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Title

Container, Metal box for Shipping and Storage of Solid, Low-Level Radioactive Material.

IL-2SQ

Approvals

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List Of Revisions

1) Specifications for 25-year service life were added, affecting sections 2.0, 3.1.2 and 3.2.2.2. Three-year service life requirements were retained in order to provide more flexibility for the use of LMBs on the Hanford site.

2) Welding specification AWS D1.1 was deleted where associated with performing welding, leaving NUREG/CR-3019 as the sole specification.

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1.0 SCOPE

This specification provides the requirements for Low-Level Metal Box (LMB) containers to be used to ship up to and including Type B Low-Level Solid Radioactive Waste on the Hanford Site only.

2.0 DOCUMENTS

Applicability. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of a conflict between the documents referenced herein and the contents of this specification, the conflict shall be brought to the attention of the Buyer.

Department of Transportation

Title 49 Code of Federal Regulations (49 CFR) - Transportation, October 1990

Part	Title
173.24	Standard Requirements for All Packages
173.411	General Design Requirements
173.412	Additional Design Requirements for Type A Package
173.461	Demonstration of Compliance With Tests
173.462	Preparation of Specimens for Testing
173.465	Type A Packaging Test
178.350	Specification 7A; General Packaging, Type A

Nuclear Regulatory Commission

- Title 10 Code of Federal Regulations (10 CFR) - Energy August 1991

Part	Title
71.43 (except (a),(d),(h))	General Standards for All Packages
71.45	Lifting and Tiedown Standards for All Packages
71.73 (a),(b),(c) (1)	Hypothetical Accident Conditions

- NUREG/CR-3019 Recommended Welding Criteria for Use in the Fabrication of Shipping Containers for Radioactive Materials, March 1984.
- NUREG/CR-3854 Fabrication Criteria for Shipping Container, March 1985.
- NUREG/CR-1815 Recommendation for Protecting Against Failure by Brittle Fracture in Ferritic Steel Shipping Containers up to Four Inches Thick, June 1981.

Steel Structures Painting Council (SSPC)

Part	Title
SSPC-PA 1-82	Shop, Field and Maintenance Painting
SSPC-SP 1-82	Solvent Cleaning
SSPC-SP 6-82	Commercial Blast Cleaning
SSPC-SP 8-82	Pickling

American Welding Society (AWS)

Part	Title
AWS D 1.1-92	Structural Welding Code
AWS B 2.1-84	Standard for Welding Procedure and Performance Qualification
AWS D 1.3-89	Structural Welding Code -- Steel
AWD D 9.1-90	Specification for Welding of Sheet Metal

Federal Specifications

Part	Title
TT-P-645B	Primer, Paint, Hi-Ratio Inorganic Zinc Rich, Water Based
TT-E-489G	Enamel, Alkyd, Gloss

American Society for Testing and Material*

Part	Title
ASTM A-36	Standard Specification for Structural Steel
ASTM D-1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM A-123	Zinc (Hot Galvanized) Coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strap
ASTM A-153	Zinc Coating (Hot Dip) on Iron and Steel Hardware
ASTM B-633	Electrodeposited Coatings of Zinc on Iron and Steel
ASTM A-463	Steel Sheet, Cold-Rolled, Aluminum-Coated Type 1 and Type 2
ASTM A-428	Weight of Coating on Aluminum-Coated Iron Steel Articles
ASTM D-1418	Rubber and Rubber Lattices -- Nomenclature

* The latest edition at the time of purchase order shall be invoked

3.0 REQUIREMENTS

3.1 ITEM DEFINITION

The metal boxes shall be made of steel in accordance with 49 CFR 173.24(c)(2). The boxes shall be of all welded construction to conform to NUREG/CR-3019 or an engineering approved equivalent specification. There shall be a non-welded positive closure system - see paragraph 3.2.1.1. The design shall be such that the weight of the empty container shall be no more than 25% of the total design gross weight. The container shall have lifting device attachment points for lifting the lid, independently of the body, that can be quickly removed or quickly made inoperable for transport. There are to be three categories of boxes (light, medium, and heavy) as noted in the following table:

WHC Low-Level Metal Box Category	Minimum Design Payload Density
LMB-L (Light)	50 lb/ft^3
LMB-M (Medium)	100 lb/ft^3
LMB-H (Heavy)	150 lb/ft^3

Specific sizes, with reasonable tolerances, shall be specified by Westinghouse Hanford Company (WHC) on a case-by-case basis. Documents needed to certify compliance with this specification are called out in Section 6.2.

