John D. O'Toole
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, NY 10003
Telephone (212) 460-2533

January 20, 1984
Re: Indian Point Unit No. 2
Docket No. 50-247

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. Steven A. Varga, Chief
Operating Reactor Branch No. 1
Division of Licensing

Dear Mr. Varga:

The attachment to this letter provides our response to Items 5, 6(b), and 7 of Enclosure 1 to your March 15, 1982 letter.

This letter completes our response to all of the NRC questions, to date, regarding the heavy loads control issue.

Should you or your staff have any further questions, please contact us.

Very truly yours,

John D. O'Toole

attach.
cc: Mr. Thomas Foley, Senior Resident Inspector
U.S. Nuclear Regulatory Commission
P.O. Box 38
Buchanan, New York 10511

8401300250 840120
PDR ADOCK 05000247
P PDR

A033
1/1

ATTACHMENT

RESPONSES TO NRC
REQUEST FOR ADDITIONAL INFORMATION
CONCERNING CONTROL OF HEAVY LOADS
LETTER FROM MR. STEVEN A. VARGA
MARCH 15, 1982

This constitutes the remaining responses to the request for information transmitted by letter dated March 15, 1982 from Mr. Steven A. Varga, NRC, concerning control of heavy loads at Indian Point Unit No. 2. Specifically, the responses to Items 5, 6(b) and 7 are provided below.

ITEM 5

You are requested to verify that a suitable margin to yield, based on static and dynamic loads, has been provided for all special lifting devices

RESPONSE:

1. Static Loading

A detailed analysis of the reactor vessel head lifting rig and the internals lifting rig, load cell, and load cell linkage has been performed by Westinghouse, the designer of these items. The attached tables, 5-1 and 5-2, summarize the stresses of each of the individual parts. These tables demonstrate that a suitable margin to yield exists for the special lifting devices.

The design criteria of section 3.2.1.1 of ANSI N14.6 requires application of stress design factors of three and five to the applicable allowable stress limits of yield and ultimate strength, respectively. All of the tensile and shear stresses, with the exception of the tensile stress in the thread of the sling leg (item 14) and the outer tube (item 25) of the internals lift rig, meet the design criteria. The results of the analysis indicate that the stresses in the sling leg and the outer tube exceed the ANSI N14.6 3W criterion on yield strength, however the resultant stresses do meet the ultimate strength criterion of 5W. Further, this is not a concern since these stresses are induced by the loading of the lower intervals. The lower intervals are only removed when a periodic inservice inspection of the vessel is required (once/10 years). Prior to removal of the lower intervals, all fuel is removed. Thus the concern for handling over fuel is non-existent in this particular case.

Application of the above design load factors to other loading conditions is not addressed in ANSI N14.6. However, these stress design factors have been used to determine the stresses of the load carrying members when subject to other loading conditions, viz. bearing, bending, compression. This is an extremely conservative approach and in some cases the resulting stresses exceed the applicable allowable stress limit. However, by using more appropriate criteria, the resulting stresses are considered acceptable.

a. Bearing Stresses

For the internals lifting rig, several parts do not meet these criteria. However, since they are localized stresses, they can, if necessary, be considered under section 3.2.1.2, which states that the stress design factors of 3.2.1.1 are not intended to apply to situations where high local stresses are relieved by slight yielding. None of the bearing stresses reaches the yield stress, and in fact, all of the bearing stresses meet the design criteria of the AISC code of 0.9 yield.

b. Fillet Weld Stresses

When applying the ANSI N14.6 5W criteria to the nominal stress values of the fillet weld connecting the leg support block to leg on the internals lift rig, and the clevis plate weld in the head lifting rig, the ASME allowable stress value is exceeded. However, since ASME criteria already include a safety factor, the stresses can be considered acceptable.

c. Structures Loaded in Compression

The spreader assembly of the reactor vessel internals lifting rig, when analyzed for axial compression loadings, meets the 3W and 5W criteria of ANSI N14.6. However, it is well known that care should be taken when analyzing members in compression to ensure elastic stability. Thus, structures loaded in compression are analyzed by the empirical equations of the ASME Boiler and Pressure Vessel Code Section III, Appendix XVII or the AISC Part 5 rules. Acceptable values are calculated using these equations.

2. Dynamic Loading

NUREG-0612, Paragraph 5.1.1(4) requires that special lifting devices should satisfy the guidelines of ANSI N14.6. NUREG-0612, 5.1.1(4) also states, "In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device".

