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§171.8 Definitions and abbreviations In this subchapter,

Bulk packaging means a packaging, other than a vessel or a barge, including a transport vehicle or freight container, in which hazardous materials are loaded with no intermediate form of containment. A Large Packaging in which hazardous materials are loaded with an intermediate form of containment, such as one or more articles or inner packagings, is also a bulk packaging. Additionally, a bulk packaging has:

- (1) A maximum capacity greater than 450 L (119 gallons) as a receptacle for a liquid;
- (2) A maximum net mass greater than 400 kg (882 pounds) and a maximum capacity greater than 450 L (119 gallons) as a receptacle for a solid; or
- (3) A water capacity greater than 454 kg (1000 pounds) as a receptacle for a gas as defined in [§ 173.115 of this subchapter](#).

Combination packaging means a combination of packaging, for transport purposes, consisting of one or more inner packagings secured in a non-bulk outer packaging. It does not include a composite packaging.

Composite packaging means a packaging consisting of an outer packaging and an inner receptacle, so constructed that the inner receptacle and the outer packaging form an integral packaging. Once assembled it remains thereafter an integrated single unit; it is filled, stored, shipped and emptied as such.

Hazardous material means a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and has designated as hazardous under section 5103 of Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions in part 173 of this subchapter.

Non-bulk packaging means a packaging which has:

- (1) A maximum capacity of 450 L (119 gallons) or less as a receptacle for a liquid;

- (2) A maximum net mass of 400 kg (882 pounds) or less and a maximum capacity of 450 L (119 gallons) or less as a receptacle for a solid;
- (3) A water capacity of 454 kg (1000 pounds) or less as a receptacle for a gas as defined in [§ 173.115 of this subchapter](#); or
- (4) Regardless of the definition of bulk packaging, a maximum net mass of 400 kg (882 pounds) or less for a bag or a box conforming to the applicable requirements for specification packagings, including the maximum net mass limitations, provided in [subpart L of part 178 of this subchapter](#).

Overpack, except as provided in subpart K of part 178 of this subchapter, means an enclosure that is used by a single consignor to provide protection or convenience in handling of a package or to consolidate two or more packages. Overpack does not include a transport vehicle, freight container, or aircraft unit load device. Examples of overpacks are one or more packages:

- (1) Placed or stacked onto a load board such as a pallet and secured by strapping, shrink wrapping, stretch wrapping, or other suitable means; or
- (2) Placed in a protective outer packaging such as a box or crate.

Package or Outside Package means a packaging plus its contents. For radioactive materials, see §173.403 of this subchapter.

Packaging means a receptacle and any other components or materials necessary for the receptacle to perform its containment function in conformance with the minimum packing requirements of this subchapter. For radioactive materials packaging, see §173.403 of this subchapter.

Receptacle means a containment vessel for receiving and holding materials, including any means of closing.

Reconditioned packaging. See [§ 173.28 of this subchapter](#).

Remanufactured packagings. See [§ 173.28 of this subchapter](#).

Residue means the hazardous material remaining in a packaging, including a tank car, after its contents have been unloaded to the maximum extent practicable and before the packaging is either refilled or cleaned of hazardous material and purged to remove any hazardous vapors.

Reused packaging. See [§ 173.28 of this subchapter](#).

Single packaging means a non-bulk packaging other than a combination packaging.

Specification packaging means a packaging conforming to one of the specifications or standards for packagings in part 178 or part 179 of this subchapter.

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§172.101 Purpose and use of hazardous materials table.

- (h) *Column 7: Special provisions.* Column 7 specifies codes for special provisions applicable to hazardous materials. When Column 7 refers to a special provision for a hazardous material, the meaning and requirements of that special provision are as set forth in §172.102 of this subpart.
- (i) *Column 8: Packaging authorizations.* Columns 8A, 8B and 8C specify the applicable sections for exceptions, non-bulk packaging requirements and bulk packaging requirements, respectively, in part 173 of this subchapter. Columns 8A, 8B and 8C are completed in a manner which indicates that “§173.” precedes the designated numerical entry. For example, the entry “202” in Column 8B associated with the proper shipping name “Gasoline” indicates that for this material conformance to non-bulk packaging requirements prescribed in §173.202 of this subchapter is required. When packaging requirements are specified, they are in addition to the standard requirements for all packagings prescribed in §173.24 of this subchapter and any other applicable requirements in subparts A and B of part 173 of this subchapter.

§172.101 Hazardous Materials Table

Symbols (1)	Hazardous materials descriptions and proper shipping names (2)	Hazard Class or Division (3)	Identification Numbers (4)	PG (5)	Label Codes (6)	Special Provisions (7)	Packaging (173.***)		
							Except-ions (8A)	Non-bulk (8B)	Bulk (8C)
	Acetone	3	UN1090	II	3	IB2, T4, TP1	150	202	242
	Acetyl bromide	8	UN1716	II	8	B2, IB2, T8, TP2	154	202	242
G	Environmentally hazardous substance, liquid, n.o.s.	9	UN3082	III	9	8, 146, 173, 335, IB3, T4, TP1, TP29	155	203	241
G	Environmentally hazardous substance, solid, n.o.s.	9	UN3077	III	9	8, 146, 335, 384, A112, B54, B120, IB8, IP3 N20, N91, T1, TP33	155	213	240
G	Flammable liquids, n.o.s.	3	UN1993	I	3	T11, TP1, TP27	150	201	243
				II	3	IB2, T7, TP1, TP8, TP28	150	202	242
				III	3	B1, B52, IB3, T4, TP1, TP29	150	203	242
D G	Hazardous waste, liquid, n.o.s.	9	NA3082	III	9	IB3, T2, TP1	155	203	241
D G	Hazardous waste, solid, n.o.s.	9	NA3077	III	9	B54, IB8, IP2, T1, TP33	155	213	240

§ 172.102 Special provisions.

