Packaging Management Council

Technical Requirements for Procurement of Industrial Packaging Type 1 (IP-1) Carbon Steel Boxes

January 27, 2020

REVISION HISTORY

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Packaging Management Council (PMC) Approvals

PMC – Chair, Sylvia McGhee	1/27/2020 Date
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PMC Specification Subcommittee Chair, Steven Fellows	1/27/2020 Date

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1.0 INTRODUCTION

The Packaging Management Council (PMC) has prepared these Technical Requirements for use by DOE contractors. This document is part of the PMC's effort to standardize practices by most, if not all, contractors. This document, along with any contractor's site-specific requirements, can be utilized to meet Department of Transportation regulations and DOE orders. If not specifically used, this document may act as a guidance document for contractors to create their own technical requirements. This document has been produced by the PMC Steel Box Working Group. Any questions, comments, or suggested changes should be directed to the PMC Coordinator.

2.0 GENERAL INFORMATION

2.1 Scope

This document identifies the Technical requirements for US Department of Transportation (DOT) IP-1 carbon steel boxes.

2.2 Box Usage

Each standard size box type will be designed so that it can be used to store and transport LSA-1 or SCO solid radioactive materials and waste having the material forms as described in Section 4.3. Oversize Boxes (referenced Section 2.2.A) shall also be designed so they can be used to store and transport a standard sized box. Boxes designed, fabricated, and procured to these technical requirements are to be utilized only for LSA-1 and SCO materials. This container is not authorized for liquids.

2.3 Regulatory Requirements

Each standard and oversized box shall meet the requirements for hazardous material packagings in Title 49 Code of Federal Regulations (CFR) Subchapter C and will be designed and marked in accordance with 49 CFR 173.411(a), Industrial Packaging Type 1 (IP-1).

2.4 References

2.4.1 Industry Standards

The following DOE orders, DOE handbooks, waste acceptance criteria, and industry standards are referenced for use in this specification. The latest available edition/amendment is to be used unless specifically given or otherwise directed by the Buyer. Materials, based on standards other than those specified herein, may be used providing mechanical, chemical, and performance properties are suitable for their design application (e.g., welding, compression, ductility, etc.) if approved by the Buyer.

- ANSI/AWS D1.1/D1.1M, Structural Welding Code-Steel
- ANSI/AWS D1.3, Structural Welding Code-Sheet Steel

- ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Code.
- ASME NQA-1-2008/1a-2009, Quality Assurance Requirements for Nuclear Facility Applications.
- ASTM A1011/A 1011 M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- ASTM A 36/A 36M, Standard Specification for Carbon Structural Steel.
- ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- ASTM A576, Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
- ASTM D 1056, Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.
- Documentation and Verification Required for Type A Packaging Use, HNF-SD-TP-TI-006, Revision 1, November 27, 2000
- DOE/NV-325, Nevada National Security Site (NNSS) Waste Acceptance Criteria (WAC)
- DOE Order 414.1D, Contractor Requirements Document (CRD), Attachment 3, Suspect/Counterfeit Items Prevention.
- DOE-HDBK-1221-2016, Change Notice 1, Suspect/Counterfeit Items Resource Handbook
- Mil-HDBK-695E, Rubber Products: Recommended Shelf-Life
- SAE J429, Mechanical and Material Requirements for Externally Threaded Fasteners.
- SAE J995, Mechanical and Material Requirements for Steel Nuts.
- SSPC-SP 1, Surface Preparation Specification No. 1, Solvent Cleaning.
- SSPC-SP 2, Surface Preparation Specification No. 2, Hand Tool Cleaning

2.5 Definitions/Abbreviations

Box Configuration– The Technical Requirements provide for multiple box configurations. A box size shall be defined (see Section 3.2.A) along with all other features that impact box structure and configuration (e.g., type of closure system, venting, and lift attachments). The configuration will be documented by use of a set of fabrication drawings. Once the Buyer and Seller concur on the set of drawings, the Buyer will identify that set of drawings in the purchase agreement by, title of drawing, drawing number, and revision. By

doing this, the Seller knows which set of drawings has been accepted by the Buyer and will be used in the fabrication of the Buyer's steel box.

Buyer – Individual who represents the organization utilizing this specification to purchase and/or inquire on the purchase of carbon steel boxes

PMC (Packaging Management Council) – The PMC is an organization that is made up of DOE contractor packaging professionals. The PMC provides a forum for the identification, analysis and resolution of issues to support DOE packaging programmatic needs and to standardize, if possible, common practices. This specification is produced as a part of the PMC's standardization effort through an approved PMC working group.