It can be inferred from this paragraph that the stress design factors specified in Section 3.2.1.1 of ANSI N14.6(3 and 5) are not all inclusive. Also, it can be inferred that the specified ANSI N14.6 stress design factors should be increased by an amount based on the crane's dynamic characteristics. The dynamic characteristics of the crane would be based on the main hook and associated wire ropes holding the hook. The Indian Point Unit No. 2 containment building crane uses sixteen(16) wire ropes to handle the load. Should the crane hook suddenly stop during the lifting or lowering of the load, a shock load could be transmitted to the connected device. Because of the elasticity of the sixteen wire ropes, the dynamic factor for the containment crane is not much larger than 1.0. The maximum design factor, that is recommended by most design tests, is a factor of 2 for loads that are suddenly applied. The stress design factors required in Section 3.2.1.1 of ANSI N14.6 are:

$$3 \text{ (weight)} < \text{Yield Strength}$$

$$5 \text{ (weight)} < \text{Ultimate Strength}$$

The factor of 3 specified certainly includes consideration of suddenly applied loads for cases where the dynamic impact factor may be as high as 2.0. Thus we consider that the use of the design criteria in ANSI N14.6 satisfies the NUREG requirement.

ITEM 6(b):

An initial load test under a load substantially greater than that for which the tested device is rated, followed by a comprehensive examination, provides a degree of assurance that design safety margins have been realized. This assurance is particularly important in situations where original design margins are not well documented as at Indian Point. In this regard, we need further information on the following lifting devices to complete our review:

b. You have stated that you do not have the capacity to load test the head lifting rig to 150% of rated load on site. You also state that little or no design information is available for this crane. Therefore, you have not supplied information to assure that design safety margins exist. A statement that the lifting device can lift 100% of its design capacity says nothing of the safety margin. Therefore you are requested to conduct some load test at greater than 100% of rated load or provide some alternative test, examination, or analysis to demonstrate that design safety margins exist for the head lifting rig.

RESPONSE:

The attached tables show that a suitable safety margin exists for all load bearing members of both the vessel head and internal lifting rigs. The analysis shows that either lifting device could lift 150% of its rated load and still be well within the margin of safety, based on yield. As a result of the safety margins shown in Tables 5-1 and 5-2, the requirement for a 150% load test is unnecessary.

ITEM 7

You are requested to verify that operating procedures have been updated to require inspection of all lifting devices not normally performed or requiring removal of protective coatings periodically. The inspection interval should be in accordance with Section 5.3.1 of ANSI N14.6 - 1978 or additional justification should be provided for the proposed extended inspection intervals in your original submittal.

RESPONSE

Prior to the use of the reactor vessel head and internals lifting rigs in the Cycle 6/7 refueling outage, plant maintenance procedures will be updated to include those examinations and inspections as identified in our letter dated August 10, 1982. These examinations and inspections meet the intent of ANSI N14.6 - 1978 Section 5.3.1 and will be performed prior to each removal of the reactor vessel head. Thus, the inspection interval requirement for the special lifting rigs, as specified by Section 5.3.1 of ANSI N14.6 - 1968, is satisfied.

TABLE 5-1

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load $W^{(b)}$	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
1	Clevis Pin (Load Sensing) ASTM A564 Type XM12	Pin Shear	4.5	13.5	22.5		
		Bearing on Hook	7.4	22.2	37.0		
		Max Bearing On Side Plate	7.4	22.2	37.0	105	135
		Pin Bending	25.4	76.2	127.0		
2	Side Plates ASTMA 533 Type B Class 1	Bearing @7 1/2"Dia. Hole	7.4	22.2	37.0		
		Tension @7 1/2"Dia. Hole	4.8	14.4	24.0		
		Shear Tearout @ 7 1/2" Dia. Hole	4.8	14.4	24.0	50	80
		Shear Tearout @ 6 1/2" Dia. Hole	4.2	12.6	21.0		
		Bearing @6 1/2" Dia. Hole	6.8	20.4	34.0		

(a) See figure 5-1 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 5-1 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load $W^{(b)}$	3W	5W	Material Allowable (ksi) $S_y^{(c)}$	$S_{ult}^{(d)}$
3	6 1/2" Dia Removable Pin ASTM A 564 Type 630°	Bending	22.7	68.1	113.5		
		Shear	5.4	16.2	27.0	105	135
		Bearing on Bushing	6.5	19.5	32.5		
		Bearing on Side Plate	6.8	20.4	34.0		
4A	Bushing AISI 4142 Heat Treat to BHN 285-341	Bearing (Outer)	5.3	15.9	26.5	128	149
		Bearing (Inner)	6.5	19.5	32.5		
4B	Sling Assembly Link ASTM A237 Class A	Tension @ Hole	5.0	15.0	25.0	50	80
		Shear @ Hole	5.0	15.0	25.0		
		Bearing @ Hole	5.4	16.2	27.0		
		Tension @ Shank	6.6	19.8	33.0		