- (b) Description of codes for special provisions. Special provisions contain packaging provisions, prohibitions, exceptions from requirements for particular quantities or forms of materials and requirements or prohibitions applicable to specific modes of transportation, as follows:
- (1) A code consisting only of numbers (for example, “11”) is multi-modal in application and may apply to bulk and non-bulk packagings.
 - (2) A code containing the letter “A” refers to a special provision which applies only to transportation by aircraft.
 - (3) A code containing the letter “B” refers to a special provision that applies only to bulk packaging requirements. Unless otherwise provided in this subchapter, these special provisions do not apply to UN, IM Specification portable tanks or IBCs.
 - (4) A code containing the letters “IB” or “IP” refers to a special provision that applies only to transportation in IBCs.
 - (5) A code containing the letter “N” refers to a special provision which applies only to non-bulk packaging requirements.
 - (6) A code containing the letter “R” refers to a special provision which applies only to transportation by rail.
 - (7) A code containing the letter “T” refers to a special provision which applies only to transportation in UN or IM Specification portable tanks.
 - (8) A code containing the letters “TP” refers to a portable tank special provision for UN or IM Specification portable tanks that is in addition to those provided by the portable tank instructions or the requirements in part 178 of this subchapter.
 - (9) A code containing the letter “W” refers to a special provision that applies only to transportation by water.

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§ 173.12 Exceptions for shipment of waste materials.

- (a) **Open head drums.** If a hazardous material that is a hazardous waste is required by this subchapter to be shipped in a closed head drum (i.e., a drum with a 7.0 cm (3 inches) or less bung opening) and the hazardous waste contains solids or semisolids that make its placement in a closed head drum impracticable, an equivalent (except for closure) open head drum may be used for the hazardous waste.
- (c) **Reuse of packagings.** A previously used packaging may be reused for the shipment of waste material transported for disposal or recovery, not subject to the reconditioning and reuse provisions contained in [§ 173.28](#) and [part 178 of this subchapter](#), under the following conditions:
- (1) Except as authorized by this paragraph, the waste must be packaged in accordance with this part and offered for transportation in accordance with the requirements of this subchapter.
 - (2) Transportation is performed by highway only.
 - (3) A package is not offered for transportation less than 24 hours after it is finally closed for transportation, and each package is inspected for leakage and is found to be free from leaks immediately prior to being offered for transportation.
 - (4) Each package is loaded by the shipper and unloaded by the consignee, unless the motor carrier is a private or contract carrier.
 - (5) The packaging may be used only once under this paragraph and may not be used again for shipment of hazardous materials except in accordance with [§ 173.28](#).

§ 173.22 Shipper's responsibility.

- (a) Except as otherwise provided in this part, a person may offer a hazardous material for transportation in a packaging or container required by this part only in accordance with the following:
- (1) The person shall class and describe the hazardous material in accordance with [parts 172](#) and [173 of this subchapter](#), and
 - (2) The person shall determine that the packaging or container is an authorized packaging, including part 173 requirements, and that it has been manufactured, assembled, and marked in accordance with:
 - (i) [Section 173.7\(a\)](#) and [parts 173, 178](#), or [179 of this subchapter](#);
 - (ii) A specification of the Department in effect at the date of manufacture of the packaging or container;
 - (iii) National or international regulations based on the UN Recommendations (IBR, see [§ 171.7 of this subchapter](#)), as authorized in [§ 173.24\(d\)\(2\)](#);
 - (iv) An approval issued under this subchapter; or
 - (v) An exemption or special permit issued under subchapter A of this chapter.
 - (3) In making the determination under [paragraph \(a\)\(2\)](#) of this section, the person may accept:

- (i) Except for the marking on the bottom of a metal or plastic drum with a capacity over 100 L which has been reconditioned, remanufactured or otherwise converted, the manufacturer's certification, specification, approval, or exemption or special permit marking (see [§§ 178.2](#) and [179.1 of this subchapter](#)); or
- (ii) With respect to cargo tanks provided by a carrier, the manufacturer's identification plate or a written certification of specification or exemption or special permit provided by the carrier.
- (4) (i) For a DOT Specification or UN standard packaging subject to the requirements of [part 178 of this subchapter](#), a person must perform all functions necessary to bring the package into compliance with [parts 173](#) and [178 of this subchapter](#), as identified by the packaging manufacturer or subsequent distributor (for example, applying closures consistent with the manufacturer's closure instructions) in accordance with [§ 178.2 of this subchapter](#).
- (ii) For other than a bulk package or a cylinder, a person must retain a copy of the manufacturer's notification, including closure instructions (see [§ 178.2\(c\) of this subchapter](#)). For a bulk package or a cylinder, a person must retain a copy of the manufacturer's notification, including closure instructions (see [§ 178.2\(c\) of this subchapter](#)), unless permanently embossed or printed on the package. A copy of the manufacturer's notification, including closure instructions (see [§ 178.2\(c\) of this subchapter](#)), unless permanently embossed or printed on the package when applicable, must be made available for inspection by a representative of the Department upon request for at least 90 days once the package is offered to the initial carrier for transportation in commerce. Subsequent offerors of a filled and otherwise properly prepared unaltered package are not required to maintain manufacturer notification (including closure instructions).

§ 173.24 General requirements for packagings and packages.

(a) **Applicability.** Except as otherwise provided in this subchapter, the provisions of this section apply to—

- (1) Bulk and non-bulk packagings;
- (2) New packagings and packagings which are reused; and
- (3) Specification and non-specification packagings.
- (b) Each package used for the shipment of hazardous materials under this subchapter shall be designed, constructed, maintained, filled, its contents so limited, and closed, so that under conditions normally incident to transportation—
 - (1) Except as otherwise provided in this subchapter, there will be no identifiable (without the use of instruments) release of hazardous materials to the environment;
 - (2) The effectiveness of the package will not be substantially reduced; for example, impact resistance, strength, packaging compatibility, etc. must be maintained for the minimum and maximum temperatures, changes in humidity and pressure, and shocks, loadings and vibrations, normally encountered during transportation;
 - (3) There will be no mixture of gases or vapors in the package which could, through any credible spontaneous increase of heat or pressure, significantly reduce the effectiveness of the packaging;
 - (4) There will be no hazardous material residue adhering to the outside of the package during transport.

