

71-5086



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October 16, 2009
09-110

E. William Brach
Director, Spent Fuel Project Office
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

- References:
- (1) Docket No. 71-5086 , TAC L32657, TAC L24272, TAC L24309
 - (2) Letter dated March 13, 2009, NRC (Saverot) to B&W NOG (Cole), Request for Additional Information for the Review of the Model No. UNC-2600 Package (TAC L24309)
 - (3) Letter dated July 27, 2009, B&W NOG (Cole) to NRC (Brach) Status of Model No. UNC-2600 Shipping Package
 - (4) Closed Meeting dated August 5, 2009 regarding the Model No. UNC-2600 Package

Subject: Response to Request for Additional Information Regarding the Model No. UNC-2600 Package

Dear Mr. Brach:

By letter dated March 13, 2009, the Nuclear Regulatory Commission requested additional information in regards to the request to transfer Certificate of Compliance No. 5086 from BWX Technologies, Inc. (BWXT) to Babcock & Wilcox Nuclear Operations Group, Inc. (B&W NOG), as well as the request to renew the license application (Reference 2). After a closed meeting with your staff on August 5, 2009 (Reference 4), B&W NOG is submitting its response to the Reference 2 letter and the revised renewal application for the Certificate of Compliance.

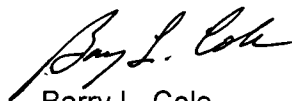
B&W NOG's letter to the NRC dated July 27, 2009 (Reference 3) confirmed that this container has not been used since April 2003 and will remain in "Out of Service" status until agreed upon by the NRC. Please note that B&W NOG's customer has requested a shipment utilizing this container by mid-December.

The answers to the RAI questions are provided as Enclosure 1. Enclosure 2 consists of the revised SARP in its entirety.

If you have any questions in this regard, please feel free to contact me at (434) 522-5665.

NM5501

Sincerely,

A handwritten signature in black ink, appearing to read "Barry L. Cole". The signature is fluid and cursive, with the first name "Barry" and last name "Cole" clearly distinguishable.

Barry L. Cole
Manager, Licensing & Safety Analysis

Enclosures

cc: NRC, Region II
NRC, Resident Inspector
NRC, Merritt Baker
NRC, Pierre Saverot

ENCLOSURE 1

B&W NOG Response to NRC Request For Additional Information (Reference 2)

Each RAI question is restated in full and followed by B&W NOG's reply.

Chapter 1 - General Information

1. Revise the SAR to clearly identify the constituent nuclides, the weight limits of the contents, and the weight limits of the package.

The application must include a description of the contents in "sufficient detail" to provide an adequate basis for evaluation of the packaging design. The information on the exact composition of the contents is not provided and staff needs to ensure that the contents of the package does not exceed one A_2 quantity because the package does not satisfy the requirement of 10 CFR 71.73. The restriction on the A_2 quantity will ensure that the radioactive materials, if released, will not impose significant radiation risks to the public and the environment.

On page 1 of the SAR, the applicant provides weight limits for the contents as well as the package. However, it is not clear if these weight limits still are applicable to the new payload restrictions.

Revise the SAR to reflect these changes if necessary. Otherwise, provide calculation for how the maximum weight of content is determined given the restrictions on the quantity (375 grams) of ^{235}U with consideration of the requested fuel enrichment.

This information is needed pursuant to the requirements of 10 CFR 71.33 and 10 CFR 71.35.

B&W NOG's Response: The SARP was revised to limit ^{235}U loading. This limitation will represent the $<A_2$ value.

Chapter 2 - Structural Evaluation

- 2.1 Revise the SAR to provide the locations of the centers of gravity for this package.

The application indicates that the "center of gravity is essentially the center of the package in both the loaded and empty conditions." This information needs to be more explicit. The weights of the individual parts of the package should also be included.

This information is needed pursuant to the requirements of 10 CFR 71.33.

- 2.2 Provide clarification on the packaging drawings and codes and standards applicable to the package.

The package is subject to codes and standards such as the American Society for Testing and Materials (ASTM) and the American Welding Society (AWS) standards.

For example, the verification that "all welds are visually acceptable" (for packages procured before 10.9.1992), as stated in Drawing No. B-2600-2, Rev. 3, sheet 4 of 6, should include the AWS procedure for weld inspection, e.g. "as a minimum, all welds are visually examined per AWS 1.6 (1999)." Also, ASTM designations for materials shall be noted.

This information is needed pursuant to the requirements of 10 CFR 71.31 (c) and 10 CFR 71.33 (a)(5).

2.3 Remove all references to any new fabrication of the package.

The SAR mentions the possibility of new construction of packages. Drawing No. B-2600-2, Rev. 3, sheet 4 of 6, also states that "welds for new construction are per AWS D-1.3." Drawing No. B-2600-2, Rev. 3, sheet 5 of 6, also states the following: "verify weld inspections for new packages." Section 7.1 mentions that "each new container must first be inspected by Quality Control."

The UNC-2600 package is a previously approved package without a "-85" or a "96" in the identification number of the Certificate of Compliance. As such, fabrication of new packages will not be authorized. A new Condition will be included in the Certificate of Compliance to clarify that the package is subject to the provisions of 10 CFR 71.19(b), which requires that all fabrication of this packaging must have been completed by April 1, 1999.

This information is needed pursuant to the requirements of 10 CFR 71.19(b).

2.4 Demonstrate via calculations or other means that the package is not affected by vibration.

Section 2.6.5 of the SAR does not discuss any peak vibration standard applicable to the package even though the vibration load is not expected to cause structural damage. The SAR states only that "vibration will not affect this welded package construction." A more rigorous (e.g. quantitative) treatment of vibration loads is needed to provide reasonable assurance that the package meets the performance requirements under normal conditions of transport. The applicant should demonstrate that the low mass to stiffness ratio is in fact sufficient to preclude vibration damage to the package.

This information is needed pursuant to the requirements of 10 CFR 71.71(c)(5).

2.5 Demonstrate via calculations or other means that the package is not affected by fatigue due to vibration or other mechanisms.

The SARP does not evaluate fatigue effects on the package, either from vibration due to transport, from opening and closing of the lid or from any other means.

This information is needed pursuant to the requirements of 10 CFR 71.71(c)(5).

B&W NOG's Response: B&W NOG takes no credit for the ability of the package to protect the content during transport; therefore, the structural evaluation is not affected.

Chapter 3 - Thermal Evaluation

- 3.1 Revise the SAR to identify the principal thermal design aspects of the UNC-2600 package.

Chapter 3 consists of one sentence, i.e., "The uranium materials are unirradiated, of low specific activity and therefore require no thermal evaluation."

While it is true that the decay heat associated with unirradiated fuel is negligible, this Chapter must present the evaluations made to demonstrate the thermal safety of the UNC-2600 package and compliance with the thermal requirements of 10 CFR Part 71 when transporting a payload.

In particular, the package component maximum temperatures and pressures under both normal and accident conditions must be provided and the material properties and component specifications of the package shall be specified in the thermal evaluation chapter. Include also a statement similar to the second paragraph of Section 4.1.

This information is necessary to determine compliance with 10 CFR 71.35.

B&W NOG's Response: B&W NOG takes no credit for the ability of the package to protect the content during transport; therefore, the thermal evaluation is not affected.

Chapter 4 - Containment

- 4.1 Revise the SAR to include the fact that the shallow angle drop orientation could result in lid separation, rupture of the container and ejection of the contents.

Section 4.3.2 refers only to the original licensing basis for the package that was tested but does not mention a potential separation of the lid from a shallow angle drop and the subsequent findings of B&W NOG.

This information is necessary to determine compliance with 10 CFR 71.51, 71.55, and 71.59.

B&W NOG's Response: B&W NOG takes no credit for the ability of the package to protect the content during transport; therefore, containment is not affected.