(a) See figure 5-1 for location of item numbers ans 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 ulitmate strength of the material (ksi)

TABLE 5-1 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load $W^{(b)}$	3W	5W	Material Allowable (ksi) $S_y^{(c)}$	$S_{ult}^{(d)}$
5	Link Lug ASTM 237 Class A	Tension @ Hole	4.0	12.0	20.0	50	80
		Shear Tearout @ Hole	4.0	12.0	20.0		
		Bearing @ Hole	6.3	18.9	31.5		
		Maximum Tension @ Root of Lug	3.7	11.1	18.5		
		Vertical Shear @ Root of Lug	1.4	4.2	7.0		
6	5" Dia. Clevis Pin ASTM A434 Class BD	Bending	10.5	31.5	52.5	105	135
		Shear	3.2	9.6	16.0		
		Bearing on Clevis	5.3	15.9	26.5		
		Bearing on Lug	6.3	18.9	31.5		

(a) See figure 5-1 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 5-1 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load $W^{(b)}$	3W	5W	Material Allowable (ksi) $S_y^{(c)}$	$S_{ult}^{(d)}$
7	Upper Clevis ASTM A237 Class A	Tension @ Hole	3.2	9.6	16.0	50	80
		Shear @ Hole	3.2	9.6	16.0		
		Bearing @ Hole	5.3	15.9	26.5		
		Thread Shear	2.3	6.9	11.5		
8	Arm ASTM A306 Gr. 70	Thread Tension	7.1	21.3	35.5	35	70
		Thread Shear	2.3	6.9	11.5		
9	Bottom Clevis ASTM A237 Class A	Stresses are the same as Item 7.	Same as Item 7	Same as Item 7	Same as Item 7	50	80

(a) See figure 5-1 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 5-1 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load W[b]	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
10	5" Dia. Bottom Clevis Pin ASTM A434 Class BD	Stresses are the same as Item 6	Same as Item 6	Same as Item 6	Same as Item 6	105	135
11	Support Lug ASTM A515 Gr. 70	Tension @ Hole	4.0	12.0	20.0	38	70
		Shear @ Hole	4.0	12.0	20.0		
		Bearing @ Hole	6.5	19.5	32.5		
12	Ring Girder ASTM A285 Gr. C	Total Shear	3.2	9.6	16.0	30	55
		Maximum Bending	2.6	7.8	13.0		
		Maximum Tensile Stress	4.8	14.4	24.0		
		Ring Girder to Support Weld	3.2	9.6	16.0	18[e]	

(a) See figure 5-1 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) 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 5-1 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL HEAD LIFT RIG

Item[a] No.	Part Name And Material	Designation	Calculated Stresses (ksi) At Load W[b]	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
13	Leg ASTM A36	Tension	9.7	29.1	48.5	38	70
14	Clevis Plate ASTM A515 Gr. 70	Weld	5.6	16.8	28.0	18[e]	
		Tension	3.2	9.6	16.0	38	70
		Shear	3.2	9.6	16.0		
		Bearing	7.3	21.9	36.5		
15	3.9" Diameter Pin ASTM A434 Class BD	Bending	18.9	56.7	94.5	110	140
		Shear	4.7	14.1	23.5		
		Bearing on Lug	7.3	21.9	36.5		
		Bearing on Clevis	7.0	21.0	35.0		

(a) See figure 5-1 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) 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 5-2

SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi) Designation	At Load W[b]	3W	5W	Material Allowable (ksi) S_y[c]	S_{ult}[d]
6	Adaptor Link	Tension @ 6.515 Hole	7.3	21.9	36.5		
	ASTM A668	Shear Tear-out @ 6.515 Hole	7.7	23.1	33.5		
	Class K	Bearing @ 6.515 Hole	6.0	18.0	30.0	75	100
	AISI 4340 Steel	Tension @ 6.015 Hole	8.7	26.1	43.5		
		Shear Tear-out @ 6.015 Hole	8.7	26.1	43.5		
		Bearing @ 6.015 Hole	8.5	25.5	42.5		
		Tension @ Mid-link	6.3	18.9	31.50		
7	Removable Pin	Shear	5.6	16.8	28.0		
	ASTM A434	Bearing on Adaptor Link	8.5	25.5	42.5	105	135
	Class BD	Bearing on Top Lug	8.9	26.7	44.5		
	AISI 4340	Bending	23.7	71.1	118.5		
8	Top Lug	Tension @ Hole	8.9	26.7	44.5		
	ASTM A515	Bearing @ Hole	8.9	26.7	44.5	38	70
	GR 70	Tension @ Base	4.4	13.2	22.0		
	QIT	Shear Tear-out	8.9	26.7	44.5		

