"Designated Original" 71-9196

ENERGY*SOLUTIONS*

October 22, 2007
E&L-034-07

Mr. Robert A. Nelson,
Chief
Licensing Section
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

REFERENCES: (1) ENERGY*SOLUTIONS* QUALITY ASSURANCE PROGRAM, APPROVAL NUMBER 0935, EXPIRES DECEMBER 31, 2016
(2) DURATEK QUALITY ASSURANCE PROGRAM, APPROVAL NUMBER 0496, EXPIRES MAY 31, 2015

Dear Mr. Nelson:

SUBJECT: TRANSFER OF AND AMENDMENT TO US NUCLEAR REGULATORY COMMISSION CERTIFICATE OF COMPLIANCE NO. 9196 FOR THE MODEL NO. UX-30 PACKAGE

Energy*Solutions* hereby requests that the subject certificate of compliance currently issued to Duratek be issued to Energy*Solutions*. In addition, Energy*Solutions* respectfully submits the attached amendment request for the Model No. UX-30 Safety Analysis Report. We request that you approve our proposed Revision 1 to the SAR and revise the Certificate to reflect the changes delineated below.

Transfer of Certificate

Duratek was acquired by Energy*Solutions* in 2006. We request that this certificate transfer be made on or after October 31, 2007, which is after the effective date of implementation of the US NRC approved Energy*Solutions* Quality Assurance Program (Reference 1).

We therefore request that Certificate No. 9196 be issued to:

Energy*Solutions*
140 Stoneridge Drive
Columbia, South Carolina 29210
Attention: Patrick L. Paquin

In accordance with this transfer, Energy*Solutions* accepts responsibility for the accuracy and completeness of the statements and representations of the previous certificate holder, Duratek. Energy*Solutions* also accepts responsibility for maintenance of the certificate and the Safety Analysis Report for the package design in accordance with the requirements of 10 CFR 71.91(c). Energy*Solutions* will maintain the records for this design in accordance with its Quality Assurance Program. The records will be located at our offices in Columbia, South Carolina in

Rec'd @ DCD on 2/9/09

NM5501
NM5524
Add: Robert A Nelson - E. Rios

the same location where these records are currently maintained by Duratek in accordance with its Quality Assurance Program.

Safety Analysis Report Amendment

Currently, we have two versions of the SAR, one proprietary and one non-proprietary. These versions are now being designated as Public (formerly non-proprietary) and Non-Public (formerly proprietary). The changes being requested apply to both versions unless otherwise noted. Our proposed revisions to the Safety Analysis Report (SAR) are as follows:

1. Contents
   Chapter 1 of the SAR has been revised to include various types of UF_6, including recycled UF_6, all with a U-235 isotope concentration of not more than 5 weight percent. Due to the inclusion of recycled UF_6 and the resulting potential for content exceeding a Type A quantity, the UX-30 package has been qualified as a Type B(U)F package.

2. Package Category
   Chapter 2 of the SAR has been revised to identify the UX-30 as a Category II package.

3. Containment Requirements
   Chapter 4 of the SAR has been revised to specify a leak rate criterion for shipment of cylinders containing recycled UF_6. An annual test to demonstrate a leak rate of less than 1×10^{-7} cm^3/sec at a test sensitivity of 5×10^{-8} cm^3/sec is required for 30B or 30C cylinders used for recycled UF_6.

4. Acceptance and Maintenance Requirements
   Chapter 8 of the SAR has been revised to add an acceptance criterion for the 30B or 30C cylinders used for recycled UF_6 of a leak rate of less than 1×10^{-7} cm^3/sec at a test sensitivity of 5×10^{-8} cm^3/sec. Also, a maintenance requirement has been added to specify annual testing of 30B or 30C cylinders used for recycled UF_6. The test acceptance criterion is a leak rate of less than 1×10^{-7} cm^3/sec at a test sensitivity of 5×10^{-8} cm^3/sec.

5. Drawings
   Drawing C-110-B-57922-0002, which is included in the public (formerly non-proprietary) version of the SAR, is referenced in the CoC. The drawing has been revised to change several notes and the title block from Duratek to Energy*Solutions*. In addition, two weld symbols on sheet 2 (zones B/7 and C/7) were corrected to conform to the proprietary drawing. These symbols were inadvertently omitted from the public drawing and have been added to reflect the package as fabricated condition, i.e., in accordance with the proprietary drawing. Proprietary Drawing C-110-57922-0001, which was previously included in the proprietary version of the SAR, is provided in the non-public version of the SAR (Attachment 3) as both proprietary and security-related sensitive information. This drawing is not currently referenced in the CoC and we request that this drawing continue to be treated in this manner. The drawing has been revised to change the title block to Energy*Solutions*.

6. Specification
   The proprietary foam specification (provided in the non-public version of the SAR only) has been changed from a Duratek to an Energy*Solutions* specification. No other changes to the specification were made.

7. Cover and Table of Contents
   The Cover and Table of Contents are revised to Revision 1 and to accommodate the changes noted above. Added to the ToC is a Revision Control Sheet which identifies the revision level of each page as the SAR is revised. This page will be updated for each subsequent revision.

To allow a reasonable transition period to the new Identification Number and Certificate of Compliance (CoC), we request the following transition period be approved: Packagings may be marked with Package Identification Number USA9196/AF-96 until two years after the date of the approval of the certificate and must be marked with Package Identification Number USA9196/B(U)F-96 after the date of the approval of the certificate plus two years and one day. Any Package transporting recycled UF_6 must be marked with Package Identification Number USA9196/B(U)F-96. Revision 22 of the CoC may be used until one year after the date of the approval of the certificate.

The pages of the public SAR revised as a result of the requested changes noted above are included as Attachment 1. The changes have been noted with margin bars identifying the location of changes. A review version of the public SAR revision pages is also provided as Attachment 2 in which new text has a double underline and deleted language is shown as "strikeout". Please insert the Attachment 1 pages as replacements for the current public (non-proprietary) SAR pages.

The pages of the non-public SAR revised as a result of the requested changes noted above are included as Attachment 3. The changes have been noted with margin bars identifying the location of changes. A review version of the non-public SAR revision pages is also provided as Attachment 4, in which new text has a double underline and deleted language is shown as "strikeout". Please insert the Attachment 3 pages as replacements for the current non-public (formerly proprietary) SAR pages. Please treat Attachment 4 as proprietary and retain or destroy in an appropriate manner after the review is complete.

Also included as Attachment 5 are suggested changes to the CoC. Finally, Attachment 6 is our proprietary information affidavit for the proprietary drawing and specification.

The six attachments to this letter are listed below:

Attachment 1 Revised public SAR pages; please replace the current pages with the pages in this attachment. Pages included are: cover, i-iv, 1-1 through 1-12 (entire Chapter 1), Drawing C-110-B-57922-0002, 2-23, 4-1 through 4-3 (entire Chapter 4), and 8-1 through 8-5 (entire Chapter 8).

Attachment 2 Review copy of revised public SAR pages

ENERGY*SOLUTIONS*

Attachment 3 Revised non-public SAR pages; please replace the current pages with the pages in this attachment. Pages included are: cover, i-iv, 1-1 through 1-12 (entire Chapter 1), Drawing C-110-B-57922-0001, 2-23, 4-1 through 4-3 (entire Chapter 4), 8-1 through 8-5 (entire Chapter 8), and Specification (Proprietary)

Attachment 4 Review copy of revised non-public SAR pages (Proprietary)

Attachment 5 Suggested changes to the CoC

Attachment 6 Proprietary Information Affidavit

Should you or members of your staff have questions about the requested SAR revision, please contact Mark Whittaker at (803) 758-1898.

Sincerely,

Patrick L. Paquin
GM – Engineering & Licensing

Attachments: As stated

140 Stoneridge Drive • Columbia, South Carolina 29210
803.256.0450 • www.energysolutions.com

Attachment 1
Revised public SAR pages

SAFETY ANALYSIS REPORT FOR MODEL UX-30 PACKAGE PUBLIC VERSION

REVISION 1

October 2007

Energy*Solutions*
140 Stoneridge Dr.
Columbia, SC 29210

TABLE OF CONTENTS

REVISION CONTROL SHEET

TITLE: Consolidated Safety Analysis Report for UX-30 Package - Public

DOCKET NO.: 71-9196

AFFECTED PAGE(S)	DOC.REV.	REMARKS
Entire Document	0	Consolidated SAR incorporating all previous changes, CoC Revision 22
i through iv	1	Revision to Type B(U)F package; October 2007
1-1 through 1-12	1	
2-23	1	
4-1 through 4-3	1	
8-1 through 8-5	1	

1.0 GENERAL INFORMATION

1.1 Introduction

1.1.1 Purpose of Application

The analyses performed and testing documented in this Safety Analysis Report demonstrate that the UX-30, along with an ANSI N14.5 compliant 30B or 30C cylinder meets the requirements for use under 10CFR71.17, "General License, NRC Approved Package," as a Type B(U)F package. The UX-30 packaging has been developed to provide a safe and reliable container for transporting standard 30-inch cylinders of uranium hexafluoride (UF_6) with a U-235 isotope concentration of not more than 5 weight percent. It should be noted that the UX-30 was previously approved by the US NRC under the provisions of 10CFR71 as a Type AF-96 Package. Throughout the SAR, reference may be made to, or results presented of, previous testing performed on the UX-30 package. This testing was performed to the 10 CFR 71 requirements for a Type AF package. However, since the tests and test acceptance criteria for a Type BF package are the same as for a Type AF package, these tests are applicable and also demonstrate the UX-30 compliance to 10 CFR 71 Type BF requirements, regardless of their designation as Type AF tests.

1.1.2 Summary Information

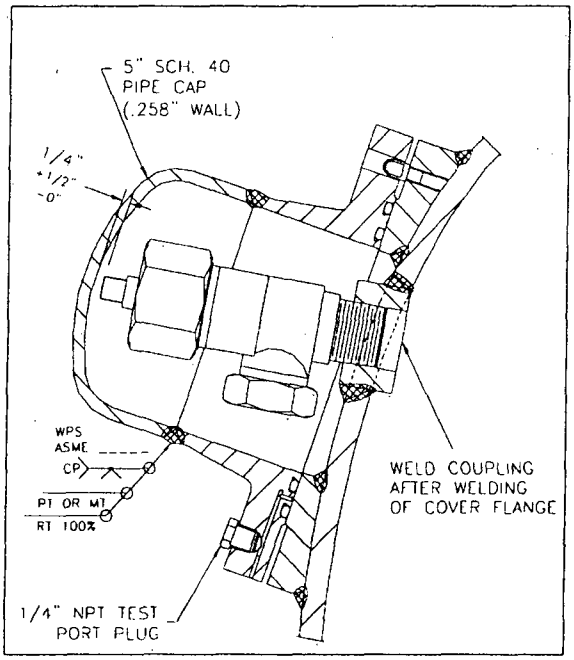
The package consists of two elements: 1) A standard 30-inch cylinder (or equivalent), and 2) a UX-30 overpack. The UX-30 is a replacement for the DOT 21PF-1B overpack. Considerable effort has gone into the design of the UX-30 overpack to eliminate operational and maintenance problems associated with the older design (e.g. rusting and corrosion, open cell foam moisture absorption, and protection of the valves on 30B cylinders). The UX-30 has been designed to meet the requirements of 10 CFR 71.

In an effort to simplify the original review and evaluation process, in 1984 a full scale UX-30 prototype with a loaded 30 inch cylinder was subjected to a series of five (5) sequential drop tests, well in excess of impact qualification requirements in 10 CFR 71. Three drops were from 30 feet

and two were 40-inch drops onto a 6-inch diameter steel post. Throughout the full series of tests the cylinder was so well protected that it experienced no deformations whatsoever. Subsequent leak tests also demonstrated that the cylinder retained its full integrity.

A second series of tests were performed in 1995 to support the review and evaluation process for upgrade of the UX-30 certification. These tests again demonstrated compliance with 10 CFR 71 requirements. The test sequence performed, which also utilized a full scale UX-30 with a loaded 30-inch cylinder, included five (5) drop tests followed by a fire test and an immersion test. The drop tests included two 30-foot drops and two 40-inch drops onto a 6-inch diameter steel post. The results of this series of tests also demonstrated the excellent protection provided to the 30 inch cylinder by the UX-30 overpack. No deformations of the 30 inch cylinder were caused by the testing; also, the fire test temperatures for the 30B cylinder surface were well within UF_6 and 30-inch cylinder safe operational limits. An immersion test confirmed that 30-inch cylinder tested did not allow water in leakage. Post-test leak testing demonstrated that the UX-30 provided the necessary protection for the 30B cylinder.

Finally, a third series of testing was performed in 2001 on the UX-30 with a 30C Cylinder instead of the standard 30-B cylinder previously used in testing. The 30C Cylinder is identical in dimensions and configuration to the standard 30-B cylinder specified by ANSI N14.1, except it is fitted with a Valve Protective Cover (VPC) that bolts over and protects the cylinder valve during transport. (Note that Addendum 2-2004 to ANSI N14.1-2001, which specifies the standard 30C cylinder, was issued after the analyses and testing using a 30C cylinder as described in this Safety Analysis Report was completed. The cylinder on which the analyses and testing was conducted was named, at the time, the "CBC Watertight™" cylinder. Since the CBC



Valve Protective Cover

Watertight™ cylinder is identical in every respect to the cylinder that became the standard 30C cylinder in Addendum 2-2004 to ANSI N14.1-2001, references in this Safety Analysis Report are to the "30C," instead of to the "CBC Watertight™" cylinder.)

The purpose of this series of tests was to demonstrate the following:

1. That the 30C is at least equivalent to the standard 30-B cylinder in meeting the transport regulations of 10CFR71. This was demonstrated by successfully completing a series of drop tests of a UX-30 package and a loaded 30C cylinder. Drops onto the corner of package were conducted from 4' and 30', followed by a drop from 40" onto a steel post.
2. That the VPC on the 30C Cylinder assures protection of the cylinder valve during the normal conditions of transport and hypothetical accident conditions of 10CFR71. The drop testing resulted in no damage to the cylinder and none to the cylinder valve even though the 40" pin drop was conducted with the UX-30 being dropped directly onto its end in the region of the VPC. The inside wall of the UX-30 was deformed sufficiently to strike the VPC, but the VPC was undamaged and protected the cylinder valve. This was evidenced by the VPC successfully passing its post-test acceptance leak test of $1x10^{-5}$ std-cm^3/sec, and by there being no damage to the cylinder valve upon examination after the VPC was removed.
3. That the VPC assures protection against leakage of water into the cylinder during the normal conditions of transport and hypothetical accident conditions of 10CFR71. As discussed above, the VPC protects the cylinder valve from damage and thus becoming a path for leakage of water into the cylinder. In addition, testing was conducted that showed a hole with a diameter that leaks $1x10^{-5}$ std-cm^3/sec, the maximum permitted leak rate of the VPC, excludes water leakage when pressurized with water exceeding the equivalent pressure of 15 meters feet of water specified in 10CFR71.73(c)(5).
4. In addition to the features of the standard 30B cylinder that protect against water in-leakage, the VPC on the 30C Cylinder provides an additional level assurance. Because of this additional assurance demonstrated by the testing, as well as the periodic and pre-shipment leak testing performed on the VPC and cylinder, the 30C Cylinder qualifies for having the

"special design features" of 10CFR71.55(c) that ensure against water leakage into the cylinder.