Seller – Primary fabricator of completed boxes built to this specification.

Shelf life - The maximum period of time, starting from the time of manufacture, that an elastomeric seal element, appropriately packaged, may be stored under specific conditions, after which time it is regarded as unserviceable for the purposes for which it was originally manufactured

2.6 PMC Responsibilities

The PMC is responsible for the origination and revision of these Technical Requirements. PMC is not responsible for any contractual issues between Buyers and Sellers.

3.0 BOX SPECIFICATIONS

3.1 Design and fabrication of IP-1 carbon steel boxes shall comply with packaging requirements in 49 CFR 173.411(b)(1). Additional design features and technical requirements for fabrication are identified in Section 3.2 below. Listed requirements are applicable to all box designs unless otherwise noted.

3.2 Basic Design and Technical Requirements

ITEM	REQUIREMENT
A. **Dimensions**	**Standard Size Boxes** 1) 6'-0"L x 4'-0"W x 2'-0"H External (~48 ft^3) 2) 7'-0"L x 4'-0"W x 2'-0"HL External (~56 ft^3) 3) 6'-0"L x 4'-0"W x 4'-0"H External (~96 ft^3) 4) 7'-0"L x 4'-0"W x 4'-0"H External (~112 ft^3) 5) 8'-0"L x 4'-0"W x 4'-0"H External (~128 ft^3) Note 1: Tolerances are stated on the fabrication drawings and will not vary unless agreed upon by the Buyer and Seller. The overall height dimension is from the bottom of the box (including riser legs) to the top (including the lid). **Oversize Boxes** Oversize boxes shall have an internal cavity that will allow boxes, 1-5 above, to fit in the box plus allow the use of loading and/or rigging, and/or blocking and bracing equipment while minimizing void spaces. The Buyer will work with the Seller in developing the design of these oversized boxes. The Buyer will provide all the information on the loading and/or rigging, and/or blocking and bracing equipment.
B. **Materials of Construction (Steel Panels & Structure)**	1) Sheet steel shall be a minimum 12-gauge sides/lid and 10-gauge bottom. ASTM A1011 Structural Steel Grade 36 Type 2 is the preferred material. Once a box design is established, tested, and/or analyzed to a classification and type/grade of A1011 steel and accepted by the Buyer, the design shall be fixed. 2) Plate, bar, and shapes shall meet or exceed the requirements of ASTM A36. 3) Structural tubing, (e.g., square, round) shall meet or exceed the requirements of ASTM A500. Bottom and sidewalls panel-to-panel joints shall be welded both external and internal as identified on the fabrication drawings.

ITEM	REQUIREMENT
C. Fabrication Drawings	Detailed drawings documenting how the specified box is fabricated.
D. Gasket Material	Gasket material shall meet ASTM D 1056. Gasket material, used for lid, filter ports, or vents shall meet the temperature requirements of −40 °C (−40 °F) to 70 °C (158 °F). There shall be at least 75% of shelf life remaining at the time the Buyer receives the box(es).
E. Bolting Hardware	Hardware shall be zinc-plated steel, 3/8" diameter minimum. Bolts shall be SAE J429 Grade 5 Hex Head or better. Hex nuts shall be SAE J995 Grade 5 or better. Bolts and nuts shall meet manufacturer and SAE requirements and the Seller will verify they are not suspect/counterfeit items (DOE –HNBK-1221-2016, Suspect/Counterfeit Items Resource Handbook)
F. Payload	All standard size boxes in section 3.2(A) shall be capable of holding 10,000 lbs. (4,536 Kgs.) minimum.
G. Strength	1) A fully loaded (max gross weight) box <u>not going to NNSS</u> shall be capable of supporting a uniformly distributed load (compressive strength) as required by 49 CFR 173.465(d) 2) A Fully loaded (max gross weight) box must meet the requirements in (1) above and those that <u>will be shipped to NNSS</u> must meet their Waste Acceptance Criteria in that the box shall be capable of supporting a uniformly distributed load (compressive strength) of 3,375 lbs./ft^2 (NNSS WAC Section 3.2.5)
H. Closure System	The box design shall have bolted closures with gasket unless otherwise specified (e.g., Clips). Gasket compression for any closure shall be no less than 20% and no greater than 80% of gasket thickness when system is fully closed. Closure system shall not interfere with box stacking capabilities.
I. Lid Locking	Each box design shall include at a minimum a ½" hole as a means of securing the lid to the lower box on two opposing corners using a standard padlock.
J. Sidewall Support	Structural members (channel, tube, angles, etc.) for sidewall support shall be located on the box interior. Note: This does not apply to structural members integral to the box closure system or riser legs located below box.

