E-12261
Revision 0
12/18/91

DESIGN CRITERIA
FOR
LIFTING SYSTEM FOR TN-40 DRY STORAGE CASK
AT PRAIRIE ISLAND

Transnuclear, Inc.
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Hawthorne, NY 10532

REVISION CONTROL SHEET

E-12261

Rev. No.	Effective Date	Affected Sections	Affected Pages	Prepared By	Approval		
					Proj. Eng.	QA Eng.	Chief Eng.
0	Jan 3c 1991	1.0 - 7.0	1 - 6	PS			

1.0 SCOPE

The scope of this document is to establish the design criteria for the design of the lifting system to be used for handling the TN-40 Dry Storage Cask at the Prairie Island facility (PI).

The lifting system shall consist of a lift beam assembly,a lift beam extension, two 6-7/8" diameter pins and a hook pin sleeve. One pin shall connect the lift beam to the lift beam extension. The other pin and sleeve shall connect the lift beam extension to the crane hook.

2.0 APPLICABLE DOCUMENTS

2.1 Codes and Standards

2.1.1 ASME Boiler and Pressure Vessel Code, Section II, Part A, Ferrous Materials.

2.1.2 ASTM Material Standards.

2.1.3 ANSI N14.6 - American National Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4500 kg) or More for Nuclear Materials. (1986)

2.1.4 NUREG-0612 "Control of Heavy Loads at Nuclear Power Plants."

2.2 TN Documents

2.2.1 E-11499, latest revision, Quality Assurance Program Plan for the Design, Procurement, Fabrication, Testing and Acceptance of TN-40 Dry Storage Cask.

2.2.2 E-11402, latest revision, Design Criteria for the TN-40 Dry Storage Cask.

2.2.3 TN Drawings

1042-30-1, latest revision, TN-40 Dry Storage Cask Assembly & Parts List.

1042-30-2, latest revision, TN-40 Dry Storage Cask Shell Assembly.

1042-30-3, latest revision, TN-40 Dry Storage Cask Shell Details & Parts List.

2.3 Other

2.3.1 Ederer Dwg. B-18555, Rev. 0, Sister Hook 125 Ton Capacity.

2.3.2 Ederer Dwg. PA-1808, Rev. B, Clearance Drawing 125/15 ton X-SAM Trolley, Northern States Power.

2.3.3 Ederer Dwg. A-14755, Rev. 0, Lower Block Assembly (Main Hoist) 125 ton M.C.L. Cap.

2.3.4 NSP Internal Correspondence from R. Johnston, to J. Kapitz, November 27, 1991, Prairie Island-NPD, Significant Elevations for Cask Handling.

2.3.5 NSP letter from J. Kapitz to M. Mason, Transnuclear, Inc. dated March 18, 1991, Prairie Island/TN-40 Lift Beam Design.

3.0 DESIGN REQUIREMENTS

3.1 The pins used to interface with the PI crane hook and lifting system shall be provided with positive locking devices.

3.2 The lifting system shall be a single failure proof lifting system.

3.3 The lift beam and lift beam extension to be furnished to the PI facility shall be of sufficient lengths to assure that the eye of the hook need not be lowered below elevation 745'.

3.4 The weight on the PI crane hook shall not exceed 125 tons. This weight includes the weight of the loaded TN-40 cask and the lifting system.

3.5 The lifting system weight shall not exceed 9000 lbs.

3.6 The lift beam and extension shall be designed for a vertical load, i.e. design load, which is based on the weight of the loaded cask plus it own weight (125 tons).

3.7 The design of the lifting system shall be in accordance with the criteria of NUREG-0612 for single failure proof handling systems.

3.8 The design of the lifting system shall consider requirements for ease of decontamination. Decontamination materials used in the facility shall not result in degradation of lifting system materials and associated hardware.

3.9 The critical elevations of the facility to be used to determine the lift beam and lift beam extension lengths are:

Maximum elevation of Crane Hook	787'-0"
Top of Pool Wall	755'-0"
Bottom of Cask in Pool	713'-6"
Minimum Pool Water Level	748'-6"

3.10 Ample clearance shall be provided for easy engagement of pins into the lift beam and PI crane hook.

3.11 The cask lift beam shall be capable of remote operation in order to remove and engage the lift beam from the cask while it is on the bottom of the pool.

