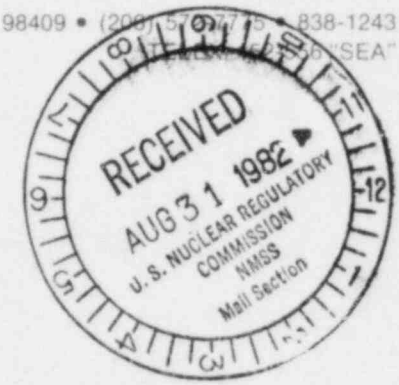
71-9145
PDR -Return 396-55

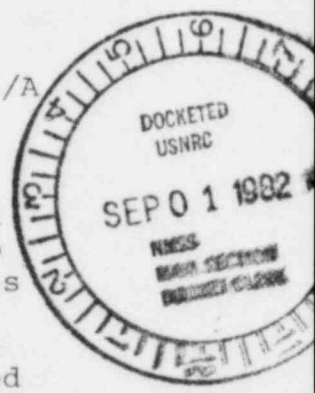
NUCLEAR
PACKAGING, INC.

815 SO. 28TH STREET • TACOMA, WASHINGTON 98409 • (206) 572-0327 • 838-1243
TELEX 32-6"SEA"



August 25, 1982

Mr. Charles E. MacDonald, Chief
Transportation Certification Branch
Division of Fuel Cycle & Material
Safety
Nuclear Regulatory Commission
Washington, DC 20555



REFERENCE: DOcket No. 71-9145
Certificate of Compliance No. USA/9145/A

Dear Mr. MacDonald:

Please find enclosed Revision 2 Amendments to the Model NUPAC 50 Safety Analysis Report, including revisions to SAR drawing X-20-201D, Sheets 1 and 2. Eight (8) copies of the amended pages and revised drawings are attached including instructions for their incorporation into the Safety Analysis Report. A check for $150.00 is enclosed to cover the minor amendment fee for Category 11E packages under 10 CFR 170.31.

The enclosed revisions change the dimensioning system used in the SAR drawing to reflect a constant position of the tiedown/lifting lugs relative to the top of the cask. Corresponding changes to the applicable sections of the Safety Analysis Report result in small changes in margins of safety. In all cases, positive margins of safety are retained.

Your expedited review of these revisions will be greatly appreciated.

Sincerely yours,

NUCLEAR PACKAGING, INC.

John D. Simchuk

JDS/pro

Aug 82-4
Applicant.....
Check No. 8118.....
Amount/ Fee Category $150 - 11E
Type of Fee. Minor
Date Check Rec'd. 8/26/82
Received By Jackson

Enclosures: Check No. 8118, $150.00
Revision 2 Amendments (8 copies)

21181

INSTRUCTIONS FOR INCORPORATION OF REVISION 2

AMENDMENTS TO NUPAC 50 SERIES CASK APPLICATION

DATED AUGUST, 1982

Insert new page 1-10	Remove old page 1-10
Insert new page 1-11	Remove old page 1-11
Insert new page 1-13	Remove old page 1-13
Insert new page 1-14	Remove old page 1-14
Insert new page 1-15	Remove old page 1-15
Insert new page 1-16	Remove old page 1-16
Insert new Drawing, X-20-201D, Revision C, Sheet 1 and 2 following Page 1-66	Remove old Drawing, X-20-201D, Revision B, Sheet 1 and 2

1.4.4 Tiedowns

Four tiedown lugs are provided to resist transportation induced loads. The applied load factors are:

$A_x = 10g$ (longitudinal)