Chapter 6 - Criticality Evaluation

- 6.1 Revise the Safety Analysis Report for the UNC-2600 package to remove the irrelevant Information presented in the following pages:

1. Table 6.1.1

On pages 14 and 15 of the SAR, the applicant provides criticality safety evaluation results for the UNC-2600 package under both Normal Conditions of Transport and Hypothetical Accident Conditions. However, it appears that the information presented on page 15 is no longer relevant to the new restrictions on the contents and is inconsistent with the information presented on page 16. The applicant is requested to examine the contents of Table 6.1.1 and make corrections if warranted.

2. Table 6.4.3

On pages 20 and 21 of the SAR, the applicant provides criticality safety evaluation results for the UNC-2600 packages with different payloads. However, it appears that the information presented in pages 20 and 21 is no longer relevant to the new design. The applicant is requested to examine the contents of Table 6.4.3 and make corrections to the SAR if warranted.

This information is needed pursuant to the requirements of 10 CFR 71.33.

B&W NOG's Response: B&W NOG takes no credit for the ability of the package to protect the content during transport. Section 6 was rewritten to explain that the shipment is limited to less than a critical mass.

Chapter 7 - Operating Procedures

- 7.1 Provide information on how the extra space will be filled if the allowed payload does not occupy the entire fuel container cavity because of the fissile material quantity limit.

Chapter 7 of the SAR provides operating procedures for the UNC-2600 package. The staff, however, was unable to find detailed information on how the extra space in the fuel container will be filled if the actual payload does not occupy the entire cavity of the container because of the limit on the maximum mass of fissile material (375 grams ²³⁵U.) Section 1.2.1 of the SAR mentions "an oak wood block measuring at least 2^{1/2}" long." Section 7.1 of the SAR states that "elements shorter than 91" may be positioned with longer oak wood spacers." These statements however do not address the question of exactly how the extra space will be filled up with various loads.

For example, if the enrichment of the fuel is 100%, the volume of the 375 grams of ²³⁵U is only about 19.84 cm³, which is about 1.21 cubic inches. In comparison, the cavity of the fuel container of the UNC-2600 package is about 1672 cubic inches. The payload in this case will only take up less than 0.1% of the space. The applicant is requested to provide information on how the contents are loaded so that they will not move inside the container during transportation.

This information is needed pursuant to the requirements of 10 CFR 71.33.

- 7.2 Revise the application to address the following items with respect to Package Operations.

- (a) Include an operational step that confirms that the fissile mass of the contents does not exceed the allowable fissile limit.
- (b) Include an operational step to make sure that the maximum payload weight is not exceeded. Section 7.1.3 states that "each box is limited to 265 lbs consisting of elements, wrapping, and spacers" but there is no operational step to ensure this weight limit is not exceeded.

This information is needed pursuant to the requirements of 10 CFR 71.87 and 71.35.

B&W NOG's Response: Section 7 was revised to clarify the limits per package, the reason for wood spacers, and to assure all shipments shall be exclusive use.

Chapter 8 - Acceptance Tests and Maintenance Program

- 8.1 Revise Section 8.1 of the SAR to clarify that each fabricated packaging must meet the conditions, dimensions, tolerances, etc., of the drawings in Appendix 2.10.1.

This information is needed pursuant to the requirements of 10 CFR 71.85(c).

- 8.2 Revise Section 8.2 of the SAR to clarify the periodic maintenance that is performed for this package.

Section 8.2 states that it provides the maintenance program for the package; however, no specific maintenance items are specified. Sections 8.2.3 and 8.2.7 should include a discussion on any moving part and components that would be expected to wear or become damaged.

This information is needed to provide assurance that the package will meet the performance standards in 10 CFR Part 71, Subpart E, throughout its service life.

B&W NOG's Response: Section 8.1 has been rewritten to state "no new fabrication is allowed;" therefore, the section is not needed. Maintenance will remain basic due to B&W NOG not taking credit for the ability of the container to protect the content during transport.

ENCLOSURE 2

UNC 2600

Safety Analysis Report for Packaging

Application for License

USA/5086/B(U)F

**Babcock & Wilcox
Nuclear Operations Group, Inc.
Lynchburg, Va.**

October 2009

Table of Contents

Page 1 of 2

	<u>Page</u>
1. General Information	
1.1. Introduction	1
1.2. Package Description	1
1.2.1. Packaging	1
1.2.2. Operational Features	2
1.2.3. Contents of Packages	2
2. Structural Evaluation	
2.1. Structural Evaluations	3
2.1.1. Discussion	3
2.2. Weights and Center of Gravity	3
2.3. Mechanical Properties of Materials	4
2.4. General Standards for all Packages	4
2.4.1. Minimum Package Size	4
2.4.2. Tamperproof Features	4
2.4.3. Positive Closure	4
2.4.4. Chemical and Galvanic Reactions	4
2.5. Lifting and Tiedown Standards for All Pkgs	4
2.5.1. Lifting Devices	4
2.5.2. Tiedown Devices	5
2.6. Normal Conditions of Transport	5
2.6.1. Heat	5
2.6.2. Cold	5
2.6.3. Pressure	5
2.6.4. Vibration	5
2.6.5. Water Spray	6
2.6.6. Free Drop	6
2.6.7. Corner Drop	6
2.6.8. Penetration	6
2.6.9. Compression	6
2.7. Hypothetical Accident Conditions	6
2.7.1. Free Drop	6
2.7.2. Puncture Test	6
2.7.3. Thermal Test	6
2.7.4. Water Immersion	7
2.7.5. Summary of Damage	7
2.8. Special Form	7
2.9. Fuel Rods	7
2.10. Appendix	7

Table of Contents (cont'd)

Page 2 of 2

	<u>Page</u>
2.10.1. Current Package Design Drawings	7
2.10.2. Original Package Design Drawings	7
3. Thermal Evaluation	7
4. Containment	
4.1. Containment Boundary	7
4.2. Requirements for Normal Conditions of Transport	8
4.2.1. Release of Radioactive Materials	8
4.2.2. Pressurization of Containment Vessel	8
4.2.3. Coolant Containment	8
4.2.4. Coolant Loss	8
4.3. Containment Requirements for Hypothetical Accident Condition	8
4.3.1. Fission Gas Products	8
4.3.2. Release of Contents	9
5. Shielding Evaluation	9
6. Criticality Evaluation	9
7. Operating Procedure	
7.1. Procedures for Loading Package Discussion and Results	10
7.2. Procedures for Unloading Package	12
7.3. Preparation of Empty Packages for Shipment	13
8. Acceptance Tests and Maintenance Program	
8.1. Acceptance	14
8.2. Maintenance Program	
8.2.1. Structural and Pressure Tests	14
8.2.2. Leak Tests	14
8.2.3. Subsystem Maintenance	14
8.2.4. Valves, Rupture Discs, and Gaskets on Containment Vessel	14
8.2.5. Shielding	14
8.2.6. Thermal	14
8.2.7. Miscellaneous	15

1.0 General Information

This package consists of an outer steel drum and an inner steel cage assembly which centers and firmly locates an inner steel box. This box contains the fuel elements authorized for shipment. All aspects of design modification, fabrication, and use are controlled under the QA Plan approved under Docket 71-0088.

1.1 Introduction:

The UNC 2600 package is used to ship fuel elements with U-235 enrichments up to 100%. Fuel elements are clad components with no exposed fissile material. Each package is limited to a maximum of 375 grams U-235. The loading will not exceed the A₂ values and will be verified prior to shipment.

No credit is taken in analysis for the shipping container. It is assumed to fail completely under the hypothetical accident condition. As a result, a Criticality Safety Index (CSI) of 50 is being assigned to the package.