ITEM	REQUIREMENT
K. Lifting/ Manipulating	1) Each box shall include riser legs to allow for manipulation with a forklift. There shall be three 4" high riser legs; installed parallel with the box short side and shall run the full length of the short side of the box. 2) Lifting attachments that are designed to lift the box with contents shall meet the requirements of 49 CFR 173.410(b). 3) Lids shall include lift handles on two opposing sides. When lid forklift channels are specified, there shall be a total of two – 8" minimum wide, 4" maximum high and installed parallel with the box short sides. Channels shall be designed to collapse on impact without penetrating any part of the box structure. Location of lid lift handles or forklift channels shall not interfere with box stacking capabilities.
L. Internal Tie-Downs	Tie-downs will be specified in the purchase order only when required by the Buyer.
M. Liners	The liner will be specific in the purchase order only when required by the Buyer.
N. **Venting**	1) The boxes will have a provision for the installation of filter vents. When filter vents are to be installed by the Seller, the Buyer will provide the filter vents. 2) Boxes shall have two filter ports located on opposing sides of the box and within 6" from the top of box. Threads shall be a ¾" diameter NPS-14 unless built to accommodate a unique filter, authorized by and provided by the Buyer. When the Seller installs filter vents, they will package in a box the hardware used for plugging ports. 3) Box designs in Section 3.2 (A) of this specification shall meet the reduction of ambient pressure requirements in 49 CFR 173.412(f).

ITEM	REQUIREMENT
O. Finish	1) Remove all sharp edges and burrs inside and out of the box 2) Boxes shall be cleaned per SSPC-SP 1 and SSPC-SP 2 or per coating manufacturers specification 3) Interior/Exterior primer/paint manufacturer and color shall be Seller's standard unless otherwise specified. 4) Primer/paint minimum thickness (unless otherwise specified) and application shall be in accordance with coating manufacturer's recommendations Coatings shall be allowed to completely cure prior to full assembly of boxes in preparation for shipment
P. Markings	1) Markings shall be per 49 CFR 172.310 (b) & (c). 2) Each box shall be identified with the Seller's name/address, box size (volume in m^3 (ft^3)), and drawing with revision number. For each box size ordered a unique serial number will be assigned and marked on the box. 3) Each box shall be marked with the **tare weight** in both kg and lbs. 4) Each box shall be marked with the **maximum payload weight** in both kg and lbs. 5) Each box shall be marked with the **maximum gross weight** in both kg and lbs. 6) Adjacent to each lid lifting attachment (handle, fork channel, etc.) stencil the following – "Lid lift only; render unusable prior transport".

3.3 Sub-tier Suppliers

Design and technical requirements from this document shall be imposed on sub-tier supplier's work and items they are supplying, as applicable. Primary fabrication functions (i.e., assembly and welding) are the responsibility of the Seller and shall not be outsourced to a sub-tier supplier.

The Seller shall identify and include in subcontracts applicable quality assurance requirements based on the graded approach when issuing procurements to their sub-tier suppliers

4.0 PERFORMANCE REQUIREMENTS

The following performance requirements apply to the box sizes designed and built in accordance with the requirements from Section 3.2 above. The Seller shall ensure the following:

4.1 Boxes are to maintain containment of material specified by Buyer under normal and routine conditions of transport and storage.

4.2 Boxes shall be capable of withstanding the effects of vibration during normal conditions of transport in accordance with 49 CFR 173.410(f). When appropriate, boxes shall meet the compressive strength requirements in Paragraph 3.2(G), only when shipping boxes to NNSS.

4.3 Design and analysis shall qualify boxes for use with Forms of Material 1, 2, & 3 as identified below.

4.3.1 Form Number 1: Solids – any particle size.

A packaging qualified for these contents is expected to contain radioactive contents of any representative particulate size.

4.3.2 Form Number 2: Solids – large particle size only (i.e., sand, concrete, debris, soil).

Contents of a corresponding particulate size such as soil or construction debris (Glass or plastic lab ware having fine particulate available for dispersion would not fit this category and would require a packaging qualified for fine particulate, Form Number 1.).

4.4.4 Form Number 3: Solids – objects with no significant dispersible or removable contamination (for definition, see 49 CFR 173.443, "Contamination Control").

- Metals with activation products
- Forms of metals/alloys/compounds of uranium, thorium
- Solid materials with the radioactive material firmly fixed in place, possibly by the application of fixing media (i.e., paint)
- Solidified material

In addition to Material Forms 1, 2, and 3, the design, and analysis of Oversize Boxes shall also accommodate a payload of one (2'-0"H or 4'-0"H) or two (2'-0"H) Standard Size Boxes as applicable for the box design.

