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JOHN E. MAIER
Vice President

TELEPHONE
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October 12, 1983

Director of Nuclear Reactor Regulation
Attention: Mr. Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Control of Heavy Loads
R. E. Ginna Nuclear Power Plant
Docket No. 50-244

Dear Mr. Crutchfield:

This letter is in response to requests from members of the NRC Staff for additional information regarding special lifting devices at Ginna. The attachment to this letter provides the requested information.

Very truly yours,

John E. Maier

John E. Maier

Attachment

A033
1/1

SECTION 1.0 SUMMARY

The following pages list additional information regarding the Special Lifting Devices at R. E. Ginna Nuclear Power Plant.

1) Reactor Internals Lift Rig - Normal use of this rig is for lifting the upper internals at refueling. The upper internals package and lifting fixture weighs approximately 26 tons. This same lifting device is also used to lift the lower internals package which weighs approximately 100 tons, including the lifting rig. The lower internals lift is not considered critical because the fuel is removed. The lower internals pick, which has been successfully performed, most recently in 1979, can be considered an adequate load test for the upper internals lift.

2) Reactor Coolant Pump Motor Sling - Attached to this report is a sketch of this lifting device (Figure 1), a list of material properties (Table 1), weld examinations done during fabrication (Table 2), and the summary of stress results (Tables 3 and 4). Also attached are certain explanations of the stress calculations.

   It can be seen from the sketch that this device is basically a spreader bar and is a very simple lifting assembly. The stress design margins are within ANSI N14.6 criteria as shown in the stress results. The welds on the rig underwent non-destructive examination during fabrication as listed in the information provided and again during our Spring 1983 outage under our continued compliance program.

   This lifting sling is used in containment where it is not feasible to be load tested due to physical space and load requirements. It cannot be removed from containment in one piece, unless the equipment hatch fixture is removed. Load testing outside containment would require decontamination.

   Based on the evaluation results, the simplicity of the device, the fact that the device has lifted 100% of its rated load, and the existence of a continued compliance inspection program RG&E believes that a load test is both unnecessary and impractical.

3) Reactor Vessel Head Lift Rig - Attached to this report is a sketch of this lifting device (Figure 2), a list of material properties (Table 5), weld examinations done during fabrication (Table 6), and the summary of stress results (Table 7).

As shown and listed in the attachments, there are three (3) sets of critical welds which were examined during construction and which are encompassed in the existing continued compliance inspection program. During our Spring 1983 outage, the link lug to sling assembly link welds were examined with the remaining weld inspections scheduled for the Spring 1984 outage.

It can be seen from Table 7 that the stress levels for lift rig components are well within ANSI N14.6 Guidelines.

Because of the size and configuration of the lifting rig, final fabrication was completed inside containment It is physically impossible to get it outside of containment in one piece. It is also, because of limited space, and the load requirements, impractical to perform a rated load test in excess of 100%. The rig has been tested to 100%.

Based on the evaluation results which show substantial margins of safety in the lifting device design, the existence of a continued compliance inspection program, and the devices proven capability to lift 100% of its design load RG&E believes that this lifting rig adequately satisfies the guidelines of ANSI N14.6. A load test is neither warranted nor practical.

SECTION 2.0 SPECIAL LIFTING DEVICE EVALUATION RESULTS

1) This section provides additional information such as sketches, material lists, weld examination requirements and stress level results for the Reactor Coolant Pump Motor Sling and the Reactor Vessel Head Lift Rig. In some cases, explanations are provided for certain stress calculations.

