ATTACHMENT 1

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SPECIFICATION

DESIGN SPECIFICATION FOR THE REACTOR VESSEL HEAD LIFTING DEVICE

MONTICELLO

NUCLEAR GENERATING STATION

Prepared for:

Northern States Power Company

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Date: 9-24-82

nutech ENGINEERS

REVISION CONTROL SHEET

SUBJECT: Design Specification for the Reactor Vessel Head Lifting Device

REPORT NUMBER: NSP-77-001

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1.0 INFORMATION AND GENERAL REQUIREMENTS

1.1 This specification provides the requirements for the analysis, design and evaluation of the Reactor Vessel Head Lifting Device located in the reactor building (elevation 1027'-8"), at the Monticello Nuclear Generating Plant.

1.2 In accordance with recent regulatory requirements, Northern States Power Company is planning to evaluate and modify, as required, certain "special lifting devices" associated with the handling of critical loads, which may impact the spent fuel, fuel in the core, or equipment that may be required to achieve safe shutdown should failure of the devices occur. This evaluation concerns itself with the analysis and possible strengthening of the Reactor Vessel Head Lifting Device.

2.0 APPLICABLE DOCUMENTS

2.1 All work performed on the Reactor Vessel Head Lifting Device shall be performed in accordance with the following documents:

2.1.1	NUREG-0612	—	"Control of Heavy Loads at Nuclear Power Plants."
2.1.2	ANSI N14.6-1978	—	"American National Standard For Lifting Devices For Shipping Containers Weighing 10,000 Pounds (4500 kg) or More For Nuclear Material."
2.1.3	ANSI B30.9-1971	—	"American National Standard, Slings."
2.1.4	ANSI B30.10-1975	—	"American National Standard, Hooks."
2.1.5	ANSI B30.16-1973	—	"American National Standard, Overhead Hoists."
2.1.6	CMAA Specification #70-1975	—	"Specifications for Electric Overhead Travelling Cranes."
2.1.7	NRC Generic letter 81-07	—	"Control of Heavy Loads," dated 12/22/81.
2.1.8	NUREG-0554	—	"Single Failure-Proof Cranes for Nuclear Power Plants."
2.1.9	ANSI N45.2-1977	—	"American National Standard, Quality Assurance Program Requirements for Nuclear Facilities."
2.1.10	ANSI N45.2.9-1974	—	"American National Standard, Requirements for Collection, Storage and Maintenance of Quality Assurance Records for Nuclear Power Plants."

2.1.11 ANSI N45.2.11-1974 -- "American National Standard, Quality Assurance Requirements for the Design of Nuclear Power Plants."

2.1.12 ANSI N45.2.12-1977 -- "American National Standard, Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants."

2.1.13 ANSI B31.1-1977 -- "American National Standard, Code for Pressure Piping, Power Piping."

2.2 The provisions of the Code of Federal Regulations, Title 10, Part 21 (10 CFR 21) apply for all materials and services provided under this specification.

2.3 Adoption of specification interpretations, Code Cases, or subsequent issues of standards specified herein shall be subject to the approval of Northern States Power Company.

3.0 STRUCTURAL MATERIALS

3.1 The material specifications for the major components of the Reactor Vessel Head Lifting Device are shown in Table 3.1.

3.2 Replacement material shall be in accordance with the materials specified in Table 3.1 or in accordance with NUREG-0554.

3.3 Degradation of materials due to radiation exposure need not be considered.

3.4 All unpainted and abraded carbon steel areas shall receive one coat of Phenoline 368 Primer and one coat of Phenoline 368 Finish Coat per the paint manufacturers recommendations. Painting may be performed prior to installation with touch-up painting after installation. This painting will be done by the Northern States Power Company.