5.0 FABRICATION AND ASSEMBLY REQUIREMENTS

5.1 Work is to be performed to the technical requirements of this document and to the latest revision of fabrication drawings and quality documents reviewed and accepted by the Buyer.

5.2 All box material and components shall be new and unused, as well as, free from defects or damage (integral to material or occurring during fabrication that would adversely affect a box's performance or maintainability).

5.3 Welding

Welding personnel shall be qualified to AWS D1.1, AWS D1.3, or ASME Section IX, as appropriate, for the work they are performing. The selected code(s) and use

of weld filler material shall be appropriate for the steel used and shall be identified in weld procedures.

5.4 Weld Inspection

Welding Inspection shall be as per AWS D1.1, and AWS D1.3. AWS Certified Welding Inspectors (CWI) will be qualified in accordance with AWS QC1. The CWI's Certificate must be current. Qualification by experience or company certification is not permitted.

5.5 Leak Tests

The Seller will determine a leak test method that will evaluate weld integrity for each standard and/or oversize box fabricated to this document. This test shall be performed prior to applying any primer or topcoat. Prior to preforming the leak test, each weld shall be verified by the Seller's CWI (see 5.4). This test is to challenge the weld integrity and ensure there are no leaks. The Seller is to close the box in accordance with their closure instructions. They are to determine the pressurization to be used and will monitor the pressure for indication of leaks not visually identifiable. When leaks are identified, they are to be repaired if applicable, in accordance with the Seller's Quality Assurance Programs (QAP).

6.0 QUALITY PROGRAM

6.1 Buyers Quality Assurance Program (QAP) Requirements

The Buyer's QAP is based on ASME NQA-1-2008/1a-2009, Quality Assurance Requirements for nuclear facility applications. Using a graded approach, the Buyer will establish specific NQA-1 requirements that the Seller must implement to ensure the technical requirements identified in this document will be met.

6.2 Buyer's Evaluation of the Seller's Quality Assurance Program

The Buyer has the option to either perform an onsite audit, perform a document review, or use of a third party audit to ensure compliance with the QA requirements identified in Section 6.1 above.

6.2.1 Document Review

Working with their welding, DOT, QA and other SMEs, the Buyer will develop a list of documents that the Seller will provide upon request for the Buyer's review. These documents can be, but not limited to, the following:

- The Seller's current QAP document
- A listing of the Seller's procedures and forms (records) used to implement their QAP. This will allow the Buyer's SMEs to request specific documents and records
- Test plans and procedures for performing tests required in Section 5 in this specification
- Inspection procedures

- Welding qualifications and certificates
- Certificate of Conformance procedure
- Training plans and records for both implement the QA program and DOT regulations
- Fabrication drawings – Complete set, etc.

6.2.2 Onsite Audit

The Buyer, at the request of the SMEs, will request documents similar to this in Section 6.2.1 in this specification. The Buyer, acting as the intermediary between the Seller's QA Manager and the Buyer's QA SME, will establish an audit plan. The Buyer's SMEs will perform an onsite assessment to determine if the Seller's QAP will ensure the technical requirements identified in this specification can be met. This onsite audit will be preformed as a pre-assessment to the award of a purchase order.

6.2.3 Use of a third party audit

DOE contractors who participate in the Energy Facility Contractors Group (EFCOG) Supply Chain Quality Task Group perform joint audits of various suppliers. They also make these audits available to other DOE contractors. A DOE contractor who chooses to use one of these audits are required to evaluate the audit report prior to acceptance to ensure the audit meets their specified QA requirements.

6.2.4 When the Seller's QA program does not meet the Buyer's QA requirements?

When the Seller cannot meet NQA-1 requirements identified in Section 6.1 above, the Buyer may use the requirements in ASME NQA-1-2008/2009a Part II: Quality Assurance Requirements for Nuclear Facility Applications, Subpart 2.14: Quality Assurance Requirements for Commercial Grade Items and Services

6.3 Suspect Counterfeit Item Prevention Program

The Buyer will work with the Seller to ensure the Seller has a Suspect Counterfeit Item (S/CI) Prevention program as required by DOE Order 414.1D, CRD, Attachment 3.