(c) **Authorized packagings.**

- (1) A packaging is authorized for a hazardous material only if—
 - (i) The packaging is prescribed or permitted for the hazardous material in a packaging section specified for that material in Column 8 of the [§ 172.101](#) table and conforms to applicable requirements in the special provisions of Column 7 of the [§ 172.101](#) table and, for specification packagings (but not including UN standard packagings manufactured outside the United States), the specification requirements in [parts 178](#) and [179 of this subchapter](#); or
 - (ii) The packaging is permitted under, and conforms to, provisions contained in subparts B or C of [part 171 of this subchapter](#) or [§ 173.3](#), [§ 173.4](#), [§ 173.4a](#), [§ 173.4b](#), [§ 173.5](#), [§ 173.5a](#), [§ 173.6](#), [§ 173.7](#), [§ 173.8](#), [§ 173.27](#), or [§ 176.11 of this subchapter](#).
- (2) The use of supplementary packagings within an outer packaging (e.g., an intermediate packaging or a receptacle inside a required inner packaging) additional to what is required by this subchapter is authorized provided all applicable requirements of this subchapter are met and, when necessary, suitable cushioning is used to prevent shifting within the packaging.

(e) **Compatibility.**

- (1) Even though certain packagings are specified in this part, it is, nevertheless, the responsibility of the person offering a hazardous material for transportation to ensure that such packagings are compatible with their lading. This particularly applies to corrosivity, permeability, softening, premature aging and embrittlement.
- (2) Packaging materials and contents must be such that there will be no significant chemical or galvanic reaction between the materials and contents of the package.
- (5) Packagings used for solids, which may become liquid at temperatures likely to be encountered during transportation, must be capable of containing the hazardous material in the liquid state.

(f) **Closures.**

- (1) Closures on packagings shall be so designed and closed that under conditions (including the effects of temperature, pressure and vibration) normally incident to transportation—

- (i) Except as provided in [paragraph \(g\)](#) of this section, there is no identifiable release of hazardous materials to the environment from the opening to which the closure is applied; and
 - (ii) The closure is leakproof and secured against loosening. For air transport, stoppers, corks or other such friction closures must be held in place by positive means.
- (2) Except as otherwise provided in this subchapter, a closure (including gaskets or other closure components, if any) used on a specification packaging must conform to all applicable requirements of the specification and must be closed in accordance with information, as applicable, provided by the manufacturer's notification required by [§ 178.2 of this subchapter](#).
- (h) **Outage and filling limits** —
- (1) **General.** When filling packagings and receptacles for liquids, sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the packaging or receptacle will occur as a result of an expansion of the liquid caused by temperatures likely to be encountered during transportation. Requirements for outage and filling limits for non-bulk and bulk packagings are specified in [§§ 173.24a\(d\)](#) and [173.24b\(a\)](#), respectively.

§ 173.24a Additional general requirements for non-bulk packagings and packages.

- (a) **Packaging design.** Except as provided in [§ 172.312 of this subchapter](#):
- (5) **Vibration.** Each non-bulk package must be capable of withstanding, without rupture or leakage, the vibration test procedure specified in [§ 178.608 of this subchapter](#).
- (b) **Non-bulk packaging filling limits.**
- (1) A non-bulk packaging not exceeding 400 kg may be filled with a liquid hazardous material only when the specific gravity of the material or gross mass of the package does not exceed that marked on the packaging, or a specific gravity of 1.2 if not marked, except as follows . . .
- (2) Except as otherwise provided in this section, a non-bulk packaging may not be filled with a hazardous material to a gross mass greater than the maximum gross mass marked on the packaging.
- (3) A non-bulk packaging not exceeding 400 kg which is tested and marked for liquid hazardous materials may be filled with a solid hazardous material to a gross mass, in kilograms, not exceeding the rated capacity of the packaging in liters, or gross mass of the package, multiplied by the specific gravity or gross mass of the package marked on the packaging, or 1.2 if not marked. In addition . . .
- (4) Packagings tested as prescribed in [§ 178.605 of this subchapter](#) and marked with the hydrostatic test pressure as prescribed in [§ 178.503\(a\)\(5\) of this subchapter](#) may be used for liquids only when the vapor pressure of the liquid conforms to one of the following:
- (i) The vapor pressure must be such that the total pressure in the packaging (i.e., the vapor pressure of the liquid plus the partial pressure of air or other inert gases, less 100 kPa (15 psia)) at 55 °C (131 °F), determined on the basis of a maximum degree of filling in accordance with [paragraph \(d\)](#) of this section and a filling temperature of 15 °C (59 °F)), will not exceed two-thirds of the marked test pressure;
 - (ii) The vapor pressure at 50 °C (122 °F) must be less than four-sevenths of the sum of the marked test pressure plus 100 kPa (15 psia); or
 - (iii) The vapor pressure at 55 °C (131 °F) must be less than two-thirds of the sum of the marked test pressure plus 100 kPa (15 psia).
- (5) No hazardous material may remain on the outside of a package after filling.
- (d) Liquids must not completely fill a receptacle at a temperature of 55 °C (131 °F) or less.

§ 173.24b Additional general requirements for bulk packagings.

- (e) **Stacking of IBCs and Large Packagings.**
- (1) IBCs and Large Packagings not designed and tested to be stacked. No packages or freight (hazardous or otherwise) may be stacked upon an IBC or a Large Packaging that was not designed and tested to be stacked upon.
- (2) IBCs and Large Packagings designed and tested to be stacked. The superimposed weight placed upon an IBC or a Large Packaging designed to be stacked may not exceed the maximum permissible stacking test mass marked on the packaging.

§173.28 Reuse, reconditioning and remanufacture of packagings.

- (a) General. Packagings and receptacles used more than once must be in such condition, including closure devices and cushioning materials, that they conform in all respects to the prescribed requirements of this subchapter. Before reuse, each packaging must be inspected and may not be reused unless free from incompatible residue, rupture, or other damage which reduces its structural integrity. Packagings not meeting the minimum thickness requirements prescribed in paragraph (b)(4)(i) of this section may not be reused or reconditioned for reuse.
- (b) Reuse of non-bulk packaging. A non-bulk packaging used more than once must conform to the following provisions and limitations:
- (1) A non-bulk packaging which, upon inspection, shows evidence of a reduction in integrity may not be reused unless it is reconditioned in accordance with paragraph (c) of this section.