The testing conducted demonstrated that the VPC on the 30C cylinder provides an additional level of protection for the cylinder valve over the standard 30-B cylinder, and protects against leakage of water into the cylinder. This Safety Analysis Report will demonstrate that the additional level of protection provided by the Valve Protective Cover allows authorization of a criticality safety index of 0.0 (zero) for the 30C cylinder.

The following report will substantiate the ability of the UX-30 package to meet or exceed all the requirements of 10 CFR 71.

Authorization is sought for shipment by cargo vessel, motor vehicle, and rail as a Fissile Material package with a criticality safety index of:

Standard 30B cylinder	5.0
Standard 30C cylinder	0.0

1.2 Package Description

1.2.1 Packaging

The UX-30 is designed to protect a standard ANSI N14.1 30B cylinder (or its equivalent), hereafter referred to as the cylinder. From Figure 1.2-1 it can be seen that the UX-30 is a horizontal right circular cylinder, 96 inches long by 43.5 inches in diameter. A horizontal parting plane allows the top half of the overpack to be removed, providing easy access to the cylinder.

All exposed surfaces of the UX-30 are fabricated from ASTM A240 304 stainless steel. The space between the inner and outer overpack shells is filled with an energy-absorbing and insulating closed-cell polyurethane foam material.

The material, designated by Energy*Solutions*' Specification No. ES-M-170, is a rigid closed-cell polyurethane foam with well-documented mechanical and thermal capabilities. Six inches of this foam completely encases the UF_6 cylinder (See Appendix 8.3.1 for the polyurethane foam material specification, ES-M-170).

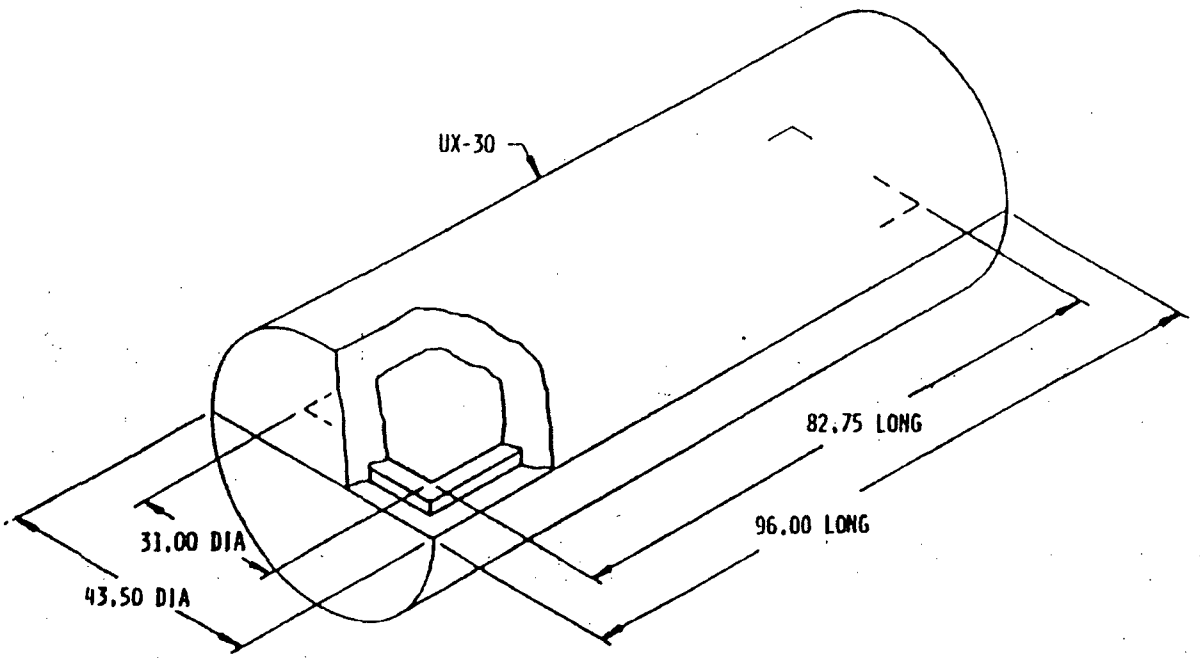


FIGURE 1.2-1
UX-30 Package Dimensions

Design features that have been employed in the UX-30 design, include:

- Indexing pins with cross-locking 'ball lock' pins assure rapid high strength package assembly.

- A 'step-down' closure design forces foreign material to travel against gravity and then through a seal to reach the overpack interior.

- Nested placement of the lid half of the overpack assures its protection during all handling operations.

The cylinder used in this safety analysis is defined by ANSI N14.1., American National Standard for Packaging of Uranium Hexafluoride for Transport. Any equivalent 30-inch cylinder currently used to transport UF_6 may also be used. See Figure 1.2-2. Typical filling and handling procedures for these cylinders are described in detail in USEC-651, Uranium Hexafluoride: Handling Procedures and Container Criteria. Essentially, liquefied UF_6 is introduced through a valve into the cylinder, filling the cylinder approximately 3/4 full. The UF_6 is allowed to cool, changing phase and volume as it cools, until the UF_6 occupies less than two-thirds of the available volume within the cylinder, and has completely solidified.

This Safety Analysis Report also includes provision for transport of the 30C cylinder in the UX-30. This cylinder is equivalent to the standard 30B cylinder specified in ANSI N14.-1, but also includes a Valve Protective Cover to preclude water intrusion (see Figure 1.2-3).

1.2.1.1 Gross Weights

The package weights are summarized to account for variance in manufacture.

PACKAGE	WEIGHTS
UF_6 maximum	5,020 lbs
UF_6 Cylinder & UX-30	3,250 lbs.
Total max gross weight	8,270 lbs.

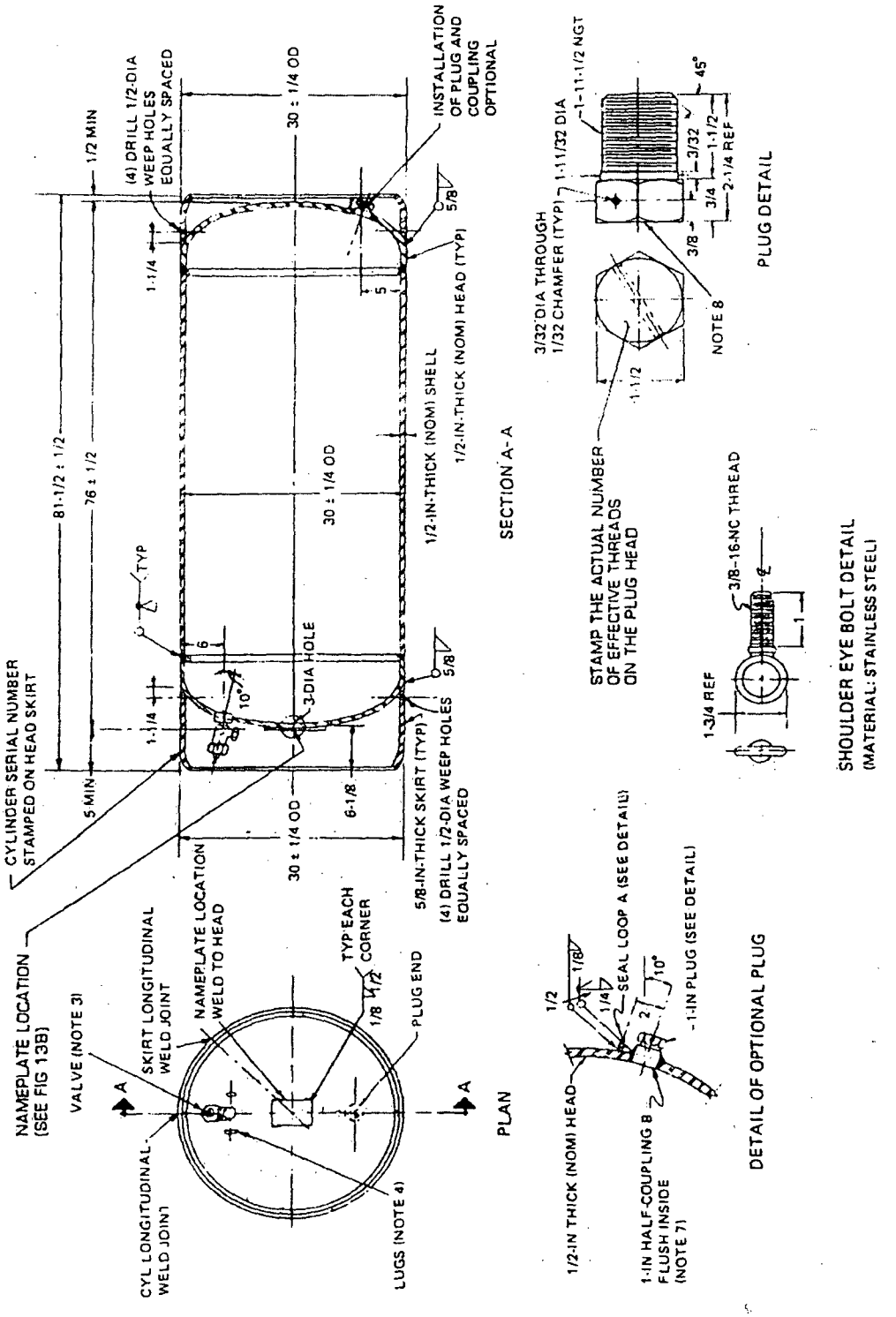


FIGURE 1.2-2
UF_6 Cylinder ANSI NI4.1-30B

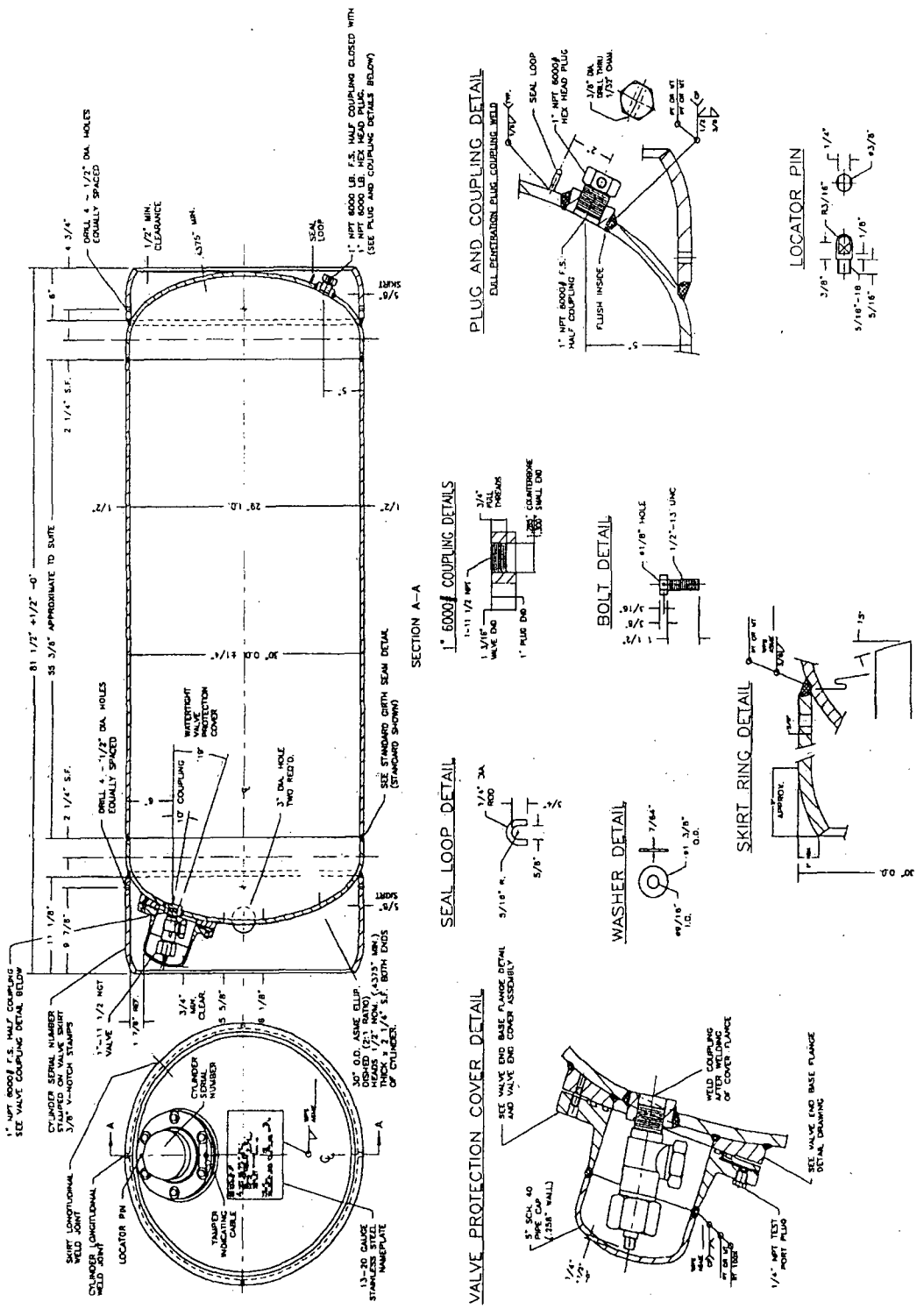


Figure 1.2 – 3
ANSI N14.1 30C Cylinder

1.2.1.2 Materials of Construction

The UX-30 is fabricated from ASTM A240 Type 304, stainless steel, ASTM A36 carbon steel (internal reinforcing), and closed-cell polyurethane foam.

1.2.1.3 Neutron Absorbers and Moderators

There are no neutron absorbers or moderators used in the UX-30 packaging.

1.2.1.4 Receptacles, Valves and Sampling Parts

There are no receptacles, valves, or sampling ports in the UX-30 overpack. The UF_6 cylinder is equipped with a 1-inch fill valve and a 1-inch plug.

1.2.1.5 Heat Dissipation Systems

The UX-30 overpack is entirely passively cooled. There are no coolants in the package design.

1.2.1.6 Protrusions

There are no inner protrusions on the UX-30 overpack. Light gauge lifting lugs extend from the overpack on each end or on the sides near the closure interface.

1.2.1.7 Shielding

There is no shielding required for the intended payload of the UX-30.

1.2.1.8 Pressure Relief Systems

There are no pressure relief systems in the UX-30.

1.2.2 Containment Boundary

The UX-30 package relies on the 30-inch cylinder to provide containment for the UF_6 payload.

1.2.3 Contents of Packaging

The maximum quantity of material per package and fissile class of the UX-30 with the 30B* cylinder shall be as shown below. The maximum quantity of material for the 30C* cylinder is the same as the 30B cylinder. The criticality safety index for the 30C cylinder is derived in Chapter 6.

