71-9073

NUCLEAR PACKAGING
A Pacific Nuclear Company

June 3, 1985

File: OH-142
Ref: 4024

PDR
return
to
3965S

Mr. Charles E. MacDonald, Chief
Transportation Certification Branch
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Reference: OH-142 Safety Analysis Report, Docket No. 71-9073

Dear Mr. MacDonald:

After some discussion with your staff, we have prepared the enclosed revised pages to the OH-142 Safety Analysis Report to adequately address leak testing requirements as well as to adjust the drawings and QA section of the report to reflect current practice. We have also included copies of page 1-90 which apparently was not included in our May 6 submittal.

The changes we have made include:

- The Operating Procedures (Section 6.0) have been revised to require all Type B quantity shipments which are not classified as LSA to be leak tight to at least 10^{-5} scc/sec. The leak test used to demonstrate this has been included as an appendix to Section 6.

- The thermal shield tolerance on the drawings has been changed to reflect a more realistic fabrication tolerance. Calculations demonstrating that the new tolerance has no effect on the package's ability to meet the requirements of 10 CFR 71 is included as Attachment I to this letter.

- The discussion of our Gamma Scan calibration has been updated to reflect our current practice.

- The Quality Assurance Section has been updated to reflect current Regulatory Guide information regarding the existence of our QA system. All outdated information has been deleted.

As you can see, all changes are very minor. Only the leak test change has any impact on safety, and this change is to make shipments demonstrably more safe than has been current practice.

25-334

June 3, 1985

Mr. Charles E. MacDonald, Chief
Transportation Certification Branch

Page 2

This revision, including revised drawings, has been copyrighted. This entire submittal contains proprietary information per the notice included on the fly leaf of this report. We are aware of your requirements to place this submittal in the Public Documents Room. This may be done with our permission; however, this permission should not be construed as a waiver of or in any way prejudicial to our lawful proprietary rights to this material. It is is done only to facilitate the issuance of a Certificate of Compliance.

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If you have any questions, please call either myself or Stephen Goetsch. Thank you very much for your help in this matter.

Very truly yours,

NUCLEAR PACKAGING, INC.

Charles J. Temus
Technical Director

Enclosed: As stated

RECEIVED
'85 JUN 27 P2:49

DOCKET NO. 71-9073
CONTROL NO. 25334
DATE OF DOC. 6/3/85
DATE RCVD. 6/5/85
FCDF _____ FDL ✓
FCDF _____ LPDR _____
WH _____ E&A REP. ✓
WHIR _____ SAFEGUARDS _____
FCDF ✓ OTHER _____
DESCRIPTION:

Revised pages to the OH-142 SAR

6/6/85 INITIAL mt

NOTES: UNLESS OTHERWISE SPECIFIED

1. MATERIAL: LOW CARBON HOT ROLLED STEEL:
   : PLATE & SHAPES CONFORM TO ASTM-A516, GR70
   : SHEETS CONFORM TO ASTM-A36 OR 304 SST PER ASTM-A240 WHERE NOTED.

2. MATERIAL : ASTM-A514 OR A517

3. FOAM: 1,000 PSI CRUSH STRENGTH RIGID POLYURETHANE. PER NUPAC FOAM SPECIFICATION NPI-F6.

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

5. REMOVED

6. REFERENCE DATA: CASK WT: 54,000LBS.
   PAY LOAD: 10,000LBS.
   GROSS WT: 64,000LBS.

7. REMOVED

8. ALL WELDING PROCEDURES AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH ASME CODE, SECTION IX.

9. ALL WELDS SHALL BE INSPECTED VIA NDT METHODS AS FOLLOWS:
   LIFTING LUG AND CIRCUMFERENTIAL CONTINUOUS WELDS: MAGNETIC PARTICLE PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 7.
   LONGITUDINAL SHELL WELD: RADIOGRAPHIC PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 2.

10. AS AN OPTION, 12 GA. NO. 304 STAINLESS STEEL CLADDING MAY BE INSTALLED ON THE INTERIOR & EXTERIOR SURFACES OF THE FLASK BODY & INTERIOR SURFACES OF THE UPPER LID, & SEAL WELDED ALONG ALL EDGES & SEAMS.

11. PAINT ALL EXPOSED CARBON STEEL SURFACES WITH ONE COAT CARBROZINC II & ONE COAT PHENOLINE 305, OR ONE PRIMER COAT (5 MILS) MOBIL CHEM EPOXY NO. 89W9 & ONE FINISH COAT (5 MILS) MOBIL CHEM EPOXY NO. 89W9.

12. COAT ALL EXPOSED EXTERIOR SURFACES OF FLASK BETWEEN UPPER AND LOWER OVERPACKS WITH ONE (1) COAT (MIN 3/16 THK) "ALBI-CLAD" NO. 89. AS AN OPTION, A 10 GA. NO. 304 STAINLESS STEEL THERMAL SHIELD MAY BE INSTALLED BETWEEN THE OVERPACKS.

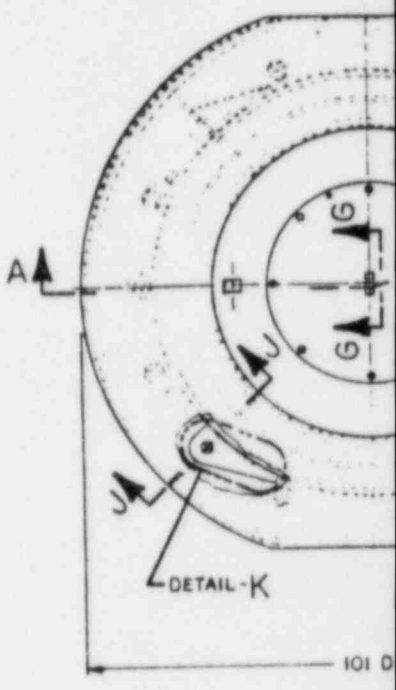
13. FLASKS FABRICATED PRIOR TO 3/84 MAY BE MADE USING ASTM-A36 MATERIAL. (FLASK BODY OUTER SHELL SHALL BE 1 1/8 IN. THICK, WITH FULL PENETRATION DOUBLE SIDED V GROOVE WELD FOR VERTICAL SEAM.)

14. NOMINAL AIR GAP (MINIMUM .05,MAXIMUM .42 in.)

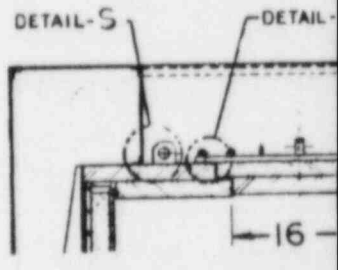
15. PACKAGE SHALL BE MARKED & IDENTIFIED IN ACCORDANCE WITH THE REQUIREMENTS OF 10 CFR 71.85(c)

16. PRIMARY & SECONDARY LIDS & DRAIN SHALL BE EQUIPPED WITH TAMPER INDICATING DEVICES IN ACCORDANCE WITH 10 CFR 71.43(b)

17.



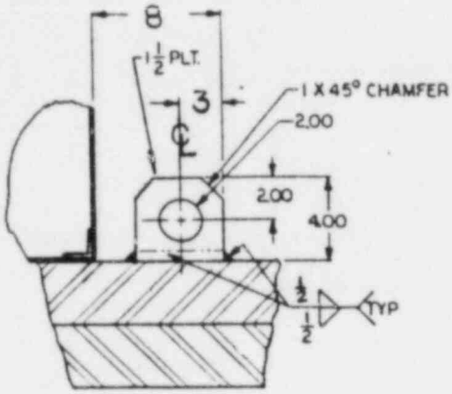
TOP VIEW SHOWING OPTIONA



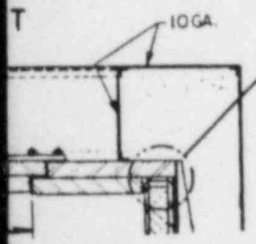
PARTIAL SECT A. A SHOWING OPTIO

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
H	SEE DCN	5-85	

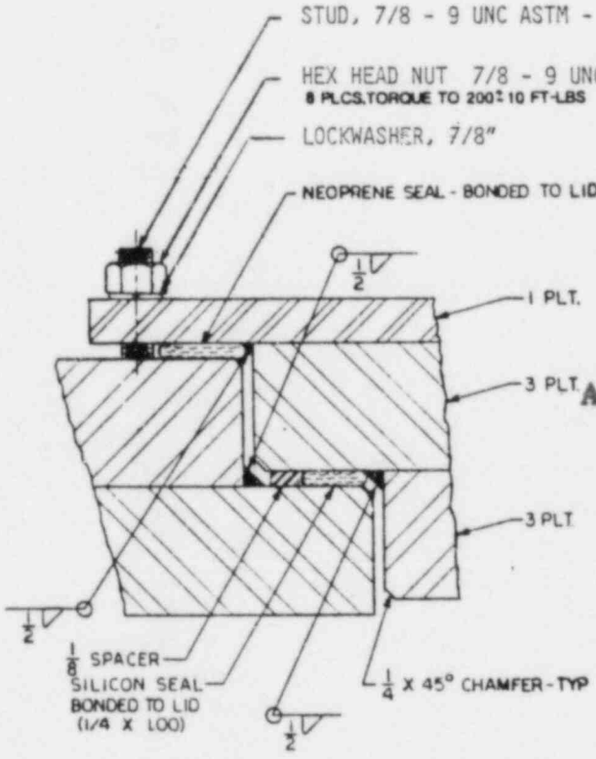
16" DIA SECONDARY LID



DETAIL - S



NAL 16" DIA SECONDARY LID



DETAIL - I

8507150615-01

ITEM	PART NO	DESCRIPTION
	ASSEMBLY & QUANTITY	LIST OF MATERIAL
REL		
APPD		
APPD		
APPD		
APPD		
QA		
CHECK		
DRAWN		

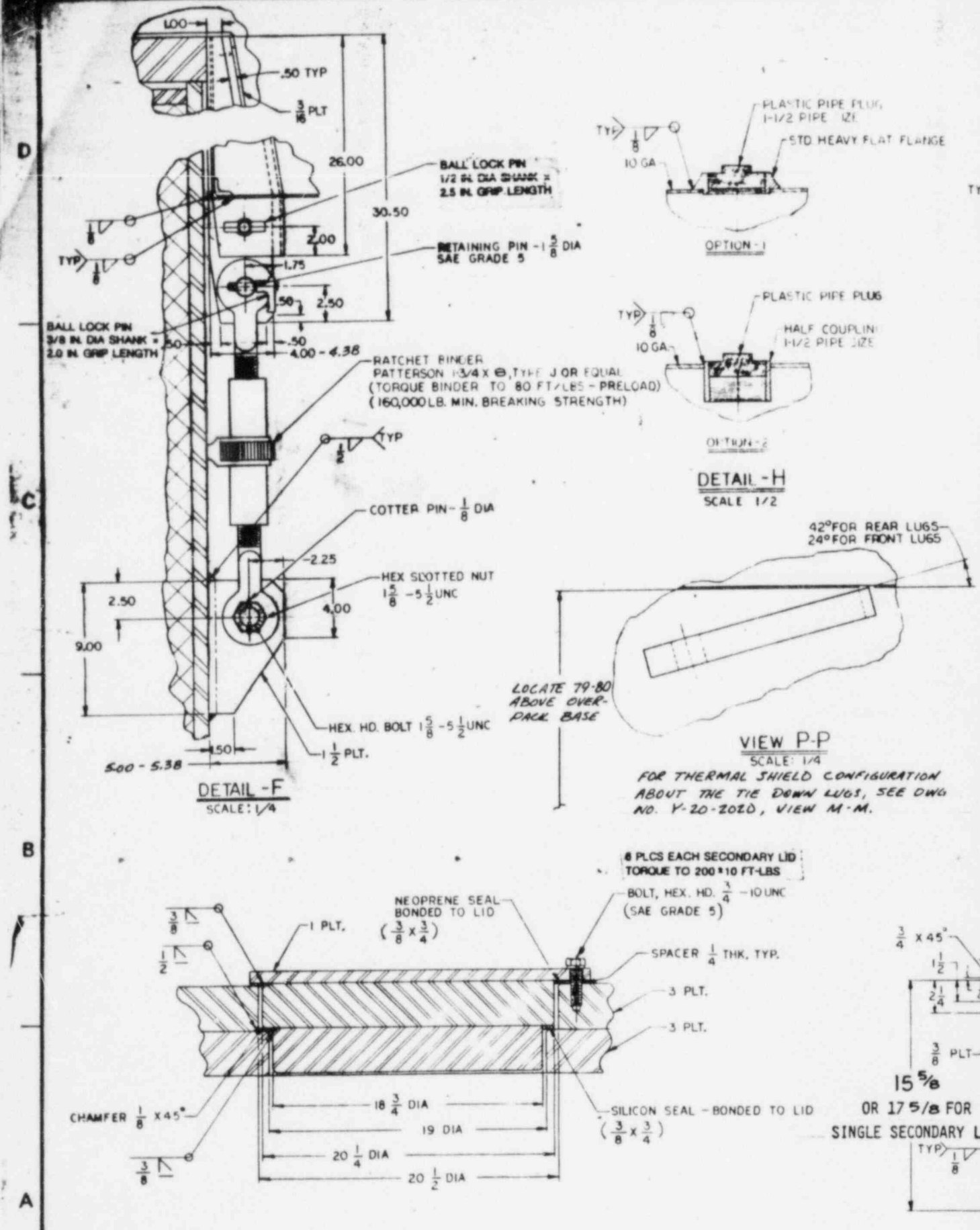
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS ±
ANGLES ±
3 PLACE DECIMALS ±
2 PLACE DECIMALS ±
1 PLACE DECIMALS ±

IT BOTH NEXT ASSY

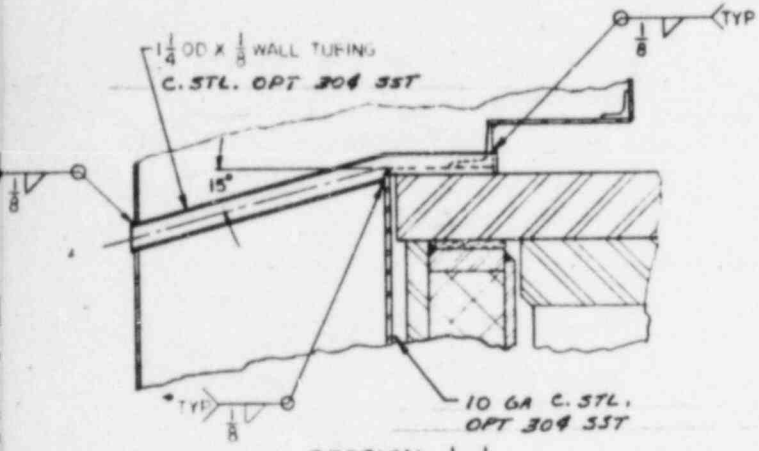
NUCLEAR PACKAGING
A Pacific Nuclear Company
FEDERAL WAY, WA.

BULK RESIN SHIPPING FLASK
MODEL OH142 MK-I

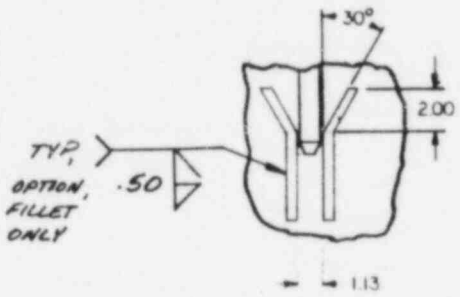
SCALE		WT.	
REV	H	SHEET	OF 3
DWG SIZE	B	DWG NO.	AL-20-202

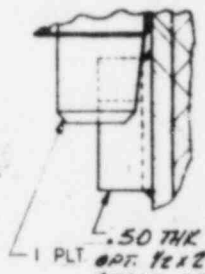

.50 TYP
3/16 PLT
26.00
30.50
2.00
1.75
.50
2.50
.50
4.00 - 4.38
.50
BALL LOCK PIN
1/2 IN. DIA SHANK =
2.5 IN. GRIP LENGTH
RETAINING PIN - 1 5/8 DIA
SAE GRADE 5
BALL LOCK PIN
3/8 IN. DIA SHANK =
2.0 IN. GRIP LENGTH
RATCHET BINDER
PATTERSON #3/4 X 8, TYPE J OR EQUAL
(TORQUE BINDER TO 80 FT/LBS - PRELOAD)
(160,000 LB. MIN. BREAKING STRENGTH)
TYP
COTTER PIN - 1/8 DIA
2.25
HEX SLOTTED NUT
1 5/8 - 5 1/2 UNC
2.50
4.00
9.00
HEX. HD. BOLT 1 5/8 - 5 1/2 UNC
1 1/2 PLT.
.50
5.00 - 5.38
DETAIL - F
SCALE: 1/4
PLASTIC PIPE PLUG
1-1/2 PIPE SIZE
STD HEAVY FLAT FLANGE
TYP
1/8
10 GA
OPTION - 1
PLASTIC PIPE PLUG
HALF COUPLING
1-1/2 PIPE SIZE
TYP
1/8
10 GA
OPTION - 2
DETAIL - H
SCALE 1/2
42° FOR REAR LUGS
24° FOR FRONT LUGS
LOCATE 79.80
ABOVE OVER-
PACK BASE
VIEW P-P
SCALE: 1/4
FOR THERMAL SHIELD CONFIGURATION
ABOUT THE TIE DOWN LUGS, SEE DWG
NO. Y-20-2020, VIEW M-M.
8 PLCS EACH SECONDARY LID
TORQUE TO 200 ± 10 FT-LBS
BOLT, HEX. HD. 3/4 - 10 UNC
(SAE GRADE 5)
NEOPRENE SEAL
BONDED TO LID
(3/8 X 3/4)
1 PLT.
SPACER 1/4 THK, TYP.
3 PLT.
3 PLT.
3/8
1/2
3/8
CHAMFER 1/8 X 45°
18 3/4 DIA
19 DIA
20 1/4 DIA
20 1/2 DIA
SILICON SEAL - BONDED TO LID
(3/8 X 3/4)
3/4 X 45°
1 1/2
2 1/4
3/8 PLT
15 5/8
OR 17 5/8 FOR
SINGLE SECONDARY LI
TYP
1/8
SECTION L-L
SCALE: 1/4
SEC
SCA
NOTES: UNLESS OTHERWISE SPECIFIED

ZONE	LTR	REVISIONS DESCRIPTION	MISC
	H	SEE DCN 5-98	



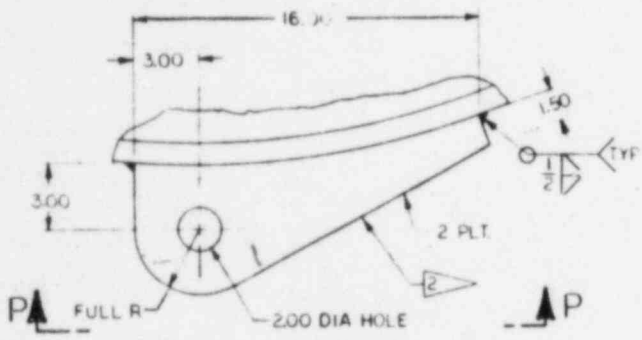
SECTION J-J
SCALE: 1/4



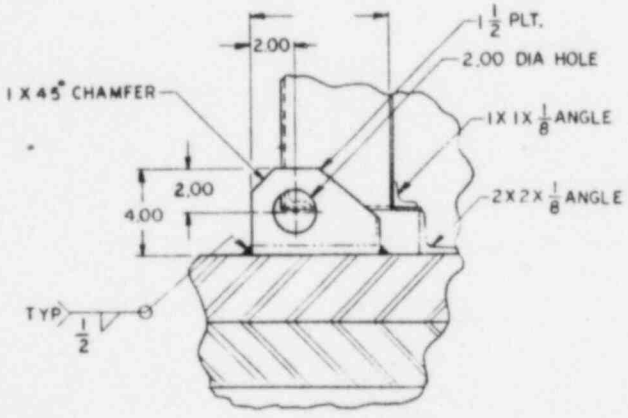


DETAIL - M
SCALE 1/4

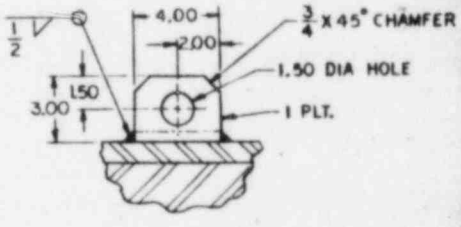
FOR THERMAL SHIELD CONFIGURATION ABOUT THE GUIDE TABS, SEE DWG. NO. Y-20-2020, DETAIL-K.