- (2) Before reuse, packagings subject to the leakproofness test with air prescribed in § 178.604 of this subchapter shall be—
- Retested without failure in accordance with § 178.604 of this subchapter using an internal air pressure (gauge) of at least 48 kPa (7.0 psig) for Packing Group I and 20 kPa (3.0 psig) for Packing Group II and Packing Group III; and
 - Marked with the letter “L”, with the name and address or symbol of the person conducting the test, and the last two digits of the year the test was conducted. Symbols, if used, must be registered with the Associate Administrator.
- (3) Packagings made of paper (other than fiberboard), plastic film, or textile are not authorized for reuse;
- (4) Metal and plastic drums and jerricans used as single packagings or the outer packagings of composite packagings are authorized for reuse only when they are marked in a permanent manner (e.g., embossed) in mm with the nominal (for metal packagings) or minimum (for plastic packagings) thickness of the packaging material, as required by § 178.503(a)(9) of this subchapter, and—
- Except as provided in paragraph (b)(4)(ii) of this section, conform to the following minimum thickness criteria:

Maximum capacity not over	Minimum thickness of packaging material	
	Metal drum or jerrican	Plastic drum or jerrican
20 L	0.63 mm (0.025 inch)	1.1 mm (0.043 inch).
30 L	0.73 mm (0.029 inch)	1.1 mm (0.043 inch).
40 L	0.73 mm (0.029 inch)	1.8 mm (0.071 inch).
60 L	0.92 mm (0.036 inch)	1.8 mm (0.071 inch).
120 L	0.92 mm (0.036 inch)	2.2 mm (0.087 inch).
220 L	0.92 mm (0.036 inch) ¹	2.2 mm (0.087 inch).
450 L	1.77 mm (0.070 inch)	5.6 mm (0.197 inch).

¹ Metal drums or jerricans with a minimum thickness of 0.82 mm body and 1.09 mm heads which are manufactured and marked prior to January 1, 1997 may be reused. Metal drums or jerricans manufactured and marked on or after January 1, 1997, and intended for reuse, must be constructed with a minimum thickness of 0.82 mm body and 1.11 mm heads.

- For stainless steel drums and jerricans, conform to a minimum wall thickness as determined by the following equivalence formula:

FORMULA FOR METRIC UNITS

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{Rm_1 \times A_1}}$$

FORMULA FOR U.S. STANDARD UNITS

$$e_1 = \frac{21.4 \times e_0}{\sqrt[3]{(Rm_1 \times A_1)/145}}$$

where:
 e_1 = required equivalent wall thickness of the metal to be used (in mm or, for U.S. Standard units, use inches).
 e_0 = required minimum wall thickness for the reference steel (in mm or, for U.S. Standard units, use inches).
 Rm_1 = guaranteed minimum tensile strength of the metal to be used (in N/mm² or for U.S. Standard units, use psi).
 A_1 = guaranteed minimum elongation (as a percentage) of the metal to be used on fracture under tensile stress (see paragraph (c)(1) of this section).

- (5) Plastic inner receptacles of composite packagings must have a minimum thickness of 1.0 mm (0.039 inch).
- (6) A previously used non-bulk packaging may be reused for the shipment of hazardous waste, not subject to the reconditioning and reuse provisions of this section, in accordance with § 173.12(c).
- (7) Notwithstanding the provisions of paragraph (b)(2) of this section, a packaging otherwise authorized for reuse may be reused without being leakproofness tested with air provided the packaging—
- Is refilled with a material which is compatible with the previous lading;
 - Is refilled and offered for transportation by the original filler;
 - Is transported in a transport vehicle or freight container under the exclusive use of the refiller of the packaging; and
 - Is constructed of—
 - Stainless steel, monel or nickel with a thickness not less than one and one-half times the minimum thickness prescribed in paragraph (b)(4) of this section;
 - Plastic, provided the packaging is not refilled for reuse on a date more than five years from the date of manufacture marked on the packaging in accordance with § 178.503(a)(6) of this subchapter; or
 - Another material or thickness when approved under the conditions established by the Associate Administrator for reuse without retesting.
- (c) Reconditioning of non-bulk packaging.
- For the purpose of this subchapter, reconditioning of metal drums is:
 - Cleaning to base material of construction, with all former contents, internal and external corrosion removed, and any external coatings and labels sufficiently removed to expose any metal deterioration that adversely affects transportation safety;
 - Restoring to original shape and contour, with chimes (if any) straightened and sealed, and all non-integral gaskets replaced: and

- (iii) Inspecting after cleaning but before painting. Packagings that have visible pitting, significant reduction in material thickness, metal fatigue, damaged threads or closures, or other significant defects, must be rejected.
- (2) For the purpose of this subchapter, reconditioning of a non-bulk packaging other than a metal drum includes:
 - (i) Removal of all former contents, external coatings and labels, and cleaning to the original materials of construction;
 - (ii) Inspection after cleaning with rejection of packagings with visible damage such as tears, creases or cracks, or damaged threads or closures, or other significant defects;
 - (iii) Replacement of all non-integral gaskets and closure devices with new or refurbished parts, and cushioning and cushioning materials; and components including gaskets, closure devices and cushioning and cushioning material. (For a UN 1H1 plastic drum, replacing a removable gasket or closure device with another of the same design and material that provides equivalent performance does not constitute reconditioning); and
 - (iv) Ensuring that the packagings are restored to a condition that conforms in all respects with the prescribed requirements of this subchapter.
- (3) A person who reconditions a packaging manufactured and marked under the provisions of subpart L of part 178 of this subchapter, shall mark that packaging as required by § 178.503(c) and (d) of this subchapter. The marking is the certification of the reconditioner that the packaging conforms to the standard for which it is marked and that all functions performed by the reconditioner which are prescribed by this subchapter have been performed in compliance with this subchapter.
- (4) The markings applied by the reconditioner may be different from those applied by the manufacturer at the time of original manufacture, but may not identify a greater performance capability than that for which the original design type had been tested (for example, the reconditioner may mark a drum which was originally marked as 1A1/Y1.8 as 1A1/Y1.2 or 1A1/Z2.0).
- (5) Packagings which have significant defects which cannot be repaired may not be reused.
- (d) Remanufacture of non-bulk packagings. For the purpose of this subchapter, remanufacture is the conversion of a non-specification, non-bulk packaging to a DOT specification or U.N. standard, the conversion of a packaging meeting one specification or standard to another specification or standard (for example, conversion of 1A1 non-removable head drums to 1A2 removable head drums) or the replacement of integral structural packaging components (such as non-removable heads on drums). A person who remanufactures a non-bulk packaging to conform to a specification or standard in part 178 of this subchapter is subject to the requirements of part 178 of this subchapter as a manufacturer.