3.1.1 Interface Definition

3.1.1.1 Maneuverability

The box shall accommodate a forklift and/or a sling for lifting. The lid shall have lifting device attachment points which are recessed, offset, or hinged in a manner which does not prohibit stacking. They shall accommodate lifting the lid alone by forklift and/or a crane.

3.1.1.2 Stacking

The box configuration shall accommodate stacking of two fully loaded boxes or stacking to a height of 12 ft, whichever is greater.

3.1.2 Item and Major Component Identification

The following identification markings and/or labels (paragraphs 3.1.2.1 thru 3.1.2.4), when specified in the buyer's purchase order, shall have a life of 25 years. Acceptable 25-year Labels are available under the following description:

Electromark Company
N-1005 ON-THE-SPOT-NUMBERING
CLASS 1E Qualified

If not otherwise specified, markings/labels shall have a minimum 1-year life.

3.1.2.1 Container Identification

The container identification shall be stamped or embossed on a nameplate and permanently attached to the box. The box shall be marked as specified in 49 CFR 173.24 and 49 CFR 178.350. No markings shall be located on the box bottom. In addition, the Seller shall mark permanently on the box the seller's lot number, the month and year of manufacture and the WHC purchase order number.

3.1.2.2 Weight Identification

All weight marking shall be in pounds (lb). The maximum design gross weight for the container shall be marked on two opposite sides and in the upper third of the box. This marking shall be in an unobstructed area, permanent and contrasting so as to be readily apparent and understood. The letters shall be a minimum of 2 in. in height. A minimum of 12 in. above and 20 in. below the weight identification markings shall be left clear for additional markings to be added by the buyer.

3.1.2.3 Box Lid Identification

The following marking shall be painted/labeled on the box lid near the lifting device attachment points "WARNING: Lifting points for Lifting Lid Only." This marking shall be in an un-obstructed area, permanent and contrasting so as to be readily apparent and understood. The letters shall be a minimum of 1 in. in height.

3.1.2.4 Content Identification

"LL" shall be painted/labeled on the box and lid. The marking on the side of the box shall be above the nameplate and be 2 in. in height as a minimum. The marking on the lid shall be in an unobstructed area. The marking shall be permanent and contrasting so as to be readily apparent and understood.

3.2 CHARACTERISTICS

3.2.1 Performance

3.2.1.1 Lid Closure

If close contact (i.e., whole body exposure 1 ft or less) is required for closing and/or sealing the lid, two persons shall be capable of performing the operation in less than fifteen minutes. The closure device must be specified in the design drawings. Welding as a means of closure is not acceptable.

3.2.1.2 Container

Container acceptance shall be based on the following transport and disposal testing criteria. The buyer may specify that the containers are to be used for either storage or burial of radioactive solid waste.

The container shall prevent loss or dispersal of the radioactive contents when subjected to the prescribed test conditions. The container shall meet the performance requirements as specified in 49 CFR 173.24. The container shall conform to the requirements of 49 CFR 173.412(m) when subjected to tests specified in 49 CFR 173.465, or evaluated against these tests by 173.461(a) and 173.462. The radioactive contents shall be simulated by the use of materials (example: flour and fluorescein), which when detected would demonstrate a release of small particulates.

The test conditions of 10 CFR 71.73(a), (b), and (c)(1) shall be met and a 30 ft drop test shall be required. As a result of the 30 ft drop, only instantaneous loss of containment on impact is acceptable so long as the seller can demonstrate that the container reseals after impact.

For disposal, containers shall be able to withstand 5 m overburden (16 psi) as required by the purchase order.

The container shall be designed to be filled from the top with a removable lid to expose the entire volume. The container shall be capable of stacking two fully loaded containers or stacking to a height of 12 ft, whichever is greater. In addition to this load the container top shall be capable of also withstanding a burial load of 852 lb per square foot. The container shall also withstand a burial side load of no less than 636 lb per square foot. If the containment is preserved, the container is considered to have withstood these loads (i.e., buckling and plastic deformations are acceptable if containment is maintained).

3.2.1.3 Lid Lifting Device Attachment Points

The lid lifting device attachment points shall be capable of supporting the weight of the lid with a safety factor of three based on the yield strength of the material. They shall be removable or otherwise capable of being made inoperable for transport, or shall be designed with strength equivalent to that required for lifting attachments. If they meet the requirements for lifting attachments, then the connection between the lid and the box must also meet the requirements while still maintaining a seal.