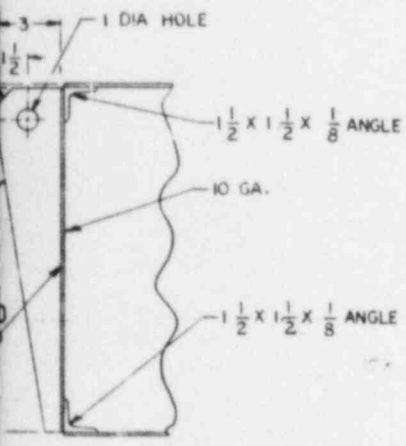
DETAIL-K
SCALE 1/4



DETAIL N-N
SCALE: 1/4



VIEW G-G
SCALE: 1/4



TION R-R
LE: 1/4

9507150615-03

ITEM	PART NO	DESCRIPTION	MATERIAL
		LIST OF MATERIAL	

ASSEMBLY & QUANITITY

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

DO NOT SCALE THIS DRAWING

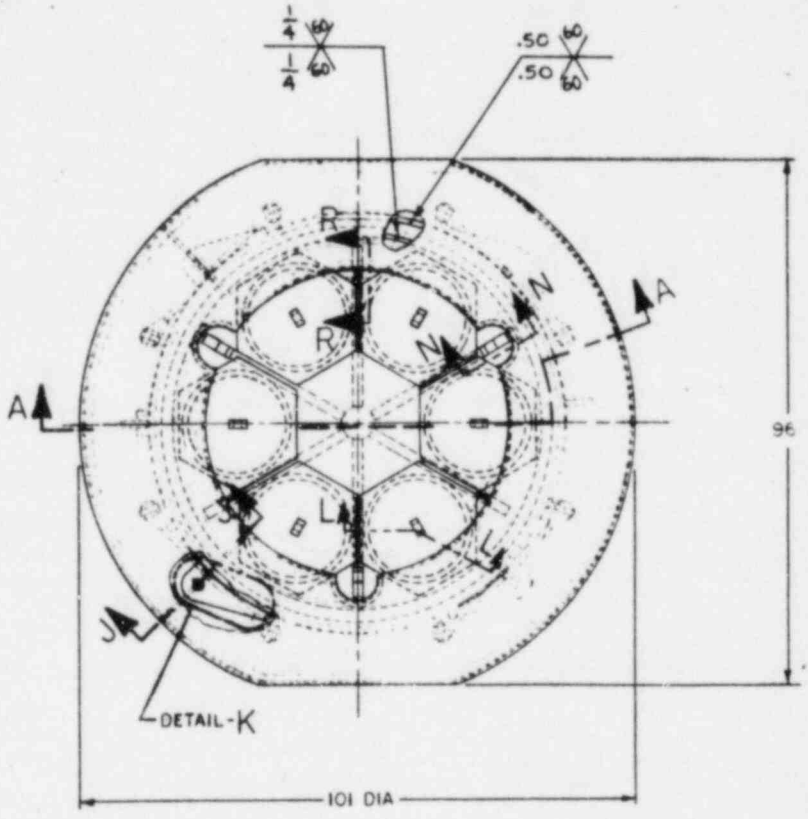
NEXT ASSY | USED ON
APPLICATION

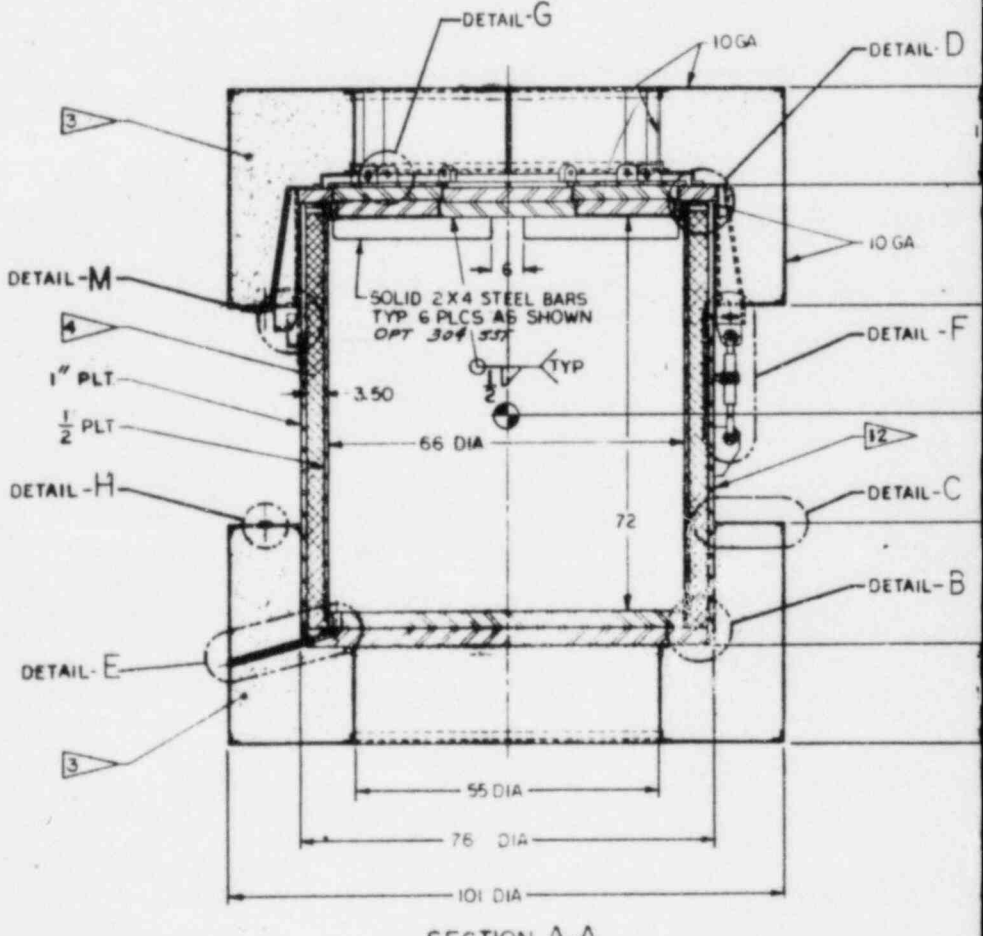
NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142 MK-I

DRAWN	CULTUM	12-21-77		1/9/80
CHECK		1-13-78	DWG REL	1-13-78
ENGR		1-13-78	MDEL REL	

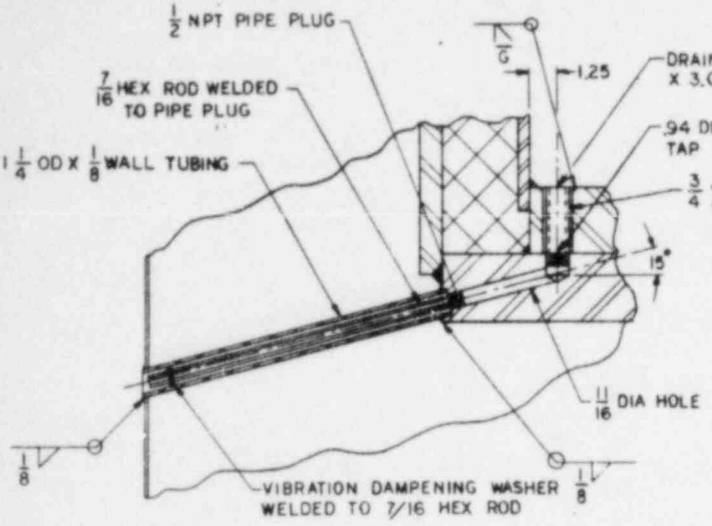
SCALE 1/16 (NOTED) WT.
REV M SHEET 3 OF 3
DWG SIZE D
DWG NO. AL-20-202


1/4 60
1/4 60
.50 60
.50 60
R
R
N
N
A
A
L
L
J
J
DETAIL-K
96
101 DIA

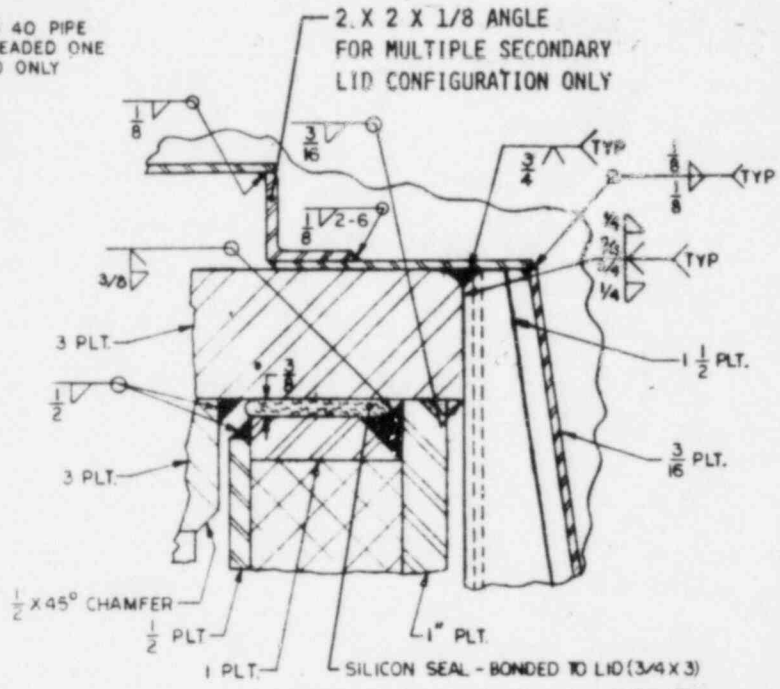

DETAIL-G
10 GA
DETAIL-D
10 GA
DETAIL-M
SOLID 2X4 STEEL BARS
TYP 6 PLCS AS SHOWN
OPT 304 SST
6
TYP
DETAIL-F
1" PLT
1/2 PLT
3.50
66 DIA
12
DETAIL-H
DETAIL-C
72
DETAIL-B
DETAIL-E
55 DIA
76 DIA
101 DIA

SECTION A-A

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	H	SEE DCN	5-85

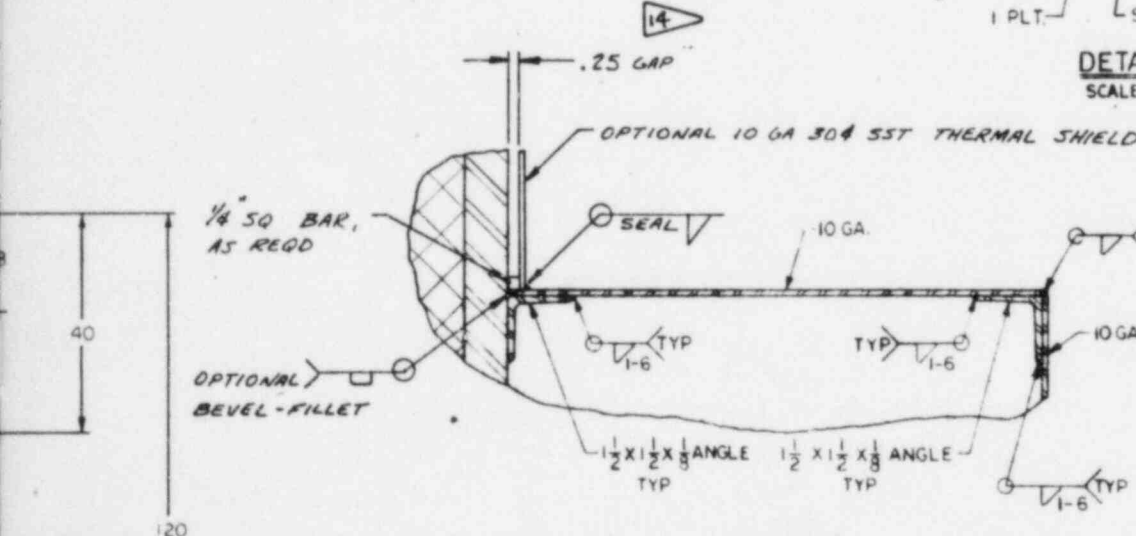


DETAIL-E
SCALE: 1/4

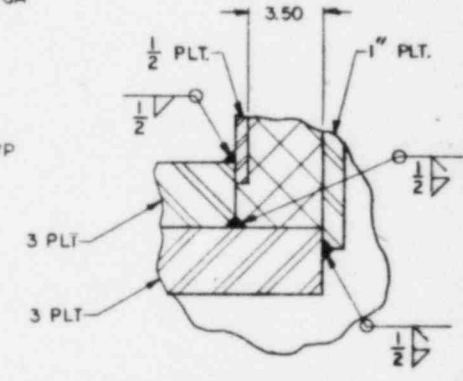


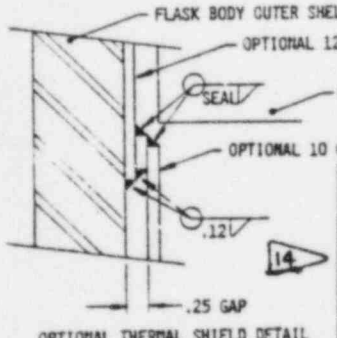
DETAIL-D
SCALE: 1/2

Also Available On Aperture Card



DETAIL-C
SCALE: 1/2
(WITH OPTIONAL THERMAL SHIELD)





OPTIONAL THERMAL SHIELD DETAIL

8507150615-02

DETAIL-B
SCALE: 1/4

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	

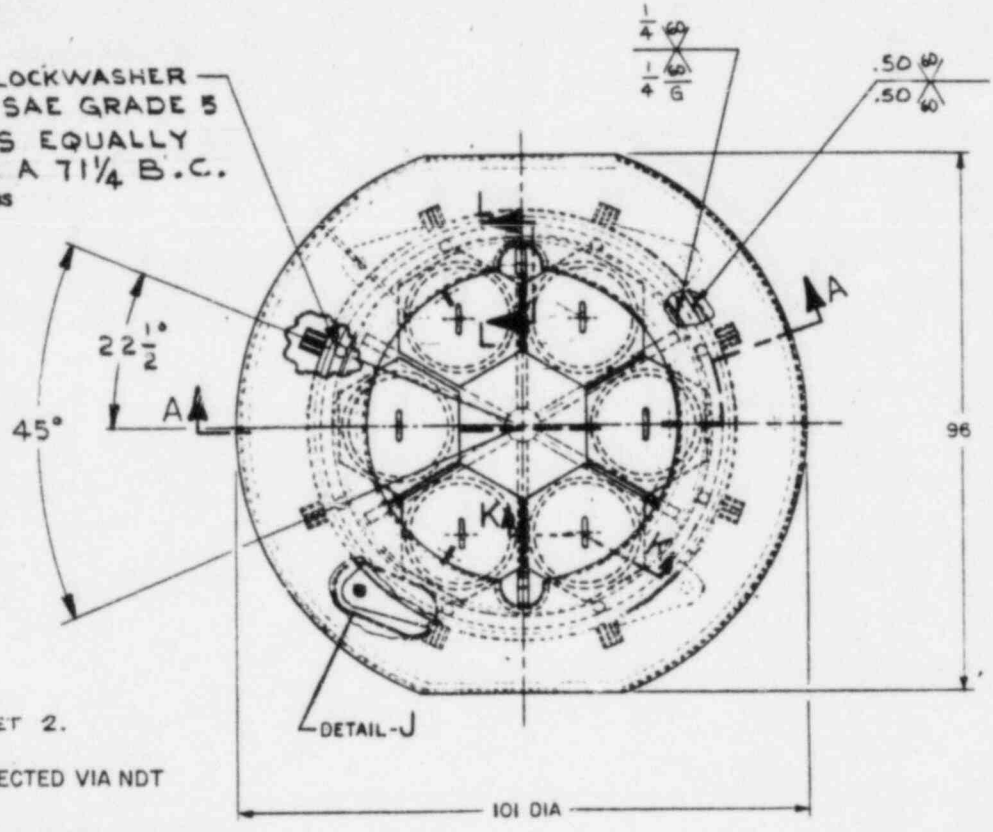
NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142 MK-1

DRAWN	CULTUM	12-30-77	QA	1/31/85
CHECK		1-13-78	ENGR REL	1-18-78
ENGR		1-18-78	PROC. REL	

SCALE 2/3 FULL | WT.
REV H | SHEET 2 OF 3
SIZE D | DWG NO. AL-20-202

STUD, NUT & LOCKWASHER
1 3/8 - 6UNC, SAE GRADE 5
TYP 8 PLCS EQUALLY
SPACED ON A 71¼ B.C.
TORQUE 300 ± 25 FT-LBS



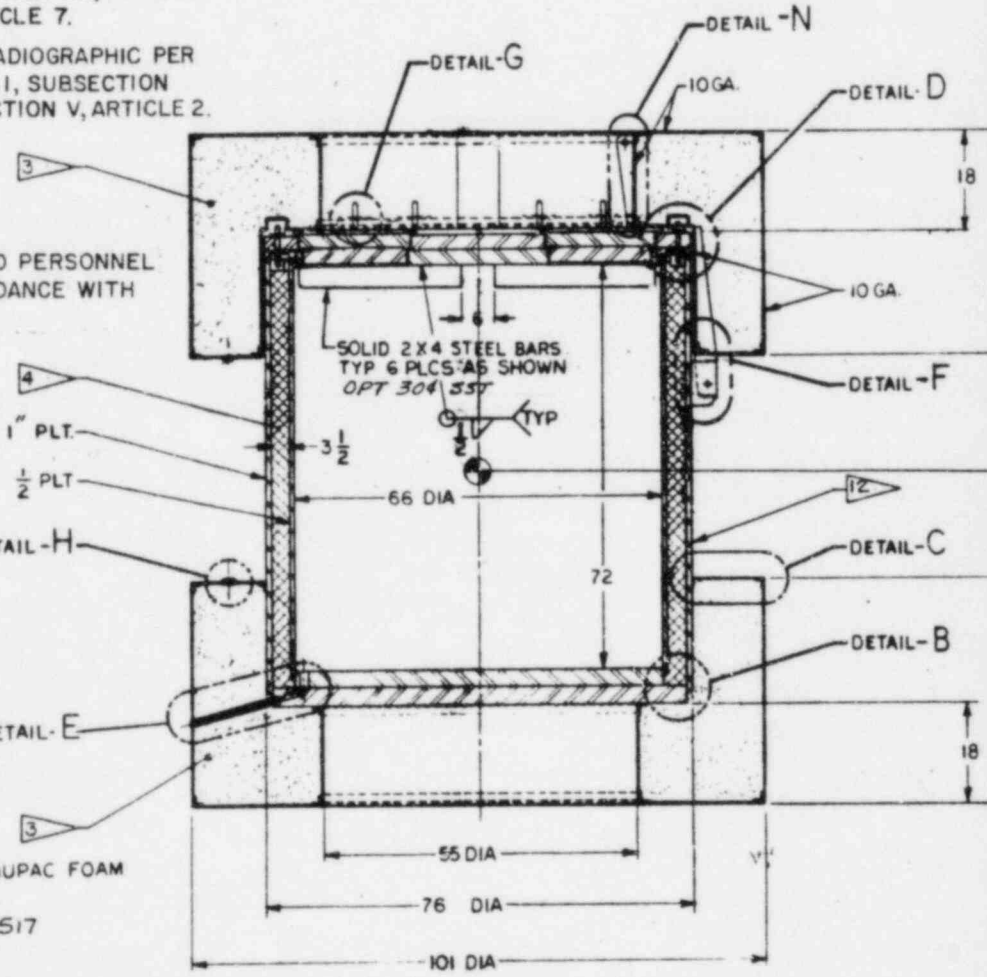
NOTES CONTINUE ON SHEET 2.