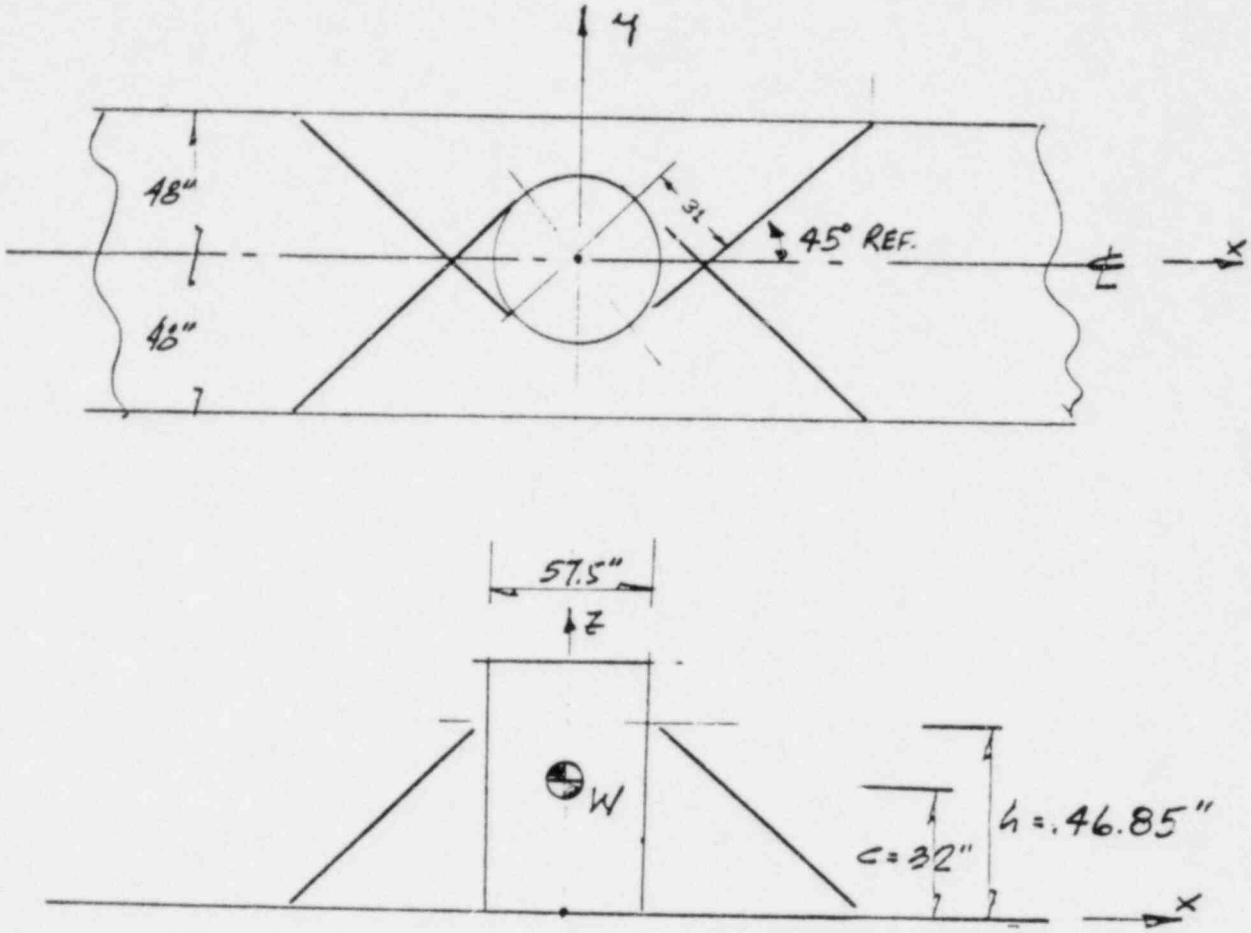
$A_y = 5$ (lateral)

$A_z = 2$ (vertical)

Each of the four tiedown lugs is located at 90^o with respect to the package at an elevation above the package base which ranges from 41.35 inches to 46.85 inches, depending upon version. The NuPac 50-4.0L version is the heaviest and has its c.g. at maximum elevation above the base; consequently is most critical. The tiedown scheme for the NuPac 50-xxL assumes a modified basket hitch arrangement involving crossed cables tangent to the package body at the tiedown lug with an approximate 2:1 horizontal to vertical aspect ratio. Tiedown cables are assumed to be tied to the transporter four feet each side of the transporter centerline. The geometry of the tiedown scheme used for loads evaluation is illustrated in the following sketch.

The tiedown cable geometry may be summarized as:

Direction	Length	Direction Cosine
Longitudinal	l_x=67.98	B_x = .635647
Lateral	l_y=67.98	B_y = .635647
Vertical	l_z=46.85	B_z = .438071



Tie-down Method

A vertical load produces a cable force of:

$$P_{Tz} = WA_z/4B_z; \text{ (4 cables acting)}$$

A longitudinal load factor produces a cable force of:

$$P_{Tx} = WA_x/2B_x \left[(c)/(h)\right] ; \text{ (2 cables acting)}$$

Similarly a lateral load factor produces a cable force of:

$$P_{Ty} = WA_y/2B_y \left[(c)/(h)\right] ; \text{ (2 cables acting)}$$

For conservatism, these three loads may be assumed to coincide for the most severely loaded cable:

$$P_T = W\left[\frac{c}{2h}\left(\frac{A_x}{B_x} + \frac{A_y}{B_y}\right) + \frac{A_z}{4B_z}\right]$$