§ 173.202 Non-bulk packagings for liquid hazardous materials in Packing Group II.

- (a) When [§ 172.101 of this subchapter](#) specifies that a liquid hazardous material be packaged under this section, only non-bulk packagings prescribed in this section may be used for its transportation. Each packaging must conform to the general packaging requirements of subpart B of part 173, to the requirements of [part 178 of this subchapter](#) at the Packing Group I or II performance level (unless otherwise excepted), and to the particular requirements of the special provisions of column 7 of the [§ 172.101](#) table.
- (b) The following combination packagings are authorized:
 - Outer packagings:*
 - Steel drum: 1A1 or 1A2
 - Aluminum drum: 1B1 or 1B2
 - Metal drum other than steel or aluminum: 1N1 or 1N2
 - Plywood drum: 1D
 - Fiber drum: 1G
 - Plastic drum: 1H1 or 1H2
 - Wooden barrel: 2C2
 - Steel jerrican: 3A1 or 3A2
 - Plastic jerrican: 3H1 or 3H2
 - Aluminum jerrican: 3B1 or 3B2
 - Steel box: 4A
 - Aluminum box: 4B
 - Natural wood box: 4C1 or 4C2
 - Plywood box: 4D
 - Reconstituted wood box: 4F
 - Fiberboard box: 4G
 - Expanded plastic box: 4H1
 - Solid plastic box: 4H2
 - Metal box other than steel or aluminum: 4N
 - Inner packagings:*
 - Glass or earthenware receptacles

Plastic receptacles

Metal receptacles

Glass ampoules

(c) Except for transportation by passenger aircraft, the following single packagings are authorized:

Steel drum: 1A1 or 1A2

Aluminum drum: 1B1 or 1B2

Metal drum other than steel or aluminum: 1N1 or 1N2

Plastic drum: 1H1 or 1H2

Fiber drum: 1G (with liner)

Wooden barrel: 2C1

Steel jerrican: 3A1 or 3A2

Plastic jerrican: 3H1 or 3H2

Aluminum jerrican: 3B1 or 3B2

Plastic receptacle in steel, aluminum, fiber or plastic drum: 6HA1, 6HB1, 6HG1 or 6HH1

Plastic receptacle in steel, aluminum, wooden, plywood or fiberboard box: 6HA2, 6HB2, 6HC, 6HD2 or 6HG2

Glass, porcelain or stoneware in steel, aluminum or fiber drum: 6PA1, 6PB1 or 6PG1

Glass, porcelain or stoneware in steel, aluminum, wooden or fiberboard box: 6PA2, 6PB2, 6PC or 6PG2

Glass, porcelain or stoneware in solid or expanded plastic packaging: 6PH1 or 6PH2

Plastic receptacle in plywood drum: 6HD1

Glass, porcelain or stoneware in plywood drum or wickerwork hamper: 6PD1 or 6PD2

Cylinders, specification, as prescribed for any compressed gas, except for Specifications 8 and 3HT

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§ 178.2 Applicability and responsibility.

(a) *Applicability.*

(1) The requirements of this part apply to packagings manufactured—

(i) To a DOT specification, regardless of country of manufacture; or

(ii) To a UN standard, for packagings manufactured within the United States. For UN standard packagings manufactured outside the United States, see [§ 173.24\(d\)\(2\) of this subchapter](#). For UN standard packagings for which standards are not prescribed in this part, see [§ 178.3\(b\)](#).

- (2) A manufacturer of a packaging subject to the requirements of this part is primarily responsible for compliance with the requirements of this part. However, any person who performs a function prescribed in this part shall perform that function in accordance with this part.
- (b) **Specification markings.** When this part requires that a packaging be marked with a DOT specification or UN standard marking, marking of the packaging with the appropriate DOT or UN markings is the certification that—
- (1) Except as otherwise provided in this section, all requirements of the DOT specification or UN standard, including performance tests, are met; and
- (2) All functions performed by, or on behalf of, the person whose name or symbol appears as part of the marking conform to requirements specified in this part.
- (c) **Notification.**
- (1) Except as specifically provided in [§§ 178.337-18, 178.338-19, and 178.345-15 of this part](#), the manufacturer or other person certifying compliance with the requirements of this part, and each subsequent distributor of that packaging must:
- (i) Notify each person to whom that packaging is transferred—
- (A) Of all requirements in this part not met at the time of transfer, and
- (B) With information specifying the type(s) and dimensions of the closures, including gaskets and any other components needed to ensure that the packaging is capable of successfully passing the applicable performance tests. This information must include any procedures to be followed, including closure instructions for inner packagings and receptacles, to effectively assemble and close the packaging for the purpose of preventing leakage in transportation. Closure instructions must provide for a consistent and repeatable means of closure that is sufficient to ensure the packaging is closed in the same manner as it was tested. For packagings sold or represented as being in conformance with the requirements of this subchapter applicable to transportation by aircraft, this information must include relevant guidance to ensure that the packaging, as prepared for transportation, will withstand the pressure differential requirements in [§ 173.27 of this subchapter](#).
- (ii) Retain copies of each written notification for at least one year from date of issuance; and
- (iii) Make copies of all written notifications available for inspection by a representative of the Department.
- (2) The notification required in accordance with this [paragraph \(c\)](#) may be in writing or by electronic means, including e-mailed transmission or transmission on a CD or similar device. If a manufacturer or subsequent distributor of the packaging utilizes electronic means to make the required notifications, the notification must be specific to the packaging in question and must be in a form that can be printed in hard copy by the person receiving the notification.
- (d) Except as provided in [paragraph \(c\)](#) of this section, a packaging not conforming to the applicable specifications or standards in this part may not be marked to indicate such conformance.
- (e) **Definitions.** For the purpose of this part—
- Manufacturer* means the person whose name and address or symbol appears as part of the specification markings required by this part or, for a packaging marked with the symbol of an approval agency, the person on whose behalf the approval agency certifies the packaging.
- Specification markings* mean the packaging identification markings required by this part including, where applicable, the name and address or symbol of the packaging manufacturer or approval agency.
- (f) No packaging may be manufactured or marked to a packaging specification that was in effect on September 30, 1991, and that was removed from this part 178 by a rule published in the Federal Register on December 21, 1990 and effective October 1, 1991.