9. ALL WELDS SHALL BE INSPECTED VIA NDT METHODS AS FOLLOWS:

LIFTING LUGS AND CIRCUMFERENTIAL CONTINUOUS WELDS: MAGNETIC PARTICLE PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 7.

LONGITUDINAL SHELL WELDS: RADIOGRAPHIC PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 2.

8. ALL WELDING PROCEDURES AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH ASME CODE, SECTION IX.



7 REMOVED

6 REFERENCE DATA:
CASK WT: 54,000 LBS.
PAY LOAD: 10,000 LBS.
GROSS WT: 64,000 LBS.

5. REMOVED

4 LEAD: PER FEDERAL SPECIFICATION QQ-L-171e, GRADE A OR C.

3 FOAM: 1,000 PSI CRUSH STRENGTH RIGID POLYURETHANE. PER NUPAC FOAM SPECIFICATION NPI-F6.

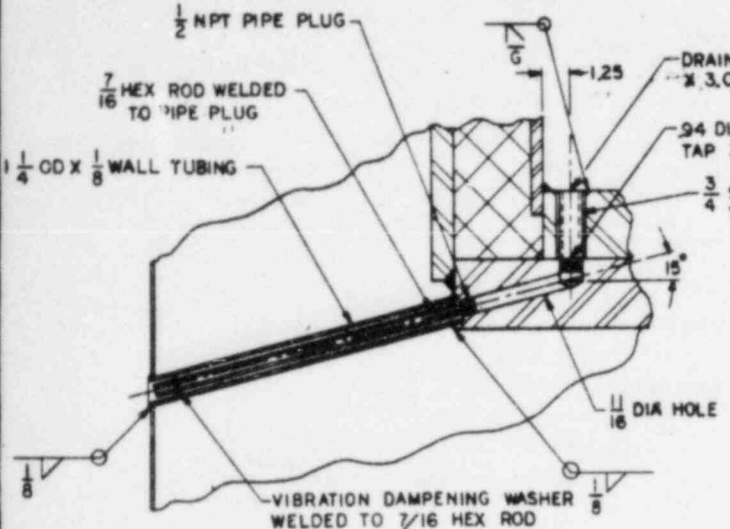
2 MATERIAL: ASTM-A514 OR A517

1. MATERIAL: LOW CARBON HOT ROLLED STEEL: PLATE & SHAPES CONFORM TO ASTM-A516, GR 70 : SHEETS CONFORM TO ASTM-A415, A36 OR 304 SST PER ASTM-A240 WHERE NOTED.

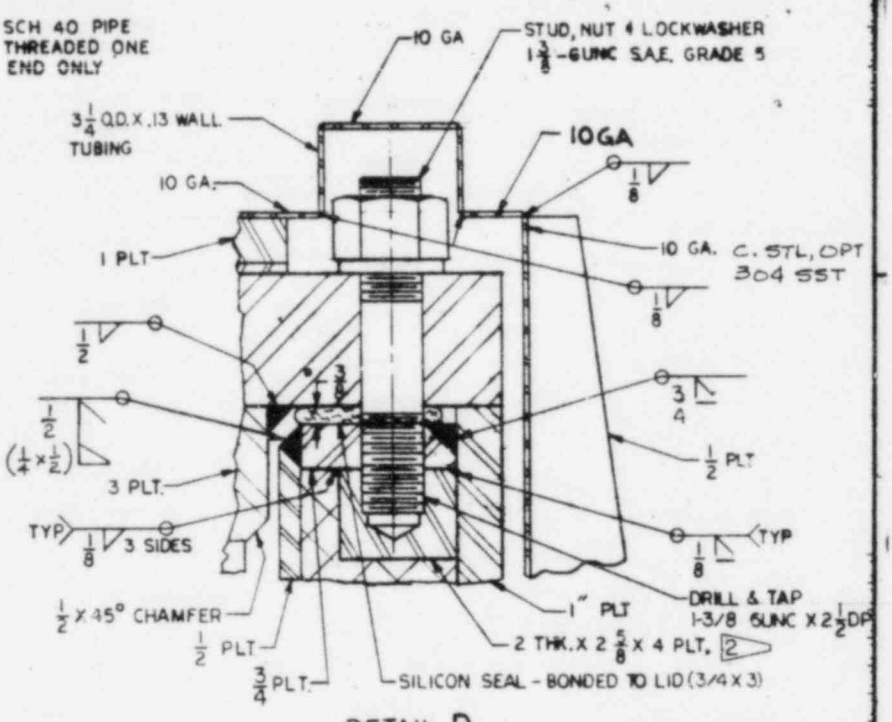
NOTES: UNLESS OTHERWISE SPECIFIED

SECTION A-A

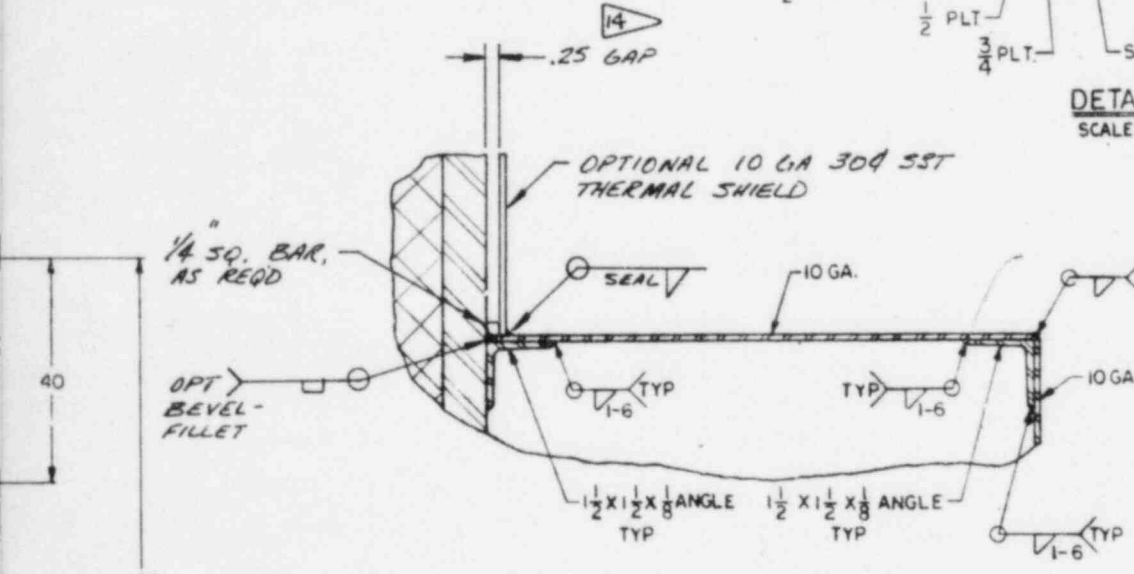
ZONE	LTR	DESCRIPTION	DATE
	G	SEE DCN	6/85



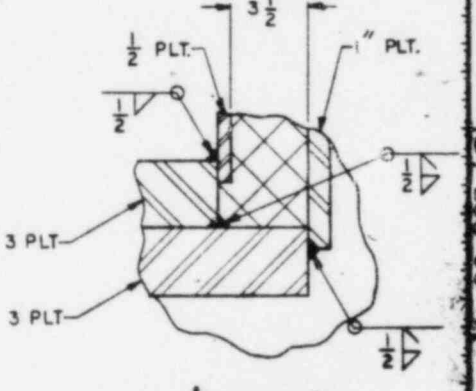
DETAIL-E
SCALE: 1/4

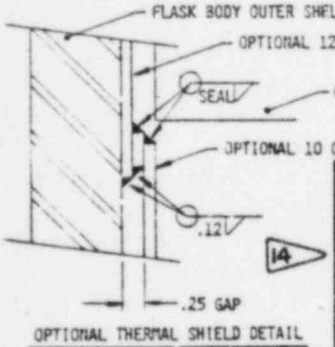


DETAIL-D
SCALE: 1/2



DETAIL-C
SCALE: 1/2
(WITH OPTIONAL THERMAL SHIELD)





OPTIONAL THERMAL SHIELD DETAIL

DETAIL-B
SCALE: 1/4

8507150615-04

ITEM	PART NO.	DESCRIPTION	MATERIAL

LIST OF MATERIAL

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142 MK-1
BOLT ON LID CONFIGURATION

ASSEMBLY & QUANTITY

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

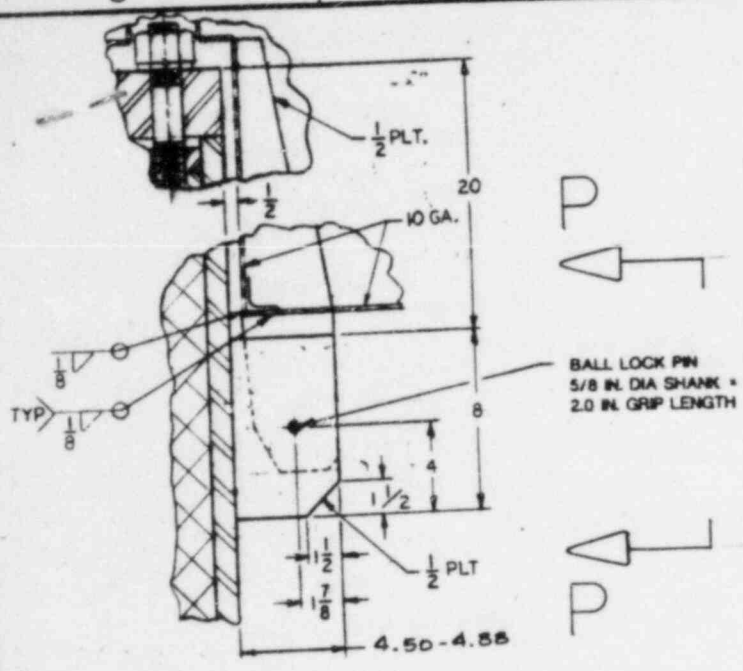
DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON

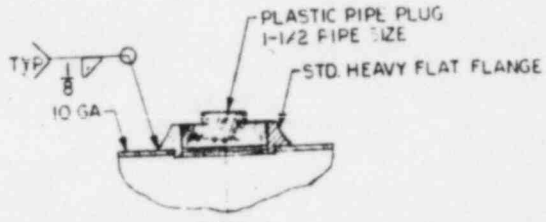
APPLICATION

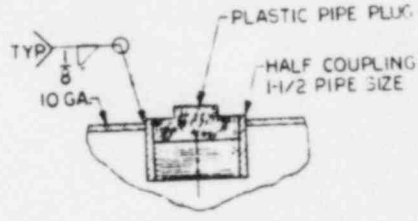
DRAWN	CULTUM	12-30-77	Q.A.	
CHECK		1-13-78	DWG. REL.	1-12-78
ENGR		1-18-78	PROC. REL.	

SCALE: 3/16 NOTED | WT
REV G | SHEET 1 OF 2
DWG SIZE D | DWG NO. AL-20-203



DETAIL - F
SCALE: 1/4





DETAIL - H
SCALE 1/2

14 NON

13. FLA AST BE SI

12. CO OVE AN INS

11. PAI & C (5 CHE

10. AS ON SU

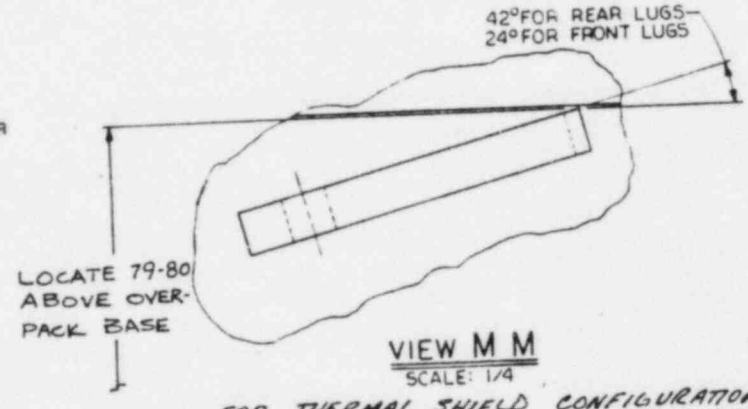
NOTE

17. PACKAGE SHALL BE MARKED & IDENTIFIED IN ACCORDANCE WITH THE REQUIREMENTS OF 10 CFR 71.85(c)

16. PRIMARY & SECONDARY LIDS & DRAIN SHALL BE EQUIPPED WITH TAMPER INDICATING DEVICES IN ACCORDANCE WITH 10 CFR 71.43(b)

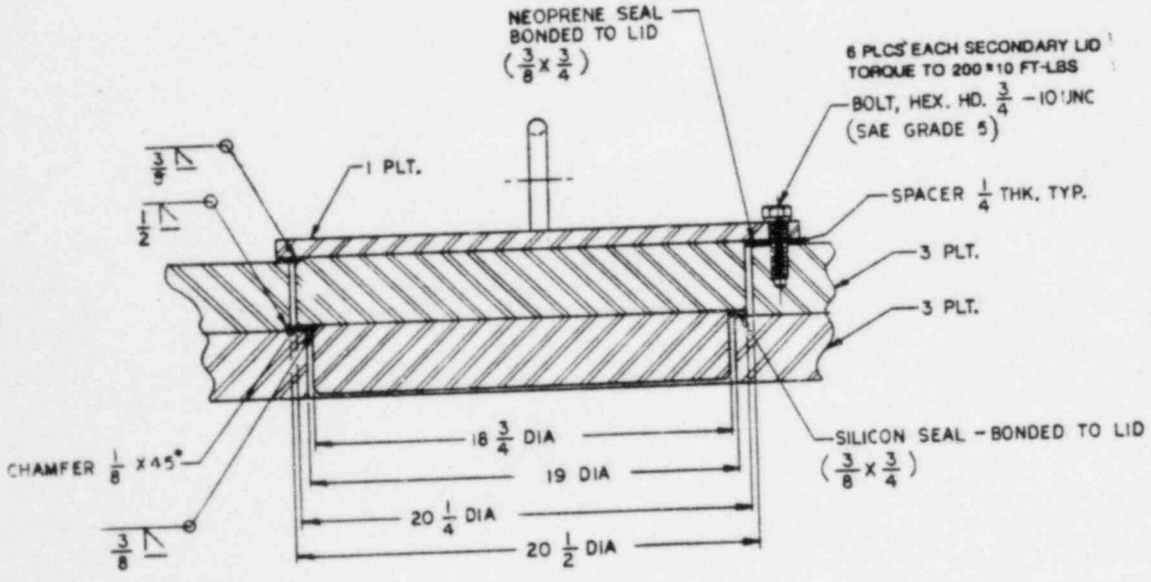
15.

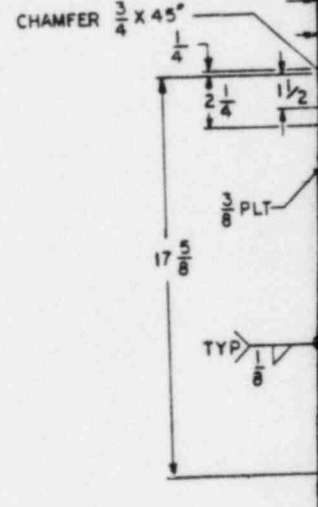
NOTES: CONTINUED



VIEW M M
SCALE: 1/4

FOR THERMAL SHIELD CONFIGURATION ABOUT THE TIE DOWN LUGS, SEE DWG. NO. Y-20-2020, VIEW M-M.





SECTION K-K
SCALE: 1/4

DETA
SCAL

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	G	SEE DCN	5/85

INAL AIR GAP (MINIMUM .05, MAXIMUM .42 in.)

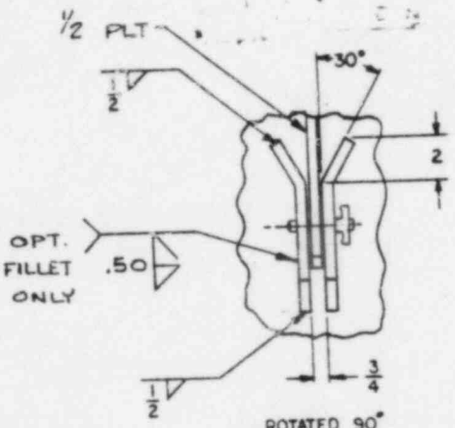
SKS FABRICATED PRIOR TO 5-84 MAY BE MADE USING M-A36 MATERIAL. (FLASK BODY OUTER SHELL SHALL 1⅛ IN. THICK, WITH FULL PENETRATION DOUBLE DED V GROOVE WELD FOR VERTICAL SEAM.)

T ALL EXPOSED EXTERIOR SURFACES OF FLASK BETWEEN UPPER AND LOWER RPACKS WITH ONE (1) COAT (MIN 3/16 THK) "ALBI-CLAD" NO. 89. AS OPTION, A 10 GA. NO. 304 STAINLESS STEEL THERMAL SHIELD MAY BE TALLED BETWEEN THE OVERPACKS.

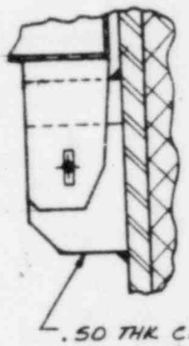
NT ALL EXPOSED CARBON STEEL SURFACES WITH ONE COAT CARBOZINC 11 NE COAT PHENOLINE 305, COLOR 727 M. GRAY, OR ONE PRIMER COAT MILS) MOBIL CHEM EPOXY NO. 69W9 & ONE FINISH COAT (5 MILS) MOBIL M EPOXY NO. 29W9, COLOR: WHITE.

AN OPTION, 12 GA NO. 304 STAINLESS STEEL CLADDING MAY BE INSTALLED THE INTERIOR & EXTERIOR SURFACES OF THE FLASK BODY & INTERIOR FACES OF THE UPPER LID, & SEAL WELDED ALONG ALL EDGES & SEAMS.

5: CONTINUED



ROTATED 90° BOTH INDEXING MEMBERS SHOWN



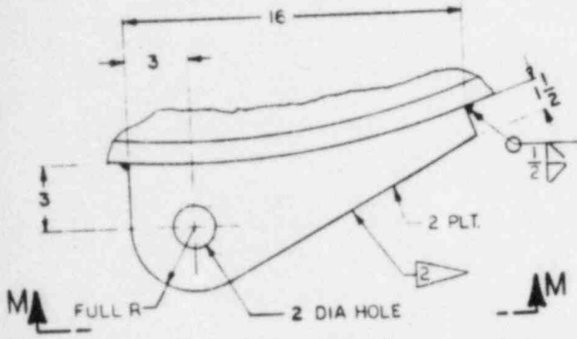
.50 THK C.S.R., OPT. 304 SST

VIEW P-P
SCALE: 1/4

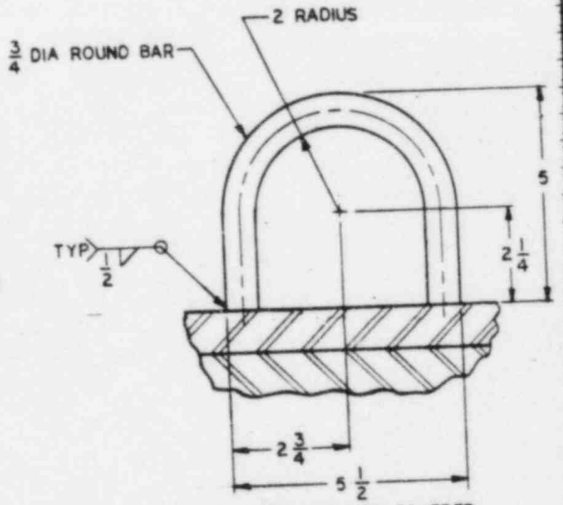
Also Available On Aperture Card

FOR THERMAL SHIELD CONFIGURATION ABOUT THE GUIDE TABS, SEE DWG NO. Y-20-2020, DETAIL K.