$$= 29{,}000\left[\frac{32}{(2)(46.85)}\left(\frac{10}{.635647} + \frac{5}{.635647}\right) + \frac{2}{(4)(.438071)}\right]$$

$$= 266{,}813 \text{ lbs.}$$

Using a 40° shearout the "T-1" lug capacity is:

$$P_x = 2F_{sy}t\left(e_d - \frac{d}{2}\cos 40^\circ\right)$$

$$= (2)(60{,}000)(2)(2.25 - \cos 40^\circ) = 356{,}149 \text{ lbs.}$$

The margin of safety for lug yield is:

$$M.S. = 356149/266813 - 1 = \underline{+ 0.33}$$

The cable load consists of both horizontal and vertical components. The horizontal load component is transferred to the outer shell through the horizontal lug plates, whereas the vertical load component

is transferred to the outer shell through the vertical lifting lug plate.

The horizontal component of the tiedown load is:

$$P_H = \left[B_x^2 + B_y^2 \right]^{\frac{1}{2}} \cdot P_T$$

$$= \left[(.635647)^2 + (635647)^2 \right]^{\frac{1}{2}} \quad (266813)$$

$$= 239,849 \text{ lbs.}$$

The vertical component of the tiedown load is:

$$P_V = B_z \cdot P_T$$

$$= (.438071)(266813) = 116,833 \text{ lbs.}$$

The horizontal component of the tiedown load is reacted by a lug-to-cask weld whose yield capacity is estimated as:

$$P_w = F_{su} A_w; \; A_w = 2(12+2)(3/8)\sqrt{2} = 14.85 \text{ in}^2$$

$$= (22,800)(14.85) = 338,580 \text{ lbs.}$$

The associated lug-to-cask horizontal weld margin of safety is:

$$\text{M.S.} = 338,580/239,849 - 1 = \underline{+ 0.41}$$

The vertical component of the tiedown load is reacted by the same load paths analyzed for lifting lugs, see Section 1.4.3.1 The lug-to-cask weld margin of safety is:

$$M.S. = 229596 / 116883 - 1 = \underline{+ 0.96}$$

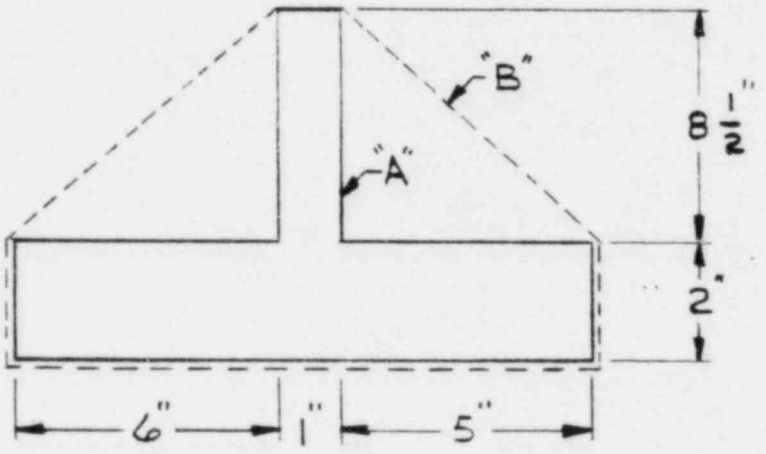
The total load applied to the outer shell is:

$$P_T = \left[P_V^2 + P_H^2\right]^{\frac{1}{2}}$$

$$= \left[(116883)^2 + (239849)^2\right]^{\frac{1}{2}} = 266{,}813 \text{ lbs.}$$

oriented at 25.98° with respect to the horizontal.

The shear stress induced in the outer shell is estimated as the total force, P_T, divided by the minimum perimeter enclosure surrounding the tiedown fitting:



Perimeter estimates:

$$P_A = (8.5+1)(2) + (6+5+2)(2) = 45 \text{ in.}$$

$$P_B = 12+4+1+ \sqrt{8.5^2+6^2} + \sqrt{8.5^2+5^2} = 37.27 \text{ in.}$$

Thus, the shell shear area is:

$$A_S = (3/8") \; P_B = 13.98 \text{ in}^2$$

The shear stress in the shell is:

$$f_s = 266813/13.98 = 19{,}085 \text{ psi}$$

The Margin of Safety in the shell is:

$$M.S. = F_{sy}/f_s - 1 = 22{,}800/19{,}085 - 1 = \underline{+ 0.19}$$

The weak link load path component is assessed as follows:

The ultimate shear-out capacity of the lug is estimated as:

$$P_{su} = 356{,}149 \quad (\frac{110{,}000}{100{,}000}) = 391{,}764 \text{ lbs.}$$