* Designations per ANSI N14.1 – 2000, "American National Standard for Nuclear Material – Uranium Hexafluoride – Packaging for Transport

Contents

(1) Type and form of the material

Commercial Natural UF_6, Enriched Commercial Grade UF_6, Depleted UF_6, Derived Enriched UF_6 or Reprocessed UF_6 in Standard ANSI N14.1 30B or 30C cylinders

(2) Maximum quantity of material per package

(i) Up to 5,020 pounds of UF_6 with a U-235 isotope concentration of not more than 5 weight percent

(ii) For Reprocessed UF_6: Fission Product Gamma Activity shall not exceed 4.4E+05 MeVBq/kgU (4.4E+05 MeV/sec kgU) and the transuranic Alpha Activity shall be less than 3.3E+03 Bq/kgU (2.0E+05 dpm/kgU)

(iii) The maximum H/U atomic ratio for the UF_6 is 0.088.

Criticality Safety Index (CSI)

Criticality safety index for the UX-30 Overpack containing a standard ANSI N14.1 30B cylinder	5.0
Criticality safety index for the UX-30 Overpack containing a standard ANSI N14.1 30C cylinder	0.0

1.2.4 Operational Features

The UX-30 is designed to replace the 21PF-1B standard DOT overpack and would be operated in much the same way. Positive closure on the UX-30 however is provided by 10 ball-lock pins, providing for quicker and easier loading and unloading operations. The closed-cell polyurethane foam combined with sealed stainless steel inner and outer shells on the UX-30 prevents much of the maintenance currently required for the 21PF-1, since water cannot penetrate either feature.

1.3 General Requirements for All Packages

Minimum Packaging Size

The UX-30 packaging overall dimensions are all much larger than the minimum 10 cm specified in CFR 71.43(a). The minimum size is 43.5 inches.

Tamperproof Feature

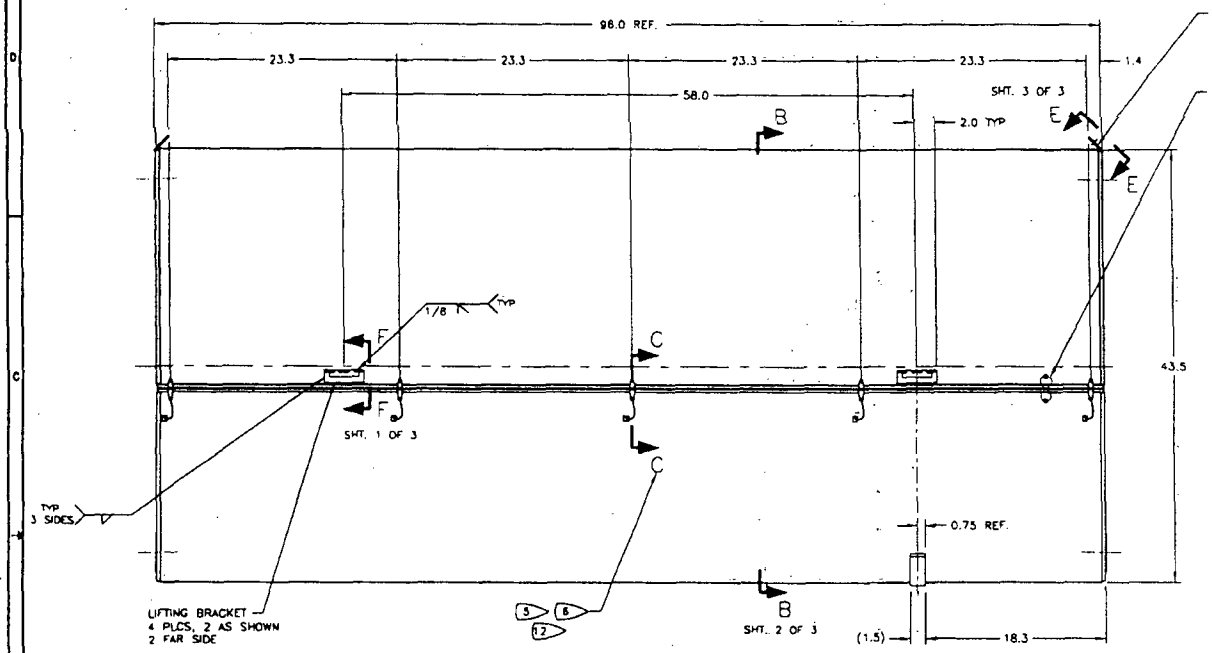
The UX-30 package is installed with a tamper-indicating seal to discourage any unauthorized opening. A tamper-indicating seal is also installed on the cylinder valve of the standard 30B cylinder, and on the VPC for the 30C Cylinder.

Positive Closure

Positive closure is effected by 10 ball-lock pins through the guide pins. Inadvertent opening is prevented by the design of the ball-lock pins, which require that the release button be pushed while the pin is pulled. A tamper-indicating seal is installed to indicate any unauthorized opening.

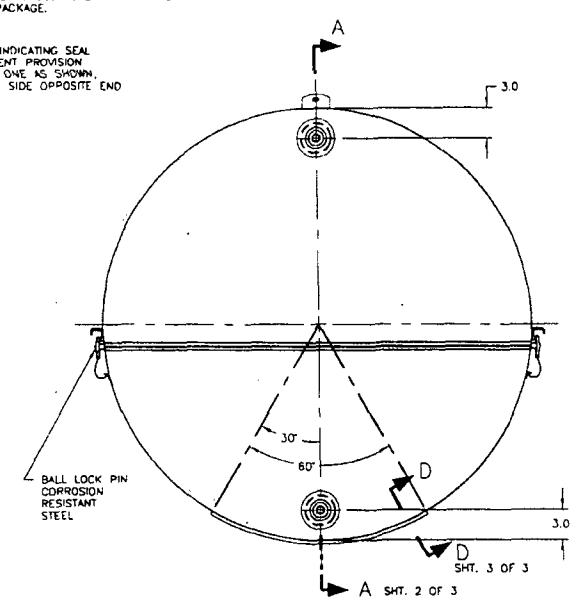
1.4 Appendix

1.4.1 UX-30 General Arrangement Drawing



UPPER OVERPACK LIFT LUGS SHALL BE PLUGGED OR CAPPED DURING SHIPMENT TO PRECLUDE USE AS LIFT POINTS FOR THE ENTIRE PACKAGE.

TAMPER INDICATING SEAL ATTACHMENT PROVISION 2 PLCS, ONE AS SHOWN, ONE FAR SIDE OPPOSITE END



UX-30 OVERPACK ASSY.

END VIEW

(5) PROPRIETARY NOTE: SEE ENERGYSOLUTIONS DRAWING NO. C-110-B-57922-0001, REV.4

(4) FOAM AND INSTRUMENTATION SHALL BE IN ACCORDANCE WITH LATEST REVISION OF ENERGYSOLUTIONS SPECIFICATION NO. ES-M-170 (DENSITY: 7.8-8.8 PCF). THE FOAM AND INSTALLATION FOR PACKAGES FABRICATED PER Rev. 13 OR EARLIER OF THE CERTIFICATE OF COMPLIANCE MUST BE FABRICATED IN ACCORDANCE WITH VECTRA SPECIFICATION No. NPI.F12

3. ALL WELDS SHALL BE VISUALLY INSPECTED IN ACCORDANCE WITH AWS D1.1 PARA 6.9 (STATICALLY LOADED).

(2) JOINTS AND SEAMS SHOWN ARE THE PREFERRED CONFIGURATION, HOWEVER, MANUFACTURING CAPABILITIES AND PREFERENCES VARY WITH INDIVIDUAL FABRICATORS, THEREFORE, SPECIFIC JOINT/SEAM CONFIGURATION AND LOCATION SHALL BE CONTROLLED HERE ONLY TO THE EXTENT THEY BE OF THE SPECIFIED MATERIAL AND AGREE DIMENSIONALLY WITH THE DESIGN. ALL WELDED JOINTS SHALL BE CONTINUOUS, EXCEPT AS OTHERWISE NOTED.

1. REFERENCE DATA:

MAX OVERPACK WEIGHT: 1650 LBS
MIN OVERPACK WEIGHT: 1450 LBS
MAX PAYLOAD WEIGHT: 6820 LBS
(MAX UF_6 WEIGHT: 5020 LBS)
MAX GROSS WEIGHT: 8270 LBS

NOTES: UNLESS OTHERWISE SPECIFIED

14. GRINDING OF WELDS SHALL BE MINIMIZED. MINIMUM PLATE THICKNESS SHALL BE NOT LESS THAN 90% OF THE THICKNESS OF A LIKE CONFIGURATION EXCEPT FOR SURFACE AREAS OF THE LESSER OF 2 SQUARE INCHES OR A 6 INCH LENGTH OF WELD SEAM, WHERE THE MINIMUM THICKNESS SHALL NOT BE LESS THAN 50% OF NOMINAL. AREAS OF EXCESSIVE GRINDING OR UNDERTHICKNESS SHALL BE REPAIRED BY WELD BUILD UP USING ASME SECTION IX QUALIFIED WELDERS AND WELD PROCEDURES.

(13) GROOVE WELD REINFORCEMENT OF 1/8" IS ACCEPTABLE.

(12) PROPRIETARY NOTE: SEE ENERGYSOLUTIONS DRAWING NO. C-110-B-57922-0001, REV.4.

(11) THE GROOVE WELD SHOWN MAYBE REPLACED WITH A SQUARE GROOVE WELD OR A FILLET WELD WITH THE HALF COUPLING RECESSED BEHIND THE OUTER COVER PLATE.

10. PROPRIETARY NOTE: SEE ENERGYSOLUTIONS DRAWING NO. C-110-B-57922-0001, REV.4

(9) LIFT LUGS DEFINED IN VIEW E-E & SECTION F-F ARE OPTIONAL & EITHER ONE CONFIGURATION OR THE OTHER SHALL BE PROVIDED, BUT NOT BOTH.

8. ALL WELDING PROCEDURES AND PERSONNEL SHALL BE QUALIFIED IN ACCORDANCE WITH AWS D1.1 OR ASME SECTION IX REQUIREMENTS.

(7) POLYMERIC PADS MAY BE ATTACHED TO INTERIOR SURFACES USING A COMPATIBLE ADHESIVE. EXACT LOCATION AND NUMBER SHALL BE OPTIONAL ACCORDING TO USER PREFERENCE.

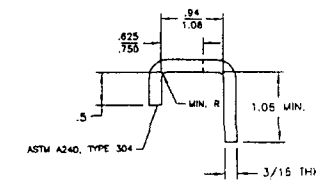
(6) PROPRIETARY NOTE: SEE ENERGYSOLUTIONS DRAWING NO. C-110-B-57922-0001, REV.4

18 PAINT EXTERIOR OF OVERPACK AS NEEDED WITH AMERLOCK 400AL PAINT OR EQUIVALENT (OPTIONAL).

(17) THIS DIMENSION TO BE 6.6" ±0.2" PRIOR TO FOAMING. MINIMUM DIMENSION AFTER FOAMING SHALL BE 6.4"

(18) FILLET WELDS OPTIONAL.

15. WHERE WELD SIZE IS NOT SPECIFIED FOR A WELD, THE WELD SIZE IS EQUAL TO THE THICKNESS OF THE THINNER OF THE TWO PLATES JOINED BY THE WELD.



(9) SECTION F-F
(TYP. 4 PLCS)
SHT. 1 OF 3

DIMENSIONS ARE IN INCHES AND DEGREES UNLESS NOTED OTHERWISE
DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH Y14.5M-1982
FRACTIONS ±1/8 DECIMALS .X±.2 .XX±.05 .XXX±.020 ANGLES ±1°