TI APERTURE CARD

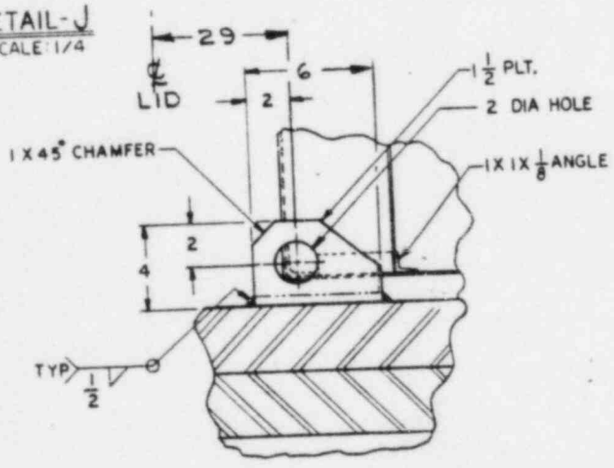


DETAIL-J
SCALE: 1/4



LIFTING BALES COVERED DURING TRANSPORT

DETAIL G-G
SCALE: 1/2



DETAIL L-L
SCALE: 1/4

IL-N
E: 1/4

9507150615-05

AL-20-203

ITEM	PART NO.	DESCRIPTION	MATERIAL

LIST OF MATERIAL

NUPAC **NUCLEAR PACKAGING, INC.**
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142 MK-I
BOLT ON LID CONFIGURATION

ASSEMBLY & QUANTITY

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

DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON | APPLICATION

DRAWN	CULTUM	12-21-77	Q.A.	
CHECK		1-13-78	DWG. REL.	1-13-78
ENGR.		1-13-78	PROD. REL.	

SCALE: 1/16 | WT. | REV G | SHEET 2 OF 2 | DWG SIZE D | DWG NO. AL-20-203

8 | 7 | 6 | 5

12. COAT ALL EXPOSED EXTERIOR SURFACES OF FLASK BETWEEN UPPER AND LOWER OVERPACKS WITH ONE (1) COAT (MIN 3/16 THK) "ALBI-CLAD" NO. 89. AS AN OPTION, A 10 GA. NO. 304 STAINLESS STEEL THERMAL SHIELD MAY BE INSTALLED BETWEEN THE OVERPACKS.

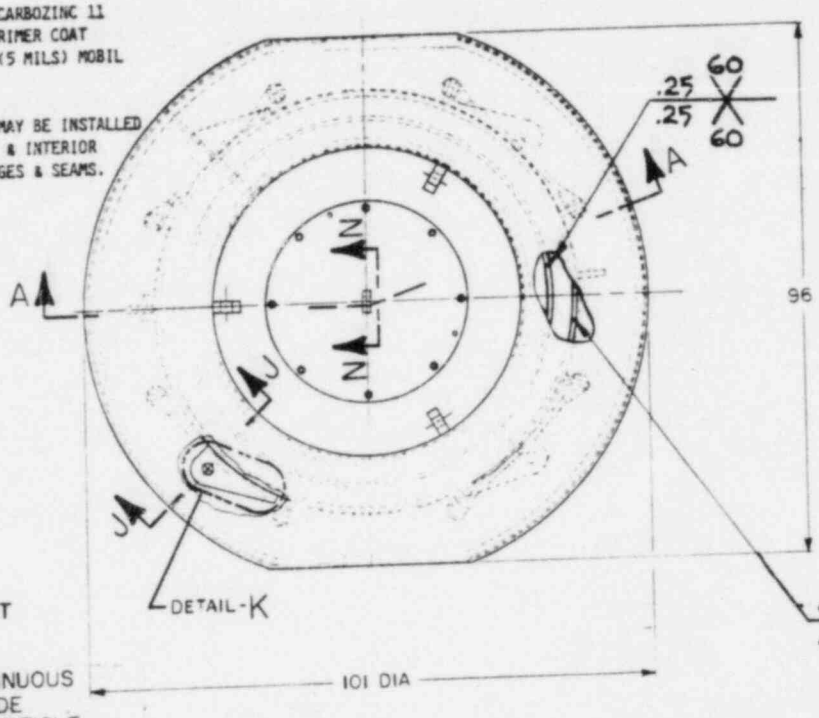
11. PAINT ALL EXPOSED CARBON STEEL SURFACES WITH ONE COAT CARBOZINC 11 & ONE COAT PHENOLINE 305, COLOR 727 M. GRAY, OR ONE PRIMER COAT (5 MILS) MOBIL CHEM EPOXY NO. 69W9 & ONE FINISH COAT (5 MILS) MOBIL CHEM EPOXY NO. 69W9, COLOR: WHITE.

10. AS AN OPTION, 12 GA NO. 304 STAINLESS STEEL CLADDING MAY BE INSTALLED ON THE INTERIOR & EXTERIOR SURFACES OF THE FLASK BODY & INTERIOR SURFACES OF THE UPPER LID, & SEAL WELDED ALONG ALL EDGES & SEAMS.

16. PACKAGE SHALL BE MARKED & IDENTIFIED IN ACCORDANCE WITH THE REQUIREMENTS OF 10 CFR 71.85(c)

15. PRIMARY & SECONDARY LIDS & DRAIN SHALL BE EQUIPPED WITH TAMPER INDICATING DEVICES IN ACCORDANCE WITH 10 CFR 71.43(b)

14.



9. ALL WELDS SHALL BE INSPECTED VIA NDT METHODS AS FOLLOWS:

LIFTING LUG AND CIRCUMFERENTIAL CONTINUOUS WELDS: MAGNETIC PARTICLE PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 7.

LONGITUDINAL SHELL WELDS: RADIOGRAPHIC PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 2.

8. ALL WELDING PROCEDURES AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH ASME CODE, SECTION IX.

7 REMOVED

6 REFERENCE DATA:
CASK WT: 54,000 LBS.
PAY LOAD: 10,000 LBS.
GROSS WT: 64,000 LBS.

5. REMOVED

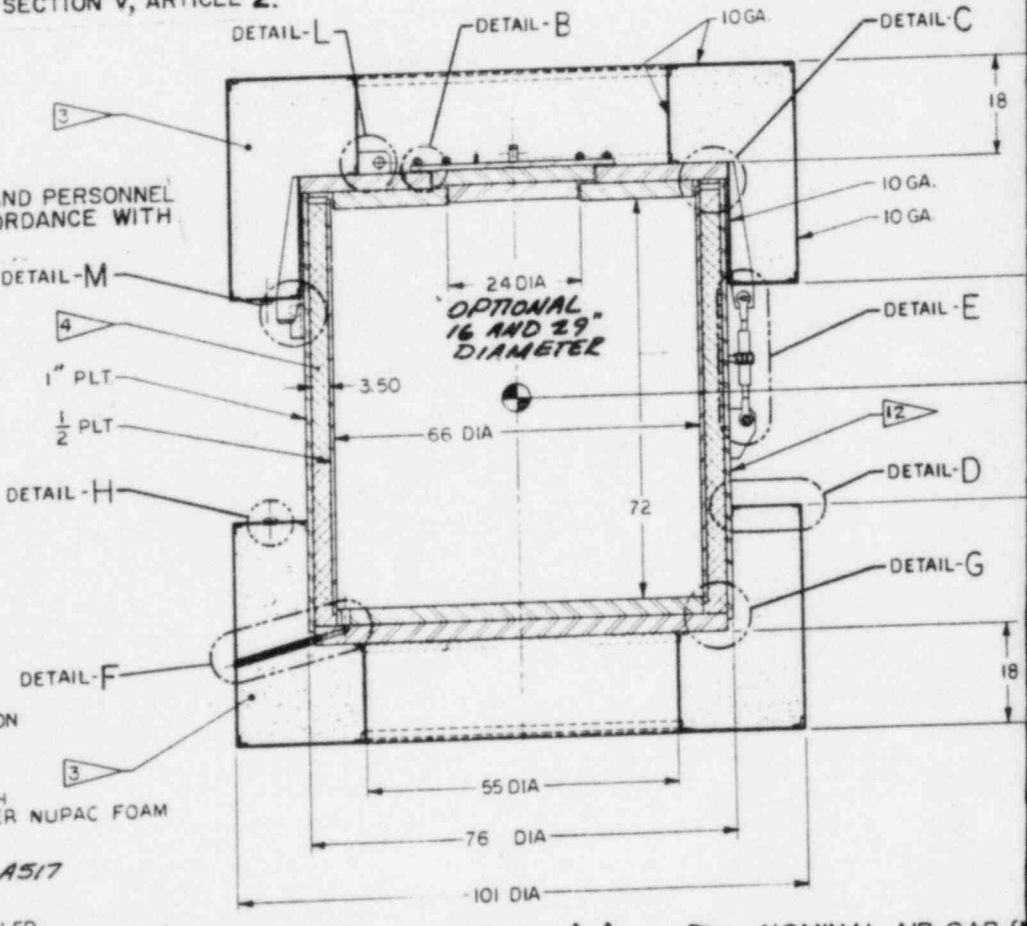
4 LEAD: PER FEDERAL SPECIFICATION QQ-L-171e, GRADE A OR C.

3 FOAM: 1000 PSI CRUSH STRENGTH RIGID POLYURETHANE. PER NUPAC FOAM SPECIFICATION NPI-F6.

2 MATERIAL: ASTM-A514 OR A517

1. MATERIAL: LOW CARBON HOT ROLLED STEEL: PLATE & SHAPES CONFORM TO ASTM-A516, GR 70, A36 OR 304 SST PER ASTM-A240 WHERE NOTED.
: SHEETS CONFORM TO ASTM-A415,

NOTES: UNLESS OTHERWISE SPECIFIED



SECTION A-A

13 NOMINAL AIR GAP (

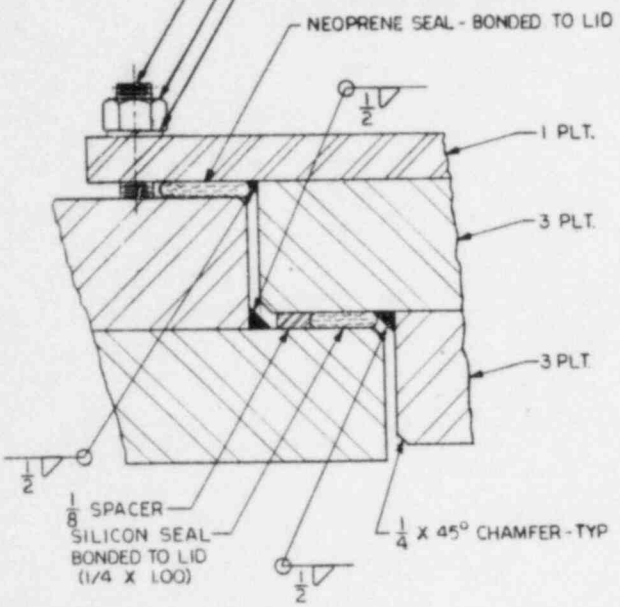
8 | 7 | 6 | 5

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	N	SEE DCN		

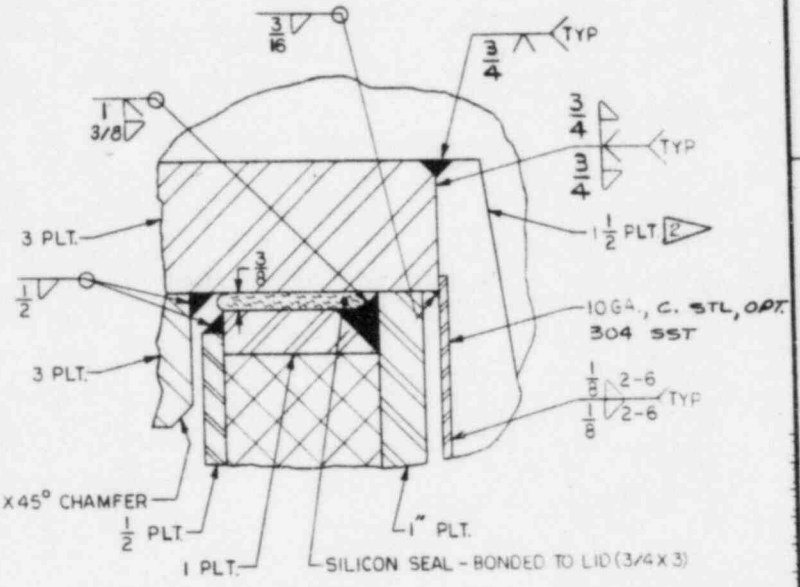
STUD, 7/8-9 UNC, ASTM-A320, GR L7 WITH 16 AND 24" LID. 1-8 UNC, ASTM-A320, GR L7 WITH 29" LID.

HEX HD NUT, 7/8-9 UNC WITH 16 AND 24" LID, 1-8 UNC WITH 29" LID. 8 PLCS. TORQUE TO 200 ± 10 FT-LBS

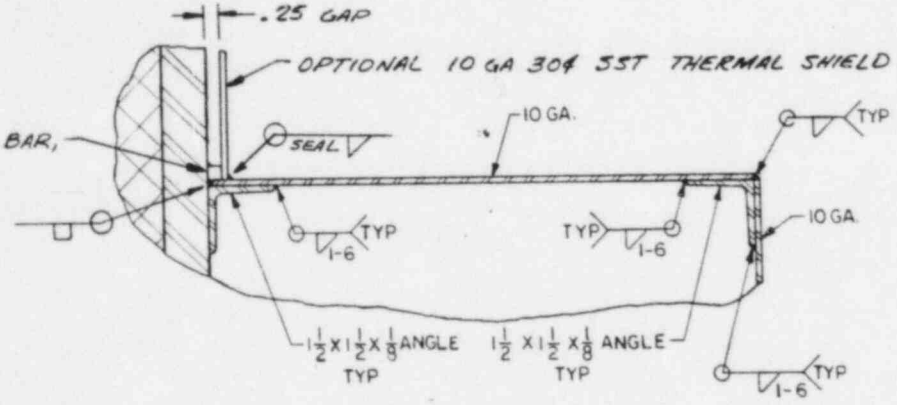
LOCKWASHER, 7/8" WITH 16 AND 24" LID, 1" WITH 29" LID.



DETAIL-B
SCALE: 1/2

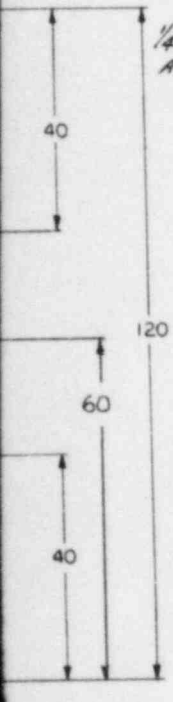


DETAIL-C
SCALE: 1/2



DETAIL-D
SCALE: 1/2

(WITH OPTIONAL THERMAL SHIELD)



MINIMUM .05, MAXIMUM .42 in.)

Also Available On Aperture Card

TI APERTURE CARD

9507150615-06

ITEM	PART NO.	DESCRIPTION	MATERIAL
		LIST OF MATERIAL	

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142

ASSEMBLY & QUANITITY

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

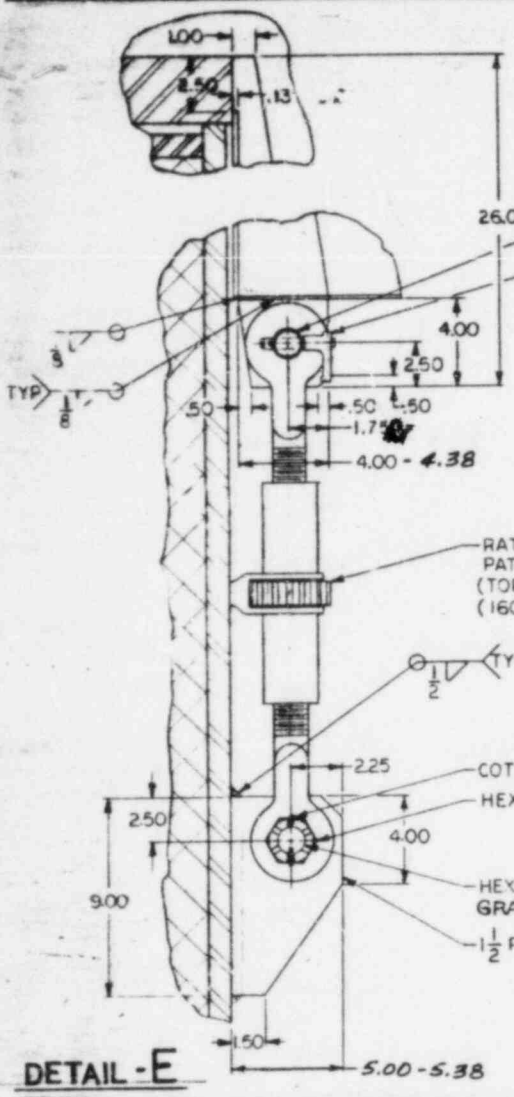
DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON

APPLICATION

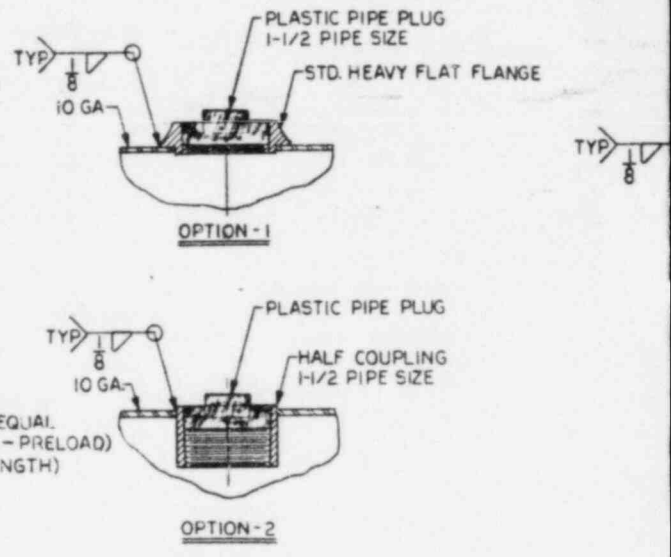
DRAWN	D. KENT	9-29-76	Q.A.	11/23/76
CHECK		9-29-76	DWG. REL.	12-3-76
ENGR.	L. HANSEN	9/29/76	PROD. REL.	