1.2 Package Description:

1.2.1 Packaging:

(1) Weights:

Nominal empty container	840 lbs
Max. weight of contents	265 lbs
Nominal gross weight	1105 lbs

(2) Materials of Construction:

The package is constructed of mild steel, using two high strength steel bolted closure flanges to retain the fuel box in an inner steel cage. The fuel box is also of mild steel construction. An oak wood block measuring at least 2-1/2" long is positioned at each end of the fuel box to prevent product damage and keep the product from moving during normal transport. Additionally, rubber bumpers are used at both ends, external to the cage, also to distribute the axial loads. The construction details are shown in Drawing B-2600-2, Sheets 1, 2, 3, 4, 5, and 6, Rev. 3 which is provided in Appendix 2.10.1.

(3) Description: (All Dimensions are Nominal)

The fuel box (inner container) is an 11 gage steel box with inside dimensions of 2-5/8" x 7" x 96". It is supported in a 22-1/2" I. D. by 102-1/2" long 14 gage steel drum by a welded reinforced insert cage. This cage is 97" long, and is formed by nine 21-1/2" diameter by 3/8" thick steel plates (disks) spaced approximately 12" apart by 1-3/4" x 1/4" steel strips welded radially to each of the nine disks. The 12" sections at either end of the cage are further strengthened by eight 1" x 1" (1/8" angle) welded to the structure.

A channel to hold the fuel box is formed through the center of the cage by 1-1/2" x 1-1/2" x 1/8" angle irons which are also welded to each disk. Four additional 1" x 1" x 1/8" angles are used to further strengthen this fuel box slot. The fuel box is retained within the cage channel by two 1/2" thick diameter high strength 4130 steel closure flanges which are secured to each end of the cage with eight 7/8" SAE Grade 5 steel bolts.

The outer container closure is a 14 gage drum lid which is secured to the drum with a 12 gage bolt locking ring with drop forged lugs, one of which is threaded, having a 5/8" diameter bolt.

(4) Pressure Relief:

Pressure buildup is precluded because the drum lid has no gasket, facilitating pressure equalization.

1.2.2 Operational Features

Use of the package is simple, with minimal operational features. Proper use of the package is described in Section 7.

1.2.3 Contents of Package

(1) Type and Form of Material

The UNC-2600 package is used to ship unirradiated fuel elements. The element is a clad fuel component. The contained uranium may be enriched up to 100% in the U-235 isotope. Each element may be wrapped in protective plastic.

(2) Maximum Quantity of Material Per Package:

375 gram U-235 as clad fuel elements,

(3) Fuel Geometry Constraints:

The inner 11 gage steel box confines the uranium materials to a 2-5/8" x 7" cross section.

2.0 Structural Evaluations

2.1 Structural Evaluations:

2.1.1 Discussion:

Section 1.2 identifies the principal construction details of the package design. Drawing B-2600-1 details the original design which had been drop tested, and is provided in Appendix 2.10.2 The current design, specified in Drawing B-2600-2 has been analytically evaluated using Finite Element Analysis (FEA).

The current design improves the mechanical retention of the fuel box within the cage, using a 12" O.D. x 1/2" thick 4130 AMS 6370 heat treated steel closure flange secured with eight 7/8" SAE Grade 5 steel bolts to each end of the cage. The use of these closure flanges adds less than 40 lbs. to the empty weight of the original package, and this is offset by a reduction in the product loading from 308 lbs. to 265 lbs. Additionally, the current design specifies that the bumper disks at each end of the cage be fabricated of a 60 durometer, ≥ 2500 psi rubber with a Bell Brittle Point temperature of at least -70F.

2.2 Weights and Center of Gravity:

The center of gravity is essentially the center of the package in both the loaded and empty conditions.

2.3 Mechanical Properties of Materials:

The package is primarily fabricated of mild steel, and the 12" diameter closure flanges are 4130 AMS 6370 heat treated (Rockwell C = 28-33) steel. The properties of these steels, the SAE Grade 5 steel bolts, and the Rubber disks at each end of the cage are provided in Appendix 2.10.4.

2.4 General Standards For All Packages:**2.4.1 Minimum Package Size:**

The package dimensions shown in drawing B-2600-2 exceed the minimum package size specifications of 10 CFR 71.

2.4.2 Tamperproof Features:

A tamperproof seal is inserted in the end of the bolt which secures the cover ring seal closure at the front of the package.

2.4.3 Positive Closure:

The inner box which contains the fuel is held closed with steel banding. The banded box is constrained by the angle iron channel within the welded cage assembly. This cage assembly is retained within the outer container, as demonstrated by the accident test sequence and the analysis discussed in Section 2.7. The outer container lid is held closed by the ring seal which is bolted closed.

2.4.4 Chemical and Galvanic Reactions:

The steel package construction is not vulnerable to degradation from such reactions during shipment, or as a result of accident conditions.

2.5 Lifting and Tiedown Standards For All Packages:**2.5.1 Lifting Devices:**

Packages are lifted to and from the transport vehicle using appropriate slings, and other normal techniques. These are engaged with fork lifts or other standard mechanisms.

2.5.2 Tie Down Devices:

No tie down devices are incorporated as part of the package design.

2.6 Normal Conditions of Transport:**2.6.1 Heat**

The low carbon steel construction of the package drums and internals, and the design and construction of the fuel elements retain ductility through a temperature range of -40 to +130 degrees, F. The rubber bumpers have a Bell Brittle Point at or below -70 F, and are serviceable at the specified -40 F. The package design imposes minimal stresses, and fracture of the steel construction or the non-brittle zirconium fuel cladding will not occur.

2.6.2 Cold

See Section 2.6.1

2.6.3 Pressure:

The package is closed with an ungasketed lid, and will not retain pressure differentials. If a gasketed lid were incorrectly applied, the outer drum may dimple, but the containment of the uranium contents will remain unimpaired.

2.6.4 Vibration:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.6.5 Water Spray:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.6.6 Free:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.6.7 Corner Drop:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.6.8 Penetration:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.6.9 Compression:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.7 Hypothetical Accident Conditions

2.7.1 Free Drop:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.7.2 Puncture Test

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.7.3 Thermal Test

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.7.4 Water Immersion

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

2.7.5 Summary of Damage:

The criticality safety analysis does not credit the ability of the shipping container to protect the contents in any way. The assumption is that during the HAC, the fuel is ejected from the shipping container and attains an optimum configuration.

2.8 Special Form

Not applicable

2.9 Fuel Rods:

Not applicable

2.10 Appendix:

2.10.1 Current Package Design Drawings

2.10.2 Original Package Design Drawing

3.0 Thermal Evaluation

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.0 Containment

4.1 Containment Boundary:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.2 Requirements For Normal Conditions of Transport:

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.2.1 Release of Radioactive Materials

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable. It is assumed that all radioactive material is released.

4.2.2 Pressurization of Containment Vessel

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.2.3 Coolant Containment

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.2.4 Coolant Loss

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.3 Containment Requirements For Hypothetical Accident Conditions

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

4.3.1 Fission Gas Products

This section is not applicable since the material being shipped is unirradiated.

4.3.2 Release of Contents

No credit is taken for the ability of the package to protect the content during transport; therefore, this section is not applicable.

5.0 Shielding Evaluation

The content of the shipping container is an unirradiated uranium fuel element. This does not result in any external dose.

6.0 Criticality Evaluation

As noted in the previous sections, no credit is taken for the ability of the package to protect the content during transport. The assumptions are: 1) the fissile material is released from the package, 2) the cladding fails, 3) the uranium becomes finely divided, 4) mixes optimally with water in a spherical geometry and 5) is fully reflected by water. To assure subcriticality in this configuration, the total amount of U-235 must be below the minimum critical mass.

The minimum critical mass of U-235 is about 820 grams¹. To provide a safety margin, the maximum allowable amount of U-235 in a shipment will be limited to 750 grams. If the maximum number of shipping containers is limited to two per shipment, each container can have 375 gram U-235 with a CSI=50.