PROPRIETARY
NON-PROPRIETARY

FSCM No. 54843
DO NOT SCALE PRINT

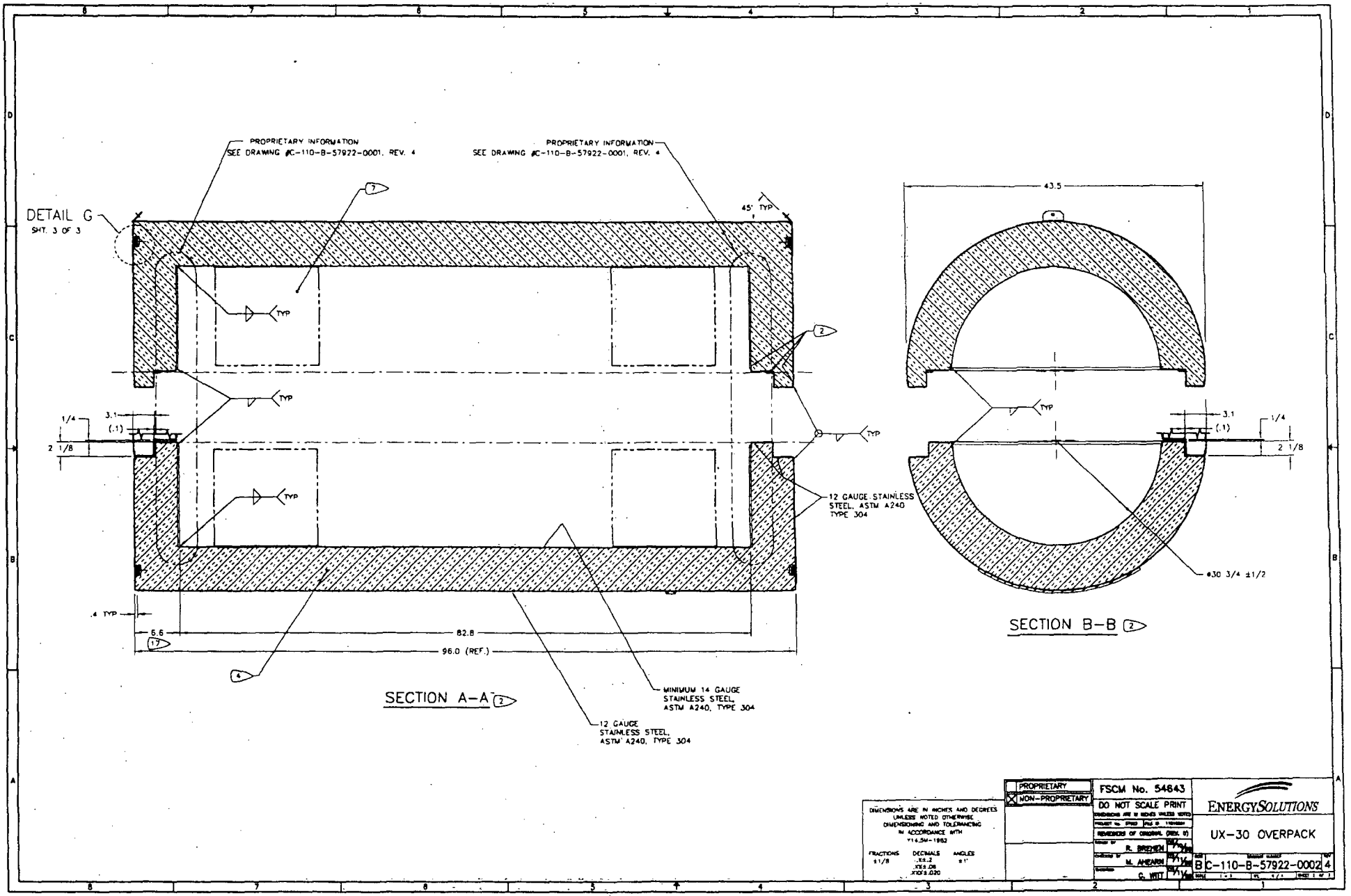
DRAWN BY	R. RINEHEM	7/14/06
ENGINEER	M. AHEARN	7/14/06
MANAGER	C. WITT	7/14/06

ENERGYSOLUTIONS

UX-30 OVERPACK

SIZE B | C-110-B-57922-0002 | REV 4

SCALE 1 = 6 | WT. 9/16 | SHEET 1 OF 3



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		R. BROWN / M. AHEARN / C. WITT
		ENERGYSOLUTIONS
		UX-30 OVERPACK
		DRAWING NUMBER: BC-110-B-57922-0002 REV: 4
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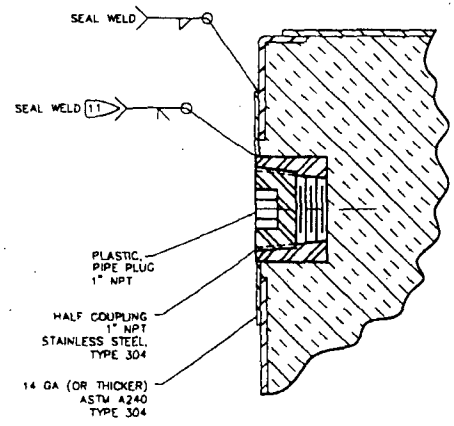
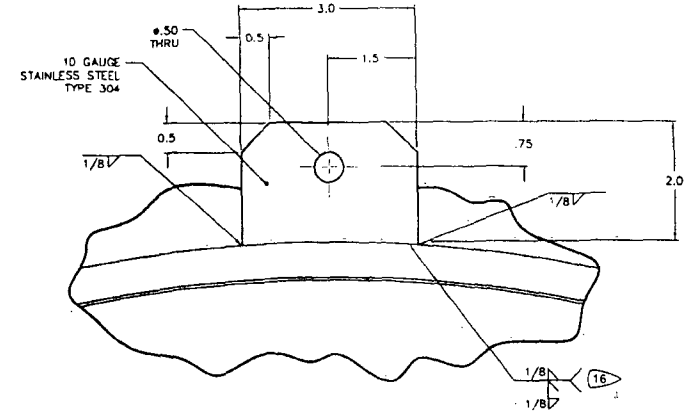


DETAIL G
(TYP. 4 PLCS)



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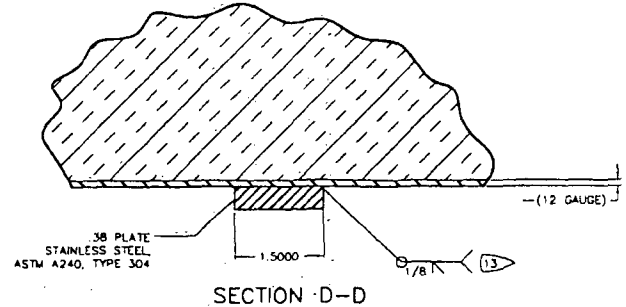

SECTION D-D

DIMENSIONS ARE IN INCHES AND DEGREES
UNLESS NOTED OTHERWISE
DIMENSIONING AND TOLERANCING
IN ACCORDANCE WITH
Y14.5M-1982

FRACTIONS ±1/8 | DECIMALS .X±.2, .XX±.05, .XXX±.020 | ANGLES ±1°

PROPRIETARY
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ENERGYSOLUTIONS

UX-30 OVERPACK

BC-110-B-57922-0002 4

SCALE 1=1 | SHEET 1 OF 1

The UX-30, being constructed from stainless steel and closed-cell polyurethane foam, will be unaffected by the temperature distribution predicted for it under normal conditions. Polyurethane foams enclosed in light gauge steel have been used extensively on Type A and B packages with no reported difficulties due to temperatures in this range.

2.6.2 Cold

A steady-state ambient temperature of -40°F will have no adverse effect on the UX-30. The ductility of the austenitic stainless steel skin is unaffected by temperatures in this range.

The UF_6 cylinder is fabricated from ferritic ASTM A516, Grade 55, steel. Regulatory Guide 7.11, "Fracture Toughness Criteria of Base Material for Ferritic Steel Shipping Cask Containment Vessels with a Maximum Wall Thickness of Four Inches (0.1m)" designates the criteria for classifying payloads for various levels of safety against brittle fracture. Table 5 of Regulatory Guide 7.11 shows that fracture toughness requirements for Category II packages may be met by using steel made to 'Fine Grain Practice' or better in thicknesses up to 0.625". ASTM A516 steels are made to fine grain practice. Therefore, the UF_6 cylinder, which has a 0.5" wall, can be considered safe from brittle fracture failure considerations as a Category II package.

4.0 CONTAINMENT

4.1 Description of Containment System

The UX-30 is designed for use in conjunction with a standard 30-inch UF_6 cylinder such as the models 30B or 30C described in ANSI N14.1, Packaging of Uranium Hexafluoride for Transport. The cylinder provides the containment boundary for the package. See drawings of the cylinders in Figure 1.2-2 and 1.2-3 or ANSI N14.1.

4.1.1 Containment Boundary

Containment Vessel

The design specifications for the UF_6 cylinder are given in ANSI N14.1, and as shown in Figure 1.2-2 for the 30B or 1.2-3 for the 30C, which are taken from ANSI N14.1. These documents list the following design conditions for the cylinders:

Design Pressure:	22 psig external
	200 psig internal
Design Temperature:	-40°F to 250°F

Containment Penetrations

The 30B and 30C cylinders are penetrated in two places: the fill valve on one end and a drain plug on the other end. The performance specifications of these components are the same as for the cylinder.

Note: The 30C cylinder has a Valve Protective Cover (VPC) to provide additional assurance against water intrusion into the cylinder. However, the VPC is not part of the containment boundary for the package.

Seals and Welds

Welds on the containment vessel are as shown in Figure 1.2-2 for the 30B, and in Figure 1.2-3 for the 30C cylinder. Pipe thread seals are indicated around the valve and drain plug threads. Performance specifications for all containment welds and threads are identical to those for the cylinder.

Closure

The fill valve and drain plug are used as closure devices on the cylinder. They shall be installed (as per the requirements of ANSI N14.1-2001) using 200 - 400 ft-lbs. of torque. The valve shall have 7 - 12 threads engaged, and the plug shall have 5 - 8 threads engaged.

4.2 Containment Under Normal Conditions of Transport

4.2.1 Containment of Radioactive Material

Recycled UF_6 (produced from reprocessed spent fuel) contains uranium isotopes, primarily ^{235}U and ^{238}U, which have unlimited A_2 values, with traces of ^{232}U, ^{234}U, and ^{236}U and also includes small amounts of transuranics, principally Np and Pu, and fission products, primarily ^{144}Ce, ^{134}Cs, ^{137}Cs, ^{95}Nb, ^{103}Ru, ^{106}Ru, ^{99}Tc and ^{95}Zr and is often a Type B quantity. Using the methodology of ANSI N14.5-1997, a maximum allowable leak rate for a Type B shipment of recycled UF_6 in a 30B or 30C cylinder can be determined. Irrespective of the actual calculated leak rate, to preclude inleakage of moist air or water (the criticality safety of the package depends on excluding water from the containment system), the cylinder must have a leak rate of less than 1×10^{-7} cm^3/sec. The package evaluation in Section 2 shows that the cylinders are capable of maintaining this condition under normal and hypothetical accident conditions.

4.2.2 Containment Vessel Pressure

Containment for the UX-30 is provided by the 30B or 30C cylinders. A cylinder is filled with liquid UF_6 and cooled allowing the UF_6 to solidify. The internal pressure of a cylinder, under normal conditions of transport is less than 11 psia (see Section 3.4.2).

4.2.3 Containment Criteria

Containment of the radioactive contents depends on proper maintenance, periodic inspections, and pre-shipment inspections of the packaging. For the leakage rate test of cylinders used for recycled UF_6, the cylinder must have a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec prior to first use of each cylinder, after maintenance, repair or

replacement of components of the containment system, and periodically at intervals not to exceed 12 months. Pre-shipment leak tests must show no detectable leakage when performed using a leak test with a sensitivity of at least 1 x 10^{-3} ref-cm^3/sec per ANSI N14.5-1997.

4.3 Containment Under Hypothetical Accident Conditions

4.3.1 Containment of Radioactive Material

Using the methodology of ANSI N14.5-1997, a maximum allowable leak rate for a Type B shipment of UF_6 in a 30B or 30C cylinder can be determined. However, to preclude inleakage of moist air or water (criticality safety of the package depends on excluding water from the containment system), the package must have a measured leak rate less than 1 x 10^{-7} cm^3/sec (see Section 4.2.3).

4.3.2 Containment Vessel Pressure

Containment for the UX-30 is provided by the 30B or 30C cylinders. A cylinder is filled with liquid UF_6 and cooled allowing the UF_6 to solidify. The internal pressure of a cylinder, under hypothetical accident conditions is dependant on the temperature of the UF_6 in the cylinder. The thermal analysis (see Section 3.5.3) shows most of the UF_6 is at 117°F while a portion of the UF_6 can be assumed to be 200°F or less. For the purposes of the leak rate evaluation, the UF_6 temperature will be assumed to be 200°F. The resulting internal pressure is 51 psia [1].

4.4 None

[1] ORNL/ENG/TM-51, "Correlation of the Thermophysical Properties of Uranium Hexafluoride over a Wide Range of Temperature and Pressure", August 1994

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8.1 Acceptance Tests

ACCEPTANCE TESTS FOR THE 30B OR 30C CYLINDER:

- Acceptance Tests For The 30B Cylinder – Designed and Manufactured per ANSI N14.1 (appropriate edition), "Uranium Hexafluoride – Packaging for Transport". Acceptance tests for the 30B cylinder shall be in accordance with ANSI N14.1 (appropriate edition).

- Acceptance Tests For The 30B Cylinder – Designed and Manufactured per ANSI N14.1 – 1995, "Uranium Hexafluoride – Packaging for Transport" and ISO 7195:1993(F), "Packaging of Uranium Hexafluoride (UF_6) for Transport". Acceptance tests for the 30B cylinder shall be in accordance with ANSI N14.1 – 1995 and ISO 7195:1993(F).

- Acceptance Tests For The 30C Cylinder - Designed and manufactured in accordance with Addendum 2-2004 to ANSI N14.1-2001.

- Acceptance Tests For The 30B or 30C Cylinder Used For Reprocessed UF_6 – in addition to the tests listed above, the cylinder must have a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec.

ACCEPTANCE TESTS FOR THE UX-30:

The following acceptance tests are for the UX-30

8.1.1 Visual Inspections and Measurements

8.1.1.1 See Appendix 8.3.1 for acceptance criteria and inspections associated with polyurethane foam manufacturing.

8.1.1.2 Prior to the first use of the package, the following inspection shall be performed:

Dimensional compliance with the drawings referenced in the Certificate of Compliance.

Verify that the packaging is free of cracks, pinholes, or defects that could reduce the effectiveness of the package.

Verify that the packaging is marked in accordance with 10 CFR 71.85 (c).

8.1.2 Weld Examinations

Prior to the first use of the package, a visual inspection of all welds to AWS D1.1 shall be performed.

8.1.3 Structural and Pressure Tests

None.

8.1.4 Leakage Tests

None.

8.1.5 Component and Material Tests

Prior to the first use of the package, an assembly test showing proper operation of closure interface and all ball-lock pins shall be performed.

8.1.5 Shielding tests

None.

8.1.7 Thermal Tests

None.

8.2 Maintenance Program

MAINTENANCE PROGRAM FOR THE 30B OR 30C CYLINDER:

- Maintenance Program For The 30B Cylinders Manufactured per ANSI N14.1 (appropriate edition), "Uranium Hexafluoride – Packaging for Transport".
    - Maintenance of the 30B Cylinders shall be performed in accordance with ANSI N14.1 (appropriate edition).
- Maintenance Program For The 30B Cylinders Manufactured In Accordance With ANSI N14.1–1995, "Uranium Hexafluoride – Packaging for Transport" and ISO 7195:1993(F), "Packaging of Uranium Hexafluoride (UF6) for Transport".
    - Maintenance of the 30B Cylinders shall be performed in accordance with ANSI N14.1 - 1995 and ISO 7195:1993(F).

- Maintenance Program for the 30C Cylinder.

    - Maintenance of the 30C Cylinder shall be performed in accordance with Addendum 2-2004 to ANSI N14.1-2001.

- Maintenance Program for 30B or 30C Cylinders Used For Reprocessed UF_6 –

    - In addition to the maintenance requirements listed above, the cylinder must be tested annually to demonstrate a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec.

MAINTENANCE PROGRAM FOR THE UX-30:

8.2.1 Structural and Pressure Tests

8.2.1.1 Visual inspection of all welds shall be carried out every 6 months.

8.2.1.2 Excessive accumulations of dirt, oil, and other debris shall be removed from the inner and outer surfaces after each use.

8.2.1.3 The dust seal and all rubber pads shall be inspected every 6 months for wear. The dust seal shall be replaced when excessive wear renders the seal ineffective.

8.2.1.4 Inner and outer surfaces shall be inspected for penetrations every 6 months. If any skin failure is observed, these may be repaired using a suitable stainless steel welding procedure. Care should be taken to avoid application of heat for an excessive duration, causing the package to change shape.

8.2.2 Leakage Tests

None.

8.2.3 Component and Material Tests

None.

8.2.4 Thermal Tests

None.

8.2.5 Miscellaneous Tests

8.2.5.1 The following inspections shall be performed to verify acceptability of the foam:

Plastic overpack foam-filling-hole plugs should be removed every 12 months to allow inspection of foam condition for indications of foam deterioration (e.g., presence of solid foam on inside of plug). Verify tight fit of plug after replacement (plug should not turn freely by hand).

Overpacks are to be weighed every 12 months to determine if water has leaked into the overpack. A weight gain of more than 25 pounds per base or lid is reason for rejection (per USEC-651, "Uranium Hexafluoride: A Manual of Good Handling Practices", DOE Field Office, Oak Ridge).

8.2.5.2 In addition to the requirements of Section 7.1.1.3 to check the ball-lock pins before each use, the pins shall also be checked for proper operation annually.