3.2.1.4 Forklift Channels

The outside of the channels shall be separated by a distance approximately 50% of the length of the box.

3.2.2 Physical

3.2.2.1 Container

The box and lid shall meet the design and construction criteria as specified in 49 CFR 173.24, 49 CFR 173.411, 49 CFR 173.412(b), (c), (d), (e), (f), (i), (j), (k), (l), and 10 CFR 71.43 (b), (c), (e), (f), (g), (h). Tiedowns shall conform to the standards found in 10 CFR 71.45 if they are present.

3.2.2.2 Paint

The paint shall provide a uniform coating for the container. The purpose of coating is to prevent rust during outdoor storage for periods of up to three years. When specified in the purchase order, however, the container shall be coated to assure a 25-year service life. In such cases, either of paragraphs 3.2.2.3 thru 3.2.2.6 (below) are considered to meet this requirement.

The paint shall be applied uniformly to the container interior and exterior. The color shall be yellow. The primer and finish coat shall conform to the requirements of the specifications TT-P-645B and TT-E-489G, respectively. They shall be applied in accordance with the procedures in SSPC-PA 1 and the manufacturer's recommendations. All surfaces shall be thoroughly cleaned to remove visible dirt, salt, oil, grease, chemical deposits, and other contaminants by either washing with a commercial detergent or by any other cleaning method that meets SSPC-SP-1 and SSPC-SP-6.

The interior and exterior surfaces shall be painted. The dry film thickness shall be continuous and without bubbles. Total dry film thickness, including primer coats, shall be a minimum thickness of 3 mils. Interior coating shall be thoroughly cured and dry before the cover is placed on the container.

3.2.2.3 25-Year Life Paint

The container shall be coated with epoxy-polyamide paint in accordance with MIL-P-24441A (SH) or a functionally equivalent paint or coating system which shall assure the container a 25-year service life. Equivalence shall be determine by the Buyer. The color shall be light gray and provide a contrasting background to the colors specified in 49 CFR 172, Appendix A, Table 1. The following requirements for pretreatment prior to painting shall be met:

- all surfaces shall be thoroughly cleaned to remove visible dirt, salt, oil, grease, chemical deposits, and other contaminants by either washing with a commercial detergent or by any other cleaning method that meets SSPC-SP-1;

- all surfaces shall be made free of visible rust, rust scale, mill scale, and other foreign matter by abrasive blasting to SSPC-SP 6 and/or pickling according to SSPC-SP 8; and

- one coat of RUST-OLEUM ZINC-SELE 9334 green primer and one coat of RUST-OLEUM 9391 white primer (or two functionally equivalent coatings as determine by the Buyer) shall be applied.

The paint shall by applied according to SSPC-PA 1. The interior and exterior surfaces shall be painted with an epoxy-polyamide coating, RUST-OLEUM 9300 Heavy Duty Epoxy System finish coat, or Buyer approved functional equivalent. The dry film shall be continuous and without bubbles. Total dry film thickness, including all primer coats, shall be a minimum thickness of 4 mils. Interior coating shall be thoroughly cured and dry before the cover is placed on the container.

3.2.2.4 Zinc Coating

The container shall be constructed from ASTM A-36 steel and zinc coated to meet the requirements of ASTM A-123 or A-153, Class B-2. If applicable, the weld surface shall be coated with zinc paint or with epoxy-polyamide paint in accordance with MIL-P-24441A (SH) (see Section 3.2.2.1). Zinc-coated surfaces must be pretreated before painting. Pretreatment by a phosphoric acid type, Porter Galvaprep 45 is recommended. The zinc-coated articles shall be free from uncoated areas, blisters, flux deposits, black spots, dross inclusions, and other types of projections that would interfere with their use. ASTM A-153, Weight of Coating Test requiring stripping, and Packaging Requirements shall not apply. The zinc coating on the inside and outside of the box and lid shall be treated with a chromate passivation process.

Nuts, bolts, signs, channels, and other steel used in the construction of the container shall be either:

(a) Hot-dipped galvanized per ASTM A-153, Class C, or

(b) Electroplated zinc per ASTM B-633, Type I, thickness classification number Fe/Zn 13.