¹ LA-10860, 1986 Revision, "Critical Dimensions of System Containing ²³⁵U, ²³⁹Pu and ²³³U" by H. C. Paxton, N. L. Provost.

7.0 Operating Procedures

The UNC-2600 Package is used to ship up to 375 g U-235 of fuel elements in non-decomposable form, and up to 100% enrichment in the U-235 isotope. CSI=50 per package, thus limiting two to a shipment. Maximum payload weight is 265 lbs. The detailed loading and unloading procedures are given below and are in compliance with subpart G of 10CFR71. All operating procedures for the UNC-2600 shipping package are approved by NOG plant management. These procedures have been prepared to meet the intent of NUREG/CR-4775, "Guide for Preparing Operating Procedures for Shipping Packages".

7.1 Procedures For Loading Package Discussion and Results

Unacceptable shipping packages shall be marked accordingly, and appropriately repaired before use.

PROCEDURE

1. Assure that the package is to be loaded in accordance with the Certificate of Compliance as specified in written procedures and check lists. Compliance with these procedures and completion of the check list shall be recorded on appropriate shipping documentation.
2. Each UNC-2600 package shall be inspected prior to each use. The following requirements are to be checked;
 - That the maintenance inspections required by Section 8.2 have been conducted within the 12 months of use.
 - Compliance with the requirements of Section 8.2.7.1.
 - That the package is in unimpaired physical condition.
 - Inspect inner box for damage.
 - Inspect bolts for thread condition.
 - Inspect the top closure flange surfaces for damage. Inspect drum lid, ring seal, and locking bolts for damage, and replace as necessary.

3. Requirements for Loading Box:

- Verify that the shipment consists only of fuel elements. Each element may be wrapped in protective plastic.
- Verify the total U-235 per package is less than 375 grams.
- Verify that the A_2 values are not exceeded based on the actual isotopic values for the loaded contents.
- Elements shorter than 91" may be positioned with longer oak wood spacers at the ends of the box to prevent their movement during transport. This bracing protects the element from shifting.
- Verify contents do not exceed 265 lbs. consisting of elements, wrapping, and wood spacers.
- Each loaded box is to be strapped closed with three (3) 0.02" tk. x 1/2" wide x 24" lg. (approx.) steel banding straps.

4. Requirements for Loading Box into Package:

- Slide the sealed box into the channel, assuring the end is flush with the face of the disk.
- Locate the 12" diam. 1/2" thick steel closure flange to align the bolt into the bolt holes, and secure each bolt with a nut. These are to engage the bolts welded to the backside of the disk, and tightened to a snug closure.

5. Requirements For Sealing Package:

- Place the rubber disk into the package to fill the free space at the front end of the package.
- Close the front of the package with a 14 ga. drum lid which has no gasket.
- Secure this lid with a 12 ga. ring seal, and secure the seal by torquing (40-45 ft. lbs.) the locking bolt into the threaded end of the ring seal. Tighten jam nut against the locking bolt, and apply the tamper-safe seal to the locking bolt.

6. Survey Requirements:

- Removable surface contamination

≤ 2200 (beta and gamma) dpm per 100 sq. cm.

≤ 220 (alpha) dpm per 100 sq. cm.

- Radiation levels ≤ 200 mrem per hour on contact.
- Radiation levels < 10 mrem per hour at 1 meter.

7. Each shipment of the UNC 2600 package shall require the preparation of, and retention for three years, of those records specified in 10CFR71.91 as appropriate.

8. Verify that each package has a proper metal identification plate welded to the outer drum.

9. All shipments shall be Exclusive Use.

7.2 Procedures For Unloading Package

The UNC-2600 package is designed to be unloaded with commonly available tools and equipment in accordance with the following procedures:

PROCEDURE

1. Prior to unloading, verify that the following documentation is included with the shipment.

- Radiological survey data
- Packing list

2. Conduct a survey prior to unloading to assure that:

- Removable surface contamination

≤ 2200 (beta and gamma) dpm per 100 sq. cm.

≤ 220 (alpha) dpm per 100 sq. cm.

- Radiation levels ≤ 200 mrem per hour on contact
 - Radiation levels < 10 mrem per hour at 1 meter
3. Remove the tamper-safe seal, drum lid, and the rubber disk to expose the bolted closure flange.
 4. Loosen and remove the eight closure flange bolt nuts and remove the flange.
 5. Remove the inner box from the package using a manual or mechanical means. Remove the three steel closure bands from the box, and remove the elements from the box in accordance with applicable criticality control limits.
 6. Replace the empty box into the package, and resecure the closure flange with the eight bolt nuts finger tightened. Replace the drum lid with the ring seal, and secure.

7.3 Preparation of Empty Package for Shipment

Empty UNC-2600 packages will be prepared for shipment by verifying the absence of fuel, closing all closure bolts, and securing the lid with a ring seal. The locking bolt is to be tamper-sealed, and appropriate labels are to be affixed to the package exterior to signify that it is empty.

A survey shall be performed on the outer package surface to ascertain that the removable surface contamination is ≤ 2200 (beta and gamma) dpm per 100 sq. cm or ≤ 220 (alpha) dpm per 100 sq. cm.

8.0 Acceptance Tests and Maintenance Program

8.1 Acceptance Tests

No new fabrication is allowed; therefore, section 8.1 is not applicable.

8.2 Maintenance Program

8.2.1 Structural and Pressure Tests

A general inspection of the shipping package shall be made annually while in service. See Section 8.2.7.1. Maintenance shall be performed prior to placing containers back into services once removed.

8.2.2 Leak Tests

Not applicable.

8.2.3 Subsystem Maintenance

Not applicable.

8.2.4 Valves, Rupture Discs, and Gaskets on Containment Vessel

Not applicable.

8.2.5 Shielding

Not applicable.

8.2.6 Thermal

Not applicable.

8.2.7 Miscellaneous

The following inspections are to be conducted;