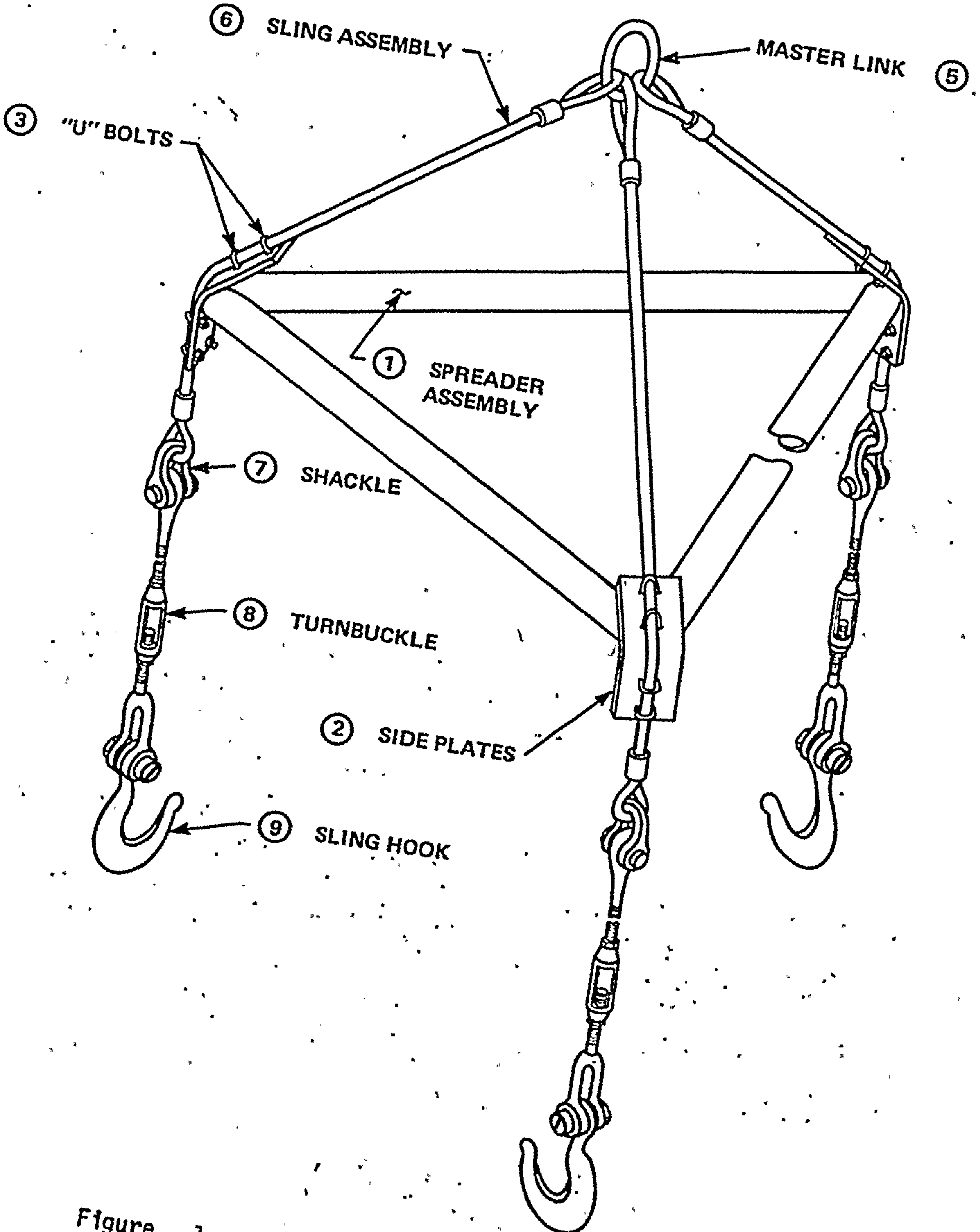


Figure 1 - Reactor Coolant Pump Motor Lift Sling

TABLE 1

REACTOR COOLANT PUMP MOTOR LIFT SLING MATERIALS AND MATERIAL PROPERTIES

Item[a]	Description	Material	Yield Strength S_y(ksi)	Ultimate Strength S_{ult}(ksi)
1	Spreader (pipe)	ASTM A 106 Grade B	35	60
2	Side plates	ASTM 212 Grade A	36	58

[a] See figure 1

TABLE 2

REACTOR COOLANT PUMP MOTOR LIFT RIG

CRITICAL ITEMS LIST OF PARTS AND WELDS

PER ANSI N14.6-1978

Item[a]	Description	Material	Non-destructive Testing	
			Material	Finished
1	Spreader	ASTM A106 Grade B		Magnetic Particle on Welds Only
2	Side Plate	ASTM A106 Grade B		
5	Master Link	Alloy Steel Forging	Radiograph	
6	Sling Assembly	Improved Plow Steel Grade		
7	Shackle	Alloy Steel Forging		
8	Turnbuckle	Alloy Steel Forging		
9	Eye Hook	Alloy Steel Forging		

[a] See figure 1

TABLE 3
SUMMARY OF RESULTS
REACTOR COOLANT PUMP MOTOR LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
		Designation	Value				
			W[b]	3W	5W	S_y[c]	S_{ult}[d]
1	Spreader	Compressive Buckling	5.2	15.4	25.7	F_c[e] = 19.35 ksi	
		Stress on Tube-to-Tube Weld	2.9	8.6	14.3	35	60
		Stress on Tube-to-Plate Weld	7.1	21.3	35.5		
2	Plate	Tension	1.9	5.6	9.3	36	58