This annual check shall consist of at least:

1. Depressing the push button and verifying the ball locks operate properly and that the push button retracts when it is released.
2. Inserting each pin into a receptacle on the UX-30 and verifying that it properly locks into place
3. Cleaning each pin by wiping it down with a clean cloth and, if necessary, lubricating it with a clean lightweight oil such as WD-40.

Malfunctioning ball-lock pins identified during this annual maintenance shall be immediately removed from service.

8.3 APPENDIX

8.3.1 Polyurethane Foam Specification ES-M-170

(Proprietary)

Appendix 8.3.1

Polyurethane Foam Specification ES-M-170

(Not Included in Public SAR)

Attachment 2
Review copy of revised public SAR pages

1.0 GENERAL INFORMATION

1.1 Introduction

~~Addendum 2-2004 to ANSI N14.1-2001, which specifies the standard 30C cylinder, was issued after the analyses and testing using 30C as described in this SAR was completed. The cylinder on which the analyses and testing was conducted was named, at the time, the "CBC Watertight™" cylinder. Since the CBC Watertight™ cylinder is identical in every respect to the cylinder that became the standard 30C cylinder in Addendum 2-2004 to ANSI N14.1-2001, references in this SAR are to the "30C," instead of to the "CBC Watertight™" cylinder.~~

1.1.1 Purpose of Application

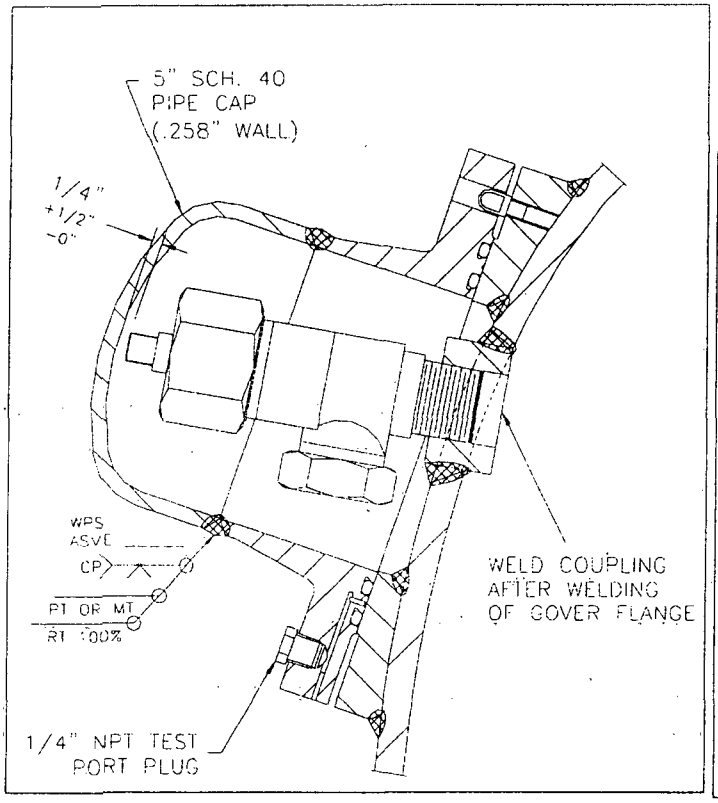
The analyses performed and testing ~~reviewed~~documented in this ~~SAR demonstrates~~Safety Analysis Report demonstrate that the UX-30, along with an ANSI N14.5 compliant 30B or 30C cylinder meets the requirements for use under 10CFR71.17, "General License, NRC Approved Package," as a Type ~~AF~~B(U)F package. The UX-30 packaging has been developed to provide a safe and reliable container for transporting standard 30-inch cylinders of ~~enriched~~ uranium hexafluoride (UF_6~~). UF_6 enriched to 5% is routinely transported from enrichment facilities such as Oak Ridge and Paducah to fuel fabricators and research facilities around the world~~) with a U-235 isotope concentration of not more than 5 weight percent. It should be noted that the UX-30 was previously approved by the US NRC under the provisions of 10CFR71 as a Type AF-96 Package. Throughout the SAR, reference may be made to, or results presented of, previous testing performed on the UX-30 package. This testing was performed to the 10 CFR 71 requirements for a Type AF package. However, since the tests and test acceptance criteria for a Type BF package are the same as for a Type AF package, these tests are applicable and also demonstrate the UX-30 compliance to 10 CFR 71 Type BF requirements, regardless of their designation as Type AF tests.

1.1.2 Summary Information

The ~~packaging~~package consists of two elements: 1) -A standard 30-inch cylinder (or equivalent), and 2) -a UX-30 overpack. The UX-30 ~~has been designed as~~ is a replacement for the DOT 21PF-1B overpack~~ developed over fifteen years ago. Because the existing 21PF-1B overpack is fabricated from light gauge carbon steel and open cell foam, rust and moisture absorption has dictated frequent maintenance and replacement~~. Considerable effort has gone into the design of the UX-30 overpack to eliminate operational and maintenance -problems associated with the older design (e.g. rusting and corrosion, open cell foam moisture absorption, and protection of the valves on 30B cylinders). The UX-30 has been designed to meet the requirements of 10 CFR 71.

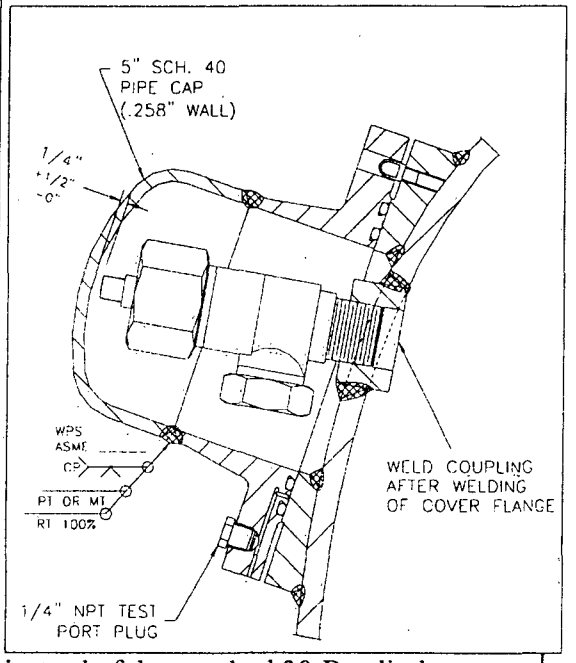
In an effort to simplify the original review and evaluation process, in 1984 a full scale UX-30 prototype with a loaded 30 inch cylinder was subjected to a series of five (5) sequential drop tests, well in excess of impact qualification requirements in 10 CFR 71. Three drops were from 30 feet and two were 40-inch drops onto a 6-inch diameter steel post. Throughout the full series of tests the cylinder was so well protected that it experienced no deformations whatsoever. Subsequent leak tests also demonstrated that the cylinder retained its full integrity.

A second series of tests were performed in 1995 to support the review and evaluation process for upgrade of the UX-30 certification. These tests again demonstrated compliance with 10 CFR 71 requirements. The test sequence performed, which also utilized a full scale UX-30 with a loaded 30-inch cylinder, included five (5) drop tests followed by a fire test and an immersion test. The drop tests included two 30-foot drops and two 40-inch drops onto a 6-inch diameter steel post. The results of this series of tests also demonstrated the excellent protection provided to the 30 inch cylinder by the UX-30 overpack. No deformations of the 30 inch cylinder were caused by the testing; -also, the fire test temperatures for the 30B cylinder surface were well within UF_6 and 30-inch cylinder safe operational limits. ~~The~~An immersion test confirmed that 30-inch cylinder tested did not allow water in leakage. Post-test leak testing demonstrated that the UX-30 provided the necessary protection for the 30B cylinder.



~~Another~~

Finally, a third series of testing was



performed in 2001 on the UX-30 with ~~the~~a 30C Cylinder instead of the standard 30-B cylinder previously used in testing. The 30C Cylinder is identical in dimensions and configuration to the standard 30-B cylinder specified by ANSI N14.1, except it is fitted with a Valve Protective Cover (VPC) that bolts over and protects the cylinder valve during transport.

Valve Protective Cover

(Note that Addendum 2-2004 to ANSI N14.1-2001, which specifies the standard 30C cylinder, was issued after the analyses and testing using a 30C cylinder as described in this Safety Analysis Report was completed. The cylinder on which the analyses and testing was conducted was named, at the time, the "CBC Watertight™" cylinder. Since the CBC Watertight™ cylinder is identical in every respect to the cylinder that became the standard 30C cylinder in Addendum 2-2004 to ANSI N14.1-2001, references in this Safety Analysis Report are to the "30C," instead of to the "CBC Watertight™" cylinder.)

Valve Protective Cover

The purpose of this series of tests was to demonstrate the following:

1. That the 30C is at least equivalent to the standard 30-B cylinder in meeting the transport regulations of 10CFR71. This was demonstrated by successfully completing a series of drop tests of a UX-30 package and a loaded 30C cylinder. Drops onto the corner of package were conducted from 4' and 30', followed by a drop from 40" onto a steel post.
2. That the VPC on the 30C Cylinder assures protection of the cylinder valve during the normal conditions of transport and hypothetical accident conditions of 10CFR71. The drop testing resulted in no damage to the cylinder, and none to the cylinder valve even though the 40" pin drop was conducted with the UX-30 being dropped directly onto its end in the region of the VPC. The inside wall of the UX-30 was deformed sufficiently to strike the VPC, but the VPC was undamaged and protected the cylinder valve. This was evidenced by the VPC successfully passing its post-test acceptance leak test of $1x10^{-5}$ std-cm^3/sec, and by there being no damage to the cylinder valve upon examination after the VPC was removed.
3. That the VPC assures protection against leakage of water into the cylinder during the normal conditions of transport and hypothetical accident conditions of 10CFR71. As discussed above, the VPC protects the cylinder valve from damage and thus becoming a path for leakage of water into the cylinder. In addition, testing was conducted that showed a hole with a diameter that leaks $1x10^{-5}$ std-cm^3/sec, the maximum permitted leak rate of the VPC, excludes water leakage when pressurized with water exceeding the equivalent pressure of 15 meters feet of water specified in 10CFR71.73(c)(5).
4. In addition to the features of the standard 30B cylinder that protect against water in-leakage, the VPC on the 30C Cylinder provides an additional level assurance. Because of this additional assurance demonstrated by the testing, as well as the periodic and pre-shipment leak testing performed on the VPC and cylinder, the 30C Cylinder qualifies for having the "special design features" of 10CFR71.55(c) that ensure against water leakage into the cylinder.

The testing conducted demonstrated that the VPC on the 30C cylinder provides an additional level of protection for the cylinder valve over the standard 30-B cylinder, and protects against leakage of water into the cylinder. This Safety Analysis Report will demonstrate that the additional level of

protection provided by the Valve Protective Cover allows authorization of a criticality safety index of 0.0 (zero) for the 30C cylinder.

The following report will substantiate the ability of the -UX-30 package to meet or exceed all the requirements of 10 CFR 71-.

Authorization is sought for shipment by cargo vessel, motor vehicle, and rail as a Fissile Material package with a criticality safety index of-:

Standard 30B cylinder	5.0
Standard 30C cylinder	0.0

1.2 Package Description

1.2.1 Packaging

The UX-30 is designed to protect a standard ANSI N14.1 30B cylinder (or its equivalent), hereafter referred to as the cylinder. From Figure 1.2-1 it can be seen that the UX-30 is a horizontal right circular cylinder, 96 inches long by 43.5 inches in diameter. A horizontal parting plane allows the top half of the overpack to be removed, providing easy access to the cylinder.

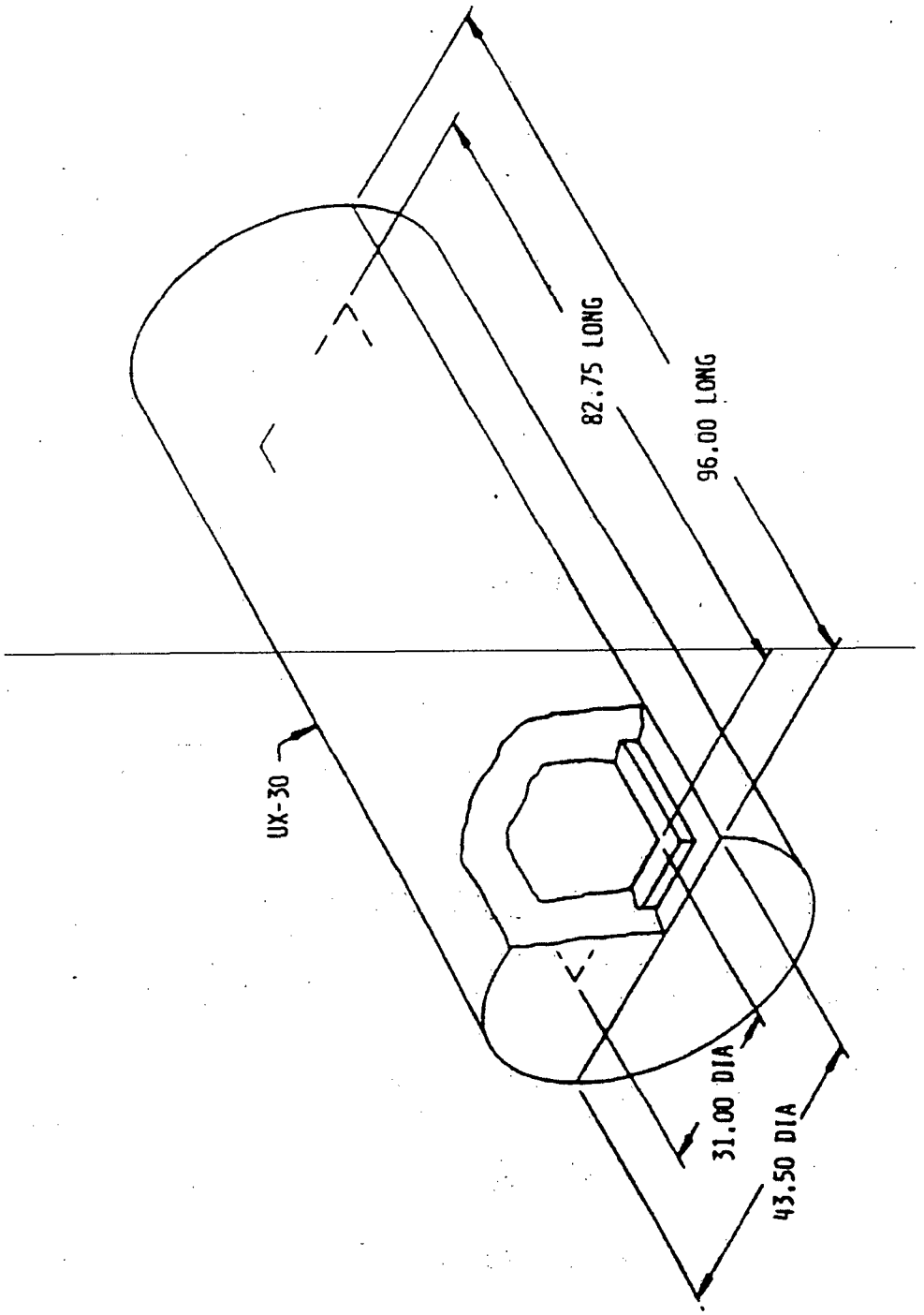
All exposed surfaces of the UX-30 are fabricated from ASTM A240 304 stainless steel. The space between the inner and outer overpack shells is filled with an energy-absorbing and insulating closed-cell polyurethane foam material. ~~This foam was developed by Nuclear Packaging, Inc. several years ago and has been successfully demonstrated for use with several existing licensed packages, the most recent of which include:~~

~~1. T-3 Spent Fuel Container, Certificate of Compliance No. 9132.~~

~~2. N-55, Certificate of Compliance No. 9070.~~

~~3. OH-142, Certificate of Compliance No. 9073.~~

The material, designated by ~~Duratek~~EnergySolutions' Specification No. ES-M-170, is a rigid closed-cell polyurethane foam with well-documented mechanical and thermal capabilities. Six inches of this foam completely encases the UF_6 cylinder (See Appendix 8.3.1 for the polyurethane foam material specification, -ES-M-170).