8.2.7.1 Within 12 Months Before Use, and Annually while in service.

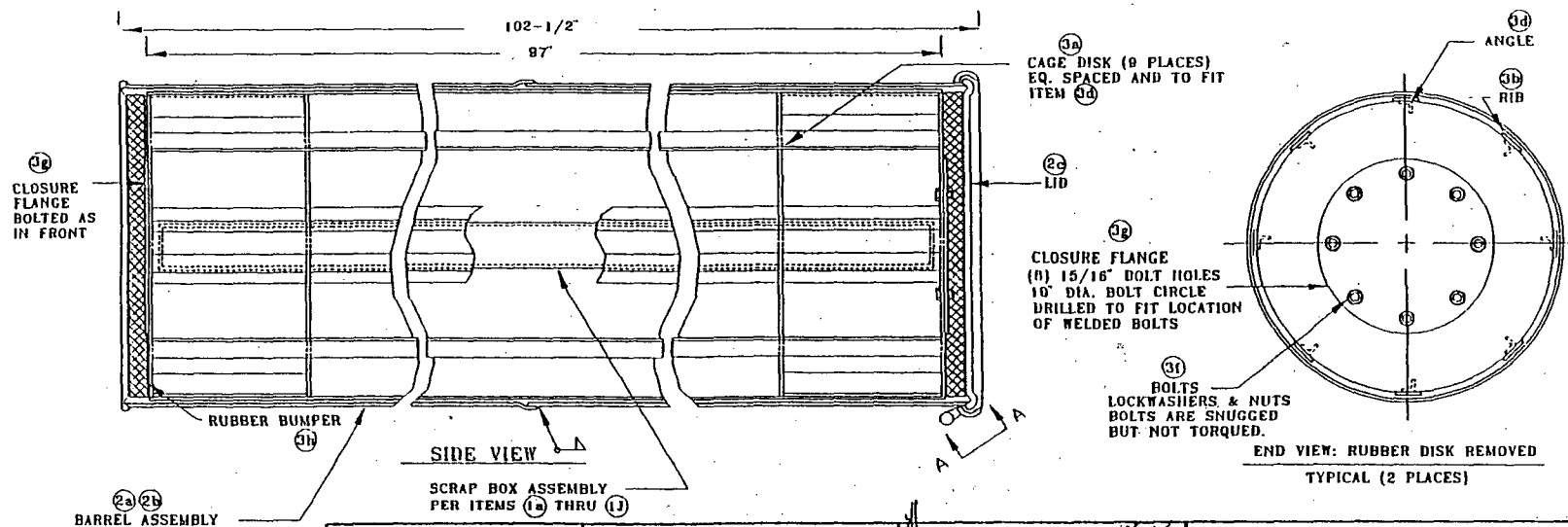
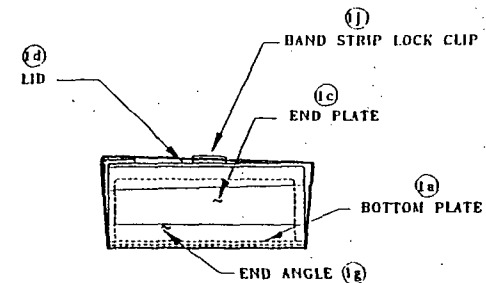
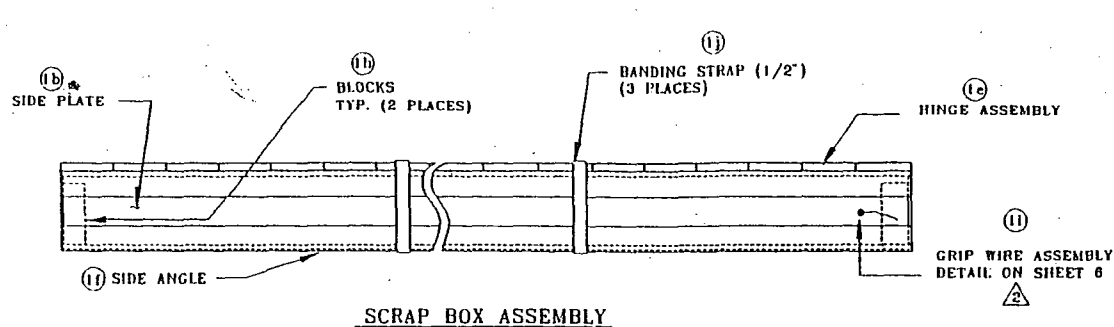
- The outer surface of the drum shall be visually inspected for rust and scratches. Such defects shall be sanded off and repainted. Any significant dents will be reworked.
- The inner cage will be removed from the outer drum and inspected for rust and broken welds. The former will be sanded and repainted, and the latter repaired.
- The bottom closure flange shall be inspected to assure that the bolt nuts are properly secured.

8.2.7.2 Prior to Every Shipment

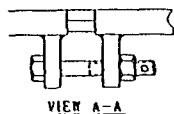
- Inspect inner box for damage.
- Inspect bolts for thread condition.
- Inspect the top closure flange surfaces for damage.
- Inspect drum lid, ring seal, and locking bolts for damage, and replace as necessary.

Appendix 2.10.1

Drawing B-2600-2, Sheets 1,2,3,4,5 and 6
Current Package Design



2d
RING SEAL PER
19 CFR 178.103-5 (1988 EDITION)
TORQUE 40-45 FT. LBS. AT CLOSURE



Revisions/Date	Revisions/Date
REV 1 8-27-93	REV 2 9-08-94
1.) ADD SHEETS 4,5	GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE, APP. 16" LG. USE OF WIRE ON BOTH ENDS OF BOX
2.) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV.	OPTIONAL WIRE CONNECTED USING 1/4" TK. 9/16"x3/4" STL TABS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK. TABS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE.
3.) END VIEW REV. TO SHOW ANGLE.	
4.) BOLTS TO SAE GRADE 5	
5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	

Revisions/Date
REV 3 10-18-94 10/20/94
"GRIP WIRE ASSEMBLY" USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE".
ONE GRIP WIRE ASSEMBLY PER BOX.

THOMAS GUTMAN CONSULTANT
W. HARTFORD, CT.

Drawn BY RH Date 10/21/93
Approved BY IG Date 10/21/93
Reviewed BY WK Date 10/21/93

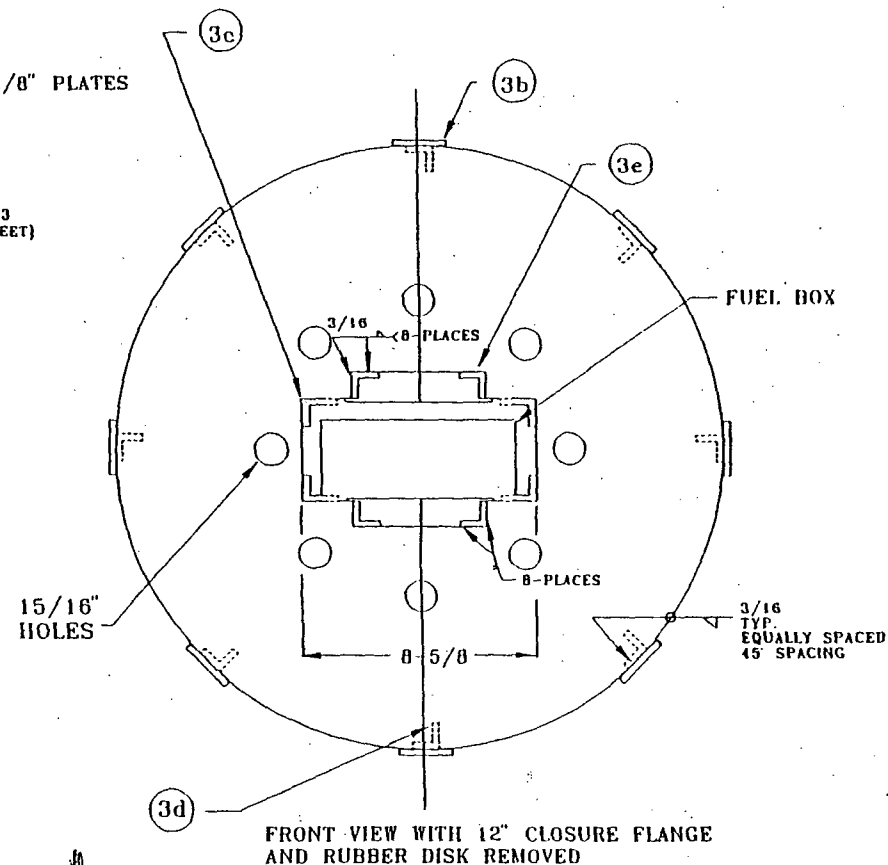
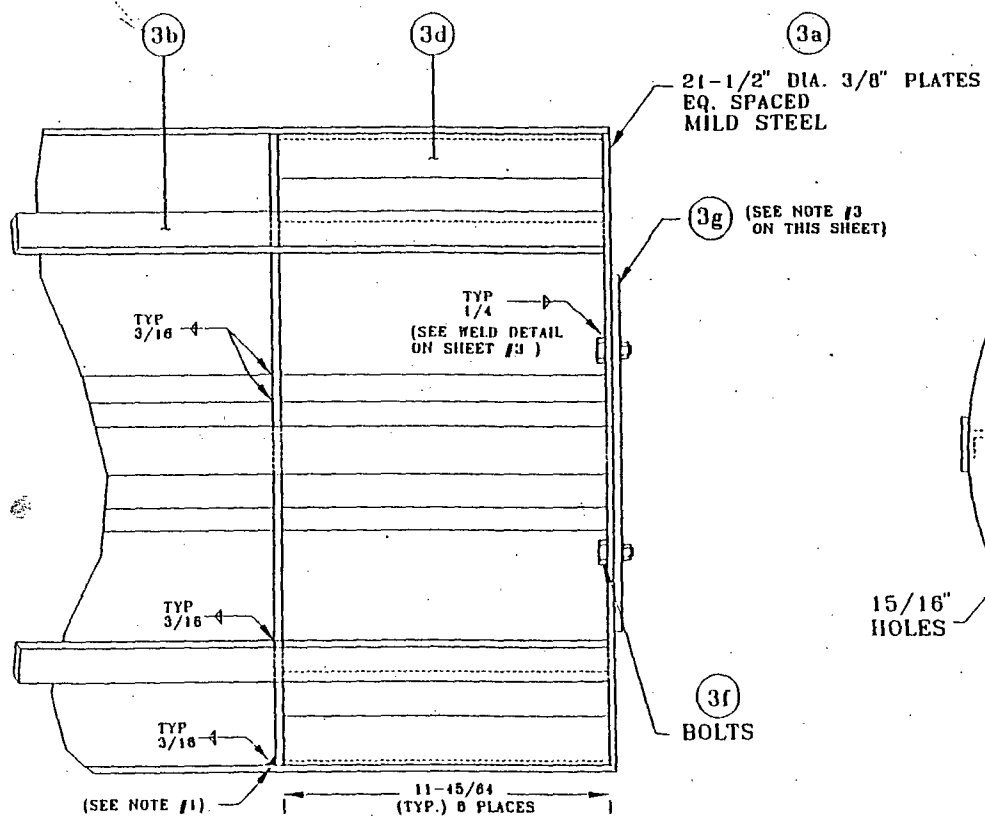
UNC-2600
UPGRADED PACKAGE