4.0 DESIGN REQUIREMENTS

4.1 General Requirements

4.1.1 The Reactor Pressure Vessel Head Lifting Device shall be designed to have interface compatibility with the following components:

4.1.1.1 The Reactor Building Crane.

4.1.1.2 The Reactor Pressure Vessel Head

4.1.1.3 The Drywell Head

4.1.1.4 The reactor building, fuel pool, and other such facilities as may be defined by the customer.

4.1.2 Potential problems related to galling and lamellar tearing shall be considered by the designer when selecting the construction materials.

4.1.3 The lifting devices shall be provided with lead-in guides and sufficient clearances so as to allow simple motion engagement.

4.1.4 The lifting devices shall be designed to assure distribution of the load to all load-bearing attachment points.

4.1.5 Load-carrying components that may become inadvertently disengaged shall be fitted with cotter pins or lock pins of a positive locking type, lock wired, or provided with a retaining latch.

4.1.6 The lifting devices shall not have exposed lubricants that contact pool water unless approved by Northern States Power Company. Sealed or dry bearings are potential substitutes in this application.

4.1.7 Lubricants subject to radiation degradation shall be silicon based, or other commercially available radiation-resistant greases and oils.

4.1.8 Exposed lubricants subject to particulate contamination shall be minimized by design of the special lifting devices with sealed bearings, etc.

4.2 Environmental Requirements

4.2.1 The lifting device shall be capable of operating within the following environmental extremes:

4.2.1.1 A temperature range of $20^{o}F$ to $130^{o}F$

4.2.1.2 Underwater and in dry air, compatible with fuel power water chemistry supplied by Northern States Power Company.

4.2.1.3 With decontamination materials as defined by Northern States Power Company.

4.2.1.4 With radiation resulting from its proximity to spent fuel.

4.3 Analysis Requirements

4.3.1 The analysis and design of modifications shall be in accordance with NUREG-0612, and applicable portions of ANSI N14.6-1978, ANSI B30.2-1976, ANSI B30.9-1971, ANSI B30.10-1975, and the CMAA specification #70-1975.

4.3.2 The load-bearing members of the lifting device shall be capable of lifting three (3) times the design load specified in 4.3.2.1, without generating a maximum stress at any point in the device in excess of the corresponding minimum yield strength (in shear or tension) of their materials of construction. They shall also be capable of lifting five (5) times the specified design load without exceeding the ultimate strength of the materials. When materials that have yield strengths above 80% of their ultimate strengths are used, the foregoing stress criteria for ultimate strength does not apply. Instead, special consideration of the material's fracture toughness shall be taken and the designer shall specify the criteria. The foregoing stress design criteria is not intended to apply to

situations where high local stresses are relieved by slight yielding in the material.

4.3.2.1 The design load (W_d) shall be:

$$W_d = W_s + d_f W_s = W_s (1+d_f)$$

where: W_s = Critical load plus static weight of intervening components

d_f = Impact allowance factor specified in CMAA #70

The maximum hoisting speed is limited by NUREG 0554 as specified in CMAA #70 for the noted capacities of the crane. If an impact allowance factor of less than 15% is used, the maximum hoist speed for the lifting device shall be clearly marked on it and the inspections in Section 6.0 of this Specification shall be properly performed and documented.

4.3.4 Load-bearing pins, extension links, and adapters used to connect mating members of the lifting device shall be designed on the basis of criteria established in Section 4.3.2. Where possible, the weight of pins should permit manual handling.

4.3.5 In the event that wire rope or chain is used as an element in the lifting device, it shall be in conformance with the American National Safety Standard for Slings, ANSI B30.9-1971.

4.3.6 Unless exempted by the provisions of materials, load-bearing members shall be subjected to a drop weight test in accordance with ASTM E 208, or a Charpy impact test in accordance with ASTM A 370 at a temperature of 40°F below the anticipated service temperature.

4.3.7 The designer shall furnish a verified stress analyses proving the adequacy of the lifting device and its components with respect to any loads that may be imposed upon them during the performance of their functions. These analyses shall also demonstrate that appropriate margins of safety have been provided.