82.75 LONG
96.00 LONG
UX-30
31.00 DIA
43.50 DIA

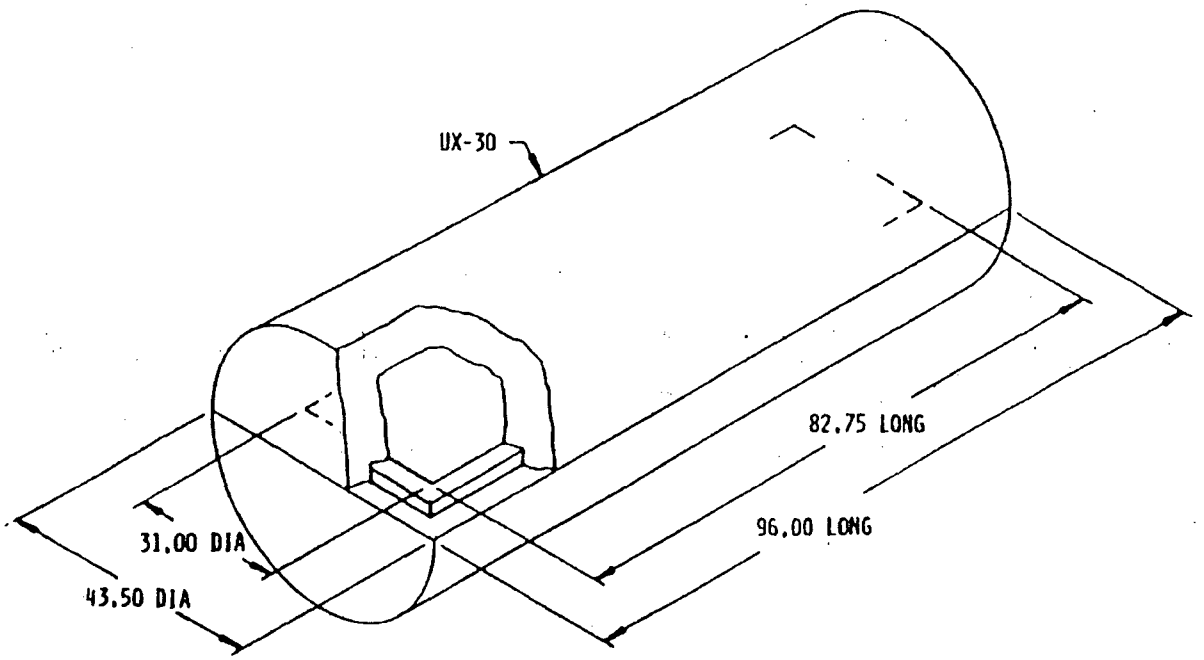


FIGURE 1.2-1
UX-30 Package Dimensions

~~The design of the UX-30 parallels in many ways the highly successful Paducah Tiger. The Paducah Tiger, Certificate of Compliance No. 6553, was developed by Nuclear Packaging, Inc. personnel for transport of the larger 48 inch cylinders of enriched UF_6. Dozens of these packages are in daily service totaling millions of miles of safe and efficient transport. Since they are almost exclusively transported by rail, the general handling environment is severe. Many of the design~~Design features that have ~~made the Paducah Tiger so successful have~~ been employed in the UX-30 design, ~~such as~~include:

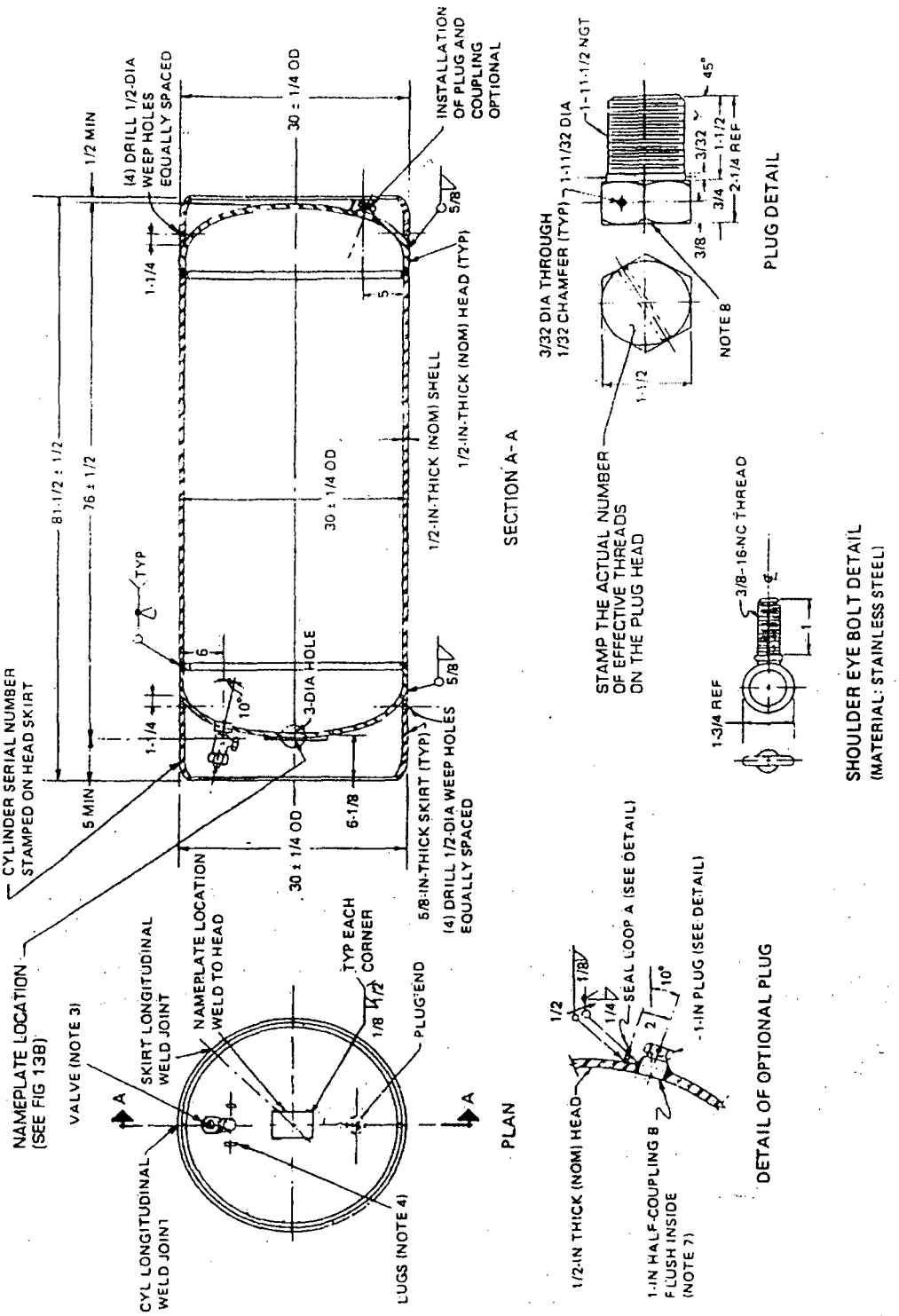
- ~~o~~ Indexing pins with cross-locking 'ball lock' pins assure rapid high strength package assembly.

- ~~o~~ A 'step-down' closure design forces foreign material to travel against -gravity and then through a seal to reach the overpack interior.

- ~~o~~ Nested placement of the lid half of the overpack assures its protection during all handling operations.

The cylinder used in this safety analysis is defined by ANSI N14.1., American National Standard for Packaging of Uranium Hexafluoride for Transport. Any equivalent 30-inch cylinder currently used to transport UF_6 may also be used. See Figure 1.2-2. Typical filling and handling procedures for these cylinders are described in detail in USEC-651, Uranium Hexafluoride: Handling Procedures and Container Criteria. Essentially, liquefied UF_6 is introduced through a valve into the cylinder, filling the cylinder approximately 3/4 full. The UF_6 is allowed to cool, changing phase and volume as it cools, until the UF_6 occupies less than two-thirds of the available volume within the cylinder, and has completely solidified.

This Safety Analysis Report also includes provision for transport of the 30C cylinder in the UX-30. This cylinder is equivalent to the standard 30B cylinder specified in ANSI N14.-1, but also includes a Valve Protective Cover to preclude water intrusion (see Figure 1.2-3).



~~FIGURE 1.2-2~~
~~UF_6 Cylinder ANSI N14.1 30B~~

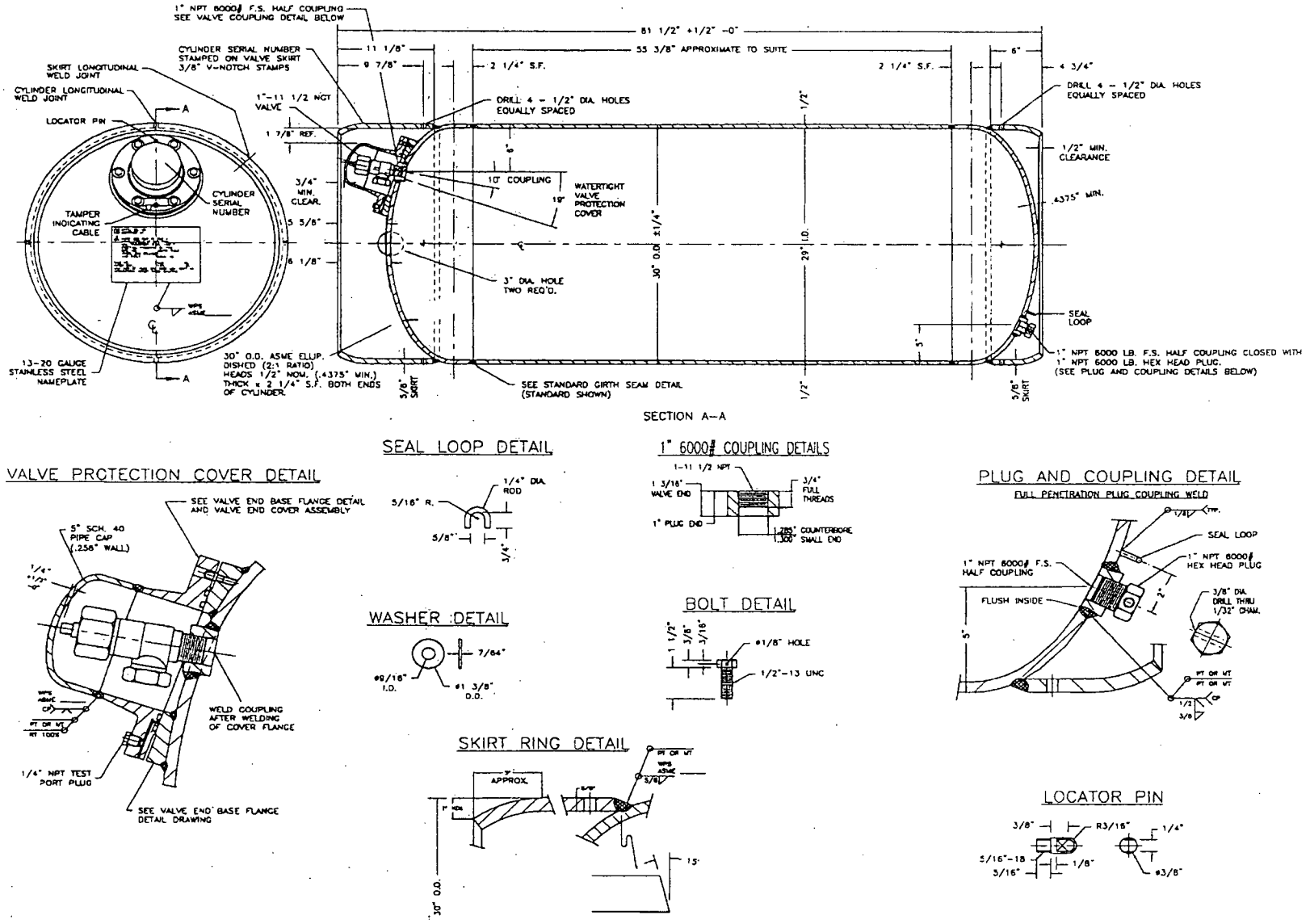


Figure 1.2 – 3
ANSI N14.1 30C Cylinder

1.2.1.1 Gross Weights

The package weights are summarized to account for variance in manufacture.

~~Package~~	~~Weights~~
~~UF_6 max~~	~~5,020 lbs.~~
~~UF_6 Cylinder & UX-30~~	~~3,250 lbs.~~
~~Total max gross weight~~	~~8,270 lbs.~~

PACKAGE	WEIGHTS
UF_6 maximum	5,020 lbs
UF_6 Cylinder & UX-30	3,250 lbs.
Total max gross weight	8,270 lbs.