NOT TO SCALE

DWG.# B-2600-2

REV.
3

SHEET 1 OF 6



NOTE:

- 1.) TYPICAL WELDMENT AS SHOWN FOR INNER & OUTER 3/8" X 21-1/2" DIAMETER DISC.
- 2.) ANGLE IRON AND BOX NOT SHOWN IN SIDE VIEW TO PRESERVE CLARITY.
- 3.) 12" O.D. X 1/2" 4130 AMS 6370 STEEL, HEAT TREAT TO ROCKWELL C HARDNESS = 28-33
FLANGE COVER TO BE PHYSICALLY MARKED TO SHOW STEEL GRADE, HARDNESS

Revisions/Date	Revisions/Date
REV 1 8-27-93	REV 2 8-08-94
1.) ADD SHEETS 4,5	GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE, APP. 18" LG. USE OF WIRE ON BOTH ENDS OF BOX
2.) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV.	OPTIONAL WIRE CONNECTED USING 1/4" TK. 9/16"x3/4" STL TAPS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK. TAPS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE
3.) END VIEW REV. TO SHOW ANGLE.	
4.) BOLTS TO SAE GRADE 5	
5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	

Revisions/Date
REV 3 10-18-94 10/21/94
"GRIP WIRE ASSEMBLY" USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE".
ONE GRIP WIRE ASSEMBLY PER BOX.

THOMAS GUTMAN CONSULTANT
W. HARTFORD, CT.

Drawn BY RH Date 10/21/94

Approved BY IG Date 10/21/94

Reviewed BY WK Date 10/21/94

UNC-2600

UPGRADED PACKAGE

NOT TO SCALE

DWG.# B-2600-2

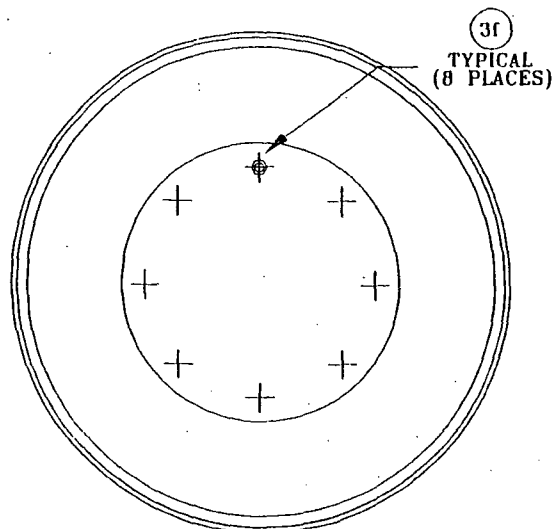
REV.
3

SHEET 2 OF 6

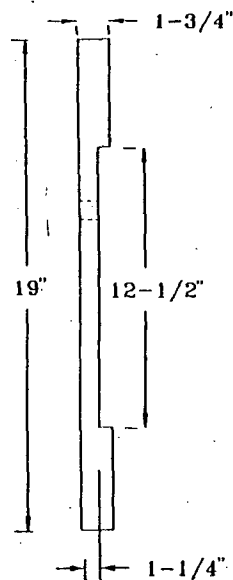


VIEW A-A

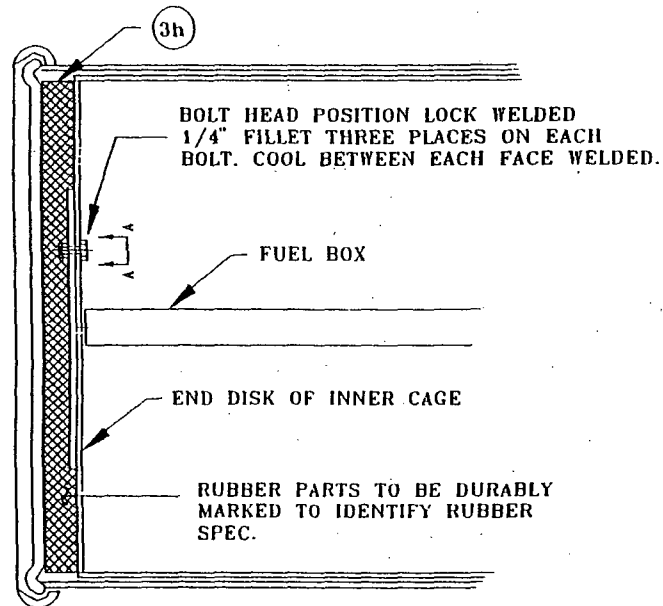
SHOWING BOLTS LOCK WELDED ON
THREE SIDES TO END DISK.



END VIEW - LID
AND RUBBER BUMPER REMOVED
FRONT & BACK



DETAIL OF RUBBER BUMPER



Revisions/Date	
REV 1	8-27-83
1.) ADD SHEETS 4,5	
2.) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV.	
3.) END VIEW REV. TO SHOW ANGLE.	
4.) BOLTS TO SAE GRADE 5	
5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	

Revisions/Date	
REV 2	9-06-94
GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE, APP. 18" LG. USE OF WIRE ON BOTH ENDS OF BOX OPTIONAL WIRE CONNECTED USING 1/4" TK. 8/16"x3/4" STL TABS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK. TABS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE.	

Revisions/Date	
REV 3	10-18-94
"GRIP WIRE ASSEMBLY" USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE".	
ONE GRIP WIRE ASSEMBLY PER BOX.	

THOMAS GUTMAN CONSULTANT
W. HARTFORD, CT.