SCALE: 1/16 (FIXED) WT.
REV N SHEET 1 OF 2
DWG SIZE D
DWG NO. Y-20-201D



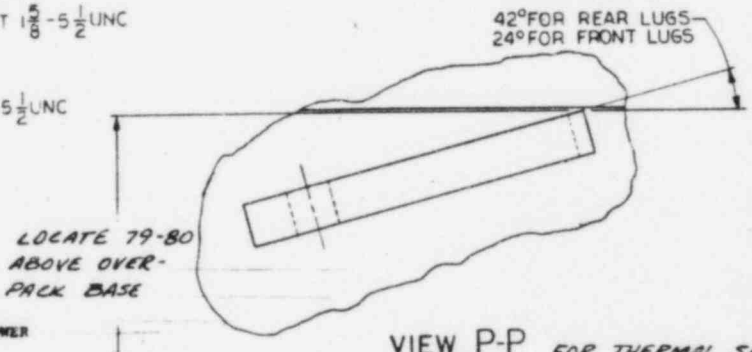
DETAIL - E

FOR TYPICAL THERMAL SHIELD CONFIGURATION ABOUT RATCHET BINDER LOWER LUG, SEE DWG. NO. Y-20-202D, DETAIL K & VIEW M-M



DETAIL - H

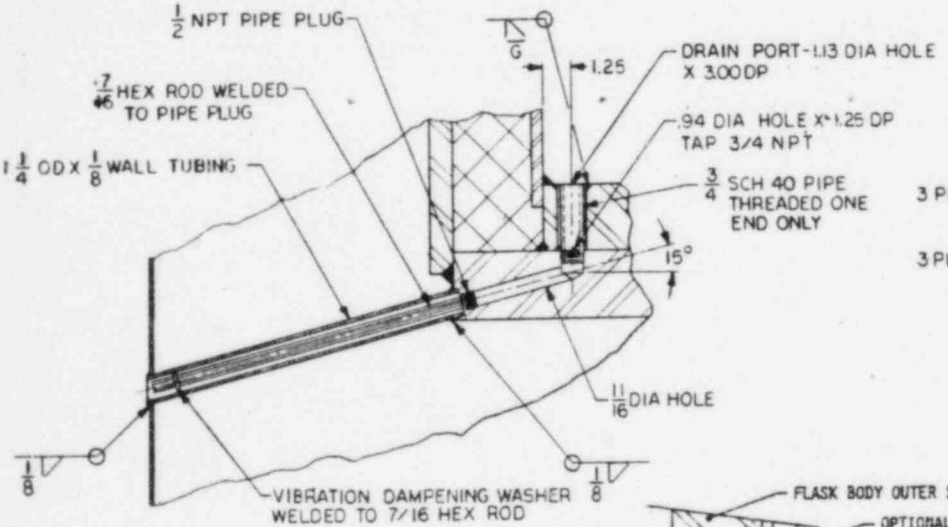
SCALE 1/2



VIEW P-P

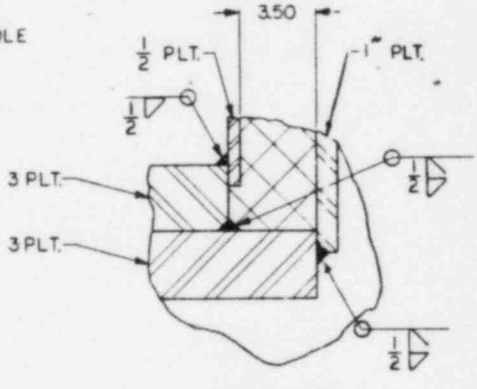
SCALE: 1/4

FOR THERMAL SHIELD ABOUT TIE DOWN L NO. Y-20-202D, VIE



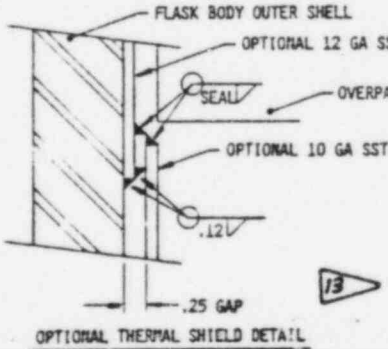
DETAIL - F

SCALE: 1/4



DETAIL - G

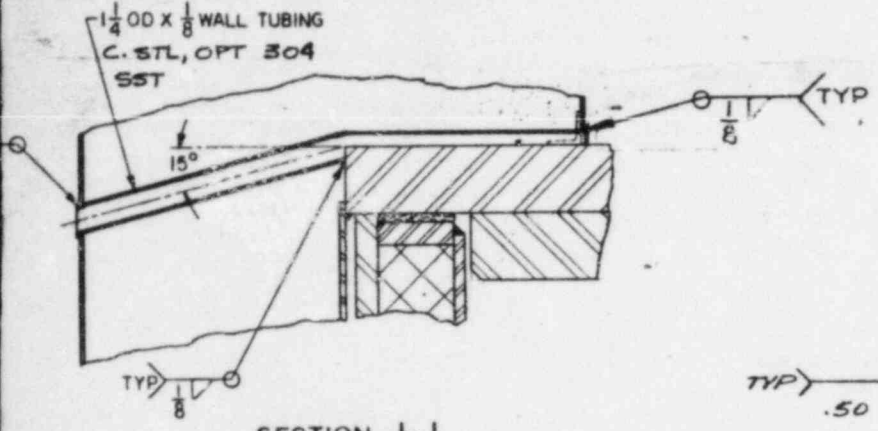
SCALE: 1/4



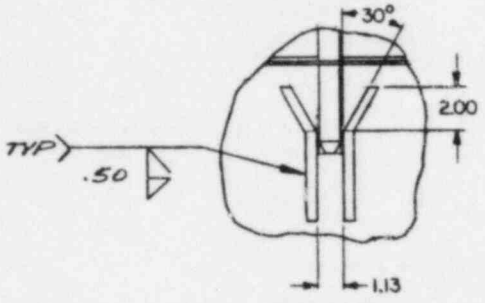
OPTIONAL THERMAL SHIELD DETAIL

NOTES: UNLESS OTHERWISE SPECIFIED

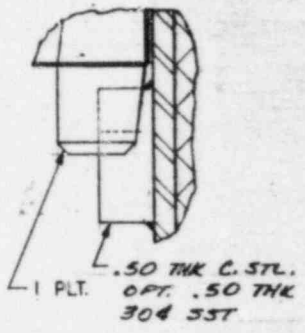
REVISIONS			
ZONE	LTR	DESCRIPTION	
	N	SEE DCN	



SECTION J-J
SCALE: 1/4

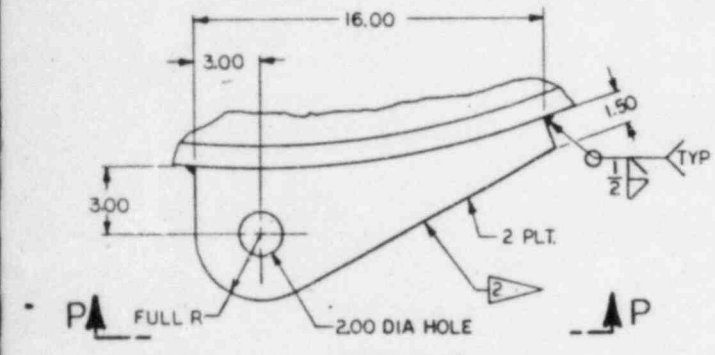


ROTATED 90°
BOTH INDEXING
MEMBERS SHOWN



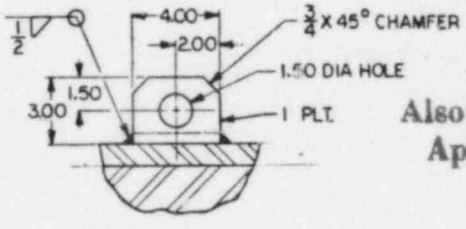
DETAIL-M
SCALE: 1/4

FOR THERMAL SHIELD CONFIGURATION
ABOUT GUIDE TABS, SEE DWG. NO.
Y-20-202D, DETAIL K.

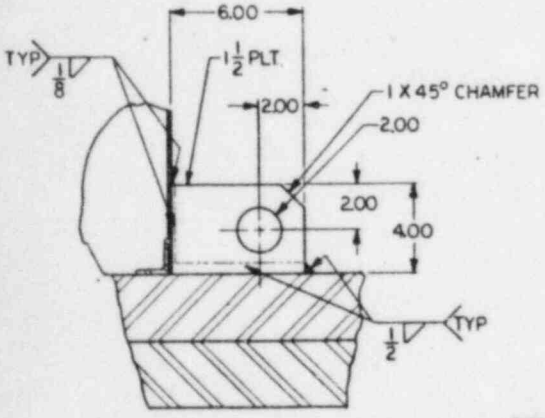


DETAIL-K
SCALE: 1/4

CONFIGURATION
IGS, SEE DWG.
Y M-M.



VIEW N-N
SCALE: 1/4



DETAIL L
SCALE: 1/4

Also Available On
Aperture Card

TI
APERTURE
CARD

8507152065-07

ASSEMBLY & QUANTITY	ITEM	PART NO.	DESCRIPTION	MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ± 2 PLACE DECIMALS ± 1 PLACE DECIMALS ±	LIST OF MATERIAL			

DO NOT SCALE THIS DRAWING

NEXT ASSY | USED ON

APPLICATION

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142

DRAWN	D. KENT	9-29-76	G.A.	4/23/85
CHK'D		1-23-85	DWG. REL.	1-23-85
ENGR		1/23/85	PROD. REL.	

SCALE: 1/16 (NOTED) WT.
REV N SHEET 2 OF 2
DWG SIZE D
DWG NO. Y-20-201D

Y-20-201D N

14 NOMINAL AIR GAP (MINIMUM .05, MAXIMUM .42 in.)

13 COAT ALL EXPOSED EXTERIOR SURFACES OF FLASK BETWEEN UPPER AND LOWER OVERPACKS WITH ONE (1) COAT (MIN 3/16 THK) "ALBI-CLAD" NO. 89. AS AN OPTION, A 10 GA. NO. 304 STAINLESS STEEL THERMAL SHIELD MAY BE INSTALLED BETWEEN THE OVERPACKS.

12 AS AN OPTION, 12 GA. NO. 304 STAINLESS STEEL CLADDING MAY BE INSTALLED ON THE INTERIOR & EXTERIOR SURFACES OF THE FLASK BODY & INTERIOR SURFACES OF THE UPPER & LOWER LIDS, & SEAL WELDED ALONG ALL EDGES & SEAMS.

11 PAINT ALL EXPOSED CARBON STEEL SURFACES WITH ONE COAT CARBOZINC 11 & ONE COAT PHENOLINE 305, COLOR 727 M. GRAY, OR ONE PRIMER COAT (5 MILS) MOBIL CHEM EPOXY NO. 89W9 & ONE FINISH COAT (5 MILS) MOBIL CHEM EPOXY NO. 89W9, COLOR: WHITE.

10. ALL WELD SHALL BE INSPECTED VIA NDT METHODS AS FOLLOWS:

LIFTING LUGS AND CIRCUMFERENTIAL CONTINUOUS WELDS: MAGNETIC PARTICLE PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 7.

LONGITUDINAL SHELL WELDS: RADIOGRAPHIC PER ASME CODE SECTION III, DIVISION I, SUBSECTION NB, ARTICLE NB-5000 AND SECTION V, ARTICLE 2.

9. ALL WELDING PROCEDURE AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH ASME CODE, SECTION IX.

8 MATERIAL: CONFORMS TO ASTM-A516 GRD. 70.

7 REMOVED

6 REFERENCE DATA:
CASK WT: 54,000 LBS.
PAY LOAD: 10,000 LBS.
GROSS WT: 64,000 LBS.

5. REMOVED

4 LEAD: PER FEDERAL SPECIFICATION QQ-L-171H, GRADE A OR C.

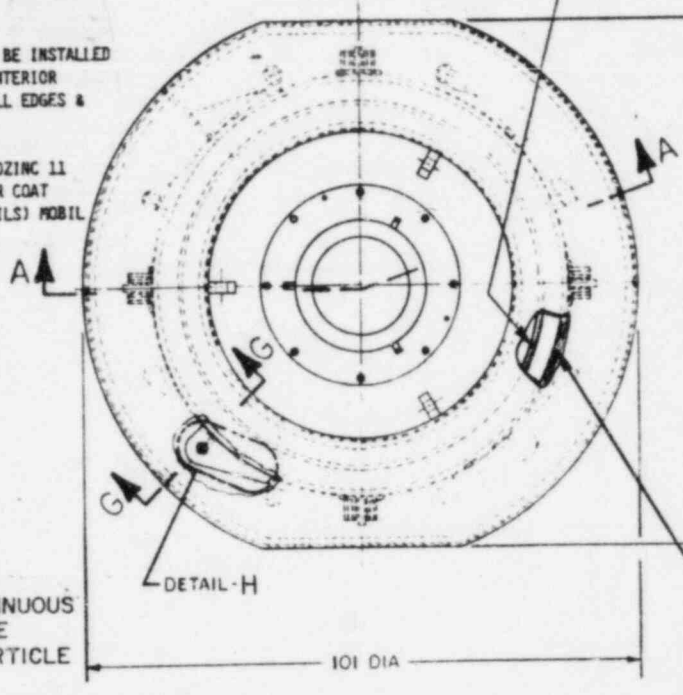
3 FOAM: 1000 PSI CRUSH STRENGTH RIGID POLYURETHANE. PER NUPAC FOAM SPECIFICATION NPI-F6.

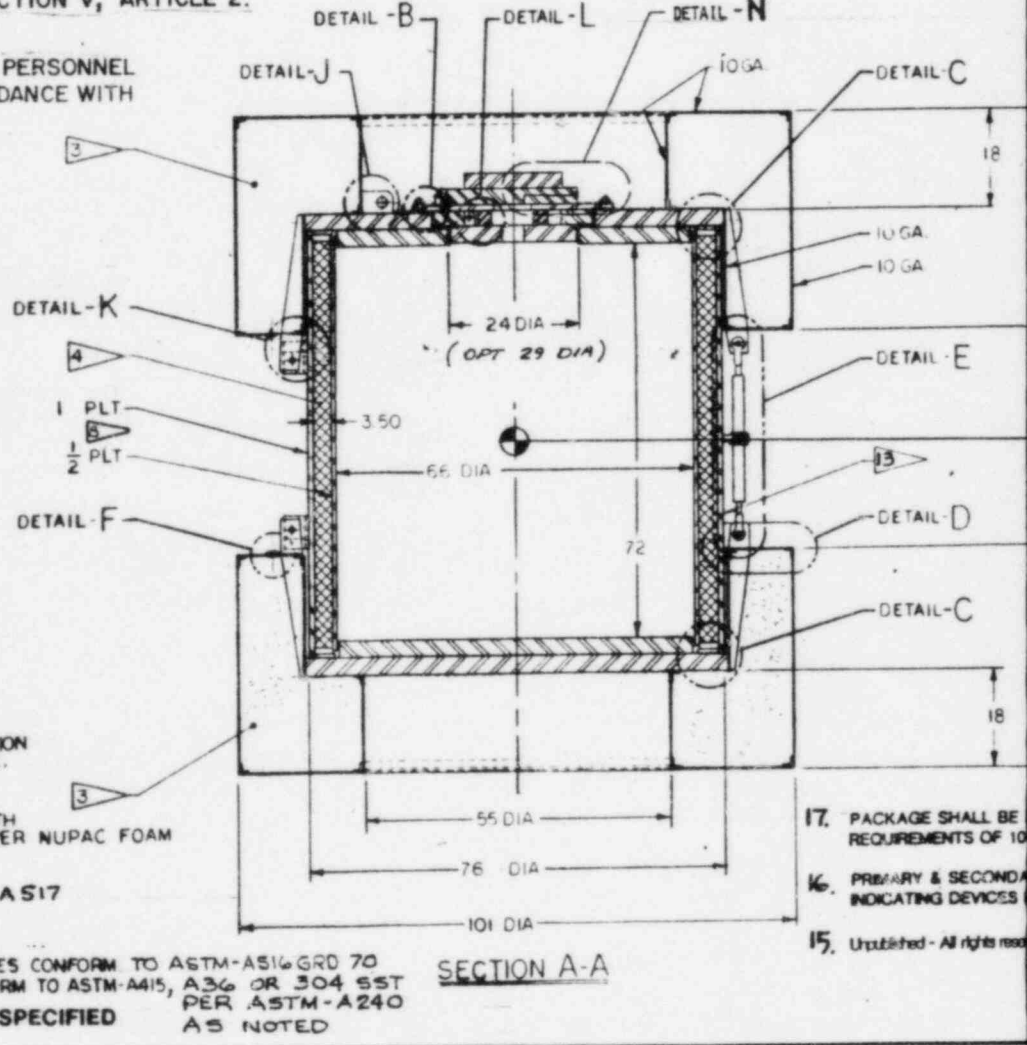
2 MATERIAL: ASTM-A514 OR A517

1. MATERIAL:
STEEL: PLATE & SHAPES CONFORM TO ASTM-A516 GRD 70
: SHEETS CONFORM TO ASTM-A415, A36 OR 304 SST PER ASTM-A240 AS NOTED

NOTES: UNLESS OTHERWISE SPECIFIED

STUD, 3/8-9 UNC
A320, GR L
ASTM-A320,
OPTIONAL Z
HEX HD. NU
(1-8 UNC
AL 29° CL
8 PLCS. TORQUE
LOCKW
(1" WI
29° C
SECON
96





SECTION A-A

17. PACKAGE SHALL BE REQUIREMENTS OF 10

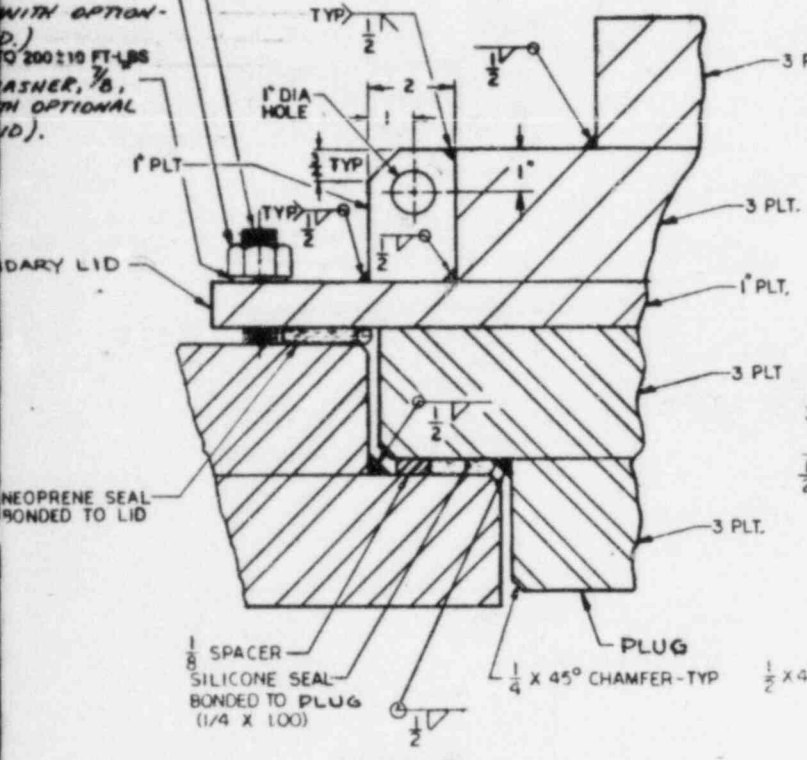
16. PRIMARY & SECONDA INDICATING DEVICES

15. Unpublished - All rights reso

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	K	SEE DCN	5/85

NC, ASTM-
(1-8 UNC,
GR 7 WITH
9" LID).

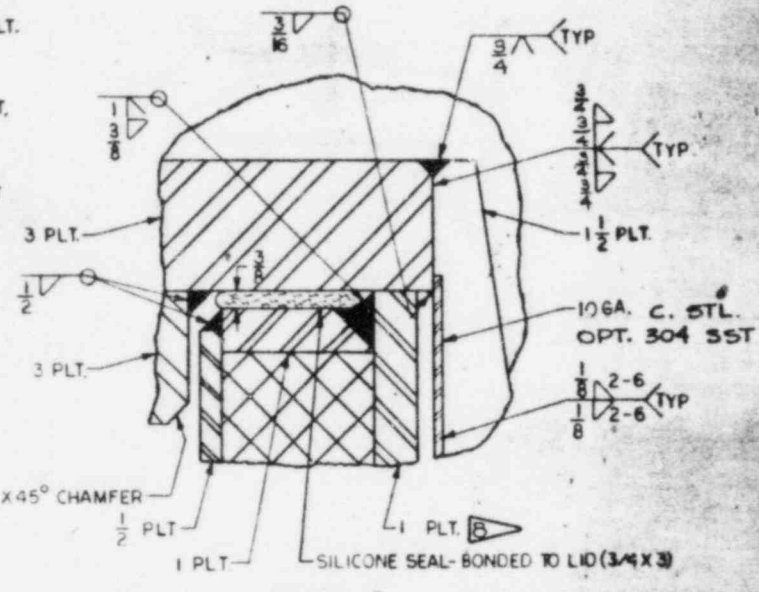
T, 7/8-9 UNC
WITH OPTION-
D.)
O 200±10 FT-LBS
ASHER, 7/8,
H OPTIONAL
ID).