As part of Seller's QA and S/CI program the Seller will have a process in place to ensure that the Certification documents, e.g., Certified Materials Test Reports (CMTRs), Calibration Certs, ISO Certs, etc., are verified. This process will ensure the effectiveness of the Seller's and the Seller's subcontractor's certification approval system. This process establishes a means to verify the validity of Seller's certificates and the effectiveness of their certification process. This can be done in one of two ways. First, by independent evaluation of requirements, this can be done by use of an independent third party organization. Second, by independent

assessment by the Seller, which is done by direct examination at the Sellers's sub-tier's facility

6.4 Award of Purchase Order

When the Buyer has completed their evaluation identified in Section 6.2 above, the Buyer may request their representative to be on site to perform specific inspections, witness tests, observe and verify processes (i.e. welding), perform document reviews, etc. The Buyer and Seller will work out a schedule to ensure these activities take place.

7.0 DOCUMENTATION

Documentation requested by the Buyer, shall be legible, and may be submitted either by a hard copy or by electronic means. Electronic submittal must be in format readable by Buyer (e.g., Adobe® PDF).

7.1 Buyer required documentation for industrial Packaging Type 1 (IP-1)

- The Seller will provide documentation showing that each lifting attachment that is a structural part of the package must be designed with a minimum safety factor of three against yielding when used to lift the package in the intended manner.
- The Seller will provide documentation showing that each box or boxes are designed so that failure of any lifting attachment under excessive load would not impair the ability of the package to meet other requirements in 49 CFR Part 173.
- The Seller will provide documentation showing that any other structural part of the package which could be used to lift the package must be capable of being rendered inoperable for lifting the package during transport or must be designed with strength equivalent to that required for lifting attachments.
- The Seller will provide documentation showing that the package is be capable of withstanding the effects of any acceleration, vibration or vibration resonance that may arise under normal conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use (49 CFR 173.24, 173.24a, and 173.24b or 49 CFR 173 Appendix C).
- The Seller will provide documentation showing that the materials of construction of the packaging and any components or structure will be physically and chemically compatible with each other.

7.2 Fabrication Drawings

Though not required by the regulations, the Buyer is requesting that the Seller produce a complete set of fabrication drawings that document the design, materials of construction, methods of construction (e.g. welding), dimensions, weight, closure and closure materials (including gaskets, closing hardware, etc.) of each item of the containment system, shielding, if applicable and packing materials used in normal transportation. For

traceability, the fabrication drawings should reference any test report that the box configuration is subjected to.

7.3 Demonstration of compliance

When the Seller chooses to use 49 CFR 173.461(a) to qualify packages as meeting the requirements in 49 CFR 173.461(a), they must clearly identify the parameters by which the analysis is performed. The detailed analysis must show that, for the contents being used during testing, the package meets the pertinent design and performance requirements for a DOT 7A Type A specification package.

8.0 STORAGE AND SHIPPING

8.1 Storage

During production and prior to shipping, materials of construction and completed boxes shall be stored in a manner that prevents degradation or damage.

8.2 Shipping

Packaging and shipping methods shall ensure that boxes are delivered to Buyer in an undamaged state. Boxes prepared for shipping shall be clean and free of dirt, oil, or other foreign contaminates. Box interior shall be free of any standing water. Box lids shall be secured to the lower box to prevent vibration induced loosening during transportation. Boxes with a clip design shall be banded and the Seller shall provide protection for paint or the lid secured by some other means. Gaskets shall not be installed, but shall be enclosed inside a waterproof bag along with the vent plugs and closure hardware. These items shall be placed inside of container and tied to a closure bolt. Boxes shall be secured to the conveyance in a manner that will prevent damage to structure or finish during transport. Tie-down straps must not be allowed to come into direct contact with coated surfaces during transport. Containers must be vented to allow barometric breathing. If installed, vent ports shall be protected from ingress of debris prior to and during transport. The containers may be tarped to provide protection from inclement weather and road hazards encountered during transport to the Buyer's facility. If used, tarps shall be secured to prevent damage to the coating from tarp movement during transportation.

9.0 MODIFICATION AND NON-CONFORMANCES

9.1 The Seller may request modifications for improvement or enhancements to this specification. The request shall identify the paragraph or appendix, the recommended change, and a justification for change.

9.2 Non-conformances to this specification or design that occur during testing or production shall be processed in accordance with the Seller's QAP. Non-conforming conditions that are minor in nature and where reworking or scrapping would not be cost-effective may be submitted to the Buyer for review and approval. Non-

conforming conditions that impact compliance with the regulatory requirements will not be accepted under any circumstance. The Buyer shall submit their approval with the resolution to the Seller's Non-Conformance Report under a separate correspondence. No box shall be delivered to the Buyer until all non-conforming conditions have been satisfactorily resolved and accepted.