Drawn BY RH Date 10/21/93
Approved BY TG Date 10/21/93
Reviewed BY WK Date 10/21/93

UNC-2600
UPGRADED PACKAGE

NOT TO SCALE

DWG.# B-2600-2

REV.
3

SHEET 3 OF 6

Scrap Assembly Box

Item #	# Reqd.	Name of Part	Stock Size	Material
1a	1	Bottom Plate	11 Ga. x 7" x 96"	LCCGS
1b	2	Side Plate	11 Ga. x 2-5/8" x 96"	LCCGS
1c	2	End Plate	11 Ga. x 2-5/8" x 7-1/4"	LCCGS
1d	1	Lid	11 Ga. x 96-1/4" x 7-9/16" (Approx.)	LCCGS
1e	1	Hinge	MS-35830-2D, (or Equiv.) 0.093" tk. x 96" lg.	Steel
1f	2	Side Angle	1" x 1" x 1/8" x 96-1/4" Angle	LCCGS
1g	2	End Angle	1" x 1" x 1/8" x 7-1/4" Angle	LCCGS
1h	2	Wood Positioner	2-3/8" x 2-1/2" x 6-3/4"	Oak wood
1i	1	Grip Wire Assy.	3/16" diam. wire x Approx. 16" lg including swaged ball shank.	Gal. or stainless steel
1i(a)	2	Tab	Ball retained by 1/4" tk. x 9/16" x 3/4" steel tabs welded to box. 5/16" hole in tabs to engage swaged ball.	
1i(b)	2	Tapered protector (optional)	1/4" tk. x 9/16" high x 2-1/2" lg. tapered at both ends to 1/4" land on top to help guide box into cage.	Steel
1j	3	Banding Straps	0.02" tk x 1/2" x 24" (approx) With 0.02" lockclips	Steel

- Box seam welds are continuous. Side angle welds 1/8" fillet, 3" lg. every 6" for the 96" lengthwise runs. Welds for packages procured on or before 10-9-92 are visually inspected. Welds for new construction are per AWS D-1.3.
- Matl. LCCGS is low carbon, commercial grade steel, also referred to as "mild steel"

Barrel Assembly

Item #	# Reqd.	Name of Part	Stock Size	Material
2a	1	Bottom Drum	14 Ga. 22-1/2" O. D. x 52" lg. Drum	LCCGS
2b	1	Top Drum with no bottom	14 Ga. 22-1/2" O. D. x 52" lg Drum	LCCGS
2c	1	Lid with no gasket	14 Ga. for 55 gal. Drum	LCCGS
2d	1	Ring Seal with 5/8" Bolt Closure drilled for tamper seal.*	12 Ga. For 55 gal Drum Bolt is torqued to 40-45 ft. lbs.	LCCGS

* Ring seal per 49CFR 178.103-5, 1988 edition.

- Welds are continuous. Welds for packages procured on or before 10-9-92 are visually inspected. Welds for new construction are per AWS D-1.3
- Matl. LCCGS is low carbon, commercial grade steel, also referred to as "mild steel"

Revisions/Date REV 1 8-27-93 1.) ADD SHEETS 4,5 2.) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV. 3.) END VIEW REV. TO SHOW ANGLE. 4.) BOLTS TO SAE GRADE 5 5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	Revisions/Date REV 2 9-08-94 GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE. APP. 16" LG. USE OF WIRE ON BOTH ENDS OF BOX. OPTIONAL WIRE CONNECTED USING 1/4" TK. 9/16" x 3/4" TK. STL TABS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK TABS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE.	Revisions/Date REV 3 10-18-94 10/24/94 "GRIP WIRE ASSEMBLY" USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE". ONE GRIP WIRE ASSEMBLY PER BOX.	THOMAS GUTMAN CONSULTANT W. HARTFORD, CT. Drawn BY RH Date 10/21/93 Approved BY TG Date 10/21/93 Reviewed BY WK Date 10/21/93 NOT TO SCALE DWG.# B-2600-2 REV. 3
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Cage Assembly

Item #	# Reqd.	Name of Part	Stock Size	Material
3a	9	Cage Disk	3/8" x 21-1/2" diam	LCCGS
3b	8	Rib	1/4" x 1-3/4" x 97" bar	LCCGS
3c	4	Support angle	1-1/2" x 1-1/2" x 1/8" angle, 97" lg.	LCCGS
3d	16	Stiffener angle	1" x 1" x 1/8" angle, 11-45/64" lg.	LCCGS
3e	4	Support angle	1" x 1" x 1/8" angle, 97" lg.	LCCGS
3f	16	Bolts	7/8" diam x 1-3/4" lg, with lock washers and nuts to fit	SAE Grade 5
3g	2	Closure Flange	1/2" tk x 12" diam	4130 AMS 6370 stl, Ht trt to Rock. C =28 -33 60 Durometer, ≤ 2500 psi Rubber Bell Brittle point, -70 F.
3h	2	Rubber bumper	19" diam x 1-3/4" tk	

- Welds are 3/16" fillet. Welds for packages procured on or before 10-9-92 are visually inspected. Welds for new construction are per AWS D-1.1.
- Matl. LCCGS is low carbon, commercial grade steel, also referred to as "mild steel"
- Closure flange bolts with lock washers are snugged, but not torqued.
- Closure flange and rubber bumper to be physically marked to identify the steel or rubber, to show the steel hardness, and to identify the drawing number. Cognizant QC to mark.

Name Plate

Item #	# Reqd.	Name of Part	Contents of Plate	Material
4a	1	Name plate	1/16" tk, and sized to fit lettering	LCCGS or SST

Plate spot welded to drum, engraved with 1/2" high lettering to show at least:

- Model UNC-2600
- Gross weight of package: 1105 lbs.
- Cert. of Compl. number 5086
- 1/8" lettering to show
Year of manufacture
Serial #

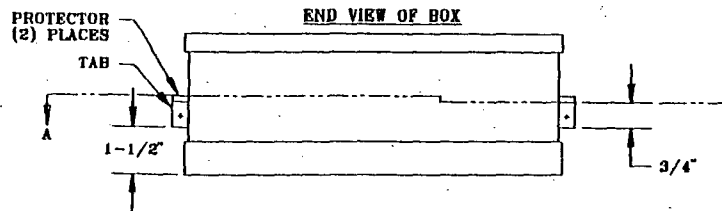
Weights

Package Gross Weight: 1105 lbs
Maximum Weight of Contents: 265 lbs.

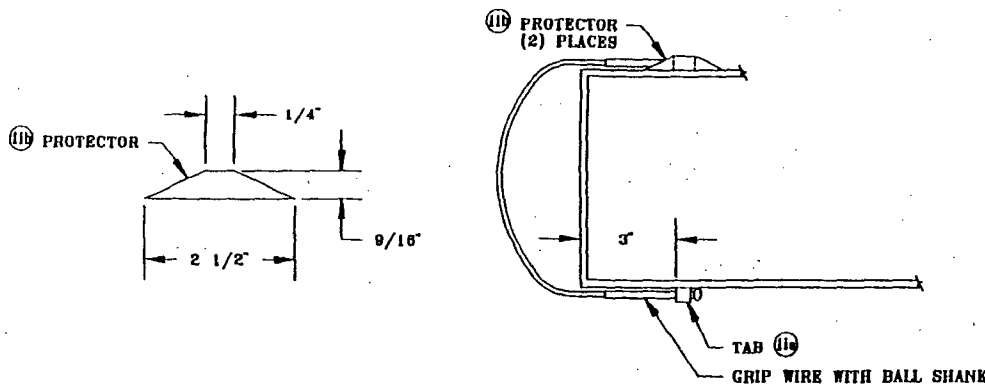
Inspection and Acceptance Criteria

- All parts to be free of raised metal, burrs, or significant dents and rust.
- Verify the identification on the Closure Flanges and the Rubber disks. These shall be traceable to the material identification, and the heat treat processing.
- • Verify weld inspections for new packages. These must be certified to AWS D-1.1 or D-1.3.
- For packages procured by B&W prior to 10-9-92, verify that all welds are visually acceptable.
- Verify the presence of a name plate showing the model number and maximum gross weight.