§ 178.3 Marking of packagings.

- (a) Each packaging represented as manufactured to a DOT specification or a UN standard must be marked on a non-removable component of the packaging with specification markings conforming to the applicable specification, and with the following:
- (1) In an unobstructed area, with letters, and numerals identifying the standards or specification (e.g. UN 1A1, DOT 4B240ET, etc.).
- (2) Unless otherwise specified in this part, the name and address or symbol of the packaging manufacturer or the person certifying compliance with a UN standard. Symbols, if used, must be registered with the Associate Administrator. Unless authorized in writing by the holder of the symbol, symbols must represent either the packaging manufacturer or the approval agency responsible for providing the most recent certification for the packaging through design certification testing or periodic retesting, as applicable. Duplicative symbols are not authorized.
- (3) The markings must be stamped, embossed, burned, printed or otherwise marked on the packaging to provide adequate accessibility, permanency, contrast, and legibility so as to be readily apparent and understood.
- (4) Unless otherwise specified, letters and numerals must be at least 12.0 mm (0.47 inches) in height except for packagings of less than or equal to 30 L (7.9 gallons) capacity for liquids or 30 kg (66 pounds) maximum net mass for solids the height must be at least 6.0 mm (0.2 inches). For packagings having a capacity of 5 L (1.3 gallons) or less or of 5 kg (11 pounds) maximum net mass, letters and numerals must be of an appropriate size.

- (5) For packages with a gross mass of more than 30 kg (66 pounds), the markings or a duplicate thereof must appear on the top or on a side of the packaging.
- (b) A UN standard packaging for which the UN standard is set forth in this part may be marked with the United Nations symbol and other specification markings only if it fully conforms to the requirements of this part. A UN standard packaging for which the UN standard is not set forth in this part may be marked with the United Nations symbol and other specification markings for that standard as provided in the ICAO Technical Instructions or the IMDG Code subject to the following conditions:
- (1) The U.S. manufacturer must establish that the packaging conforms to the applicable provisions of the ICAO Technical Instructions (IBR, see [§ 171.7 of this subchapter](#)) or the IMDG Code (IBR, see [§ 171.7 of this subchapter](#)), respectively.
 - (2) If an indication of the name of the manufacturer or other identification of the packaging as specified by the competent authority is required, the name and address or symbol of the manufacturer or the approval agency certifying compliance with the UN standard must be entered. Symbols, if used, must be registered with the Associate Administrator.
 - (3) The letters “USA” must be used to indicate the State authorizing the allocation of the specification marks if the packaging is manufactured in the United States.

§ 178.502 Identification codes for packagings.

- (a) Identification codes for designating kinds of packagings consist of the following:
- (1) A numeral indicating the kind of packaging, as follows:
 - (i) “1” means a drum.
 - (ii) “2” means a wooden barrel.
 - (iii) “3” means a jerrican.
 - (iv) “4” means a box.
 - (v) “5” means a bag.
 - (vi) “6” means a composite packaging.
 - (vii) “7” means a pressure receptacle.
 - (2) A capital letter indicating the material of construction, as follows:
 - (i) “A” means steel (all types and surface treatments).
 - (ii) “B” means aluminum.
 - (iii) “C” means natural wood.
 - (iv) “D” means plywood.
 - (v) “F” means reconstituted wood.
 - (vi) “G” means fiberboard.
 - (vii) “H” means plastic.
 - (viii) “L” means textile.
 - (ix) “M” means paper, multi-wall.
 - (x) “N” means metal (other than steel or aluminum).
 - (xi) “P” means glass, porcelain or stoneware.
 - (3) A numeral indicating the category of packaging within the kind to which the packaging belongs. For example, for steel drums (“1A”), “1” indicates a non-removable head drum (*i.e.*, “1A1”) and “2” indicates a removable head drum (*i.e.*, “1A2”).
- (b) For composite packagings, two capital letters are used in sequence in the second position of the code, the first indicating the material of the inner receptacle and the second, that of the outer packaging. For example, a plastic receptacle in a steel drum is designated “6HA1”.
- (c) For combination packagings, only the code number for the outer packaging is used.
- (d) Identification codes are set forth in the standards for packagings in [§§ 178.504](#) through [178.523 of this subpart](#).
- Note to [§ 178.502](#): Plastics materials include other polymeric materials such as rubber.

§ 178.503 Marking of packagings.