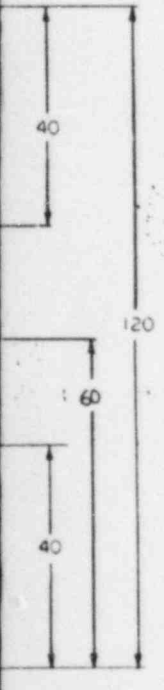
DARY LID

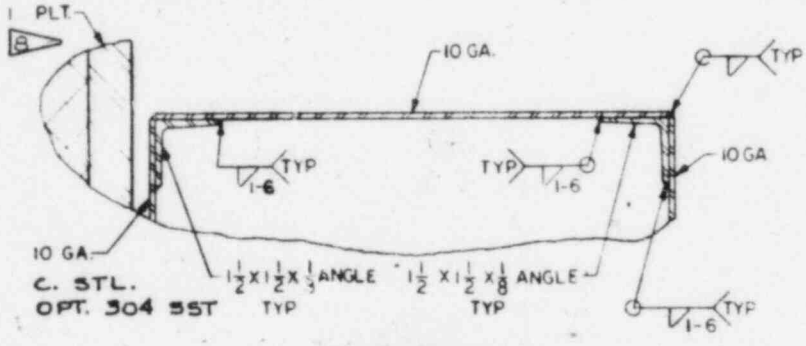
NEOPRENE SEAL
BONDED TO LID

DETAIL-B
SCALE: 1/2



DETAIL-C
SCALE: 1/2





DETAIL-D
SCALE: 1/2
(BINDER LUG OMITTED FOR CLARITY)

Also Available On
Aperture Card

TI
APERTURE
CARD

Y-20-2020 K

8507150615-08

MARKED & IDENTIFIED IN ACCORDANCE WITH THE
CFR 71.85(c)

RY LIDS & DRAIN SHALL BE EQUIPPED WITH TAMPER
N ACCORDANCE WITH 10 CFR 71.43(b)

ved under copyright law.

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	

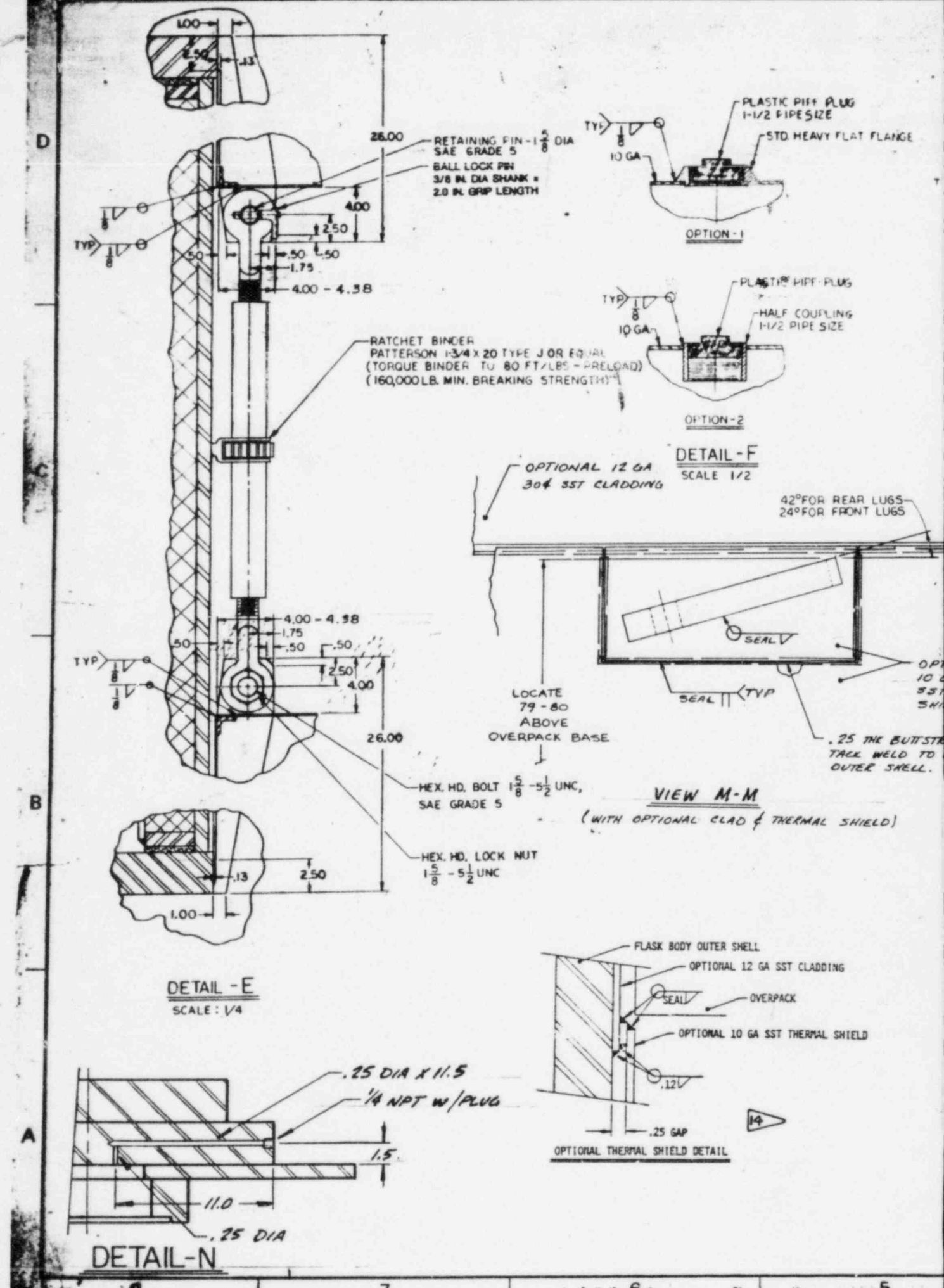
NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142 - MK2

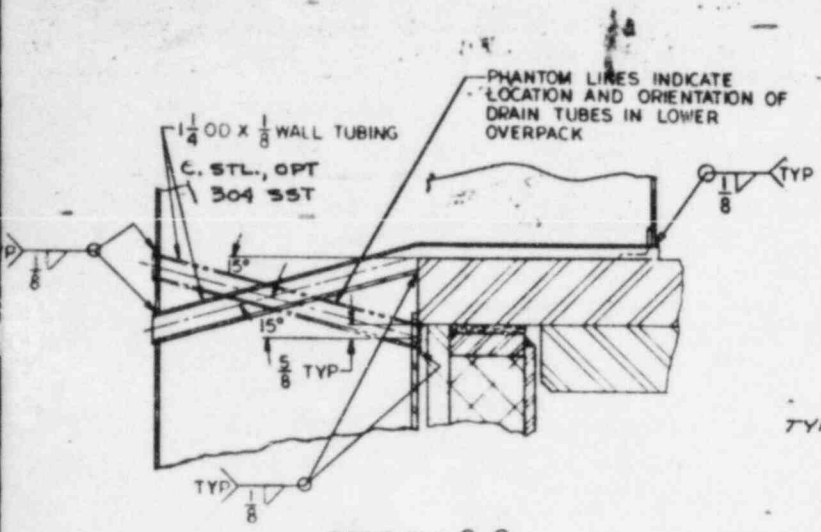
DRAWN	CULTUM	12-9-77		1-12-78
CHECK	D. KENT	12-28-78	ENGR. REL.	1-10-78
ENGR.		1-10-78	PROD. REL.	

SCALE: 1/16 FULL | WT. | REV K | SHEET OF

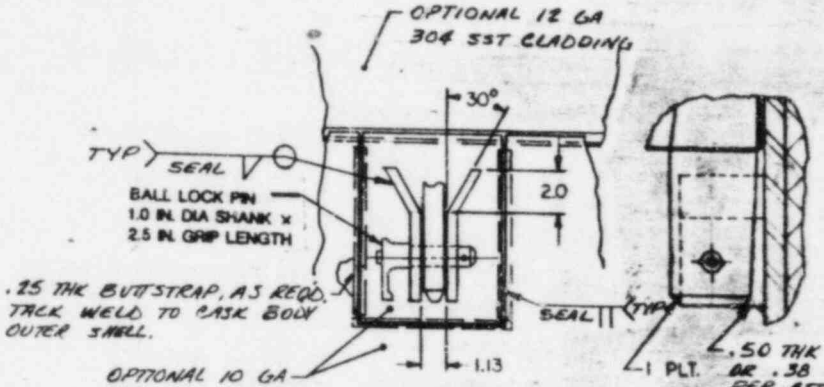
SIZE D | DWG NO. Y-20-2020 K


1.00
2.50
.13
26.00
RETAINING PIN - 1 5/8 DIA SAE GRADE 5
BALL LOCK PIN 3/8 IN. DIA SHANK x 2.0 IN. GRIP LENGTH
4.00
2.50
TYP 1/8
.50
.50
.50
1.75
4.00 - 4.38
RATCHET BINDER PATTERSON 1-3/4 X 20 TYPE J OR EQUAL (TORQUE BINDER TO 80 FT/LBS - PRELOAD) (160,000 LB. MIN. BREAKING STRENGTH)
4.00 - 4.38
1.75
.50
.50
.50
2.50
4.00
26.00
HEX. HD. BOLT 1 5/8 - 5 1/2 UNC, SAE GRADE 5
HEX. HD. LOCK NUT 1 5/8 - 5 1/2 UNC
.13
2.50
1.00
DETAIL - E
SCALE : 1/4
PLASTIC PIPE PLUG 1-1/2 PIPE SIZE
STD. HEAVY FLAT FLANGE
10 GA
OPTION - 1
PLASTIC PIPE PLUG
HALF COUPLING 1-1/2 PIPE SIZE
10 GA
OPTION - 2
DETAIL - F
SCALE 1/2
OPTIONAL 12 GA 304 SST CLADDING
42° FOR REAR LUGS
24° FOR FRONT LUGS
SEAL
SEAL
TYP
LOCATE 79 - 80 ABOVE OVERPACK BASE
.25 THK BUTT STR TACK WELD TO OUTER SHELL.
VIEW M-M
(WITH OPTIONAL CLAD & THERMAL SHIELD)
.25 DIA x 11.5
1/4 NPT W/PLUG
1.5
11.0
.25 DIA
DETAIL-N
FLASK BODY OUTER SHELL
OPTIONAL 12 GA SST CLADDING
SEAL
OVERPACK
OPTIONAL 10 GA SST THERMAL SHIELD
.12
.25 GAP
14
OPTIONAL THERMAL SHIELD DETAIL

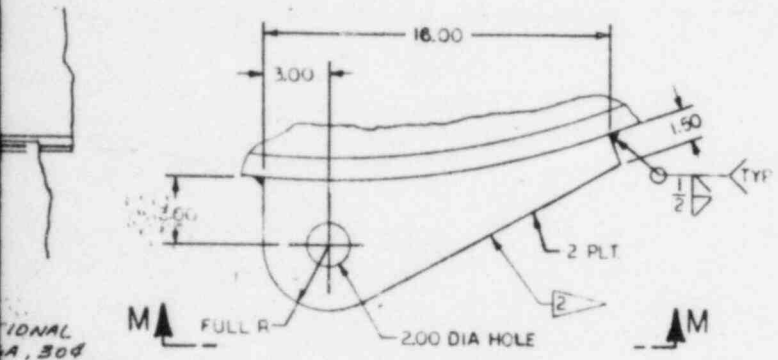
REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	K	SEE DCN	



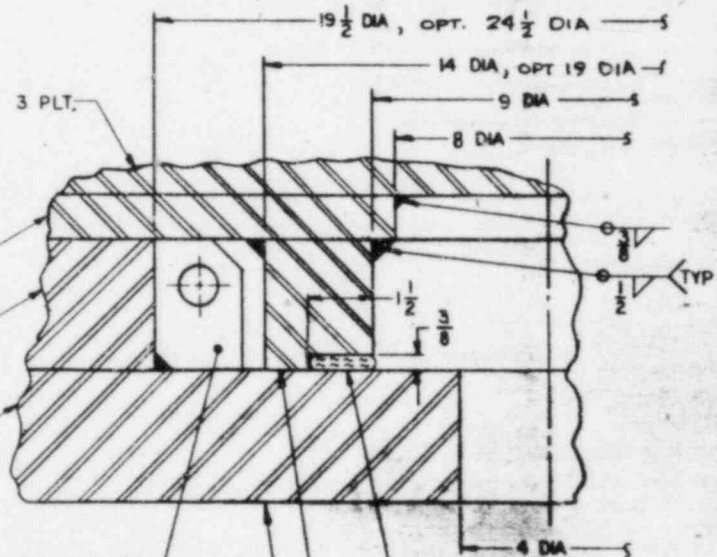
SECTION G-G
SCALE: 1/4



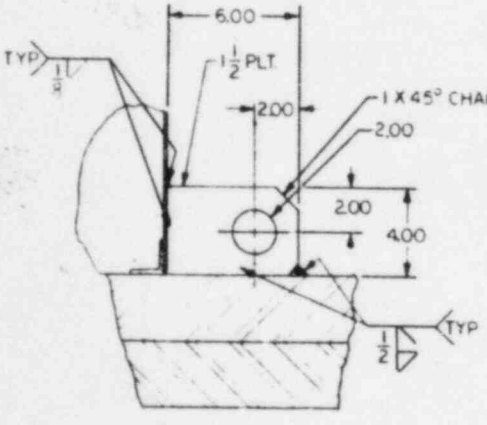
DETAIL - K
SCALE: 1/4



DETAIL-H
SCALE: 1/4



DETAIL - L
SCALE: NONE



DETAIL J
SCALE: 1/4

8507150615-09

ITEM	PART NO.	DESCRIPTION	MATERIAL

LIST OF MATERIAL

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

NUCLEAR PACKAGING, INC.
TACOMA, WASHINGTON

BULK RESIN SHIPPING FLASK
MODEL OH142-MK2

DRAWN	CULTUM	12-9-77	Q.A.	7-12-77
CHECK	D. KENT	12-28-77	DWG. REL.	
ENGR		1-18-77	PROD. REL.	

SCALE: 1/16 | WT. | REV K | SHEET 1 OF 2 | SIZE D | DWG NO. Y-20-202D

CALCULATION OF EFFECTS OF THERMAL SHIELD GAP VARIATION ON CASK THERMAL RESPONSE -

NORMAL CONDITIONS OF TRANSPORT

ASSUMPTIONS: 400 WATTS INTERNAL DECAY HEAT

2950 Btu/12 HR-FT^2 ON UPPER HORIZONTAL FLAT SURFACES = 245.8 BTU/HR-FT^2

100 °F AMBIENT AIR TEMP.

IF THE SMALLEST MEASURED GAP (0.057 IN.) IS ASSUMED TO BE UNIFORM OVER THE CASK, THERMAL RESISTENCE WILL DECREASE, AND HEAT FLOW OUT OF THE CASK WILL INCREASE, RESULTING IN OVERALL LOWER TEMPERATURES.

IF THE LARGEST MEASURED GAP (0.401 IN.) IS ASSUMED, THE FOLLOWING ANALYSIS WILL APPLY:

CONDUCTIVE HEAT TRANSFER -

$$q = \frac{\Delta T}{R}$$

WHERE $R = \frac{L}{kA}$

SO $q = \frac{kA\,\Delta T}{L}$

CONSERVATIVELY ASSUME ΔT WILL REMAIN THE SAME FOR THE FIRST CUT. TAKE CONSERVATIVE THERMAL CONDUCTIVITY OF AIR AS $k = 0.0174$ Btu/HR-FT^2-°F.

$\Delta T = 171.1 - 127.6$ (NODES 61 & 68, TYPICAL) = 43.5 °F.

L = GAP BETWEEN THERMAL SHIELD AND CASK WALL

$L = 0.401$ IN

$q = 1.888\ A$ Btu/FT^2-HR

RADIENT HEAT TRANSFER-

AT GAPS IN THE NEIGHBORHOOD OF .057-.401 IN., RADIENT HEAT TRANSFER WILL BE ESSENTIALLY CONSTANT. ASSUMING SURFACES OF EQUAL AREA AND CONSERVATIVELY TAKING SHAPE FACTOR F_{12} AS 1, WE GET:

$$q = \frac{GA\,(T_2^4 - T_1^4)}{\left(\frac{1}{\epsilon_1} - 1\right) + \left(\frac{1}{\epsilon_2} - 1\right) + 1}$$

WHERE G = STEFAN-BOLTZMAN CONSTANT

$= 0.1714 \times 10^{-8}$ Btu/HR-FT^2-$^\circ$R

$T_2 = 171.1 + 460 = 631.1\ ^\circ$R

$T_1 = 127.6 + 460 = 587.6\ ^\circ$R

ϵ_1 = EMISSIVITY OF STAINLESS THERMAL SHIELD

$= 0.5$

ϵ_2 = EMISSIVITY OF CARBON STEEL CASK WALL

$= 0.9$

$q = (32.0)A$ Btu/FT^2-HR

SINCE RADIENT HEAT IS ESSENTIALLY CONSTANT WITH GAP VARIATION, CHANGE IN HEAT TRANSFER WILL BE DUE TO CHANGE IN CONDUCTIVE q ONLY. TO FIND THE DIFFERENCE, CALCULATE q FOR NOMINAL GAP-

$L = 0.25$ IN.

$$q = \frac{(0.0174)(43.5)A}{0.25}$$

$q = 3.028\ A$ Btu/hr-FT^2

$\Delta q = (3.028 - 1.891)A = 1.140\ A$ Btu/hr-FT^2

FOR A NET CHANGE OF $\frac{1.140}{32.0 + 3.028} = 0.033$

CONSERVATIVELY ASSUME ΔT WILL INCREASE PROPORTIONALLY WHILE THERMAL SHIELD TEMP. REMAINS CONSTANT. THIS IS EXTREMELY CONSERVATIVE:

$\Delta T = (1.033)(43.5) = 44.9$

CASK WALL TEMP. $= 127.6 + 44.9 = 172.5$°F (171.1 °F CALCULATED FOR .25" GAP)

THIS TEMPERATURE IS NOT SIGNIFICANT IN TERMS OF CASK OPERATIONAL CAPABILITY UNDER NORMAL CONDITIONS OF TRANSPORT.

ACCIDENT CONDITIONS

ASSUMPTIONS: 30 MIN. FIRE AT 1475°F

SURFACE EMISSIVITY = 0.8

INITIAL AIR TEMP. = 130°F

POST-BURN AIR TEMP = 70°F

IN THIS CASE, WITH HEAT TRANSFER INWARD TO THE CASK, THE MINIMUM MEASURED GAP (0.057 IN.) WILL BE THE WORST CASE

CONDUCTIVE HEAT TRANSFER -

$$q = \frac{kA\Delta T}{L}$$

$k = .04$

$L = 0.057$ IN.

$\Delta T = 1443.7 - 167.2 = 1276.5°F$

(TYPICAL, NODES 68 & 61 AT END OF BURN)

$q = 896\ A$ Btu/hr-FT²

FOR NORMAL 0.25 IN. GAP -

$q = 204\ A$ Btu/hr-FT²

$\Delta q = 692\ A$ Btu/hr-FT²

RADIENT HEAT TRANSFER -

$$q = \frac{GA(T_2^4 - T_1^4)}{\left(\frac{1}{\epsilon_1} - 1\right) + \left(\frac{1}{\epsilon_2} - 1\right) + 1}$$

$= 10,538\ A$ Btu/hr-FT²

$\sigma = .1714 \times 10^{-8}$

$\epsilon_1 = .5$ } Per assumptions
$\epsilon_2 = .9$ } IN SAR

FOR THE CASK SIDE WALL ONLY. THERE WILL ALSO BE HEAT TRANSFER IN THROUGH THE LIDS IN THE FORM OF :

$$q_L = G A_L \epsilon (T_e^4 - T_L^4)$$

WHERE $\epsilon = 0.8$ (DEFINED BY NRC)

$T_e = 1475 + 460 = 1935°R$

$T_L = 547.2 + 460 = 1007.2°R$ (NODE 8, TYP.)

$q_L = 17,812\ A_L$ Btu/hr-FT²

FOR THE THERMAL SHIELD, $A = \pi(76.0)(40)/144 = 66$ FT²

for .25 gap $q = (10,538 + 204)(66) = 7.09 \times 10^5$ BTU/HR

for .057 gap $q = (10,538 + 896)(66) = 7.55 \times 10^5$ BTU/HR

FOR THE LIDS, $A_L = \frac{\pi}{4}(55.0)^2/144 = 16.5$ FT²

$q_L = (17,812)(16.5) = 2.94 \times 10^5$ BTU/HR

HEAT GAIN DIFFERENCE IS:

$\Delta q = (692)(66) = .457 \times 10^5$ BTU/HR

% DIFFERENCE $= \frac{.457 \times 10^5}{(7.09 + 2.94) \times 10^5} = 0.046 = 4.6\%$

AGAIN ASSUMING A PROPORTIONAL TEMPERATURE CHANGE-

.25 gap CASK WALL TEMP $\Delta t = 167.2_{(t=.5\text{ hours})} - 117.9_{(t=0} = 49.3$ °F

.057 gap CASK WALL TEMP $\Delta t = 49.3(1.046) = 51.57$

NEW CASK WALL MAX TEMP, ASSUMING .057" gap = 117.9 + 51.6 = 169.5°F

THIS TEMPERATURE WILL HAVE NO SIGNIFICANT EFFECT ON CASK OPERATIONAL CAPABILITY. A LARGE MARGIN OF SAFETY CONTINUES TO EXIST AGAINST LEAD MELT AND OTHER TEMPERATURE-RELATED DESIGN CONSTRAINTS.