Dimensions of all components shall be adjusted before coating, or after, to accommodate the added thickness of the zinc. Zinc-coated threaded parts shall be coated with a lubricant which shall be dry to the touch. Coated parts shall be easily assembled. ASTM A-153, Weight of Coating Test, requiring stripping, and the packaging requirements shall not apply.

3.2.2.5 Aluminum Coating

The container shall be constructed from ASTM A-36 steel and aluminum coated to meet the requirements of ASTM A-463, Type 2, 72-100. The coating on any surface shall be a minimum of 1.7 mils. Aluminum-coated articles shall be free from uncoated areas, blisters, flux deposits, black spots, dross inclusions, and other types of projections that would interfere with their use. The thickness of the aluminum coating on the inside and outside of the box and lid shall be determined as per ASTM A-428.

Nuts, bolts, rings, channels, and other steel used in the construction of the container shall be hot-dipped aluminum-coated according to ASTM A-463, Type 2, 72-100. The coating shall be 1.7 mils thick minimum on any given surface. Dimensions of all components shall be adjusted before coating to accommodate the added thickness of the aluminum. Aluminum-coated threaded parts shall be coated with a lubricant which shall be dry to the touch. Coated parts shall be easily assembled.

3.2.2.6 Stainless Steel

Three hundred (300) Series Stainless Steel is an acceptable material of construction. Stainless steel containers shall not require additional coating. Superficial marks are acceptable.

3.2.2.7 Weight

The weight of the empty container (i.e., box and lid) shall not exceed 25% of the maximum gross weight for the container.

3.2.2.8 Dimensions

The interior and exterior dimensions of the container shall be specified by the buyer.

3.2.2.9 Gaskets

Gasket material shall be flexible cellular rubber material as defined in MATERIAL D 1056. Temperature range: - 40 °F to + 158 °F. Durometer 00 Scale equals 35 ± 10 points. The 25% compression deflection equals 2 to 5 psi. Thickness tolerance: 1/8 in. ± 0.020 in.; 3/16 in., 1/4 in., 5/16 in. ± 0.025 in.; 3/8 in. ± 0.035 in.; 1/2 in. ± 0.040 in.; 5/8 in. ± 0.040 in., 3/4 in. ± 0.065 in. Substitutes for this material must be approved by WHC prior to use.

3.2.2.10 Reinforcements

Corrugation, crimping, ribs, and channels shall be authorized as approved strengthening devices.

3.2.2.11 Welds

Welds shall conform to NUREG/CR-3019.

3.2.3 Environments

3.2.3.1 Operating Performance

The container shall be capable of meeting the operating performance requirements specified herein during and after exposure to any feasible combination of the following environmental conditions.

a.	Pressure	Maximum:	20 psia
		Minimum:	3.2 psia
b.	Temperature	Maximum:	120 °F
		Minimum:	-27 °F
c.	Humidity	Maximum:	100% relative
		Minimum:	20% relative
d.	Rain	Maximum of 2.5 in. in any 24-hour period including short period extremes of 2 in. in one hour	

4.0 QUALITY ASSURANCE PROVISIONS

4.1 TESTING

Unless otherwise specified in the contract or purchase order, it shall be the responsibility of the Seller to conduct the required tests in Section 6.2 or provide calculations. The Seller shall provide the controls that insure that the procedures and material meet the requirements of this specification. The Buyer reserves the right to inspect the documentation for conformance to requirements when deemed necessary to assure that the container conforms to this specification.

4.2 VERIFICATION

4.2.1 Maneuverability and Lid Closure

The maneuverability and lid closure performance shall be demonstrated and accepted by the buyer.

4.2.2 Paint

The Seller shall provide documentation that identifies the paint used, the name and address of the paint manufacturer, and the product qualification to verify that the paint and primer meet the requirements of this specification.

4.2.3 Test Documentation

The Seller shall provide the Buyer with a complete set of documentation according to paragraph 6.0

4.3 QUALITY CONFORMANCE

The container shall be receipt inspected by the buyer's Quality Assurance (QA) department for conformance to the requirements of this specification. The container shall be welded in conformation with NUREG/CR-3019, or an engineering approved equivalent specification. Visual inspection of final pass shall be in accordance with AWS D 1.1, Section 8. Magnetic Particle (MT) inspection in accordance with Section 8, Part D shall be required for all welds on low carbon steel containers. Non-magnetic materials shall be Liquid Penetrant (PT) tested according to Section 8, Part D.