- (a) A manufacturer must mark every packaging that is represented as manufactured to meet a UN standard with the marks specified in this section. The markings must be durable, legible and placed in a location and of such a size relative to the packaging as to be readily visible, as specified in [§ 178.3\(a\)](#). Except as otherwise provided in this section, every reusable packaging liable to undergo a reconditioning process which might obliterate the packaging marks must bear the marks specified in [paragraphs \(a\)\(1\) through \(a\)\(6\)](#) and [\(a\)\(9\)](#) of this section in a permanent form (e.g. embossed) able to withstand the reconditioning process. A marking may be applied in a single line or in multiple lines provided the correct sequence is used. As illustrated by the examples in [paragraph \(e\)](#) of this section, the following information must be presented in the correct sequence. Slash marks should be used to separate this information. A packaging conforming to a UN standard must be marked as follows:
- (1) Except as provided in [paragraph \(e\)\(1\)\(ii\)](#) of this section, the United Nations symbol as illustrated in [paragraph \(e\)\(1\)\(i\)](#) of this section (for embossed metal receptacles, the letters “UN” may be applied in place of the symbol);

- (2) A packaging identification code designating the type of packaging, the material of construction and, when appropriate, the category of packaging under [§§ 178.504 through 178.523 of this subpart](#) within the type to which the packaging belongs. The letter “V” must follow the packaging identification code on packagings tested in accordance with [§ 178.601\(g\)\(2\)](#); for example, “4GV”. The letter “W” must follow the packaging identification code on packagings when required by an approval under the provisions of [§ 178.601\(h\) of this part](#);
 - (3) A letter identifying the performance standard under which the packaging design type has been successfully tested, as follows:
 - (i) X—for packagings meeting Packing Group I, II and III tests;
 - (ii) Y—for packagings meeting Packing Group II and III tests; or
 - (iii) Z—for packagings only meeting Packing Group III tests;
 - (4) A designation of the specific gravity or mass for which the packaging design type has been tested, as follows:
 - (i) For packagings without inner packagings intended to contain liquids, the designation shall be the specific gravity rounded down to the first decimal but may be omitted when the specific gravity does not exceed 1.2; and
 - (ii) For packagings intended to contain solids or inner packagings, the designation shall be the maximum gross mass in kilograms;
 - (5) (i) For single and composite packagings intended to contain liquids, the test pressure in kilopascals rounded down to the nearest 10 kPa of the hydrostatic pressure test that the packaging design type has successfully passed;
 - (ii) For packagings intended to contain solids or inner packagings, the letter “S”;
 - (6) The last two digits of the year of manufacture. Packagings of types 1H and 3H shall also be marked with the month of manufacture in any appropriate manner; this may be marked on the packaging in a different place from the remainder of the markings;
 - (7) The state authorizing allocation of the mark. The letters ‘USA’ indicate that the packaging is manufactured and marked in the United States in compliance with the provisions of this subchapter;
 - (8) The name and address or symbol of the manufacturer or the approval agency certifying compliance with subpart L and [subpart M of this part](#). Symbols, if used, must be registered with the Associate Administrator;
 - (9) For metal or plastic drums or jerricans intended for reuse or reconditioning as single packagings or the outer packagings of a composite packaging, the thickness of the packaging material, expressed in mm (rounded to the nearest 0.1 mm), as follows:
 - (i) Metal drums or jerricans must be marked with the nominal thickness of the metal used in the body. The marked nominal thickness must not exceed the minimum thickness of the steel used by more than the thickness tolerance stated in ISO 3574 (IBR, see [§ 171.7 of this subchapter](#)). (See [appendix C of this part](#).) The unit of measure is not required to be marked. When the nominal thickness of either head of a metal drum is thinner than that of the body, the nominal thickness of the top head, body, and bottom head must be marked (e.g., “1.0-1.2-1.0” or “0.9-1.0-1.0”).
 - (ii) Plastic drums or jerricans must be marked with the minimum thickness of the packaging material. Minimum thicknesses of plastic must be as determined in accordance with [§ 173.28\(b\)\(4\)](#). The unit of measure is not required to be marked;
 - (10) In addition to the markings prescribed in [paragraphs \(a\)\(1\) through \(a\)\(9\)](#) of this section, every new metal drum having a capacity greater than 100 L must bear the marks described in [paragraphs \(a\)\(1\) through \(a\)\(6\)](#), and [\(a\)\(9\)\(i\)](#) of this section, in a permanent form, on the bottom. The markings on the top head or side of these packagings need not be permanent, and need not include the thickness mark described in [paragraph \(a\)\(9\)](#) of this section. This marking indicates a drum's characteristics at the time it was manufactured, and the information in [paragraphs \(a\)\(1\) through \(a\)\(6\)](#) of this section that is marked on the top head or side must be the same as the information in [paragraphs \(a\)\(1\) through \(a\)\(6\)](#) of this section permanently marked by the original manufacturer on the bottom of the drum; and
 - (11) Rated capacity of the packaging expressed in liters may be marked.
- (b) For a packaging with a removable head, the markings may not be applied only to the removable head.
- (c) **Marking of reconditioned packagings.**
- (1) If a packaging is reconditioned, it shall be marked by the reconditioner near the marks required in [paragraphs \(a\)\(1\) through \(6\)](#) of this section with the following additional information:
 - (i) The name of the country in which the reconditioning was performed (in the United States, use the letters “USA”);
 - (ii) The name and address or symbol of the reconditioner. Symbols, if used, must be registered with the Associate Administrator;
 - (iii) The last two digits of the year of reconditioning;
 - (iv) The letter “R”; and
 - (v) For every packaging successfully passing a leakproofness test, the additional letter “L”.
 - (2) When, after reconditioning, the markings required by [paragraph \(a\)\(1\) through \(a\)\(5\)](#) of this section no longer appear on the top head or the side of the metal drum, the reconditioner must apply them in a durable form followed by the markings in [paragraph \(c\)\(1\)](#) of this section. These markings may identify a different performance capability than that for which the original design type had been tested and marked, but may not identify a greater performance capability. The markings applied in accordance with this paragraph may be different from those which are permanently marked on the bottom of a drum in accordance with [paragraph \(a\)\(10\)](#) of this section.

(d) **Marking of remanufactured packagings.** For remanufactured metal drums, if there is no change to the packaging type and no replacement or removal of integral structural components, the required markings need not be permanent (e.g., embossed). Every other remanufactured drum must bear the marks required in [paragraphs \(a\)\(1\)](#) through [\(a\)\(6\)](#) of this section in a permanent form (e.g., embossed) on the top head or side. If the metal thickness marking required in [paragraph \(a\)\(9\)\(i\)](#) of this section does not appear on the bottom of the drum, or if it is no longer valid, the remanufacturer also must mark this information in permanent form.