(a) See figure 5-2 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 5-2 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
		Designation	At Load				
			W[b]	3W	5W	S_y[c]	S_{ult}[d]
9	Support Pipe ASTM A106 Steel	Tension	3.6	10.8	18.0	35	60
10	Support Plate ASTM A515 Gr. 70 Q&T	Tension	0.8	2.4	4.0	38	70
11	Side Lug ASTM A588 Gr. 70 Q&T	Tension @ Hole	5.6	16.8	28.0	38	70
		Combined Stress @ Weld	7.3	21.9	36.5		
		Shear @ Weld	2.2	6.6	11.0		
		Bearing @ Hole	8.2	24.6	41.0		
12	Clevis Pin ASTM A434 Class BD AISI 4340 St	Shear	5.2	15.6	26.0	110	140
		Bearing On Pin	8.3	24.9	41.5		
		Bearing On Side Lug	8.3	24.9	41.5		
		Bending	21.1	63.3	105.5		

(a) See figure 5-2 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 5-2 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
			At Load				
		Designation	W[b]	3W	5W	S_y[c]	S_{ult}[d]
13	Upper Clevis SA-508 Cl. 2 Q&T	Tension @ Pin Hole	8.5	25.5	42.5	50	80
		Bearing @ Pin Hole	8.3	24.9	41.5		
		Thread Shear	3.6	10.8	18.0		
		Tear-out Shear	8.5	25.5	42.5		
14	Sling Leg AISI 1117 Hot Rolled or 1018 Cold Rolled	Thread Shear	3.6	10.8	18.0	32	60
		Tension @ Thread	11.8	35.4	59.0		
15	Lower Clevis SA-508 Cl 2 Q&T	Thread Shear	3.6	10.8	18.0	50	80
		Tension In Lug	8.5	25.5	42.5		
		Shear Tear-out	8.5	25.5	42.5		
16	Clevis Bolt ASTM A434 Class BD AISI 4340	Shear	6.1	18.3	30.5	105	135
		Bearing	8.2	24.6	41.0		

(a) See figure 5-2 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 5-2 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
			At Load				
		Designation	W[b]	3W	5W	S_y [c]	S_{ult} [d]
17	Spreader Leg ASTM A36	Compression Bearing On Backing Block	7.0 10.3	21.0 30.9	36.0 51.5	F_a = 19.8[f] 36	 58
18	Backing Block ASTM A276 Type 304 Cond. A	Compression Bearing	8.6 10.3	25.8 30.9	43.0 51.5	30	75
19	End Plate ASTM A36	Bearing	7.0	21.0	36.0	36	58
20	Spacer ASTM A588 Gr. A or B	Bearing Tension Shear in Weld	8.2 8.2 1.9	24.6 24.6 5.7	41.0 41.0 9.5	50 18.0[g]	70

(a) See figure 5-2 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)
(f) F_a is the compressive buckling 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 5-2 (cont)

SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
			At Load				
		Designation	W[b]	3W	5W	S_y [c]	S_{ult} [d]
21	Channel ASTM A36	Tension @ Cross-section	9.6	28.8	48.0	36	58
22	Brace Plate ASTM A36	Shear (weld)	5.4	16.2	27.0	36 18[g]	58
23	Leg Support Block AISI 8620	Shear (weld) Thread Shear	5.4 6.3	16.2 18.9	27.0 31.5	40 18[g]	65
24	Adaptor ASTM A276 Type 304 H.R. & Pick. Cond. A.	Thread Shear @ 4.5" Dia. Thd. Tension @ 4 1/2" Dia. Thd.	2.5 9.3	7.5 27.9	12.5 46.5	30	75

(a) See figure 5-2 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 5-2 (cont)