(a) See figure 1 for location of item number and section
(b) W is the total static weight of the component and the lifting device
(c) S_y is the yield strength of the material (ksi)
(d) S_{ult} is the ultimate strength of the material (ksi)
(e) F_c is the compressive buckling strength of the material (ksi)

TABLE 4

COMPARISON OF DESIGN LOADS
AND RATED LOAD VALUES OF THE NON-DESIGNED
ITEMS OF THE R.C. PUMP MOTOR LIFT SLING

No.(7)	Item	Loads (Pounds)(6)			Ultimate(3) Load	Safety Factor(4)
		Design	Rated(1) Load Value	Proof(2) Load		
5	Master Link	81,000	160,000	320,000	544,000	3.4:1
6	Sling	81,000	81,000(5)	94,000(5)	405,000	5:1(5)
7	Shackle	27,000	70,000	154,000	420,000	6:1
8	Turnbuckle	27,000	37,000	74,000	185,000	5:1
9	Hook	27,000	38,750	77,500	131,750	3.4:1

NOTES:

(1) RATED LOAD VALUE - The maximum recommended load that should be exerted on the item. The following terms are also used for the term Rated Load: "SWL", "Safe Working Load", "Working Load", "Working Load Limit", and the "Resultant Safe Working Load." All rated load values, are for in-line pull with respect to the centerline of the item.

(2) PROOF LOAD - The average force to which an item may be subjected before visual permanent deformation occurs or a force that is applied in the performance of a proof test.

(3) ULTIMATE LOAD — The average load or force at which item fails or no longer supports a load.

(4) SAFETY FACTOR - An industry term denoting theoretical reserve capability. Usually computed by dividing the catalog stated ultimate load by the catalog stated working load limit and generally expressed as a ratio, for example 5 to 1.

TABLE 4 (Cont).

(5) This information is as stated on Westinghouse drawing AED SK 618J644 TXK Sub 5 as follows: "Safe working load of this sling assembly is 81,000 lb and a safe factor of 5:1." Catalog information is not applicable.

(6) The rated load value, proof load, ultimate load and safety factor information was obtained from the following vendor catalogs:

a. S.G. Taylor Chain Co., Inc., Bulletin AS-67 Alloy Steel Chain Assemblies, Attachments for items 5 and 9.

b. Pennsylvania Sling Co. for item 6.

c. Crosby Group, 950 General Catalog, June 1981 for items 7 and 8.

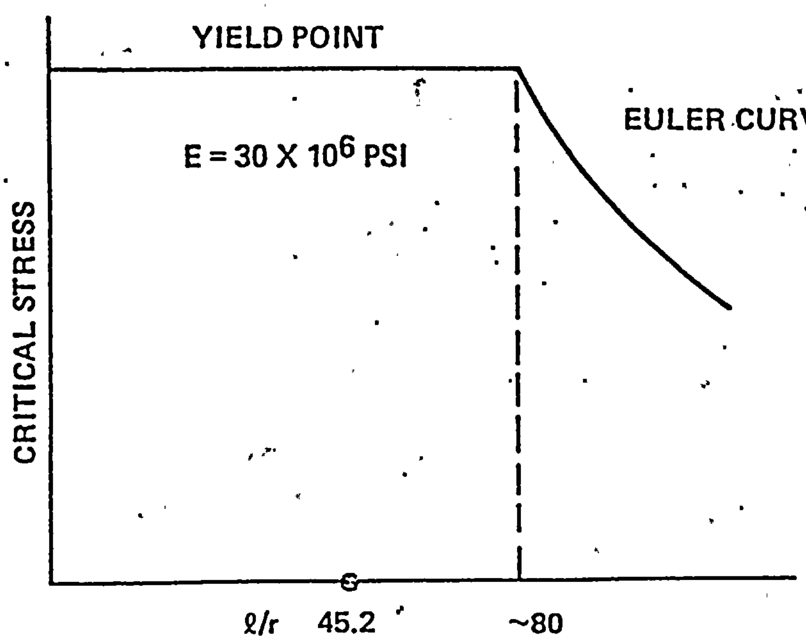
(7) Refer to figure 1 for identification of items.