THE CHANGE IN GAP MADE A DIFFERENCE OF 2.3°F in the CASK WALL TEMPERATURE.

MODEL OH-142 SHIPPING CONTAINER

REVISION 10

DELETION AND INSERTION INSTRUCTIONS

Delete	Insert
6-3	6-3
7-1	7-1
7-3 thru 7-5	7-3 thru 7-20
8-1	8-1
Dwg. AL-20-202	Dwg. AL-20-202
Sheets 1 thru 3	Sheets 1 thru 3
Dwg. AL-20-203	Dwg. AL-20-203
Sheets 1 thru 2	Sheets 1 thru 2
Dwg. Y-20-201D	Dwg. Y-20-201D
Sheets 1 thru 2	Sheets 1 thru 2
Dwg. Y-20-202D	Dwg. Y-20-202D
Sheets 1 thru 2	Sheets 1 thru 2

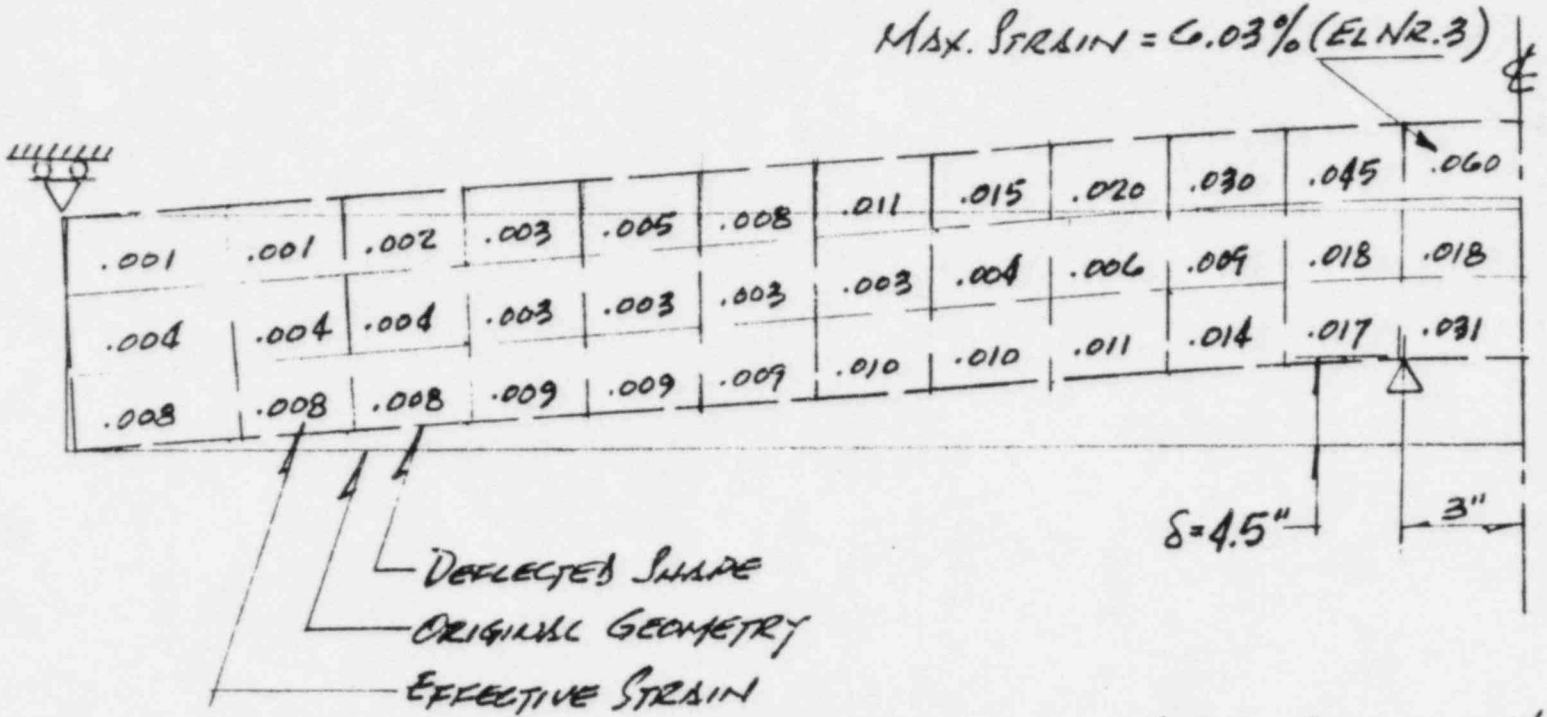
Page 1-90 was inadvertently omitted from Revision 8 please find attached.

ANSYS RESULTS

AT Δ PIN DEFLECTION = 4.5" *

(MAX. PIN DEFLECTION = 4.3") **

SCALE: 1:10 DEFLECTION



NOTES:

* ANSYS LOAD STEP 7
** MAX. PIN STROKE & PLATE DEFLECTION

$$\text{RUPTURE M.S.} \geq \frac{\text{ALLOW. STRAIN} = 10\%}{\text{MAX. STRAIN \%}} - 1 \geq +0.66$$

6.1.7

The lug in the center of the secondary lid may be used to remove the secondary lid from the cask. Care should be taken to avoid damage to the gasket in the lip of the secondary lid.

6.1.8

Inspect secondary lid studs, bolts and nuts for signs of wear. Damaged threads and excessive corrosion shall be cause for replacement of these items.

6.1.9

Load cask through secondary lid. Replace secondary lid and torque bolts to 200 ± 10 ft-lbs.

6.1.10

Survey the loaded cask to assure compliance with 10 CFR 71.47. Inspect for surface contamination per the requirements of 10 CFR 71.81(i).

6.1.11

If the shipment is not classified as Low Specific Activity material, a leak-test per section 7.2.5 shall be performed.

6.1.12

Inspect the package for proper labeling necessary to meet all applicable regulations.

7.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

7.1 Acceptance Tests

The Model OH-142 packaging shall be inspected and released for use by responsible operation personnel prior to loading. The following items will be included in such inspection:

7.1.1

Before first use, all OH-142 package configurations shall be subjected to the leak test as described below in section 7.2.5.

7.1.2

All configuration checks described in section 6.2.8 above.

7.1.3

The cask shall be pressure tested to 1.5 times the normal operating pressure of the cask. This may be taken conservatively as the pressure given for the Hypothetical Accident Condition in Section 1.7.3.3. In that section, the pressure is given as 11.59 psig, so this test shall be carried out at 17.4 psig.

7.1.4

The integrity of the shield shall be demonstrated by means of a gamma scan performed on the lead-filled cylinder during the fabrication process. See Appendix 7.3.1 for a description of this procedure.

7.2.5.12 The package should be leak tested utilizing a halogen detector type test in accordance with Appendix 7.3.2. The halogen gases shall be introduced to the fully assembled package through appropriate fittings in the drain port area or a vent port, if so equipped. (See Dwg Y-20-201D, Detail F; Y-20-202D, Detail N; Dwg. AL-20-202, Detail E; or AL-20-203, Detail E).

7.2.5.2 The leak test described in Section 7.2.5.1 shall be performed at the Primary and Secondary lid seals and at all ports as appropriate for the particular OH-142 cask configuration. The acceptance criterion will be 10^{-5} std cm^3/s. Test sensitivity will be approximately $5x10^{-6}$ std cm^3/s.

7.3 APPENDIX

APPENDIX 7.3.1 DISCUSSION OF GAMMA SCAN PROCEDURE

Lead shielding integrity shall be confirmed via gamma scanning. There are two gamma scan techniques utilized. The main difference is in the method utilized to determine acceptance criteria.

Both Gamma Scan Techniques are exactly the same in all other respects and are conducted as follows.

An Eberline E120 probe or equivalent is used to scan the outer surface of the cask while an Iridium 192 or Cobalt 60 source of sufficient strength is present in the center of the cask. The source is first placed on the bottom of the cask while the surface is scanned around its circumference parallel to the source. The source is then moved up a pre-determined distance and the circumference scanned again. This sequence is repeated until the entire cask surface is scanned.

For these tests, the cask surface is gridded (in this case the grid consists of 4 inch squares) and a chart is made to reflect the gridded cask surface. Readings are taken from each grid square by scanning every point in the grid and recording the maximum reading in the corresponding grid on the chart. This data then serves as the raw gamma scan results. All readings are in Milliroentgens (MR).

The readings are evaluated by comparing them to predetermined MR values for nominal, or as designed, lead thickness and nominal -10% lead thickness.

The two different methods utilized to determine acceptance criteria are discussed below.

The Laboratory Calibration Method (NuPac Procedure GS-001) utilizes test blocks of the cask wall made up of lead and steel sheets. The test blocks simulate nominal or as designed and -10% lead thicknesses. The source is placed behind the test block at a distance equal to the inside radius of

the cask. The probe is then placed on the outside of the test block and readings are taken. This sequence is repeated on the nominal and -10% test blocks and the data is recorded.

The resultant values are then averaged. A ratio of the values is also developed. Then the average value is multiplied by the ratio. The value so derived is the maximum acceptable value for the shielding to be inspected.

An optional Laboratory Calibration Method can be utilized in lieu of the lead/steel calibration mockup method. In that case, calculations are run to establish acceptance criteria.

To do this, compiled source power data and attenuation characteristics data for steel, lead and distance through air are utilized to calculate the expected readings at the cask surface. The calculations allow for different source powers and are corrected for nominal and -10% shielding configurations.

The following excerpt from NuPac Gamma Scan Procedure No. GS-001 is provided to illustrate the calculation Method of Laboratory Calibration:

1.1 The nominal and -10% shielding calibration MR readings may be obtained via calculation as an option. These calculations shall be performed as follows:

1.1.1 Data and transmission charts found in the Tech/Ops Gamma Radiography Radiation Handbook shall be utilized. Copies of the handbook can be obtained from:

Tech/Ops, Inc.
Radiation Products Division
40 North Avenue
Burlington, Mass. 01803

1.2.2 Attachment A, Table 2, 'Selected Radioisotope Data' from the handbook shall be utilized to obtain source power data. (Copy of Table 2 included as Attachment A.)

1.2.3 Attachment B figures of the handbook shall be utilized to determine the attenuation of Gamma Rays in the shielding materials utilized in the cask to be inspected. (Copy of typical figures included as Attachment B.)

1.2.4 The following is an example of the calculated calibration method using Cobalt 60:

EXAMPLE

Cask O.D. 48 in. Cask I.D. 36 in. I.D. Wall 0.50 in. O.D. Wall 0.50 in. FE

Lead Shielding = 5.0 in. Less 10% lead shielding = 4.5 in.

Total FE shielding = 1.0 in.
Source Cobalt 60 strength 15 curies x 14.0 = 210 R/Hr at 12 in. (using Attachment A).

210 R/Hr at 12 in. = 52.5 R/Hr at 24 in. This would be the outer surface of the cask.

52.5 R/hr at 24 in. x reduction factor for 1.0 in. FE 0.58 = 30.45 R/Hr.
30.45 R/Hr at 24 in. x reduction factor for 5.0 Pb 0.0009 = 27.4 Mr/Hr.

30.45 R/Hr at 24 in. x reduction factor for 4.5 in Pb 0.000185 = 56.3 Mr/Hr (using Attachment B).

Design thickness reading at cask surface = 27.4 Mr/Hr.
Design thickness reading less 10% Pb = 56.3 Mr/Hr.

The following is an example of the calculated calibration method using Iridium 192:

EXAMPLE

Cask O.D. 48 in. Cask I.D. 46 in. I.D. Wall 0.25 in. FE O.D. Wall 0.25 in. FE

Lead Shielding = 1.5 in less 10% lead = 1.35 in.

Total FE Shielding 0.50 in.

Source Iridium 192 50 curies x 5.9 = 295 R/hr at 12 in. (using Attachment A).

295 R/Hr. at 12 in. = 73.75 R/Hr at 24 in. This would be the outer surface of the cask.

73.75 R/Hr at 24 in. x Reduction Factor for 0.50 in. FE 0.55 = 40.5625 R/Hr.
40.5625 R/Hr. x Reduction Factor for 1.50 Pb. 0.0024 = 0.09735 R/hr.
40.5625 R/Hr. x Reduction Factor for 1.35 in. Pb. 0.004 = 0.16225 R/Hr. (using Attachment B.)

Design thickness reading at cask surface = 97.35 Mr/Hr.
Design thickness reading less 10% of Pb = 162.2 Mr/Hr.

The calculation values and methods are based on data developed during approximately 300 actual calibrations utilizing the lead sheet/steel plate sandwich technique described in Rev. 4 of the referenced procedure.

Additional correlation has been provided by the use of established attenuation values obtained from the various figures found in the Tech/Ops Radiation Safety Handbook. This reference source is a recognized standard document utilized throughout the NDE industry. This information, together with NuPac's, extensive laboratory data enabled NuPac to develop the current optional calculation method of laboratory calibration for gamma scan.

The calculation method provides a greater degree of accuracy and correlation to the actual gamma scan conditions present in a typical cask than the lead and steel plate setup used in the past. It also reduces operator exposure during the calibration phase. The resultant calibration values for acceptance of the lead shield are, in fact, slightly more conservative and therefore assure a greater margin of safety for the shield.

The resultant improvement in the calibration of gamma scan acceptance criteria provides greatly improved accuracy and repeatability.

To illustrate this accuracy, correlation and conservativeness, the calibration data for a typical OH-142 gamma scan was rerun using the calculation method of Laboratory Calibration. The original calibration technique for this cask had been the lead and steel setup method.

The correlation between the two Laboratory Calibration methods is essentially identical. The variance in the acceptance criteria between the two methods is from .3 MR in the nominal to .1 MR in the -10% values. This equals to more than 2% variance between the Pb/FE and calculation methods of Laboratory Calibration. The difference in percentage (DIFF, %) between the nominal and -1-% values for the two calibrations is also very close with the Pb/FE at 64% and the Calc at 63%. The calibration results follow:

SUMMARY OF GAMMA SCAN ACCEPTANCE VALUES - OH-142

Source Type	Source Strength (curies)	Calib Type (1)	Nominal Value (MR)(2)	-10% Value (MR)(3)	Diff (%)(4)
Co 60	11	Pb/FE	21.5	33.5	64%
Co 60	11	Calc	21.2	33.4	63%

NOTES:

1. Pb/FE = Laboratory Calibration using lead and steel sheets to simulate the cask wall. Calc = Laboratory Calibration using the calculation method.

2. Nominal Values is the calibrated acceptance value expected if the lead and steel thickness meet the design requirements.

3. The -10% value is the calibrated gamma reading expected if the lead thickness is 10% less than that required by the design. The steel thickness is assumed to be at the nominal. This reading will be larger than the nominal reading. No reading above this value during actual gamma scan inspection is acceptable.

4. DIFF (%) refers to the percentage of difference between the Nominal and -10% values. A variance of approximately 5 to 6% between the nominal and -10% values of separate calibrations is normal. This is attributable to differences in lead density (cast vs. rolled sheet), accuracy of meters and related equipment, as rolled steel thickness variables, etc.

The Field Calibration Method (NuPac Procedure GS-002) utilizes a specially fabricated test lid which incorporates a holder for various lead and steel sheet thicknesses. This fixture is installed onto the cask to be scanned. The test lid is then set up to simulate the nominal lead thickness, the source is placed below the test lid in the cask at a distance equal to the inside radius of the cask. Readings are then taken. The test lid is then set up to recreate the -10% lead thickness configuration, and readings are again taken.

Other readings are then taken in 1/8 inch lead thickness increments between and beyond the two base readings until four to eight readings are obtained. The data is then plotted on a chart of readings versus lead thickness. The value for nominal lead -10% is then utilized as the maximum acceptable reading during the actual gamma scan.

