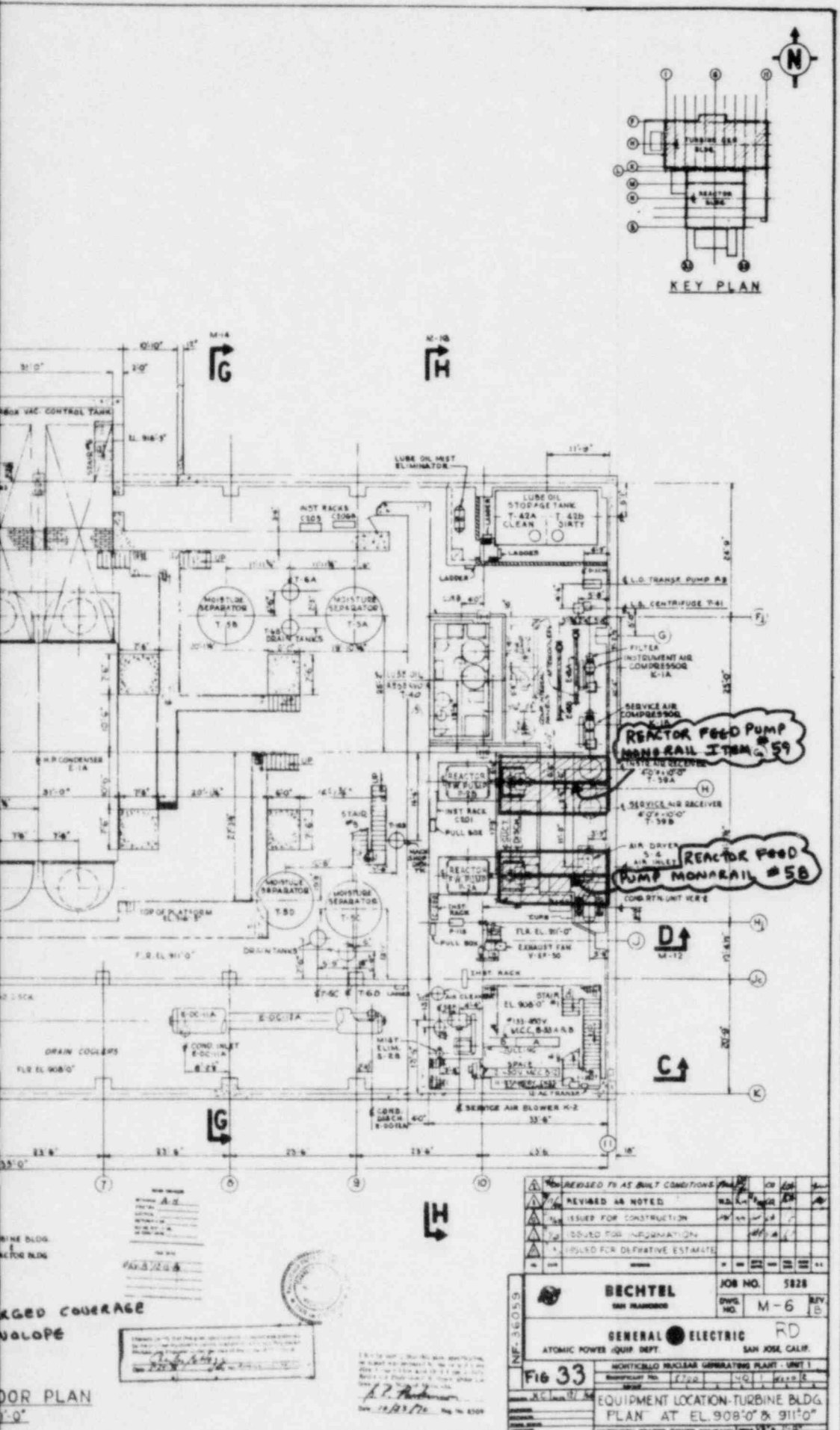



TYPICAL SYMBOL

ENLARGED COVERAGE ENVELOPE

| | |
|---|---|
| AUGUST 1981 | |
| FIG. 3.2 | LOAD HANDLING PATHS RADWASTE BLDG. PLAN AT EL 935'-0", 947'-0" & 962'-6" |


M-13
E
M-15
F
M-9
A
D
M-12
C
M-11
WATERBOX SCAV. PUMPS
TURBINE BLDG. INDUSTRIAL WASTE SUMP PUMPS
4160 V. SWITCHGEAR
480 V. LOAD CENTERS
D.C. PANEL D111
AIR EJECTOR E-2A
AIR EJECTOR E-2B
STEAM PACKING EXHAUSTER E-42
SEAL OIL UNIT S-8
MAIN SEAL OIL PUMP
MAIN SEAL SURGE TANK
GEN. & TURB. BEARING LIQUID LEVEL CONTROL TANK C-83
PIPEWAY
SUMP
CONDENSATE PUMPS
L.P. CONDENSER E-1B
SUMP PUMPS
FILTER V-F-11
COND. BACKWASH RECEIVING TANK
COND. BACKWASH TRANSFER PUMP
COND. DRIP TK PUMPS
T-92 CONDENSATE DRIP TANK
D-5 COND. VAC. PUMP
SAMPLE RACK
P-122 COND. DEMINERALIZER HOLDING PUMP (TYP.)
PARTIAL PLAN AT ELEV. 925'-0"
GROUND FL
EL. 9




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | | REVISED TO AS BUILT CONDITIONS | | | | | | |
| 3 | | REVISED AS NOTED | | | | | | |
| 2 | | ISSUED FOR CONSTRUCTION | | | | | | |
| 1 | | ISSUED FOR INFORMATION | | | | | | |
| | | ISSUED FOR DEFINITIVE ESTIMATE | | | | | | |

BECHTEL SAN FRANCISCO — JOB NO. 5828 — DWG. NO. M-6 — REV. B

GENERAL ELECTRIC — ATOMIC POWER EQUIP. DEPT. — SAN JOSE, CALIF. — RD

NF-36059

FIG 33

MONTICELLO NUCLEAR GENERATING PLANT - UNIT 1

EQUIPMENT LOCATION-TURBINE BLDG. PLAN AT EL. 908'-0" & 911'-0"

NORTHERN STATES POWER COMPANY — NF-36059C

RGED COVERAGE
UOLOPE

OOR PLAN
'-0"