The ultimate capacity of the lug-to-cask weld is:

$$P_w = \left[548{,}625^2 + 372{,}030^2\right]^{\frac{1}{2}} = 662{,}869 \text{ lbs.}$$

Where: vertical ultimate capacity = 229,596 (35/21.6)

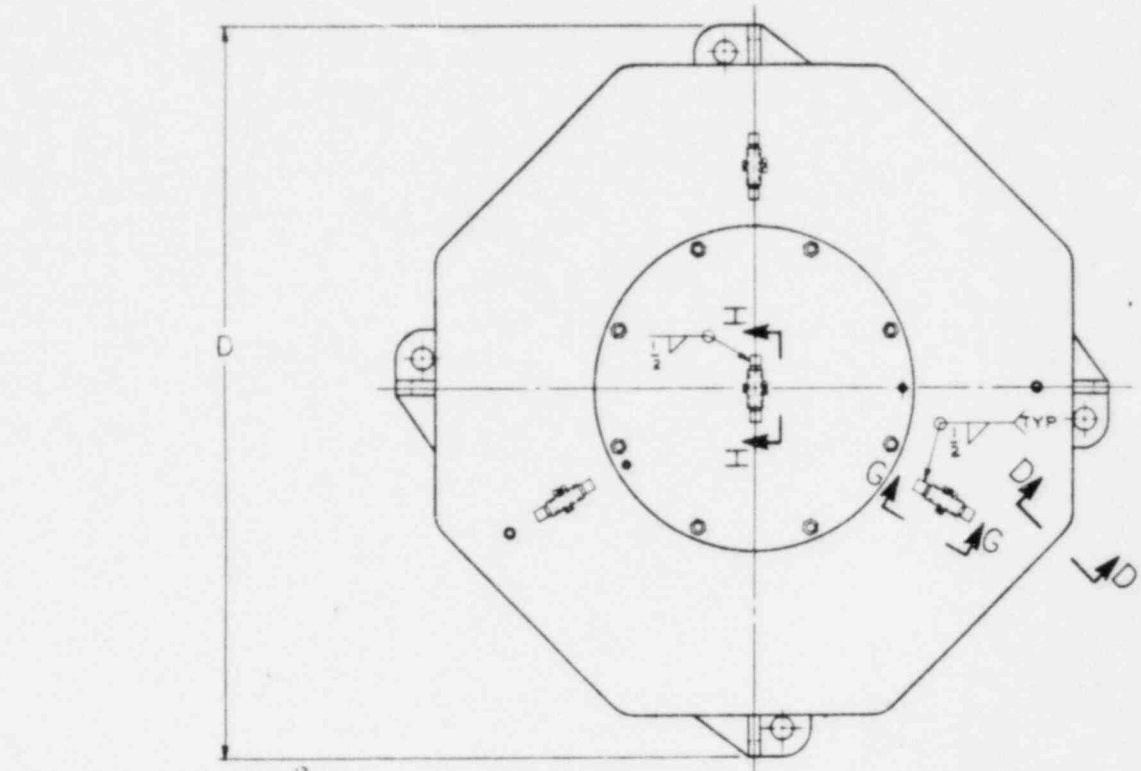
= 372,030

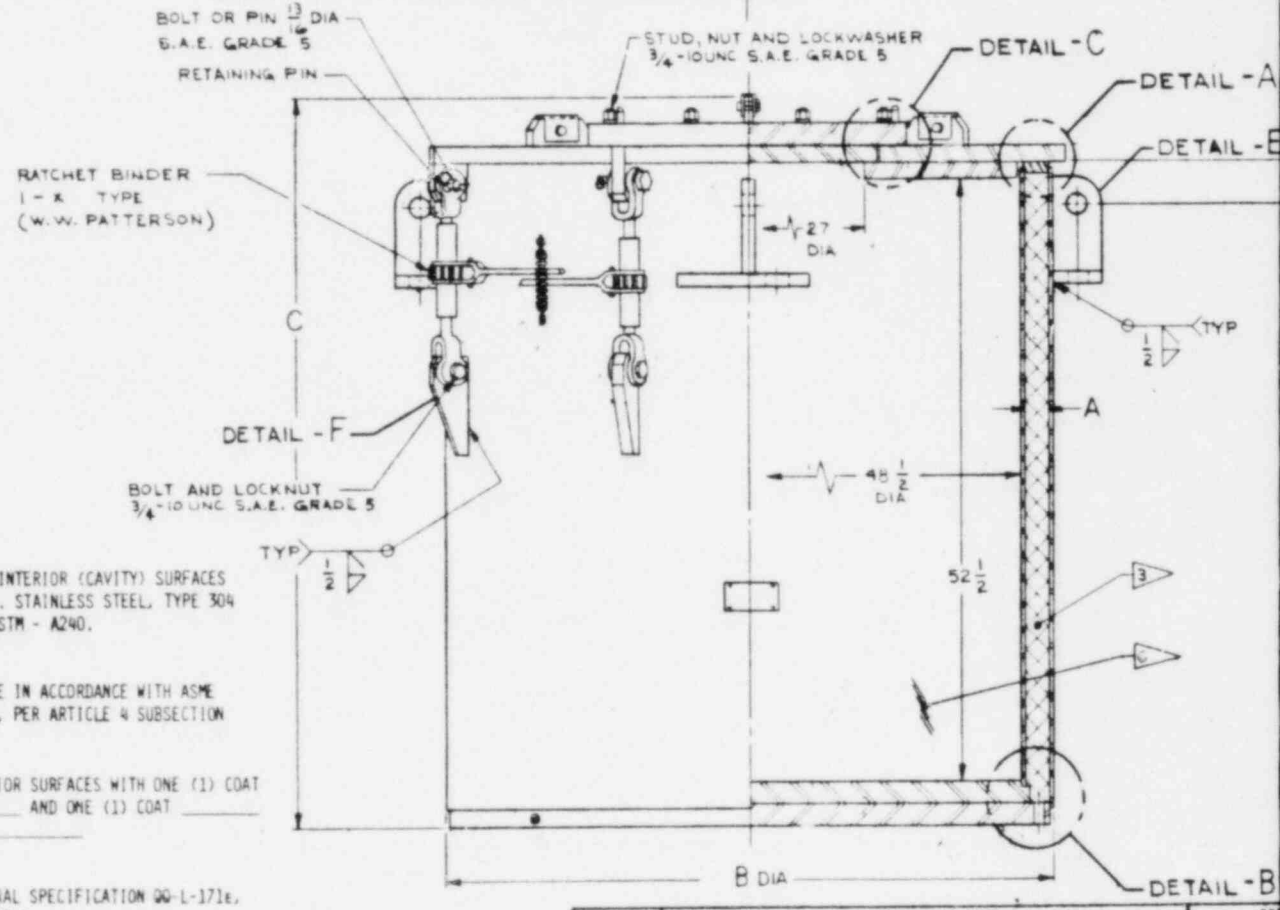
horizontal ult. capacity = 338,580 (35/21.6)

= 548,625

The ultimate capacity of the outer shell is:

$$P_c = (42{,}000)(13.98) = 587{,}160 \text{ lbs.}$$





6 OPTIONAL: CASK INTERIOR (CAVITY) SURFACES LINED WITH 12GA. STAINLESS STEEL, TYPE 304 CONFORMING TO ASTM - A240.

5. WELDING SHALL BE IN ACCORDANCE WITH ASME CODE SECTION IX, PER ARTICLE 4 SUBSECTION QW-400.

4 PAINT ALL EXTERIOR SURFACES WITH ONE (1) COAT _____ AND ONE (1) COAT _____
COLOR: _____

3 LEAD: PER FEDERAL SPECIFICATION QQ-L-171E, GRADE A OR C

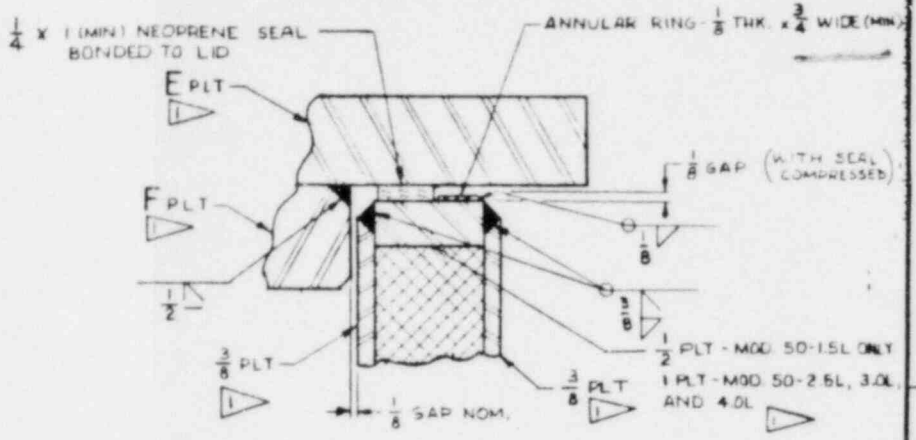
2 MATERIAL: U.S. T-1 STEEL ASTM - A514

1 MATERIAL: STEEL PER ASTM - A516 GRD. 70.

NOTES: UNLESS OTHERWISE SPECIFIED

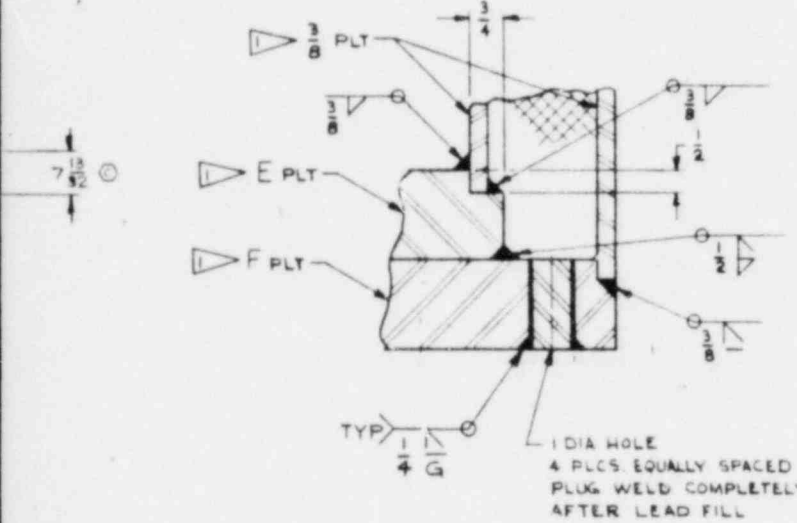
CASK MODEL	DIMENSIONAL DATA						REF
	A	B	C	D	E	F	CASK WT.
50-1.5L	1.25	52.50	[illegible]13	61.50	1.00	1.25	8965
50-2.5L	2.25	54.50	65.38	63.50	2.00	2.00	15125
50-3.0L	2.75	55.50	66.88	64.50	2.00	2.50	17850
50-4.0L	3.75	57.50	70.38	66.50	3.00	3.00	24615

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REV PER ENGR REQUEST	5/30/80	

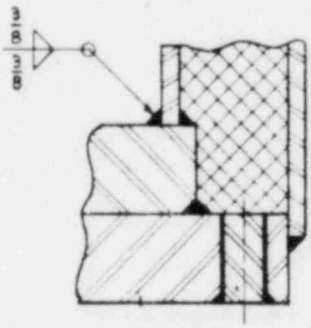


(GASKET SHOWN UNCOMPRESSED)

DETAIL - A
SCALE: 1/2



OPTION - 1



OPTION - 2

DETAIL - B
SCALE: 1/2

ERENCE DATA	
PAY LOAD	GROSS WT.
4200	13165
	19325
	22050
4200	28815

ASSEMBLY & QUANTITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS ±
ANGLES ±
3 PLACE DECIMALS ±
2 PLACE DECIMALS ±
1 PLACE DECIMALS ±

DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON

APPLICATION

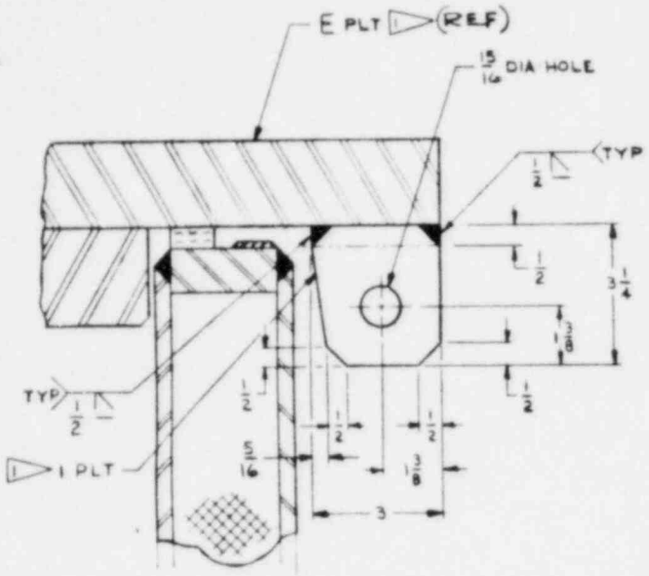
ITEM	PART NO.	DESCRIPTION	MATERIAL
		LIST OF MATERIAL	

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

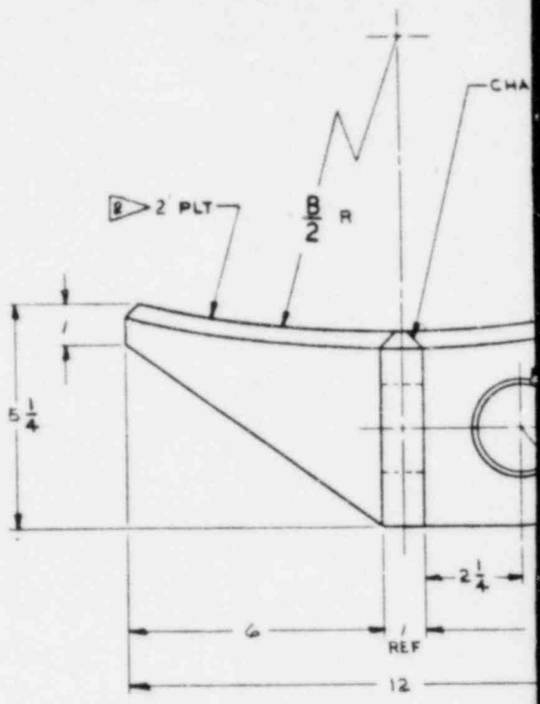
TRANSPORTATION SHIELD
TYPE A
MODEL "NUPAC 50"

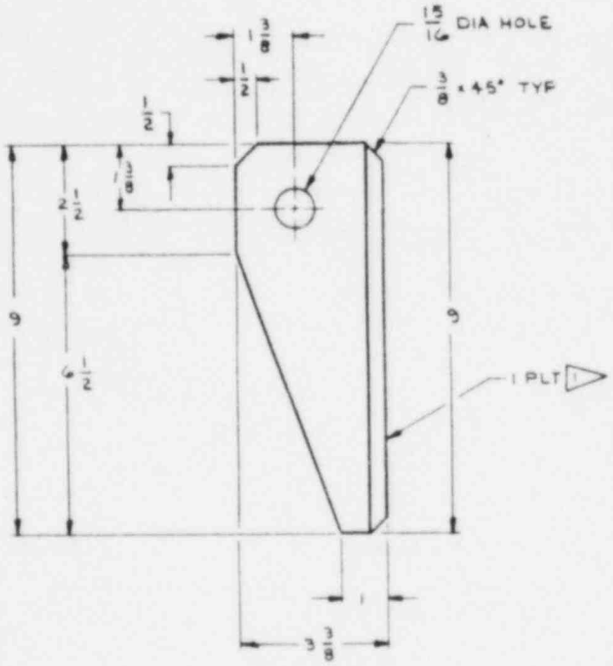
DRAWN CULTUM	8-28-80	QA	9-11-80	SCALE 1/8 & NOT B/D · WT SEE CHART · REV C · SHEET 1 OF 2
CHECK	9-11-80	DWG. REL.	9-11-80	
ENGR	9-11-80	PROD. REL.		DWG SIZE D · DWG NO. X-20-201D