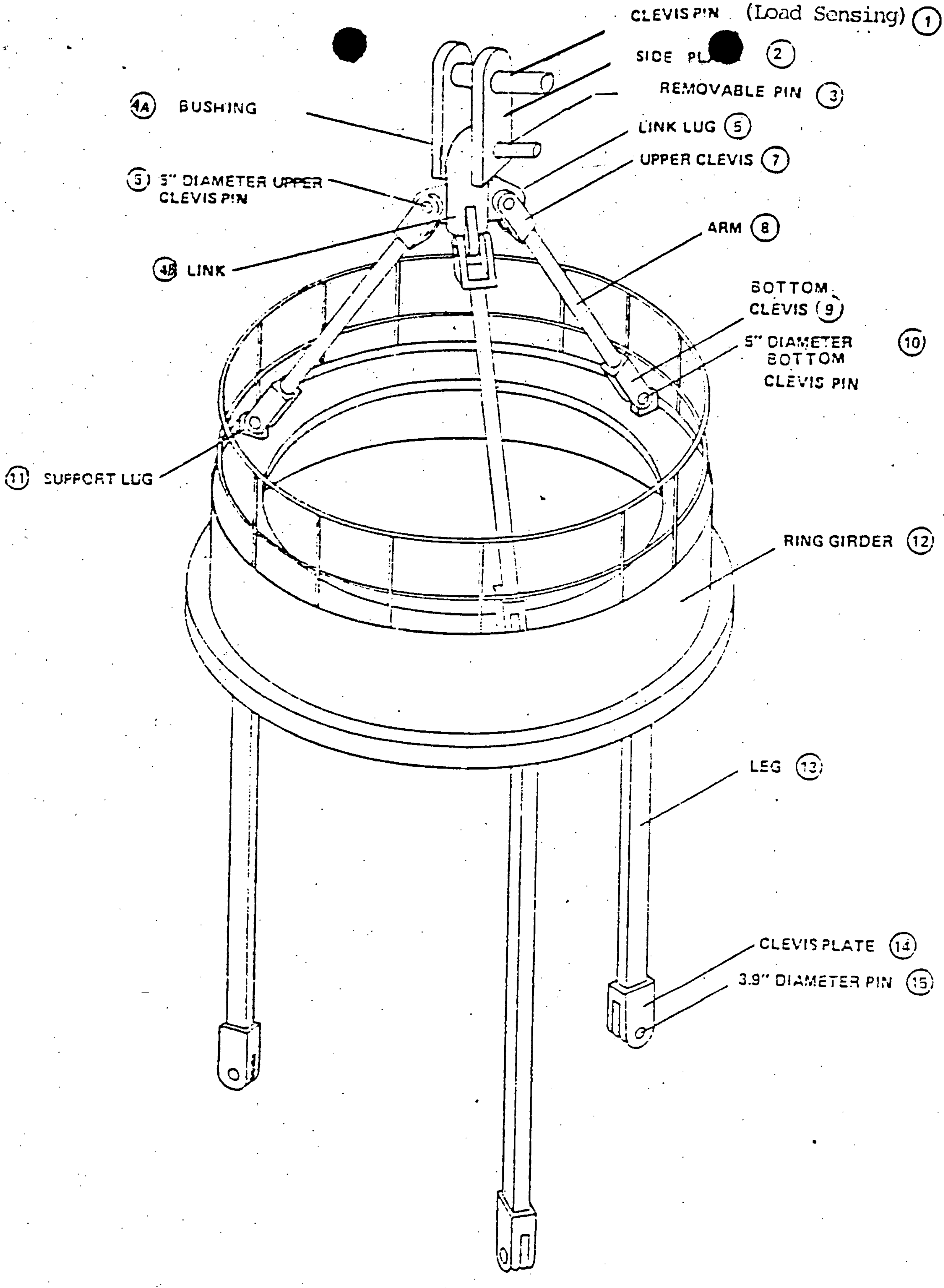
SUMMARY OF RESULTS

REACTOR VESSEL INTERNALS LIFT RIG,

LOAD CELL AND LOAD CELL LINKAGE

Item[a] No.	Part Name And Material	Calculated Stresses (ksi)				Material Allowable (ksi)	
			At Load				
		Designation	W[b]	3W	5W	S_y[c]	S_{ult}[d]
25	Outer Tube ASTM A312 Type 304 Smls. Cf. & Ht. Tr.	Thread Shear @ 5.5" Dia Thd Tension @ Thd Relief	6.3 10.7	18.9 32.1	31.5 53.5	30	75
26	Guide Sleeve ASTM A276 Type 304 Hot Rolled & Pickled Cond. A	Bearing On Engaging Screw Thread Shear	19.0 6.3	57.0 18.9	95.0 31.5	30	75
27	Engaging Screw ASTM A564 Grade 630 Cond. 1100	Bearing on Guide Sleeve Tension @ Thread Relief Thread Shear	19.0 14.1 7.4	57.0 42.3 22.2	95.0 70.5 37.0	115	140