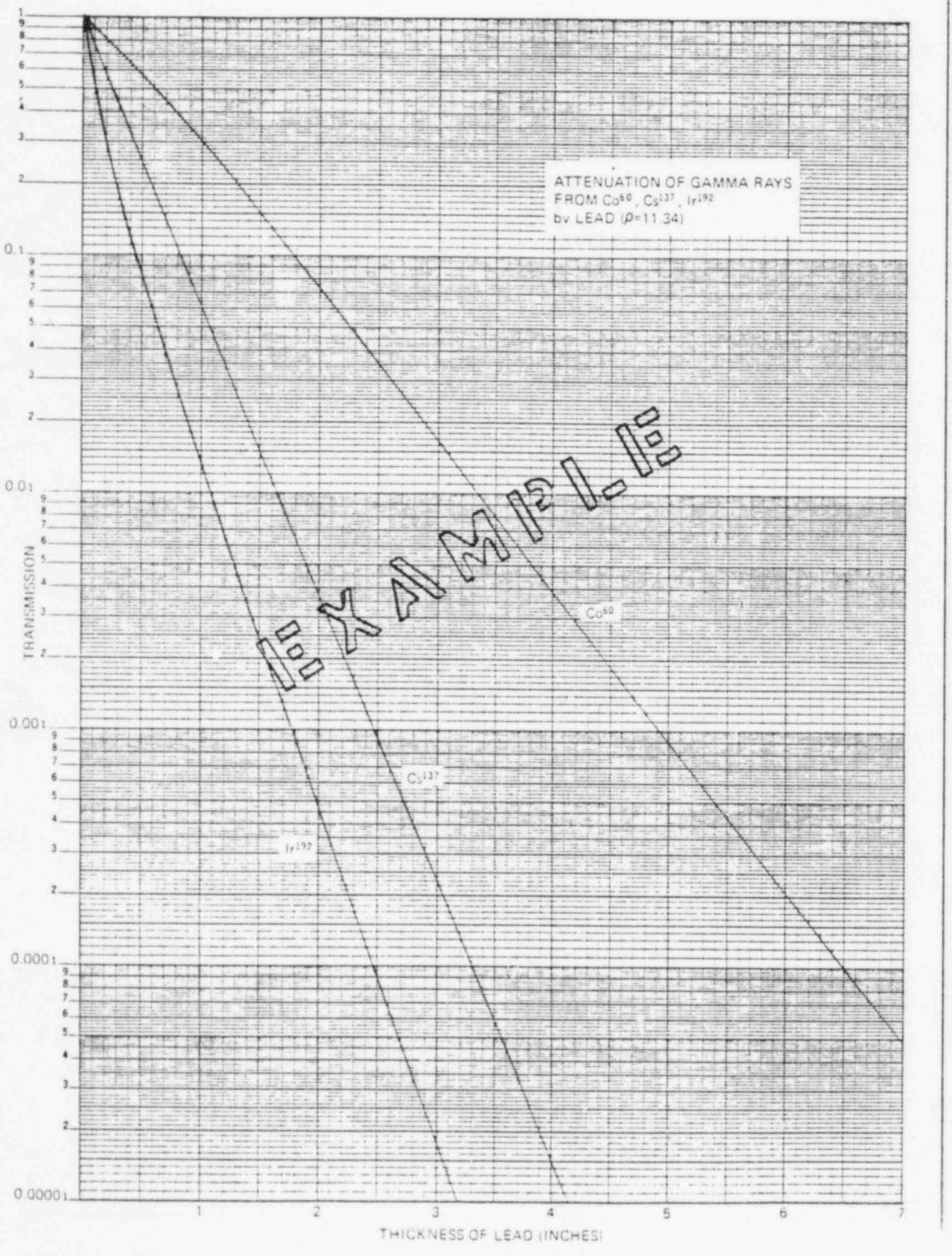
GS - 001 - ATTACHMENT A

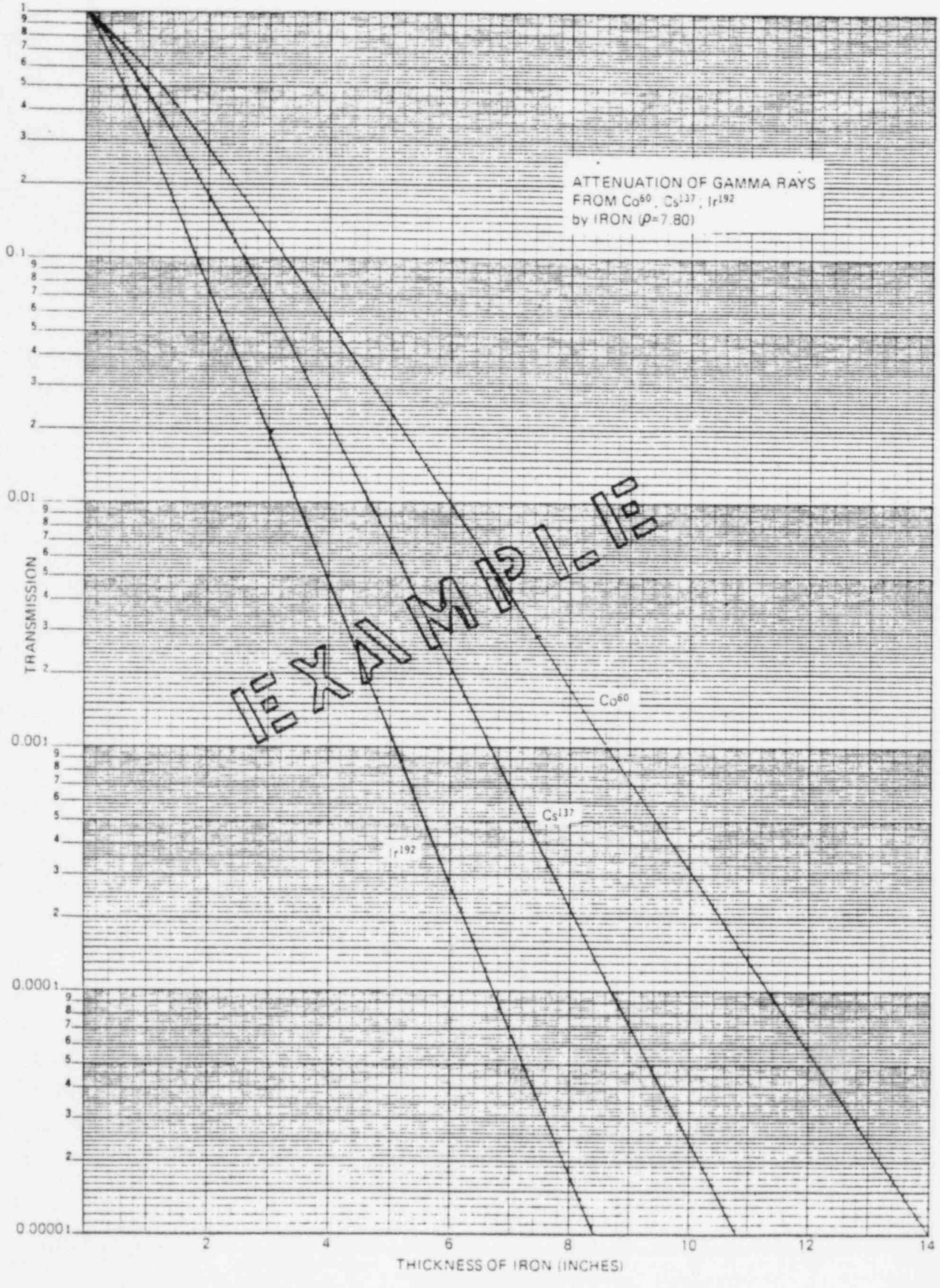
TABLE 2
SELECTED RADIOISOTOPE DATA

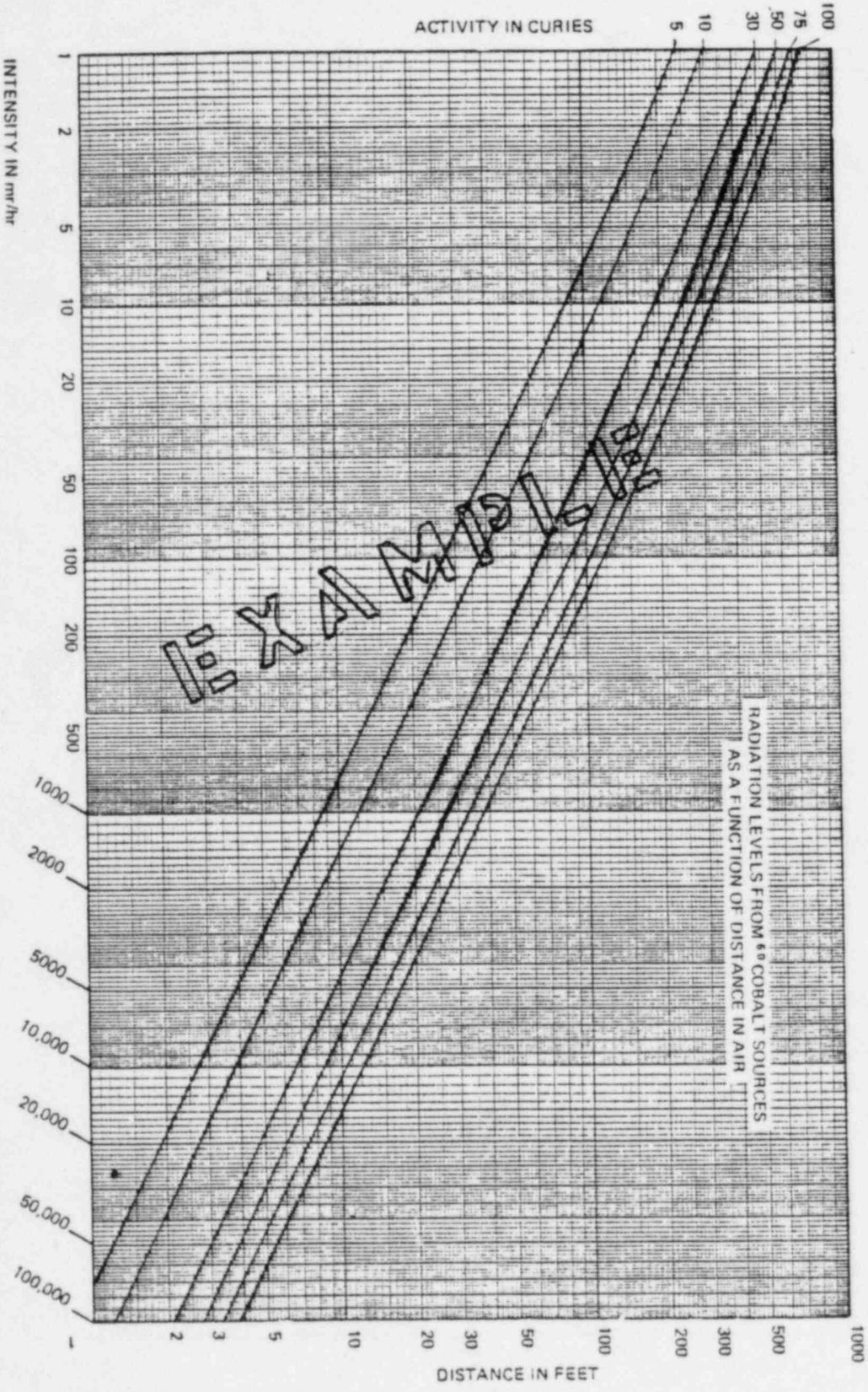
Radioisotope	*Halflife*	*Principal Photon Energies (keV)*	*Specific Gamma Ray Constant R/hr per curie*	
			at 1 foot	*at 1 meter*
Cesium[137]	30y	662	3.4	0.32
Cobalt[60]	5.3y	1173, 1332	14.0	1.30
Iridium[192]	74d	311, 468, 603	5.9	0.55*
Thulium[170]	134d	84, Yb x-rays	0.015	0.0014
Ytterbium[169]	32d	63, 110, 131 177, 198, 308 Tm x-rays	1.35	0.125

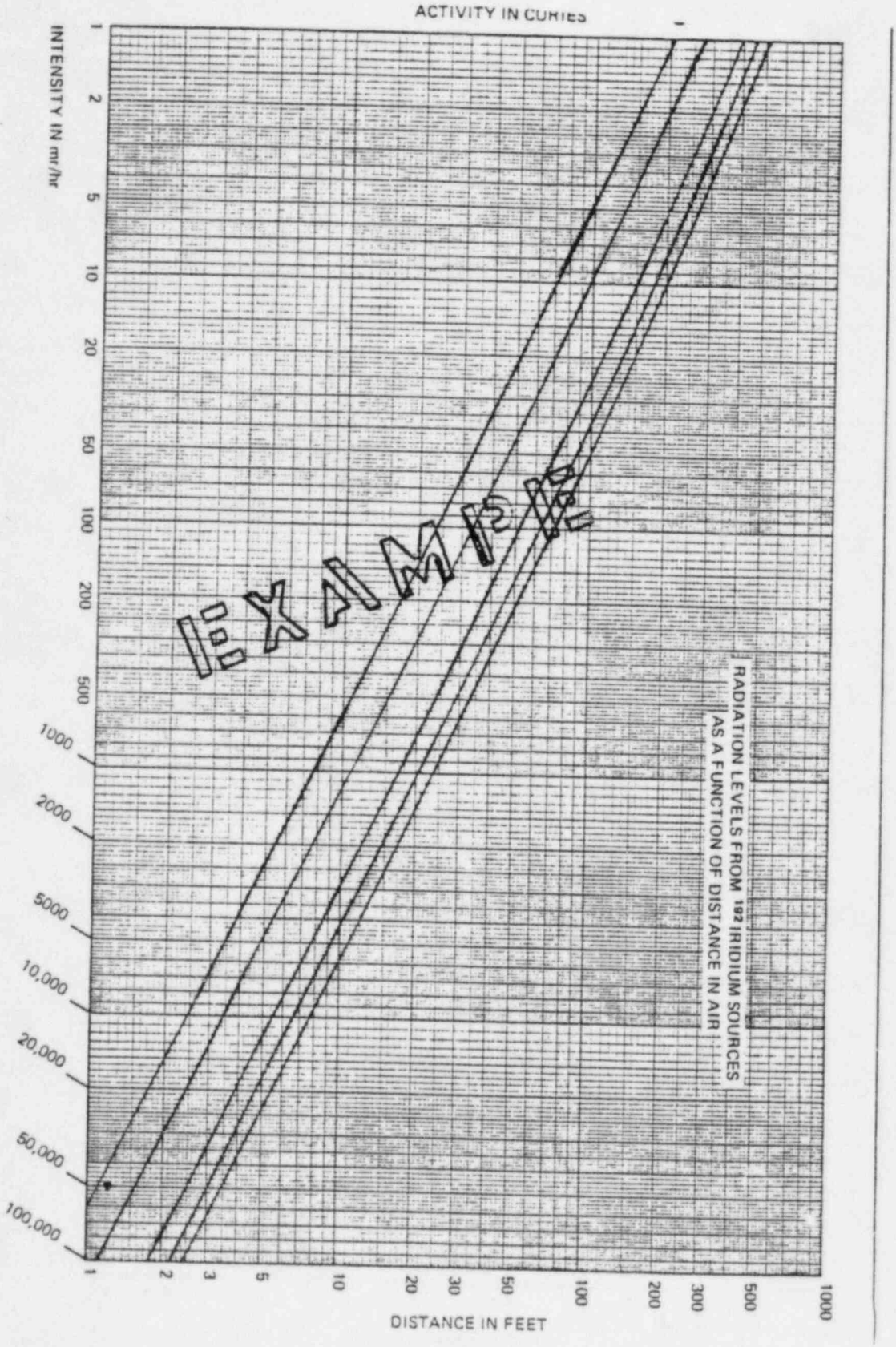
*American National Standards Institute Standard N432 has proposed a value of 0.48R-m²/hr-Ci for the specific gamma ray constant for Iridium 192.

GS - 001 - ATTACHMENT B




ATTENUATION OF GAMMA RAYS
FROM Co60, Cs137, Ir192
by IRON (ρ=7.80)
EXAMPLE
Co60
Cs137
Ir192
TRANSMISSION
THICKNESS OF IRON (INCHES)
1
0.1
0.01
0.001
0.0001
0.00001
2
4
6
8
10
12
14


ACTIVITY IN CURIES
5
10
30
50
75
100
INTENSITY IN mr/hr
1
2
5
10
20
50
100
200
500
1000
2000
5000
10,000
20,000
50,000
100,000
RADIATION LEVELS FROM 60 COBALT SOURCES
AS A FUNCTION OF DISTANCE IN AIR
2
3
5
10
20
30
50
100
200
300
500
1000
DISTANCE IN FEET


ACTIVITY IN CURIES
INTENSITY IN mr/hr
1
2
5
10
20
50
100
200
500
1000
2000
5000
10,000
20,000
50,000
100,000
EXAMPLE
RADIATION LEVELS FROM 192 IRIDIUM SOURCES
AS A FUNCTION OF DISTANCE IN AIR
1
2
3
5
10
20
30
50
100
200
300
500
1000
DISTANCE IN FEET

NUCLEAR PACKAGING
A Pacific Nuclear Company

APPENDIX 7.3.1

PROCEDURE FOR

SEAL INTEGRITY LEAK TEST

OF THE

OH-142 TYPE B SHIPPING CONTAINER

LT-23

REV. 0

MAY 31, 1985

Prepared By	6/4/85 Date
Engineering	6/4/85 Date
Quality Assurance	6/4/85 Date
Manufacturing/Production	6/4/85 Date
N/A Other	— Date
Document Control/Release	6.4.85 Date

1.0 SCOPE

1.1 This procedure provides methods and requirements for the verification of seal integrity on the OH-142 Type B Shipping Container.

1.2 The tests in this procedure are to be performed prior to first use as part of the cask acceptance inspection with the test described in reference 2.8. Thereafter, a seal integrity test will only be performed as part of in-service and/or maintenance testing

1.3 The tests shall be performed as required by 10 CFR 71.87 (c) and the specific sections of USNRC Certificate of Compliance No. 71-9073.

2.0 REFERENCE DOCUMENTS

2.1 ANSI N14.5 Leakage Tests on Packages for Shipment of Radioactive Materials.

2.2 RDT Standard, F5-1T, Cleaning and Cleanliness Requirements for Nuclear Components.

2.3 Code of Federal Regulations No. 10, Part 71.

2.4 NUPAC Quality Procedure No. QP-5, Quality Planning

2.5 NUPAC Quality Procedure No. QP-6, Inspection and Verification

2.6 NUPAC Quality Procedure No. QP-7, Discrepancy Reporting and Control

2.7 NUPAC OH-142 Operation and Maintenance Manual OM-12

2.8 NUPAC Procedure No. LT-22, OH-142 Structural Pressure Test.

3.0 REQUIREMENTS

3.1 The cask assembly shall have been inspected and tested in accordance with the reference 2.8 pressure test procedure and written inspection instructions prepared and completed in accordance with reference 2.4 and 2.5. These acceptance activities shall have been performed prior to first use.

3.2 Prior to each seal integrity test, the cleanliness of the internal and external surfaces shall be in accordance with reference 2.2 sections as directed by Quality Planning per reference 2.4.

3.3 The seal integrity test described in this procedure shall be performed prior to first use. It shall then be performed prior to each shipment and after each seal replacement or annual maintenance activity.

3.4 The following test equipment shall be required for the seal integrity test.

3.4.1 LEAK DETECTOR: A General Electric Model H-10, TIF Model 5500 or equivalent halogen gas leak detector capable of detecting a leak rate of 1/2 ounce/year.

3.4.2 HALOGEN GAS SOURCE: Dichlorodifluoromethane (Freon R-12 refrigerant) shall be utilized to provide the halogen gas and pressurization for the seal integrity test.

The Freon R-12 container shall be pressurized with appropriate shut off valves and fittings to interface with the cask vent or drain port.

3.4.3 GAUGE: A gauge capable of indicating pressure up to 10 psig to an accuracy of +/- .50 % of the indicated reading shall be utilized.

3.4.4 THERMOMETER: A thermometer with a range of -20° to +120° F, accurate to +/- 2° F, shall be utilized to obtain cask temperatures.

3.5 Cask seal integrity shall be tested with the cask fully assembled in the shipping configuration as specified in the applicable requirements of reference 2.7.

4.0 PROCEDURE

4.1 Verify that all cask configuration, cleanliness and test equipment requirements of Section 3.0 of this procedure have been met.

4.2 Adjust the sensitivity of the leak tester to 1/2 ounce/year as required in the applicable manufacturer's instruction manual.

4.3 Install the appropriate fittings and gauge on the cask vent or drain port for injecting the Freon R-12 into the cask containment cavity.

NOTE: ASSURE THAT THE GAUGE IS PLACED TO INDICATE CONTAINMENT CAVITY PRESSURE.

4.4 Measure cask body temperature to an accuracy of +/- 2° F. Record the temperature for use in Step 4.5.

4.5 Pressurize the cask containment cavity with Freon R-12 through the provided pressurization port to the pressure required for the cask temperature obtained in Step 4.4 as shown in table 1 below.

TABLE 1

REQUIRED CHARGE PRESSURE(PSIG) AT GIVEN TEMPERATURE (° F)	
CASK BODY TEMPERATURE RANGE (° F)	CHARGE PRESSURE (PSIG)
30 - 40	3.3
41 - 70	3.4
71 - 100	3.5
101 - 120	3.6
USE OF THE CHARGE PRESSURES SHOWN IN THIS TABLE WITH THE HALOGEN DETECTOR SET AT 1/2 OZ/YEAR WILL DETECT LEAKAGE TO A NORMAL LEAK RATE OF 1.0×10^{-5} atm - cm^3/sec	

NOTE: THE FREON CONTAINERS MUST NORMALLY BE IN AN UPRIGHT POSITION TO ASSURE THAT THE FREON IS IN A GASEOUS STATE. HOWEVER, SOME SUPPLIED PRESSURIZED FREON CONTAINERS MAY REQUIRE A DIFFERENT ORIENTATION. BE SURE TO REFER TO THE CONTAINER LABELING FOR SPECIAL INSTRUCTIONS. THE RATE OF FREON INJECTION CAN BE INCREASED BY PLACING THE CONTAINER IN A PAN OF LUKEWARM WATER. THIS MAY BE PARTICULARLY HELPFUL WHEN THE AMBIENT TEMPERATURE IS BELOW 45 DEGREES F.

4.6 After the Freon R-12 has been injected per Step 4.5, close off the injection valve so that the gas cannot escape from the cask containment cavity.

4.7 Hold the probe of the adjusted leak detector 1/16 to 1/8 inches from the interface areas of the primary and secondary lids and/or the overpack to cask body area.

4.8 Move the probe along the area being inspected at a rate not exceeding 2 1/2 feet/minute. Probe all areas described in Step 4.7.

4.9 If the probe passes over a leak, there will be a visual and audible signal from the detector corresponding to the one obtained during the detector adjustment and calibration check discussed in paragraph 4.2.

5.0 ACCEPTANCE CRITERIA

5.1 No leak rate greater than 1/2 ounce/year shall be acceptable.

With the detector adjusted and calibrated per paragraph 4.2, an audible signal or signal light will be emitted by the detector. This will indicate that the cask is rejectable as exceeding the specified leak rate.

5.2 If a greater leak rate than that stated in 5.1 is observed, seal condition, fastener and ratchet binder torque and seal interfaces shall be checked and the test rerun.

5.3 If the test is failed three (3) consecutive times, a Quality Discrepancy Report (QDR) shall be prepared and dispositioned in accordance with reference 2.7 before proceeding further.

8.0 QUALITY ASSURANCE

NuPac's quality assurance program used for the design, fabrication, assembly, testing, use and maintenance of the NuPac OH-142 cask is designed and administered to meet the 18 criteria of 10 CFR 71, Subpart H. A description of the program has been submitted to the NRC under NuPac letter QA-78-1, Rev. 4, dated January 28, 1985, and has received Quality Assurance Program Approval No. 0192.