Revisions/Date	Revisions/Date	Revisions/Date	THOMAS GUTMAN CONSULTANT W. HARTFORD, CT.		
REV 1 8-27-93 1) ADD SHEETS 4.5 2) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV. 3.) END VIEW REV. TO SHOW ANGLE. 4.) BOLTS TO SAE GRADE 5 5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	REV 2 9-08-94 GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE, APP. 16" LG. USE OF WIRE ON BOTH ENDS OF BOX OPTIONAL WIRE CONNECTED USING 1/4" TK. 9/16" x 3/4" TK. STL TABS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK. TABS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE.	REV 3 10-18-94 10/22/94 "GRIP WIRE ASSEMBLY" USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE". ONE GRIP WIRE ASSEMBLY PER BOX.	Drawn BY RH Date 10/21/93	UNC-2600 UPGRADED PACKAGE	
			Approved BY TG Date 10/21/93		
			Reviewed BY WK Date 10/21/93		
			NOT TO SCALE	DWG.# B-2600-2	REV. 3
			SHEET 5 OF 6		



3/16" DIAM x APPROX. 16" LG. INCL'D. SHANK
FROM AIRCRAFT SPRUCE CAT. GAL OR ST. STEEL
6x17 CABLE (Pg. 105). ITEM MS20804C
(Pg. 104) BALL SHANK SUPPLIER SWAGED
TO EACH END OF WIRE.



SECTION A-A

11a 9/16" x 3/4" x 1/4" TK. MILD STL. TAB
WITH 5/16" HOLE. WELDED TO BOX
WITH 1/4" FILLET WELDS. WELDS
NOT TO INTERFERE WITH HOLE FOR
WIRE. ROUND CORNERS. BREAK EDGES
OTHER THAN WELD EDGE, AND HOLE
TO APP. 1/16" RAD.

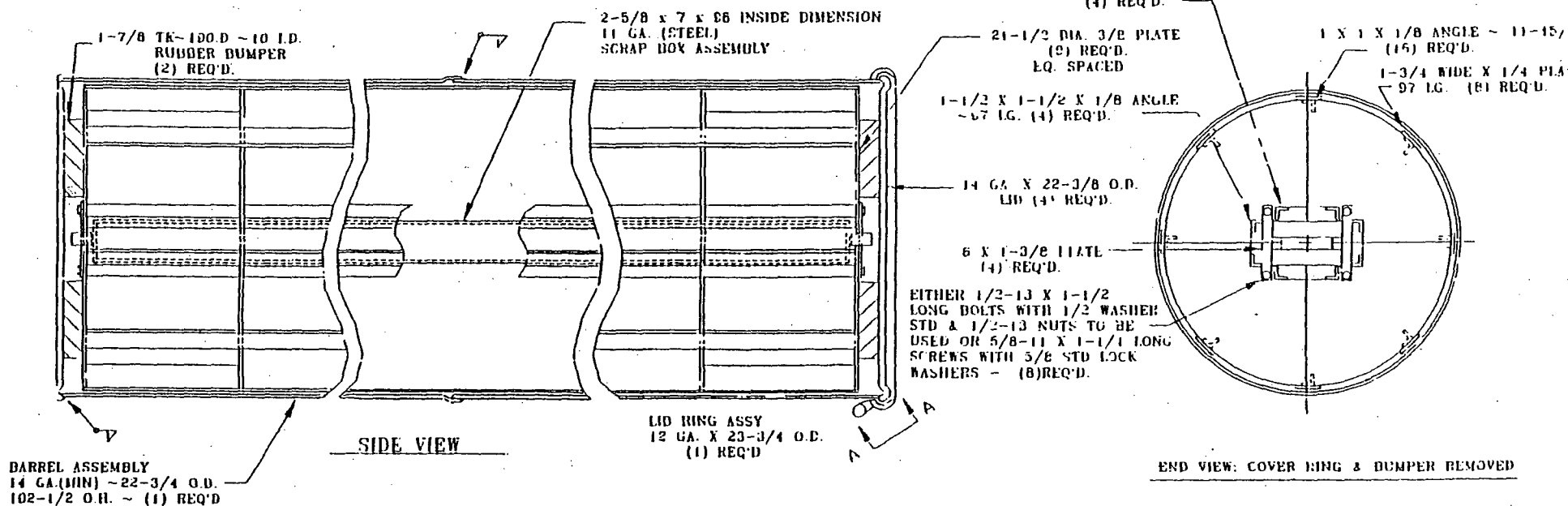
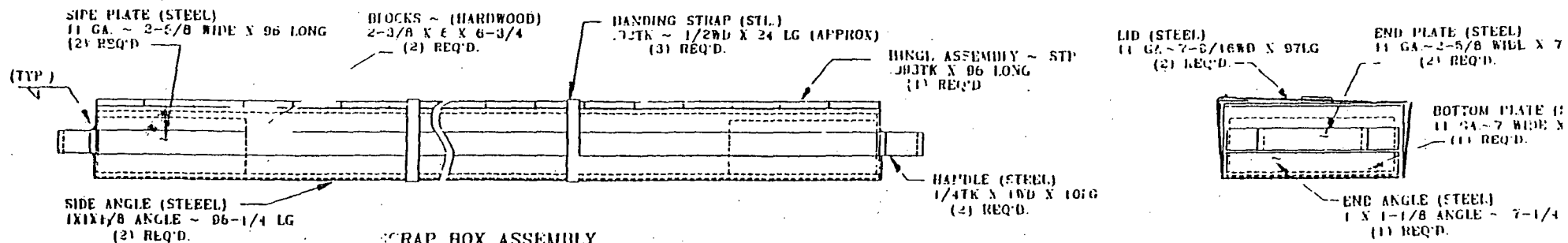
11b 1/4" TK. x 9/16" x 2-1/2" LG. TAPERED
PROTECTOR WELDED ON TOP OF TAB
WITH 1/8" FILLET WELDS NOT TO
INTERFERE WITH TAB OR GRIP WIRE.

ITEM 11. GRIP WIRE ASSEMBLY, 11(a) TAB,
AND OPTIONALLY 11(b) PROTECTOR
GRIP WIRE ASSEMBLY TO PULL BOX FROM CAGE.
NOT FOR LIFTING

Revisions/Date	Revisions/Date	Revisions/Date	THOMAS GUTMAN CONSULTANT W. HARTFORD, CT.		
REV 1 8-27-93 1.) ADD SHEETS 4,5 2.) GRIP WIRE REV. TO 3/16" DIA. AIRCRAFT WIRE ATTACHED WITH PAD EYES, OR EQUIV. 3.) END VIEW REV. TO SHOW ANGLE. 4.) BOLTS TO SAE GRADE 5 5.) IMPROVED ASSEMBLED VIEWS FOR CLARIFICATION	REV 2 9-08-94 GRIP WIRE IS 3/16" DIAM. AIRCRAFT CONTROL WIRE. APP. 16" LG. USE OF WIRE ON BOTH ENDS OF BOX OPTIONAL WIRE CONNECTED USING 1/4" TK. 9/16" x 3/4" TK. STL TABS WELDED TO BOX. 1/4" FILLET WELDS SPACED TO ACCOMMODATE WIRE IN 5/16" HOLE. WIRE SECURED USING SWAGED BALL AND SINGLE SHANK. TABS MAY BE PROTECTED WITH TAPERED PROTECTOR TO EASE PLACEMENT INTO CAGE.	REV 3 10-18-94 GRIP WIRE ASSEMBLY USED AS DEFINITION TO REPLACE PRIOR REFERENCES TO "AIRCRAFT GRIP WIRE" AND "AIRCRAFT CONTROL WIRE". ONE GRIP WIRE ASSEMBLY PER BOX.	Drawn BY RH Date 10/21/93	UNC-2800 UPGRADED PACKAGE	
			Approved BY TG Date 10/21/93		
			Reviewed BY WK Date 10/21/93		
			NOT TO SCALE	DWG.# B-2800-2	REV. 3
SHEET 6 OF 6					

Appendix 2.10.2

Drawing B-2600-1
Original Package Design



THOMAS GUTMAN CONSULTANT W. HARTFORD, CT.			
Revisions/Date	Drawn by R.D.H. Date 11/3/92	UNC-2600 PACKAGE AS TESTED	
	Approved by T.G. Date 11/1/92	NOT TO Scale: SCALE	
		DWG# B-2600-1	0