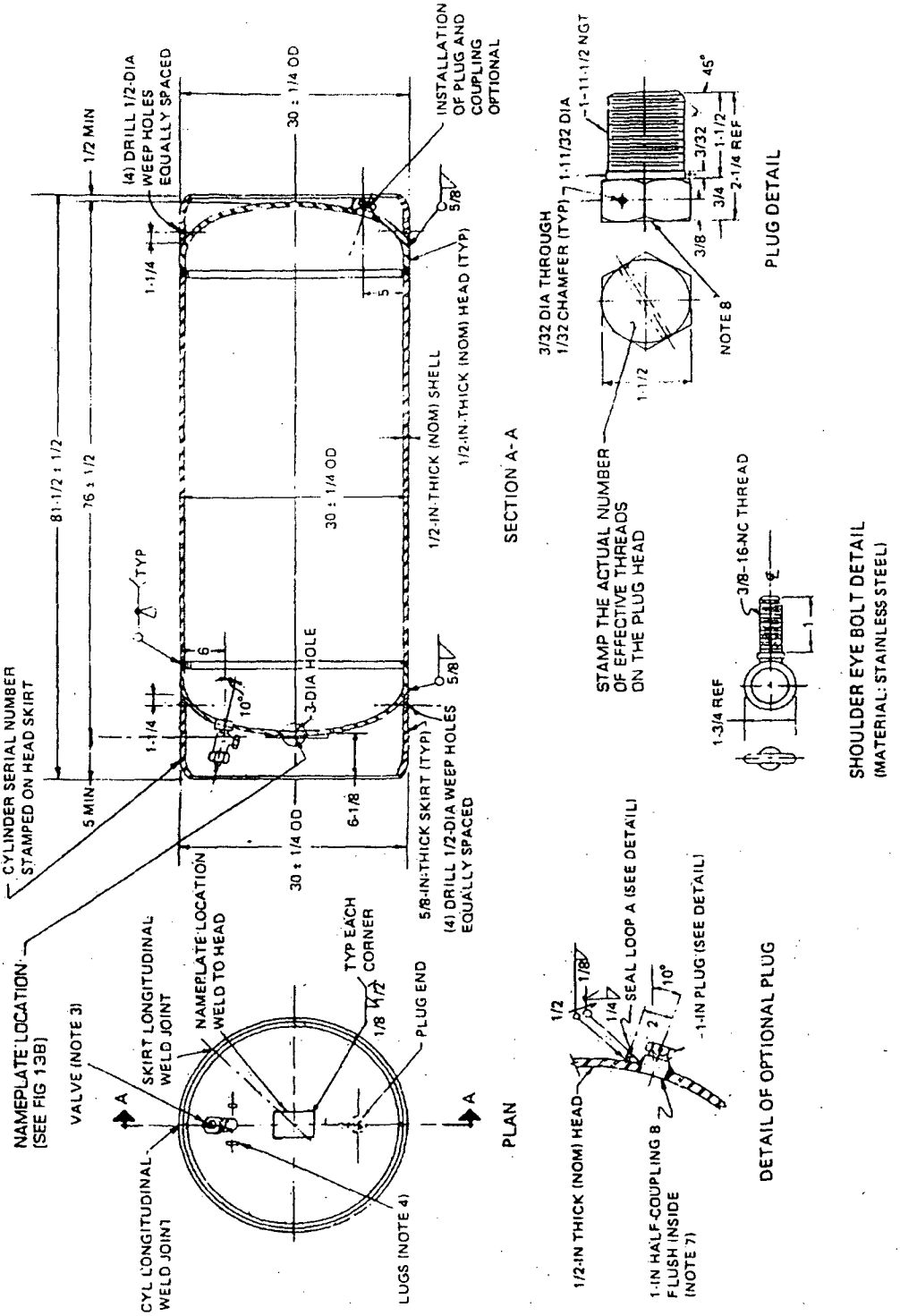


FIGURE 1.2-2
UF_6 Cylinder ANSI NI4.1-30B

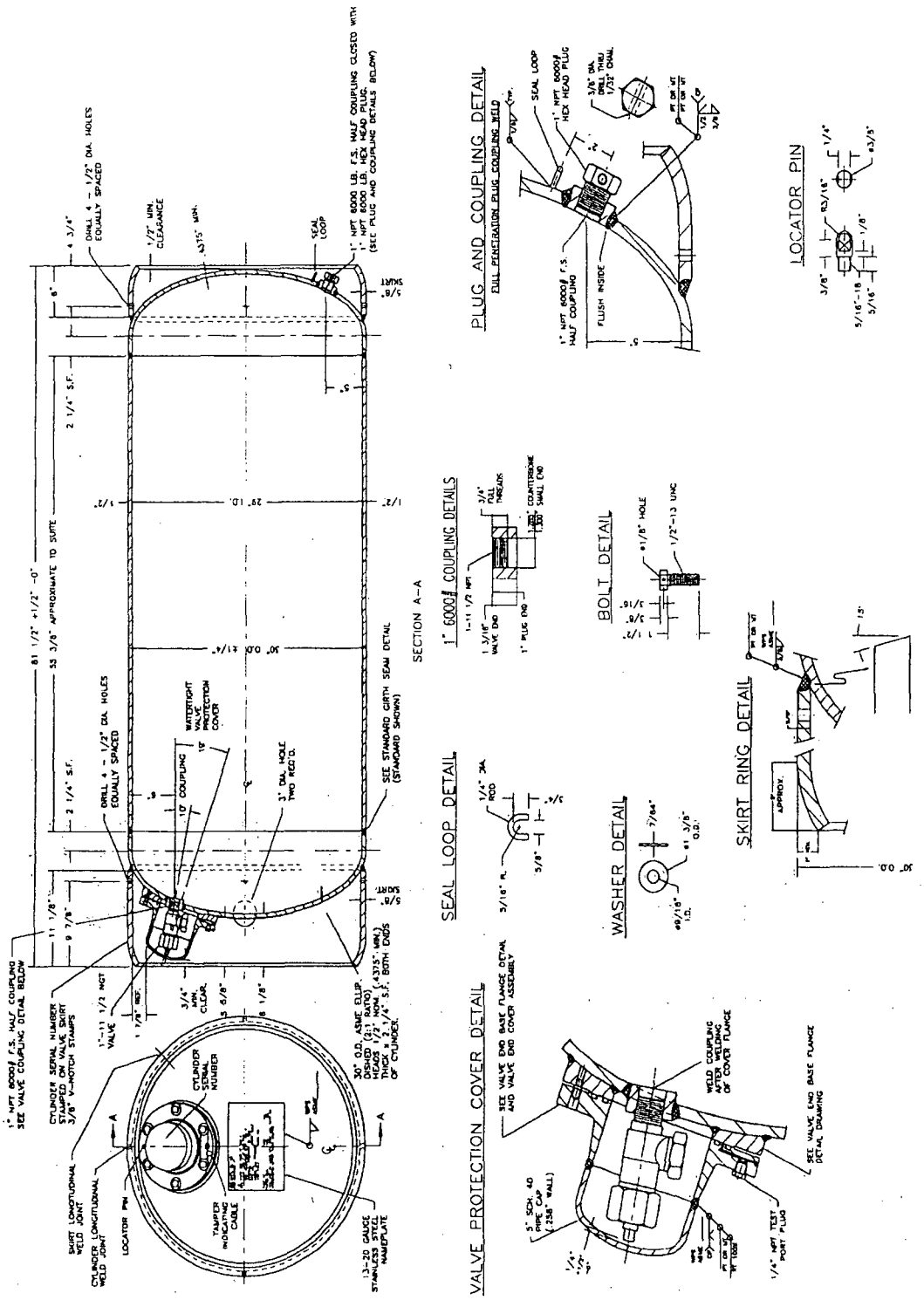


Figure 1.2 – 3
ANSI N14.1 30C Cylinder

1.2.1.2 Materials of Construction

The UX-30 is fabricated from ASTM A240 Type 304, stainless steel, ASTM A36 carbon steel (internal reinforcing), and closed-cell polyurethane foam.

1.2.1.3 Neutron Absorbers and Moderators

There are no neutron absorbers or moderators used in the UX-30 packaging.

1.2.1.4 Receptacles, Valves and Sampling Parts

There are no receptacles, valves, or sampling ports in the -UX-30 overpack. The UF_6 cylinder is equipped with a 1-inch fill valve and a 1-inch plug.

1.2.1.5 Heat Dissipation Systems

The UX-30 overpack is entirely passively cooled. There are no coolants in the package design.

1.2.1.6 Protrusions

There are no inner protrusions on the UX-30 overpack. Light gauge lifting lugs extend from the overpack on each end or on the sides near the closure interface.

1.2.1.7 Shielding

There is no shielding required for the intended payload of the UX-30.

1.2.1.8 Pressure Relief Systems

There are no pressure relief systems in the UX-30.

1.2.2 Containment Boundary

The UX-30 package relies on the 30-inch cylinder to provide containment for the UF_6 payload.

1.2.3 Contents of Packaging

The maximum quantity of material per package and fissile class of the UX-30 with the 30B* cylinder shall be ~~in accordance with the limits of: DOT specification 21PF-1B (49 CFR 173.417, Table 3),~~ as shown ~~in Table 1.2-1.~~below. The maximum quantity of material for the 30C* cylinder is the same as the 30B cylinder. The criticality safety index for the 30C cylinder is derived in Chapter 6.

~~Table 1.2-1~~
~~UX-30 Material Quantities~~

~~Inner Cylinder Designation~~	~~Maximum Weight of UF_6 Contents~~	~~Maximum Enrichment (W%)~~	~~Criticality Safety Index~~
~~30B*~~	~~5,020~~	~~5.0~~	~~5.0~~
~~30C*~~	~~5,020~~	~~5.0~~	~~0.0~~

* Designations per ANSI N14.1~~, ANSI N14.1~~ – 2000, "American National Standard for Nuclear Material – Uranium Hexafluoride – Packaging for Transport

Contents

(1) Type and form of the material

Commercial Natural UF_6, Enriched Commercial Grade UF_6, Depleted UF_6, Derived Enriched UF_6 or Reprocessed UF_6 in Standard ANSI N14.1 30B or 30C cylinders

(2) Maximum quantity of material per package

(i) Up to 5,020 pounds of UF_6 with a U-235 isotope concentration of not more than 5 weight percent

(ii) For Reprocessed UF_6: Fission Product Gamma Activity shall not exceed 4.4E+05 MeVBq/kgU (4.4E+05 MeV/sec kgU) and the transuranic Alpha Activity shall be less than 3.3E+03 Bq/kgU (2.0E+05 dpm/kgU)

(iii) The maximum H/U atomic ratio for the UF_6 is 0.088.

Criticality Safety Index (CSI)

Criticality safety index for the UX-30 Overpack containing a standard ANSI N14.1 30B cylinder	5.0
Criticality safety index for the UX-30 Overpack containing a standard ANSI N14.1 30C cylinder	0.0

1.2.4 Operational Features

The UX-30 is designed to replace the 21PF-1B standard DOT overpack and would be operated in much the same way. Positive closure on the UX-30 however is provided by 10 ball-lock pins, providing for quicker and easier loading and unloading operations. The closed-cell polyurethane foam combined with sealed stainless steel inner and outer shells on the -UX-30 prevents much of the maintenance currently required for the 21PF-1, since water cannot penetrate either feature.

1.3 General Requirements for All Packages

Minimum Packaging Size

The UX-30 packaging overall dimensions are all much larger than the minimum 10 cm specified in CFR 71.43(a). The minimum size is 43.5 inches.

Tamperproof Feature

The UX-30 package is installed with a tamper-indicating seal to discourage any unauthorized opening. A tamper-indicating seal is also installed on the cylinder valve of the standard 30B cylinder, and on the VPC for the 30C Cylinder.

Positive Closure

Positive closure is effected by 10 ball-lock pins through the guide pins. Inadvertent opening is prevented by the design of the ball-lock pins, which require that the release button be pushed while the pin is pulled. A tamper-indicating seal is installed to indicate any unauthorized opening.

1.4 Appendix

1.4.1 UX-30 General Arrangement Drawing

The UX-30, being constructed from stainless steel and closed-cell polyurethane foam, will be unaffected by the temperature distribution predicted for it under normal conditions. Polyurethane foams enclosed in light gauge steel have been used extensively on Type A and B packages with no reported difficulties due to temperatures in this range.

2.6.2 Cold

A steady-state ambient temperature of -40°F will have no adverse effect on the UX-30. The ductility of the austenitic stainless steel skin is unaffected by temperatures in this range.

The UF_6 cylinder is fabricated from ferritic ASTM A516, Grade 55, steel. ~~The draft~~ Regulatory Guide 7.11, ~~"Fracture~~ "Fracture Toughness Criteria of Base Material for Ferritic Steel Shipping Cask Containment Vessels with a Maximum Wall Thickness of Four Inches (0.1m)" ~~invokes the use of NUREG/CR-1815 for evaluating resistance to brittle fracture at low temperatures, and~~ designates the criteria for classifying payloads for various levels of safety against brittle fracture. Table ~~1~~ 5 of ~~that document~~ Regulatory Guide 7.11~~, reproduced below as Table 2.6-1 indicates that the payload of a Category II package is less than 3000A_2, 3000A_1 or 30,000 curies. Since there is less than one curie of uranium in the designated payload, and 10CFR71 does not limit quantities of uranium enriched to less than 20% by either A_1 or A_2 values, the UX-30 is considered a Category III package.~~ shows that

~~TABLE 2.6-1~~

~~Categories and Associated Radioactivity~~

~~Limits for Shipping Containers~~

~~CATEGORY I~~	~~CATEGORY II~~	~~CATEGORY III~~
~~Applies if quantity per package is:~~	~~Applies if quantity per package is:~~	~~Applies if quantity per package is:~~
~~greater than or equal to $3(10)^4$, $3(10)^3A_2$, or $3(10)^3A_1$ ci.~~	~~less than $3(10)^4$ and $3(10)^3A_2$ or $3(10)^3A_1$ ci, but greater than or equal to $30A_2$ or $30A_1$ ci.~~	~~less than $30A_2$ and $30A_1$ ci.~~
		~~Also applies if contents are:~~
		~~(1) low specific activity materials, or, (2) objects with fixed contamination (not readily dispersible) and the total quantity per package is less than $3(10)^4$ ci, $3(10)^3A_2$ ci, and $3(10)^3A_1$ ci.~~

~~Fracture~~ fracture toughness requirements for Category ~~III~~ II packages may be met~~, according to NUREG/CR-1815,~~ by using steel made to 'Fine Grain Practice' or better in thicknesses up to 0.625". ASTM A516 steels are made to fine grain practice. Therefore, the UF_6 cylinder, which has a 0.5" wall, can be considered safe from brittle fracture failure considerations as a Category II package.

4.0 CONTAINMENT

4.1 Description of Containment System

The UX-30 is designed for use in conjunction with a standard 30-inch UF_6 cylinder such as the models 30B or 30C described in ANSI N14.1, Packaging of Uranium Hexafluoride for Transport. The cylinder provides the containment boundary for the package. See drawings of the cylinders in Figure ~~4.1~~1.2-~~2~~1 and ~~4.1~~1.2-~~3~~2 or ANSI N14.1.

4.1.1 Containment Boundary

Containment Vessel

The design specifications for the UF_6 cylinder are given in ANSI N14.1, and as shown in Figure ~~4.1-1~~1.2-2 for the 30B or ~~4.1-2~~1.2-3 for the 30C, which are taken from ANSI N14.1. These documents list the following design conditions for the cylinders:

Design Pressure:	22 psig external
	200 psig internal
Design Temperature:	-40°F to 250°F

Containment Penetrations

The 30B and 30C cylinders are penetrated in two places: the fill valve on one end and a drain plug on the other end. The performance specifications of these components are the same as for the cylinder.

Note: The 30C cylinder has a Valve Protective Cover (VPC) to provide additional assurance against water intrusion into the cylinder. However, the VPC is not part of the containment boundary for the package.

Seals and Welds

Welds on the containment vessel are as shown in Figure ~~4.1~~1.2~~-1~~-2 for the 30B, and in Figure ~~4.1~~1.2~~-2~~-3 for the 30C cylinder. Pipe thread seals are indicated around the valve and drain plug threads. Performance specifications for all containment welds and threads are identical to those for the cylinder.