Structures Loaded in Compression and Bending

The spreader assemblies of the reactor vessel internals lift rig and the reactor coolant pump motor lift sling do not meet the ANSI N14.6 criteria of 5W when analyzed for axial compression loadings and comparing to the allowable stresses of the AISC code (instead of the corresponding ultimate strength of the 5W criterion). If we were to use the corresponding ultimate strenth acceptance criteria for the 5W loading conditions, the structure would be adequate. However, it is well known that care should be taken when addressing members in compression to ensure elastic stability. Thus, structures loaded in compression are analyzed by the empirical equations of the[1] ASME Boiler and Pressure Vessel Code Section III, Appendix XVII or the AISC[2] Part 5 rules.

If we were designing a new structure, the material and member size would be changed to ensure these allowable stresses would be satisfied for all loading conditions. However, these calculations are being applied to an existing structure and since these conditions are not satisfied, then the ultimate load carrying capability must be determined.

The column under consideration is relatively short (kl/r=45.2). Timoshenko (3) states that experiments show that short columns buckle when the compressive strength reaches the material yield point. (The horizontal line on the figure below).



COLUMN BUCKLING

Therefore the total stress

$$\sigma = \frac{P}{A}$$

must be less than or equal to the material yield stress.

For the case of the internals lift rig spreader:

$$\sigma_{Total} = \frac{P}{A} = 4531 \text{ psi}$$

which is less than the material yield strength (Sy)

Then to find the ultimate column load, let $\sigma_{max} = S_y = 36,000$ psi

Then the maximum column load is the ration of

$$\sigma_{max}/\sigma_{total} = \frac{36,000}{4,531} = 7.9$$

Thus the ultimate column load is 7.9 times the nominal value.

The internals lift rig spreader members are considered acceptable for this condition of axial compression.

Similarly, the ultimate load for the reactor coolant pump motor lift sling is 6.7 times the nominal value and also considered acceptable.

Rated Load Values of the Reactor Coolant Pump Motor Lift Sling

Since most of the components that comprise the reactor coolant pump motor sling are pre-engineered components, application of the criteria of section 3.2.1.1 of ANSI N14.6 to these components is not appropriate. Therefore, Table 4 has been prepared from catalog information and list the various load conditions. Noting that the safety factors are based on the ratio of the ultimate strength of the material to the rated load value, the sling is acceptable for five times the design load.

REFERENCES

1) ASME Boiler and Pressure Vessel Code, Section III, Division I, "Nuclear Power Plant Components," American Society of Mechanical Engineers, New York, 1980

2) Manual of Steel Construction, Seventh Edition, American Institute of Steel Construction, New York, 1973

3) Timoshenko, S., Strength of Materials, Part 1, Elementary Theory and Problems, D. Van Nostrand Company, Inc., Third Edition, April, 1955, pp. 263-279.