3.12 Slings shall be provided for the lift beam. The slings may be attached to the lift beam and utilized to remove/replace the cask lid.

3.13 The lifting system shall be designed for a 0.25G lateral load.

3.14 The design of the lift beam shall allow free rotation of the lift arms for engagement of the cask trunnions.

4.0 STRESS CRITERIA

4.1 In addition to the stress design factor guidance in ANSI N14.6, an additional factor of 1.05 shall be used to account for any dynamic loads from the Ederer (PI) crane. The allowable stress criteria for the design of the lifting system shall be as follows:

4.1.1 The maximum tensile stress in the lifting system for a vertical load of 10.5 times the design load shall not exceed the minimum ultimate tensile strength of the lifting system material.

4.1.2 The maximum tensile stress in the lifting system for a vertical load of 6.3 times the design load shall not exceed the minimum yield strength of the lifting system materials.

4.1.3 The average bearing stress in the lifting system for a vertical load of 10.5 times the design load shall not exceed the minimum ultimate strength of the lifting system material.

4.1.4 The average bearing stress in the lifting system for a vertical load of 6.3 times the design load shall not exceed the minimum yield strength of the lifting system material.

4.1.5 Maximum shear stress due to 10.5 times the design load shall not exceed 50% of the minimum ultimate tensile strength of the lifting system materials.

4.1.6 Maximum shear stress due to 6.3 times the design load shall not exceed 50% of the minimum yield strength of the lifting system materials.

4.2 The above stress criteria do not apply to localized stresses relieved by slight yielding of the materials.

4.3 The yield and minimum ultimate tensile strengths shall be obtained at the design temperature of 100°F.

5.0 MATERIAL REQUIREMENTS

5.1 The mechanical properties of the lift beam materials shall be obtained from ASME B&PV Code, Section II, Material Specifications, or ASTM Material Specifications. The material shall be procured to the above material specifications to assure that values utilized in design calculations are met.

5.2 The materials selected for the lifting system and related accessories shall be compatible with the PI crane hook and other interfacing components.

6.0 PERFORMANCE REQUIREMENTS

6.1 The lifting system shall be designed such that wetting of the PI crane cables shall not be necessary during cask handling.

6.2 The lifting system shall be tested in accordance with the acceptance testing requirements of ANSI-N14.6 to 150% of the design load.

6.3 Non painted threaded parts and bearing surfaces shall be suitably protected to prevent corrosion.

7.0 QUALITY ASSURANCE REQUIREMENTS

7.1 The lifting system is a critical component during lifting and handling operations of TN-40 casks and therefore has been designated as safety related.

7.2 The design, procurement, fabrication and acceptance of the lift beam shall be in accordance with Project QA Plan E-11499.

7.3 Design calculations and drawings shall be prepared in accordance with the Project QA Plan and Transnuclear's Corporate QA Procedures. The design drawings shall be the basis for the procurement specification and subsequent fabrication drawings.