X-20-201D C

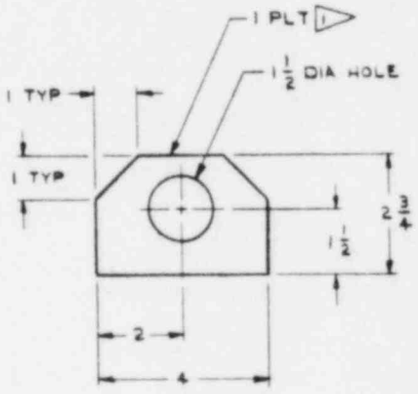


SECTION D-D
SCALE: 1/2





DETAIL-F
SCALE: 1/2

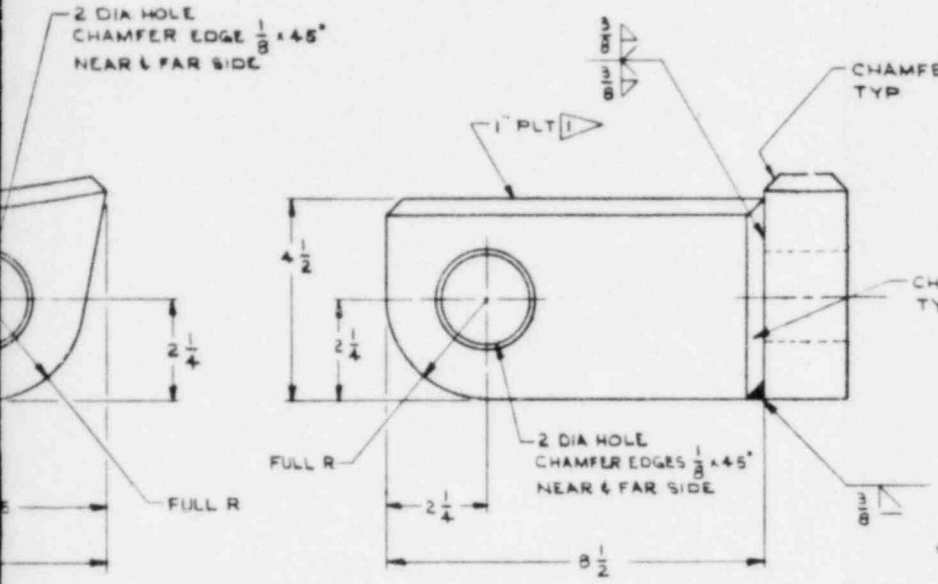


VIEW G-G
SCALE: 1/2

VIEW H-H
SCALE: 1/2

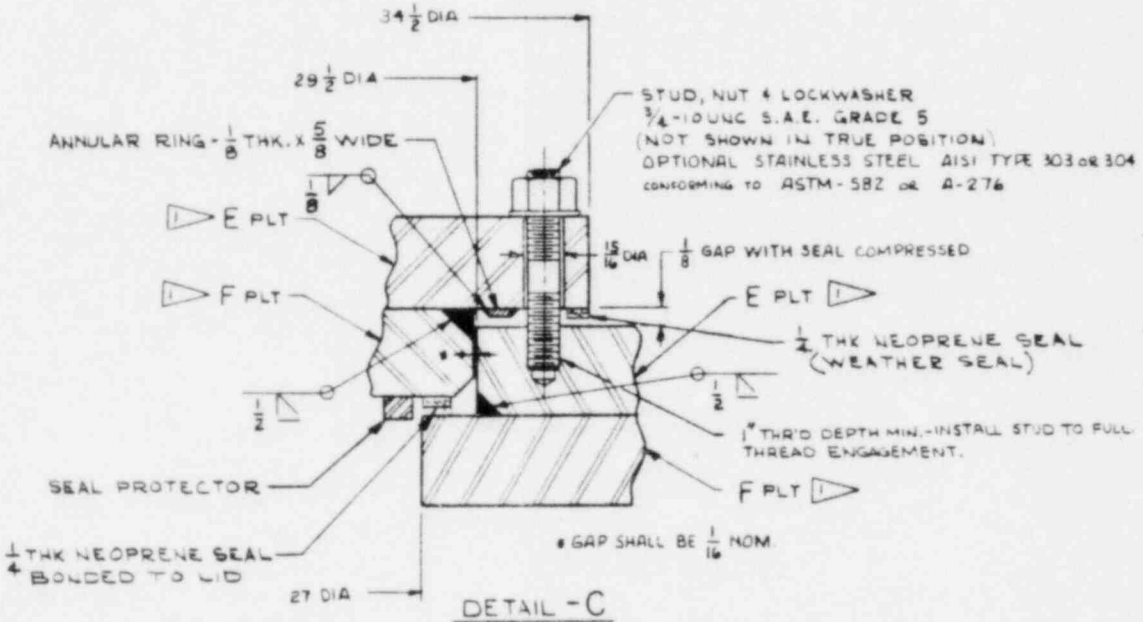
NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	B	REVISED DWG TO CORRECT DRAFTING ERROR I.D. WAS SHOWN 54 1/8 INCORRECTLY OPTIONAL DETAIL REMOVED	1/21/81	
	C	REVISED DWG TO CHANGE LIFT/TIE DOWN LUG LOCATION DIMENSION. WAS SHOWN 55 1/8 FROM BASE	8/25/82	



DETAIL - E

SCALE: 1/2



DETAIL - C

SCALE: 1/2

(GASKET SHOWN UNCOMPRESSED)

X-20-201D C

ITEM	PART NO.	DESCRIPTION	MATERIAL

LIST OF MATERIAL

NUCLEAR PACKAGING, INC.

TACOMA, WASHINGTON

TRANSPORTATION SHIELD

TYPE A

MODEL "NUPAC 50"

ASSEMBLY & QUANTITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ±

DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON

APPLICATION

DRAWN CULTUM	8-28-80	P.A.	9-11-80	SCALE: 1/8 & NOTED / WT. SEE CHART
CHECK	9-11-80	DWG. REL.	9-11-80	REV C / SHEET 2 OF 2
ENGR.	9-11-80	PROD. REL.		DWG SIZE D / DWG NO. X-20-201D