4.4 Decontamination Requirements

4.4.1 Cracks, crevices, holes, pockets, cavities, or other areas where radioactive contaminants are likely to collect shall be avoided unless required for a specific function.

4.4.2 Fabricated items and assemblies shall be designed to allow for decontamination washdown and to permit complete runoff of washdown solutions by drain holes, channels, or pipes.

4.4.3 Machined intersecting plane surfaces shall be provided with radii as opposed to intersections.

4.4.4 In welding, if the cover pass is free from coarse ripples, irregular surfaces, deep ridges, or valleys between beads, grinding of the bead is not necessary.

4.4.5 Surface finishes subject to washdown shall be 250 rms (root mean square) or less.

4.4.6 Mechanical joints that are not subject to routine or periodic disassembly after initial fabrication shall be seal welded all around.

5.0 FABRICATION OF MODIFICATIONS

5.1 The designer shall prepare a specification for the fabrication of modifications to the lifting device. The specification shall state the requirements for drawings, materials, special processes, in-process inspection, final product inspection, quality assurance and record retention. The specification shall provide any information which is to be provided on the nameplate or otherwise marked on the device.

6.0 EXAMINATION AND LOAD TESTING REQUIREMENTS

6.1 Acceptance Testing

6.1.1 Prior to its initial use following any major maintenance or alteration, the lifting device shall be subjected to a proof test load equal to 150% of the maximum load to which the device will be subjected. After sustaining the load for a period of not less than 10 minutes, critical areas including all load-bearing welds shall be subjected to nondestructive examination in accordance with Section 7.0 of this Specification.

6.1.2 Major maintenance or alteration is defined as a repair or design change in which load-bearing members are subjected to heating above 300°F (150°C), removal of significant quantities of metal, or plastic deformation.

6.2. Testing to Verify Continuing Compliance

6.2.1 Prior to any refueling/maintenance outage where usage is being considered, and following any incident in which load bearing members of the lifting device may have been subjected to loads substantially in excess of those for which it has been qualified, the lifting device shall be subjected to one of the following:

(1) Proof load testing as described in Section 6.1.1 of this Specification.

(2) In cases where conditions permit, in lieu of proof load testing, visual inspection for damage and/or deformation and nondestructive testing in accordance with Section 7.0 of this Specification of the major load-carrying welds and critical load-carrying components may be accomplished.

7.0 NONDESTRUCTIVE TESTING

7.1 Inspections utilizing liquid dye penetrant or magnetic particle examination methods shall be performed by using written procedures and by personnel, both qualified in accordance with the rules in the current edition of ASME Boiler and Pressure Vessel Code, Section V, Articles 1, 6, 7, 24 and 25.

7.2 Liquid dye penetrant and magnetic particle acceptance standards shall be as indicated in paragraphs NF-5350 and NF-5340 of the current edition of ASME Boiler and Pressure Vessel Code, Section III, Division 1, "Nuclear Power Plant Components."

8.0 DOCUMENTATION REQUIREMENTS

8.1 As a minimum, the documentation shall include the following:

a) Certified Design Report
b) Certified construction drawings
c) Certified material test reports or certificates of compliance
d) Inspection Reports
e) Proof Testing Reports

9.0 QUALITY ASSURANCE REQUIREMENTS

9.1 All work shall be in accordance with a QA program complying with 10CFR50, Appendix B, and ANSI N45.2-1977 and appropriate supplementary N Series N45.2 Standards given in Section 2.0.

9.2 All work shall be subject to review by the enforcement authorities having jurisdiction at the plant site and the Owner's representatives.

TABLE 3.1

Material Specification for Major Components

of Reactor Vessel Head Lifting Device

Component Description	Material Specification
Plate Girders	ASTM A36
Lifting Lugs	ASTM A36
Hook Box	ASTM A36
Hook Pins	ASTM A519
Anchor Shackles	AISI 1035 (Bow) AISI 4130 (Pin)
Turnbuckles	AISI 1035