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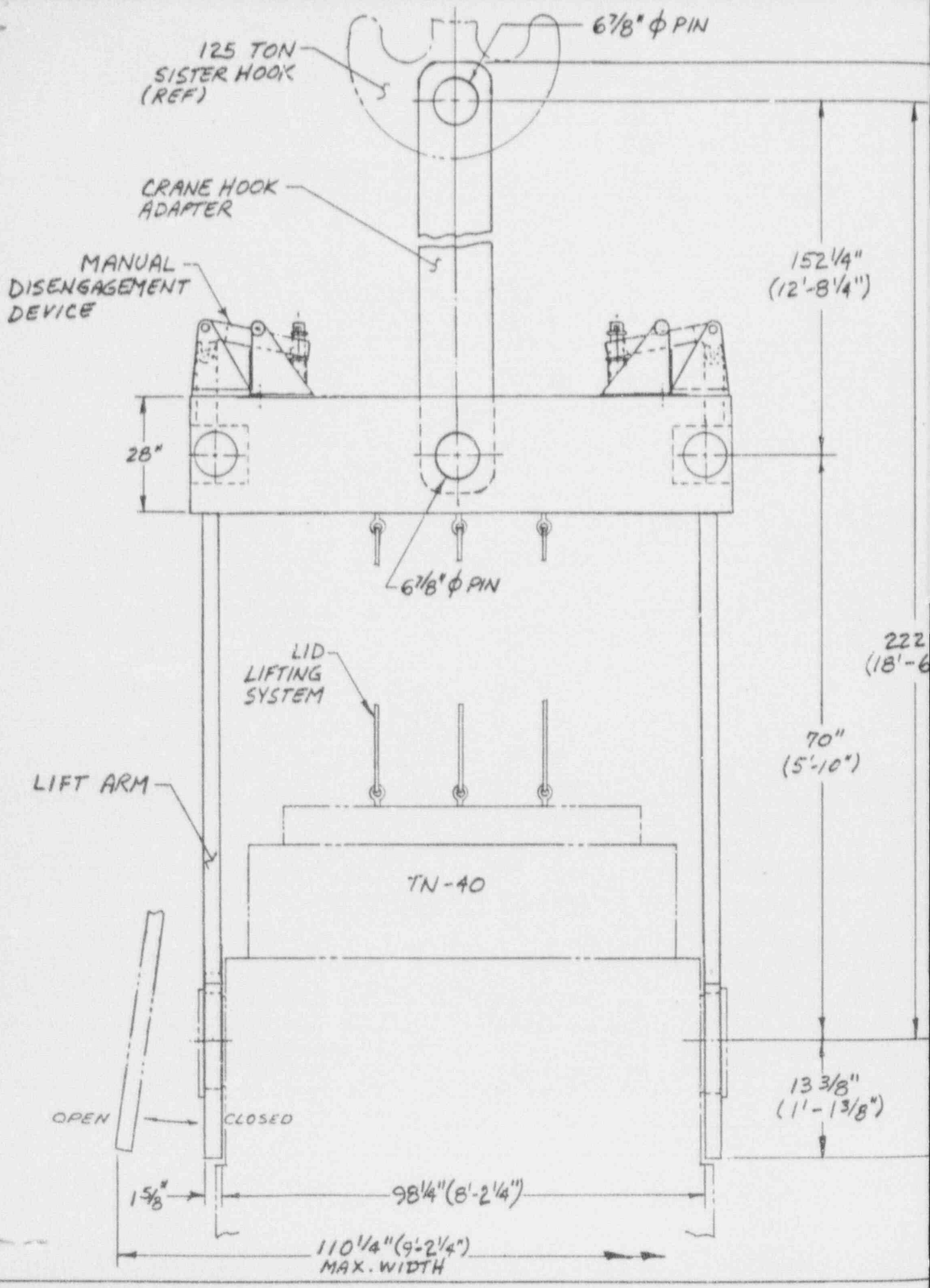
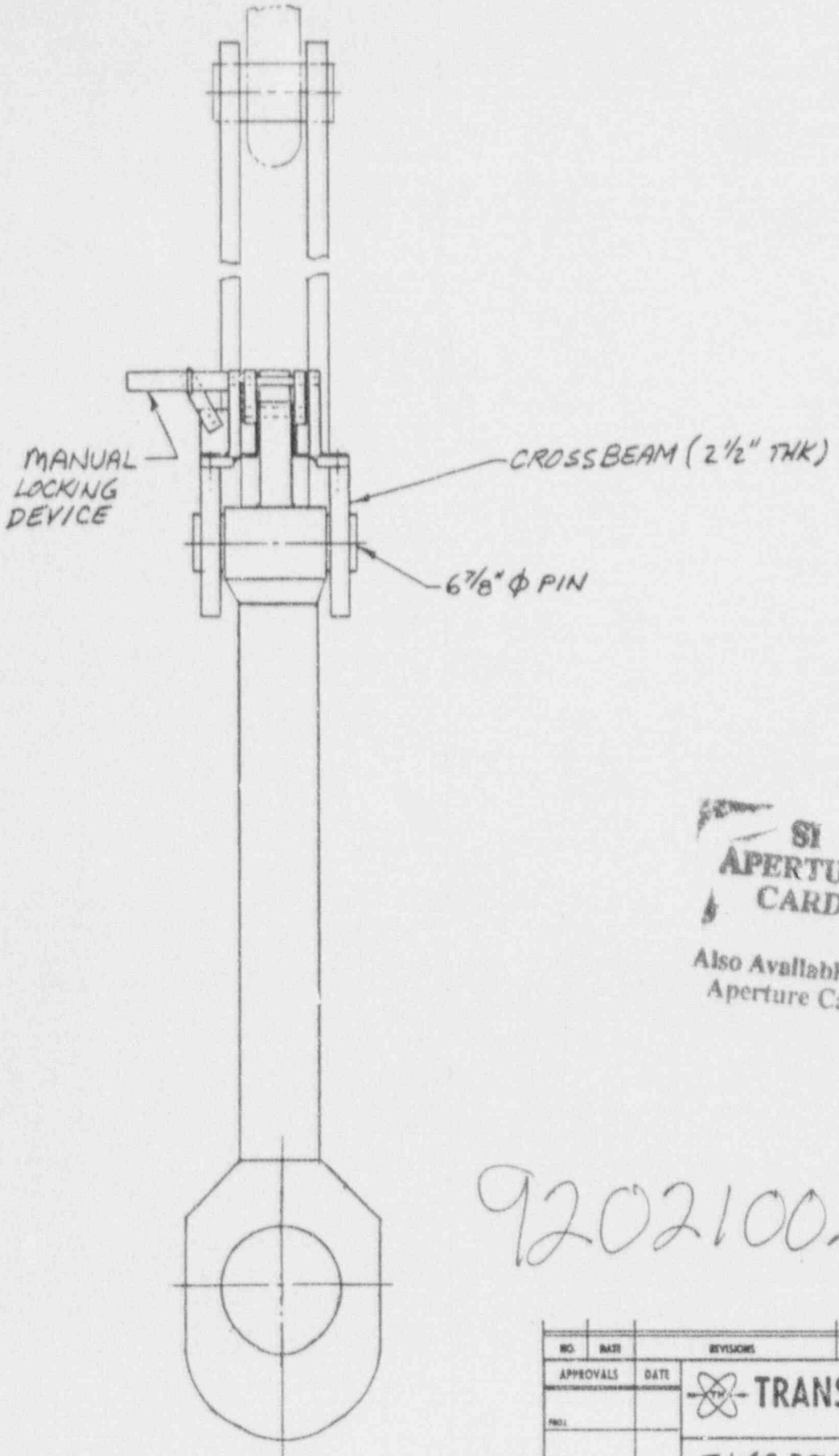

6 7/8" ϕ PIN
125 TON
SISTER HOOK
(REF)
CRANE HOOK
ADAPTER
MANUAL
DISENGAGEMENT
DEVICE
152 1/4"
(12'-8 1/4")
28"
6 7/8" ϕ PIN
LID
LIFTING
SYSTEM
222
(18'-6
70"
(5'-10")
LIFT ARM
TN-40
OPEN
CLOSED
13 3/8"
(1'-1 3/8")
1 5/8"
98 1/4" (8'-2 1/4")
110 1/4" (9'-2 1/4")
MAX. WIDTH



1/4"
'1/4")

242.50"
(20'-2 1/2")
O.A.H.

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NO.	DATE	REVISIONS	DWN.	CK'D		QA	PROJ.

APPROVALS	DATE	TRANSNUCLEAR, INC. HAWTHORNE, N.Y.			
PROJ.		TN-40 DRY STORAGE CASK LIFT BEAM CONCEPT			
QA					
CK'D BY PS	30 Jan 92				
DWN. BY J.T.G.	30 Jan 92	NONE SCALE	B SIZE	SK-1042-7 DWG. NO.	0 REV.