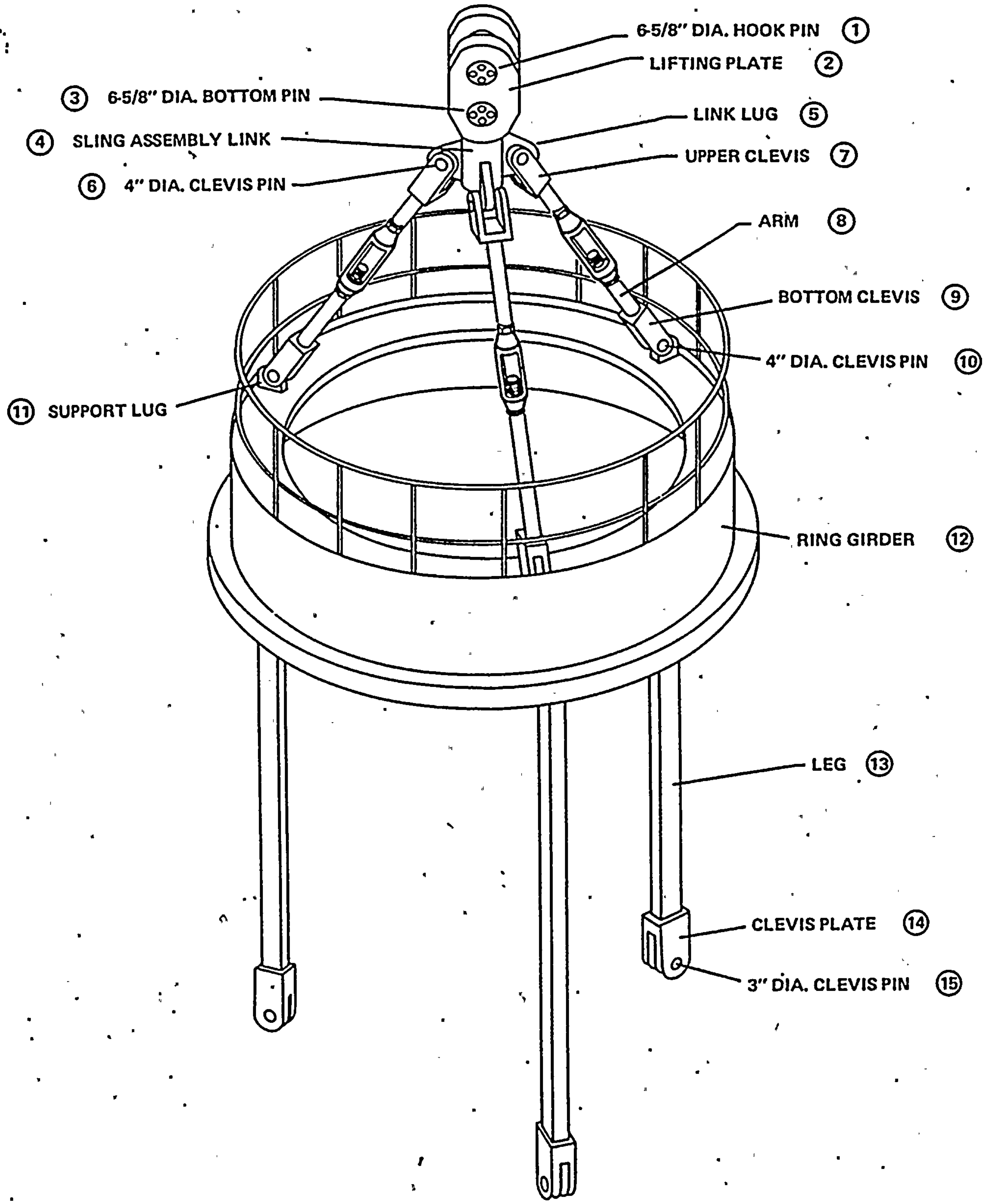


Figure 2 - Reactor Vessel Head Lift Rig

TABLE 5

REACTOR VESSEL HEAD LIFT RIG MATERIAL AND MATERIAL PROPERTIES

Item[a]	Description	Material	Yield Strength S_y (ksi)	Ultimate Strength S_{ult} (ksi)
1,3,6, 10,15	6-5/8" Dia. Hook Pin 6-5/8" Dia. Bottom Pin 4" Dia. Clevis Pin 4" Dia. Bottom Clevis Pin 3" Diameter Pin	ASTM A434 Class BD	100 105	130 135
2,11, 14	Lifting Plate Support Lug Clevis Plate	ASTM A514 or VSS T1	90	100
4,5,7 9	Sling Assembly Link Link Lug Upper Clevis Bottom Clevis	ASTM A237 Class A	36 50	70 80
8	Arm	ASTM A306 Gr. 70	35	70
12	Ring Girder	ASTM A285 GR. C	30	55
13	Leg	ASTM A36 (A 501)	36	58

(a)See figure 2

TABLE 6

REACTOR VESSEL HEAD LIFT RIG

CRITICAL ITEMS LIST OF WELDS

PER ANSI N14.6-1978

Item[a]	Weld Description	Non-destructive Testing	
		Root Pass	Final
4,5	Link Lugs to Link (full penetration)		Radiograph Magnetic Particle
11,12	Ring Girder to Support Lug (fillet)		Magnetic Particle
14	Clevis Plate to Leg (fillet)	Magnetic Particle	Magnetic Particle

(a) See figure 2

TABLE 7

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi) Designation	Value W[b]	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
1	6 5/8" Dia. Hook Pin ASTM A 434 Class BD	Bending	11.7	35.1	58.5	100	130
		Shear	2.8	8.4	14.0		
		Bearing	5.0	15.0	25.0		
2	Lifting Plate ASTM A 514 or USS T1	Tension	4.3	12.9	21.5	90	100
		Shear	4.3	12.9	21.5		
		Bearing	4.9	14.7	24.5		
3	6 5/8" Dia. Bottom Pin ASTM A 434 Class BD	Bending	11.7	35.1	58.5	100	130
		Shear	2.8	8.4	14.0		
		Bearing	5.0	15.0	25.0		