5.0 DATA SUBMITTAL REQUIREMENTS

The Seller shall provide for the Buyer's review and approval three complete sets of drawings, test procedures, and engineering evaluations (calculations) or comparative data showing that construction methods, container design, and materials of construction comply with this specification. This information shall be provided prior to authorizing manufacture of the item and two additional sets shall accompany each order of boxes shipped. The Seller shall provide tare weights for the box and lid. The Seller shall provide container closure instruction including torquing requirements.

5.1 QUALITY ASSURANCE DOCUMENTATION

The Quality Assurance requirements shall be specified by the buyer in the purchase order. When specified in the purchase order, the following documents shall be submitted for review and approval prior to use.

- Welding Procedures
- Welding Procedures Qualification Records
- Welder Qualification Records
- Magnetic Particle Examination Procedure
- Liquid Penetrant Examination Procedure
- Nondestructive Testing Personnel Qualifications

5.2 TEST RESULTS DOCUMENTATION

It shall be demonstrated that the container meets the following:

1. Drop Tests

   - 30-Foot Drop Requirement [10 CFR 71.73(a), (b), and (c)(1)].

2. Standard Requirements for All Packages (49 CFR 173.24)

3. General Design Requirements (49 CFR 173.411)

4. Additional Design Requirements for Type A Packages [49 CFR 173.412(b), (c), (d), (e), (f), (i), (j), (k), (l), (m)]

5. Type A Package tests (49 CFR 173.465)

6. Specification 7A Requirements (49 CFR 178.350)

7. General Standards for All Packages [10 CFR 71.43, except (a) and (d)]

8. Loading Requirements and Operating Performance Requirements as stipulated in Sections 3.2.1.2 and 3.2.3.1

6.0 TEST CONTENTS

Test contents consist of soil, tools, damaged or obsolete equipment (e.g., valves, piping, etc.), and miscellaneous debris (objects such as metal scrap, rubber, plastic, paper, wood, cloth, concrete, building rubble, etc.).

Heavy, bulky materials (concrete chunks, motors, pumps), equipment or material with sharp corners or protrusions which could result in highly localized forces, shall be securely fastened/positioned within the package.

SPECIFICATION RELEASE RECORD

Contractor Name	Facility Or Project Identification	SRR No.
Westinghouse Hanford Co.	Packaging Design Engineering	011047

Specification No.	Rev	TITLE
HS-BP-0041	E	Container, Metal Box for Shipping and Storage of Solid, Low-Level Radioactive Material

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Originator	R.R. Cruz R.R. Cruz	
Dept. HLEAF 84 200	Phone 2-1468	DATE
Design		
Check		
Quality Assurance	D.W. Smith	4/8/93
Project	J.W. Thornton	4/8/93
Program		
Safety	Per telecon R.R. Cruz for R.L. Martin	4/12/93

Key Words

Container, Shipping, Storage, Low-Level Material IL-2SQ

DISTRIBUTION

NAME	LOC.	QTY.	NAME	LOC.	QTY.
SJ Amir	N3-11	1	JA Lauck	B5-20	1
WB Barton	L4-75	1	RL Martin	R3-20	1
RB Bendixsen	N1-75	1	MW Meagher	G1-61	1
TL Bennington	H4-16	1	GW Mettler	R3-20	1
TD Blankenship	B1-58	1	MR Morton	R2-77	1
WW Bowen	S6-65	1	JN Nansen	L6-35	1
RF Carlstrom	G2-02	1	SH Norton	N3-14	1
MR Carver	N3-11	1	T Romano	G2-02	1
KE Conlin	L6-18	1	MM Serkowski	S6-70	1
GL Dunford	R1-51	1	JS Sheehan	N3-11	1
LJ Estey	T5-20	1	DW Smith	L6-35	1
JG Field	G2-02	1	RG Stickney	L0-17	1
PW Griffen	R2-77	1	JW Thornton	G2-03	1
DG Harlow	S6-17	1	RJ Thompson	S6-17	1
LM Hay	G2-02	1	SL Thompson	G1-61	1
JJ Hogan	G1-40	1	EA Weakley	L6-26	1
DR Kibbe	H5-33	1	BF Weaver	T3-11	1
TA Lane	S0-61	1	JM Welsch	L6-13	1
RR Cruz	G2-03	1	RG Dieffenbacher	H6-01	1

Release Stamp

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