(a) See figure 5-2 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)



Reactor Vessel Head Lift Rig

Figure 5-1

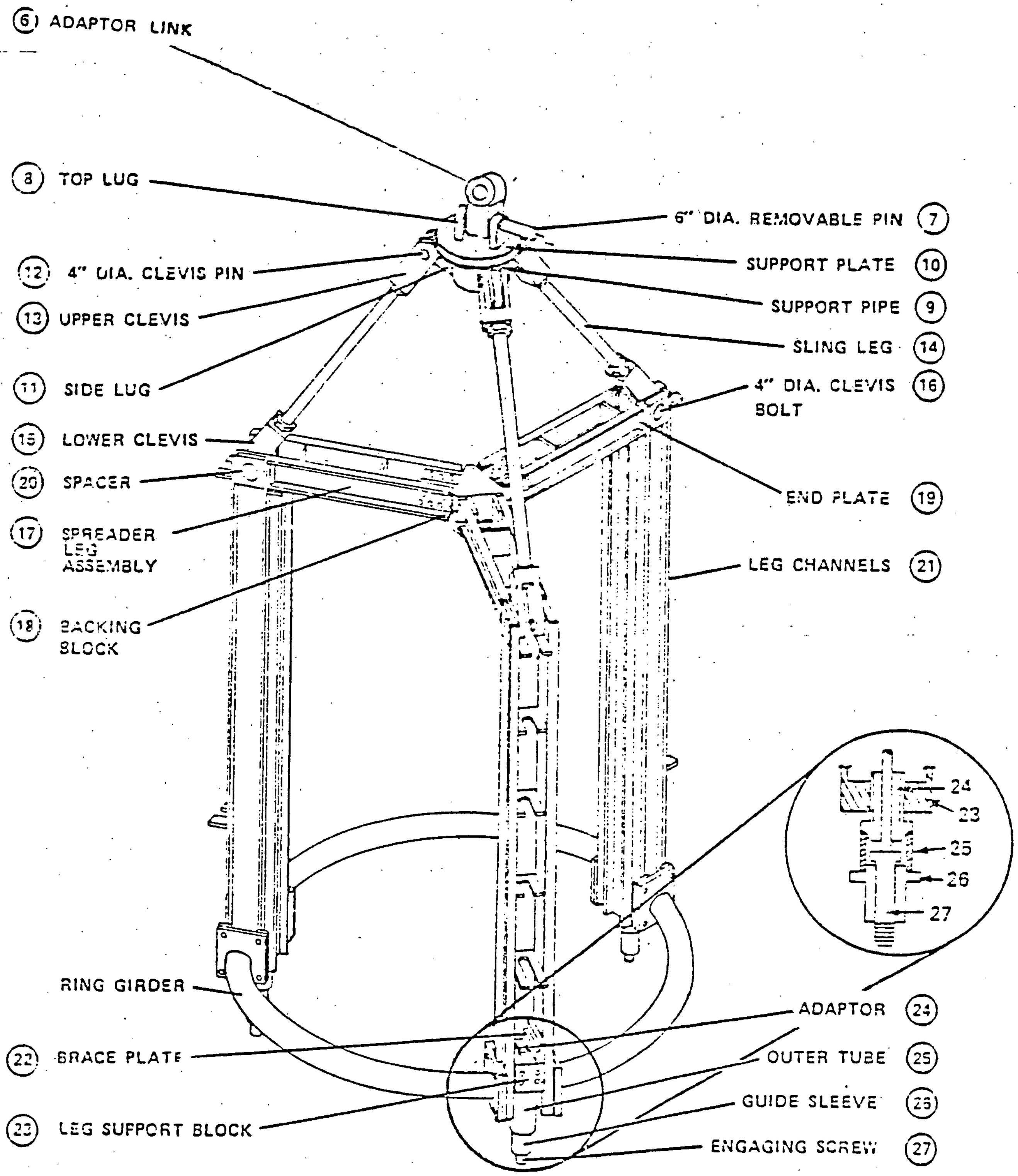


Figure 5-2

Reactor Vessel Internals Lift Rig, Load Cell and Linkage