Closure

The fill valve and drain plug are used as closure devices on the cylinder. They shall be installed (as per the requirements of ANSI N14.1-2001) using 200 - 400 ft-lbs. of torque. The valve shall have 7 - 12 threads engaged, and the plug shall have 5 - 8 threads engaged.

~~4.1.2 Special Requirements for Plutonium~~

~~Not Applicable.~~

~~4.2 General Considerations~~

~~4.2.1 Type A Fissile Packages~~

4.2 Containment Under Normal Conditions of Transport

4.2.1 Containment of Radioactive Material

Recycled UF_6 (produced from reprocessed spent fuel) contains uranium isotopes, primarily ^{235}U and ^{238}U, which have unlimited A_2 values, with traces of ^{232}U, ^{234}U, and ^{236}U and also includes small amounts of transuranics, principally Np and Pu, and fission products, primarily ^{144}Ce, ^{134}Cs, ^{137}Cs, ^{95}Nb, ^{103}Ru, ^{106}Ru, ^{99}Tc and ^{95}Zr and is often a Type B quantity. Using the methodology of ANSI N14.5-1997, a maximum allowable leak rate for a Type B shipment of recycled UF_6 in a 30B or 30C cylinder can be determined. Irrespective of the actual calculated leak rate, to preclude inleakage of moist air or water (the criticality safety of the package depends on excluding water from the containment system), the cylinder must have a leak rate of less than 1×10^{-7} cm^3/sec. The package evaluation in Section 2 shows that the cylinders are capable of maintaining this condition under normal and hypothetical accident conditions.

4.2.2 Containment Vessel Pressure

Containment for the UX-30 is provided by the 30B or 30C cylinders. ~~Fabrication, examination, and testing requirements for these cylinders are established by the standard by which they are~~

~~designed and fabricated, ANSI N14.1, "American National Standard for Nuclear Material – Uranium Hexafluoride – Packaging for Transport." Periodic and pre-shipment leak rate testing requirements of the cylinders are also set by ANSI N14.1~~A cylinder is filled with liquid UF_6 and cooled allowing the UF_6 to solidify. The internal pressure of a cylinder, under normal conditions of transport is less than 11 psia (see Section 3.4.2).

~~4.2.2 Type B Packages~~

~~Not Applicable.~~

~~4.2.3 Combustible Gas Generation~~

~~There are no materials used in the cavity of the cylinders that can generate combustible gases.~~

4.2.3 Containment Criteria

Containment of the radioactive contents depends on proper maintenance, periodic inspections, and pre-shipment inspections of the packaging. For the leakage rate test of cylinders used for recycled UF_6, the cylinder must have a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec prior to first use of each cylinder, after maintenance, repair or replacement of components of the containment system, and periodically at intervals not to exceed 12 months. Pre-shipment leak tests must show no detectable leakage when performed using a leak test with a sensitivity of at least 1×10^{-3} ref-cm^3/sec per ANSI N14.5-1997.

~~FIGURE 4.1-1~~

~~Standard UF_6 Cylinder ANSI N14.1-30B~~

Figure 4.1 - 2
ANSI N14.1 30C Cylinder

4.3 Containment Under ~~Normal Conditions of Transport~~

~~4.3.1 Containment Design Criterion~~

~~Containment criterion for the 30B and 30C cylinders are established by the requirements of ANSI N14.1.~~

~~4.3.2 Demonstration of Compliance with Containment Design Criterion~~

~~Sections 2.6 and 3.4 demonstrate that the containment vessel is unaffected by Normal Conditions of Transport. There will therefore be no direct release of radioactive material from the cylinder.~~

~~4.4 Containment Under~~ Hypothetical Accident Conditions

4.4.~~3~~.1 Containment ~~Design Criterion~~of Radioactive Material

~~Containment criteria for the Type 30B and 30C cylinders are the requirements of ANSI N14.1~~Using the methodology of ANSI N14.5-1997, a maximum allowable leak rate for a Type B shipment of UF_6 in a 30B or 30C cylinder can be determined. However, to preclude inleakage of moist air or water (criticality safety of the package depends on excluding water from the containment system), the package must have a measured leak rate less than 1×10^{-7} cm^3/sec (see Section 4.2.3).

4.4.~~3~~.2 ~~Demonstration of Compliance with~~ Containment ~~Design Criterion~~Vessel Pressure

~~Sections 2.7 and 3.5, and Appendices 2.10.4 and 3.6.3, indicate that the containment vessel is unaffected by the hypothetical accident conditions required by 10 CFR 71. Therefore, there will be no release of radioactive materials from these events~~Containment for the UX-30 is provided by the 30B or 30C cylinders. A cylinder is filled with liquid UF_6 and cooled allowing the UF_6 to solidify. The internal pressure of a cylinder, under hypothetical accident conditions is dependant on the temperature of the UF_6 in the cylinder. The thermal analysis (see Section 3.5.3) shows most of the UF_6 is at 117°F while a portion of the UF_6 can be assumed to be 200°F or less. For the purposes of the leak rate evaluation, the UF_6 temperature will be assumed to be 200°F. The resulting internal pressure is 51 psia [1].

[1] ORNL/ENG/TM-51, "Correlation of the Thermophysical Properties of Uranium Hexafluoride over a Wide Range of Temperature and Pressure", August 1994

~~4.5 Leakage Rate Tests for Type B Packages~~

~~Not Applicable~~

~~4.4Appendix~~

4.4 None

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

8.1 Acceptance Tests

ACCEPTANCE TESTS FOR THE 30B OR 30C CYLINDER:

- Acceptance Tests For The 30B Cylinder – Designed and Manufactured per ANSI N14.1 (appropriate edition), "Uranium Hexafluoride – Packaging for Transport". Acceptance tests for the 30B cylinder shall be in accordance with ANSI N14.1 (appropriate edition).

- Acceptance Tests For The 30B Cylinder – Designed and Manufactured per ANSI N14.1 – 1995, "Uranium Hexafluoride – Packaging for Transport" and ISO 7195:1993(F), "Packaging of Uranium Hexafluoride (UF_6) for Transport". Acceptance tests for the 30B cylinder shall be in accordance with ANSI N14.1 – 1995 and ISO 7195:1993(F).

- Acceptance Tests For The 30C Cylinder - Designed and manufactured in accordance with Addendum 2-2004 to ANSI N14.1-2001.

- Acceptance Tests For The 30B or 30C Cylinder Used For Reprocessed UF_6 – in addition to the tests listed above, the cylinder must have a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec.

ACCEPTANCE TESTS FOR THE UX-30:

The following acceptance tests are for the UX-30

8.1.1 Visual Inspections and Measurements

8.1.1.1 See Appendix 8.3.1 for acceptance criteria and inspections associated with polyurethane foam manufacturing.

8.1.1.2 Prior to the first use of the package, the following inspection shall be performed:

Dimensional compliance with the drawings referenced in the Certificate of Compliance.

Verify that the packaging is free of cracks, pinholes, or defects that could reduce the effectiveness of the package.

Verify that the packaging is marked in accordance with 10 CFR 71.85 (c).

8.1.2 Weld Examinations

Prior to the first use of the package, a visual inspection of all welds to AWS D1.1 shall be performed.

8.1.3 Structural and Pressure Tests

None.

8.1.4 Leakage Tests

None.

8.1.5 Component and Material Tests

Prior to the first use of the package, an assembly test showing proper operation of closure interface and all ball-lock pins shall be performed.

8.1.5 Shielding tests

None.

8.1.7 Thermal Tests

None.

8.2 Maintenance Program

MAINTENANCE PROGRAM FOR THE 30B OR 30C CYLINDER:

- Maintenance Program For The 30B Cylinders Manufactured per ANSI N14.1 (appropriate edition), "Uranium Hexafluoride – Packaging for Transport".

  ♦ Maintenance of the 30B Cylinders shall be performed in accordance with ANSI NI4.1 (appropriate edition).

- Maintenance Program For The 30B Cylinders Manufactured In Accordance With ANSI N14.1–1995, "Uranium Hexafluoride – Packaging for Transport" and ISO 7195:1993(F), "Packaging of Uranium Hexafluoride (UF6) for Transport".

  ♦ Maintenance of the 30B Cylinders shall be performed in accordance with ANSI NI4.1 - 1995 and ISO 7195:1993(F).

- Maintenance Program for the 30C Cylinder.

  - Maintenance of the 30C Cylinder shall be performed in accordance with Addendum 2-2004 to ANSI N14.1-2001.

- Maintenance Program for 30B or 30C Cylinders Used For Reprocessed UF_6 –

  - In addition to the maintenance requirements listed above, the cylinder must be tested annually to demonstrate a measured leak rate less than 1×10^{-7} cm^3/sec. The leakage rate tests are performed per ANSI N14.5-1997 using a leak test with a test sensitivity of at least 5×10^{-8} ref-cm^3/sec.

MAINTENANCE PROGRAM FOR THE UX-30:

8.2.1 Structural and Pressure Tests

8.2.1.1 Visual inspection of all welds shall be carried out every 6 months.

8.2.1.2 Excessive accumulations of dirt, oil, and other debris shall be removed from the inner and outer surfaces after each use.

8.2.1.3 The dust seal and all rubber pads shall be inspected every 6 months for wear. The dust seal shall be replaced when excessive wear renders the seal ineffective.

8.2.1.4 Inner and outer surfaces shall be inspected for penetrations every 6 months. If any skin failure is observed, these may be repaired using a suitable stainless steel welding procedure. Care should be taken to avoid application of heat for an excessive duration, causing the package to change shape.

8.2.2 Leakage Tests

None.

8.2.3 Component and Material Tests

None.

8.2.4 Thermal Tests

None.

8.2.5 Miscellaneous Tests

8.2.5.1 The following inspections shall be performed to verify acceptability of the foam:

Plastic overpack foam-filling-hole plugs should be removed every 12 months to allow inspection of foam condition for indications of foam deterioration (e.g., presence of solid foam on inside of plug). Verify tight fit of plug after replacement (plug should not turn freely by hand).

Overpacks are to be weighed every 12 months to determine if water has leaked into the overpack. A weight gain of more than 25 pounds per base or lid is reason for rejection (per USEC-651, "Uranium Hexafluoride: A Manual of Good Handling Practices", DOE Field Office, Oak Ridge).

8.2.5.2 In addition to the requirements of Section 7.1.1.3 to check the ball-lock pins before each use, the pins shall also be checked for proper operation annually.

This annual check shall consist of at least:

1. Depressing the push button and verifying the ball locks operate properly and that the push button retracts when it is released.
2. Inserting each pin into a receptacle on the UX-30 and verifying that it properly locks into place
3. Cleaning each pin by wiping it down with a clean cloth and, if necessary, lubricating it with a clean lightweight oil such as WD-40.

Malfunctioning ball-lock pins identified during this annual maintenance shall be immediately removed from service.

8.3 APPENDIX

8.3.1 Polyurethane Foam Specification ES-M-170

(Proprietary)

Appendix 8.3.1

Polyurethane Foam Specification ES-M-170

(Not Included in Public SAR)

Attachment 5
Suggested changes to the CoC

Suggested Changes to the Certificate of Compliance #9196

5(a)(2) Description

Overpack for 30-inch ~~enriched~~ uranium hexafluoride (UF_6) cylinders...

5(b) Contents

(1) Type and form of material
Commercial Natural UF_6, Enriched Commercial Grade UF_6, Depleted UF_6, Derived Enriched UF_6 or Reprocessed UF_6 in Standard ANSI N14.1 30B or 30C cylinders

(2) Maximum quantity per package
5,020 pounds of UF_6 with a U-235 isotope concentration of not more than 5 weight percent. The maximum H/U atomic ratio for the UF_6 is 0.088. For Reprocessed UF_6, the Fission Product Gamma Activity shall not exceed 4.4E+05 MeVBq/kgU (4.4E+05 MeV/sec kgU) and the transuranic Alpha Activity shall be less than 3.3E+03 Bq/kgU (2.0E+05 dpm/kgU)

12. Packagings may be marked with Package Identification Number USA9196/AF-96 until [two years after date of approval of the certificate] and must be marked with Package Identification Number USA9196/B(U)F-96 after [two years plus one day after the date of the approval of certificate]. Any Package transporting recycled UF_6 must be marked with Package Identification Number USA9196/B(U)F-96.

14. Revision 22 of the CoC may be used until [one year after the date of the approval of the certificate].

Attachment 6
Proprietary Information Affidavit

ENERGYSOLUTIONS

AFFIDAVIT
SUBMITTED BY ENERGYSOLUTIONS
CONCERNING CONFIDENTIAL INFORMATION AND TRADE SECRETS

STATE OF SOUTH CAROLINA]
] *ss.*
COUNTY OF LEXINGTON]

I, Patrick L. Paquin, depose and say that I am duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified below as proprietary. The following documents, which is included with our submittal letter E&L-034-07, Transfer of and Amendment to US Nuclear Regulatory Commission Certificate of Compliance No. 9196 For the Model No. UX-30 Package contains proprietary information that should be withheld from public disclosure:

Attachment 3: Revised non-public SAR pages
Attachment 4: Review copy of revised non-public SAR pages

I have personal knowledge of the criteria and procedures utilized by Energy*Solutions* in designating information as a trade secret or as confidential information of a commercial or financial nature. The information in ths Safety Analysis Report contains unique information related to design and fabrication techniques and on the nature of the foam material used as part of the structure of the package. Detailed information including certain certification data has always been held in confidence by Energy Solutions. The packaging design and processes used in manufacturing certain components are considered confidential information that includes Company trade secrets incorporated into such design processes, and the data contained in the proprietary information submitted to the Commission contains the type of information Energy*Solutions* regards as protected and of the type not to be disclosed to unauthorized persons.

The information designated here as proprietary is not available from public sources. Public disclosure of this information would cause substantial harm to the competitive position of Energy*Solutions*. The Company has made substantial investments in salaries and capital equipment and has committed to refine and improve Energy*Solutions*'s radioactive waste management system. Competitors of Energy*Solutions* would have great difficulty in duplicating the methods developed by Energy*Solutions*, due not only to the financial investment of Energy*Solutions*, but also to the unique skills, talents, and expertise of Energy*Solutions* employees who have developed these concepts. Disclosure of this information could cause Energy*Solutions* to lose the financial opportunity and business associated with this and other projects similar in nature.

Patrick L. Paquin
General Manager, Engineering & Licensing

STATE OF SOUTH CAROLINA]
] *ss.*
COUNTY OF LEXINGTON]

On this 22th day of October 2007, before me, a Notary Public in and for the State of South Carolina, duly commissioned and sworn, personally appeared Patrick Paquin, General Manager, Engineering & Licensing for Energy*Solutions*, and on oath stated that he was authorized to make this affidavit on behalf of the corporation.

IN WITNESS WHEREOF, I have set my hand and affixed my official seal the day and year first above written.

Notary Public, State of South Carolina
My Commission Expires July 31, 2009

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