(a) See figure 2 for location of item numbers and section

(b) W is the total static weight of the component and the lifting device

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi)

TABLE 7 (cont.)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
		Designation	Value				
			W[b]	3W	5W	S_y[c]	S_{ult}[d]
4	Sling Assembly Link ASTM A 237 Class A	Tension @ Hole	2.4	7.2	12.0	36	70
		Shear @ Hole	2.4	7.2	12.0		
		Bearing @ Hole	3.6	10.8	18.0		
		Tension @ Shank	3.8	11.4	19.0		
5	Link Lug ASTM 237 Class A	Tension @ Hole	3.3	9.9	16.5	36	70
		Shear Tearout @ Hole	3.3	9.9	16.5		
		Bearing @ Hole	4.9	14.7	24.5		
		Maximum Tension @ Root of Lug	2.5	7.0	12.5		
		Vertical Shear @ Root of Lug	1.1	3.3	5.5		

(a) See figure 2 for location of item numbers and section.

(b) W is the total static weight of the component and the lifting device.

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi).

TABLE 7 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi) Designation	Value $W^{(b)}$	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
6	4" Dia.	Bending	11.3	33.9	56.5	105	135
	Clevis Pin	Shear	2.8	8.4	14.0		
	ASTM A 434	Bearing	5.0	15.0	25.0		
	Class BD						
7	Upper Clevis	Tension @ Hole	2.9	8.7	14.5	50	80
	ASTM A 237	Shear @ Hole	2.9	8.7	14.5		
	Class A	Bearing @ Hole	4.5	13.5	22.5		
8	Arm	Thread Tension	6.2	18.6	31.0	35	70
	ASTM A 306	Tension @ Full Section	5.4	16.2	27.0		
	Gr. 70	Thread Shear	2.9	8.7	14.5		
8.1	Turnbuckle		69.4[e]			167.8[f]	
	C-1035						

(a) See figure 2 for location of item numbers and section

(b) W is the total static weight of the component and the lifting device

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi)

(e) Design load (maximum applied load)

(f) Safe working load (contains 5:1 safety factor)

TABLE 7 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi) Designation	Value W[b]	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
9	Bottom Clevis ASTM A 237 Class A	Stresses are the same as Item 7.	Same as Item 7	Same as Item 7	Same as Item 7	50	80
10	4" Dia. Bottom Clevis Pin ASTM A 434 Class BD	Stresses are the same as Item 6 except for: Bearing	 5.0	 15.0	 25.0	105	135
11	Support Lug ASTM A 514 or USS T1	Tension @ Hole Shear @ Hole Bearing @ Hole	3.3 3.3 5.1	9.9 9.9 15.3	16.5 16.5 25.5	38	70

(a) See figure 2 for location of item numbers and section

(b) W is the total static weight of the component and the lifting device

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi)

TABLE 7 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item No.[a]	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
		Designation	Value				
			W[b]	3W	5W	S_y[c]	S_{ult}[d]
12	Ring Girder ASTM A 285 GR. C	Total Shear	1.6	4.8	8.0	30	55
		Maximum Bending	1.0	3.0	5.0		
		Maximum Tensile Stress	2.1	6.3	10.5		
		Ring Girder to Support Weld	1.6	4.8	8.0	18[g]	
13	Leg ASTM A 36 (A-501)	Tension	5.3	15.9	26.5	36	58
14	Clevis Plate ASTM A 515 GR. 70 Q&T	Weld	2.3	6.9	11.5	18[g]	
		Tension	3.5	10.5	17.5	38	70
		Shear	3.5	10.5	17.5		
		Bearing	6.6	19.8	33.0		

(a) See figure 2 for location of item numbers and section

(b) W is the total static weight of the component and the lifting device

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi)

(g) Stress limit for fillet weld from ASME Boiler & Pressure Vessel Code, Section III, Division 1 - Subsection NF 1980 Edition, Table NF - 3292.1-1 page 50

TABLE 7 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
		Designation	Value				
			$W^{(b)}$	3W	5W	S_y [c]	S_{ult} [d]
15	3" Diameter Pin ASTM A 434 Class BD	Bending Shear Bearing	14.3 3.7 8.8	42.9 11.1 26.4	71.5 18.5 44.0	110	140

(a) See figure 2 for location of item numbers and section

(b) W is the total static weight of the component and the lifting device

(c) S_y is the yield strength of the material (ksi)

(d) S_{ult} is the ultimate strength of the material (ksi)