(e) **The following are examples of symbols and required markings.**

(1)

(i) The United Nations symbol is:



(ii) The circle that surrounds the letters “u” and “n” may have small breaks provided the following provisions are met:

(A) The total gap space does not exceed 15 percent of the circumference of the circle;

(B) There are no more than four gaps in the circle;

(C) The spacing between gaps is separated by no less than 20 percent of the circumference of the circle (72 degrees); and

(D) The letters “u” and “n” appear exactly as depicted in [§ 178.503\(e\)\(1\)\(i\)](#) with no gaps.

(3) Examples of markings for reconditioned packagings are as follows:



1A1/Y1.4/150/92
USA/RB/93 RL

(as in [§ 178.503\(c\)\(1\)](#)).

§ 178.504 Standards for steel drums.

(a) The following are identification codes for steel drums:

(1) 1A1 for a non-removable head steel drum; and

(2) 1A2 for a removable head steel drum.

(b) Construction requirements for steel drums are as follows:

(1) Body and heads must be constructed of steel sheet of suitable type and adequate thickness in relation to the capacity and intended use of the drum. Minimum thickness and marking requirements in [§§ 173.28\(b\)\(4\)](#) and [178.503\(a\)\(9\) of this subchapter](#) apply to drums intended for reuse.

(2) Body seams must be welded on drums designed to contain more than 40 L (11 gallons) of liquids. Body seams must be mechanically seamed or welded on drums intended to contain only solids or 40 L (11 gallons) or less of liquids.

(3) Chimes must be mechanically seamed or welded. Separate reinforcing rings may be applied.

(4) The body of a drum of a capacity greater than 60 L (16 gallons) may have at least two expanded rolling hoops or two separate rolling hoops. If there are separate rolling hoops, they must be fitted tightly on the body and so secured that they cannot shift. Rolling hoops may not be spot-welded.

(5) Openings for filling, emptying and venting in the bodies or heads of non-removable head (1A1) drums may not exceed 7.0 cm (3 inches) in diameter. Drums with larger openings are considered to be of the removable head type (1A2). Closures for openings in the bodies and heads of drums must be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges may be mechanically seamed or welded in place. Gaskets or other sealing elements must be used with closures unless the closure is inherently leakproof.

(6) Closure devices for removable head drums must be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with all removable heads.

(7) If materials used for body, heads, closures, and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments must be applied. These coatings or treatments must retain their protective properties under normal conditions of transport.

(8) Maximum capacity of drum: 450 L (119 gallons).

(9) Maximum net mass: 400 kg (882 pounds).

§ 178.601 General requirements.

- (a) **General.** The test procedures prescribed in this subpart are intended to ensure that packages containing hazardous materials can withstand normal conditions of transportation and are considered minimum requirements. Each packaging must be manufactured and assembled so as to be capable of successfully passing the prescribed tests and of conforming to the requirements of [§ 173.24 of this subchapter](#) at all times while in transportation.
- (b) **Responsibility.** It is the responsibility of the packaging manufacturer to assure that each package is capable of passing the prescribed tests. To the extent that a package assembly function, including final closure, is performed by the person who offers a hazardous material for transportation, that person is responsible for performing the function in accordance with [§§ 173.22 and 178.2 of this subchapter](#).
- (c) **Definitions.** For the purpose of this subpart:
- (1) **Design qualification testing** is the performance of the tests prescribed in [§ 178.603](#), [§ 178.604](#), [§ 178.605](#), [§ 178.606](#), [§ 178.607](#), [§ 178.608](#), or [§ 178.609](#), as applicable, for each new or different packaging, at the start of production of that packaging.
- (2) **Periodic retesting** is the performance of the drop, leakproofness, hydrostatic pressure, and stacking tests, as applicable, as prescribed in [§ 178.603](#), [§ 178.604](#), [§ 178.605](#), or [§ 178.606](#), respectively, at the frequency specified in [paragraph \(e\)](#) of this section. For infectious substances packagings required to meet the requirements of [§ 178.609](#), periodic retesting is the performance of the tests specified in [§ 178.609](#) at the frequency specified in [paragraph \(e\)](#) of this section.
- (3) **Production testing** is the performance of the leakproofness test prescribed in [§ 178.604 of this subpart](#) on each single or composite packaging intended to contain a liquid.
- (4) **A different packaging** is ...
- (d) **Design qualification testing.** The packaging manufacturer shall achieve successful test results for the design qualification testing at the start of production of each new or different packaging.
- (e) **Periodic retesting.** The packaging manufacturer must achieve successful test results for the periodic retesting at intervals established by the manufacturer of sufficient frequency to ensure that each packaging produced by the manufacturer is capable of passing the design qualification tests. Changes in retest frequency are subject to the approval of the Associate Administrator for Hazardous Materials Safety. For single or composite packagings, the periodic retests must be conducted at least once every 12 months. For combination packagings, the periodic retests must be conducted at least once every 24 months. For infectious substances packagings, the periodic retests must be conducted at least once every 24 months.
- (f) **Test samples.** The manufacturer shall conduct the design qualification and periodic tests prescribed in this subpart using random samples of packagings, in the numbers specified in the appropriate test section. In addition, the leakproofness test, when required, shall be performed on each packaging produced by the manufacturer, and each packaging prior to reuse under [§ 173.28 of this subchapter](#), by the reconditioner.
- (j) **Coatings.** If an inner treatment or coating of a packaging is required for safety reasons, the manufacturer shall design the packaging so that the treatment or coating retains its protective properties even after withstanding the tests prescribed by this subpart.
- (k) **Number of test samples.** Except as provided in this section, one test sample must be used for each test performed under this subpart.
- (l) **Record retention.** Following each design qualification test and each periodic retest on a packaging, a test report must be prepared.
- (1) The test report must be maintained at each location where the packaging is manufactured, certified, and a design qualification test or periodic retest is conducted as follows:

Responsible party	Duration
Person manufacturing the packaging	As long as manufactured and two years thereafter.
Person performing design testing	Design test maintained for a single or composite packaging for six years after the test is successfully performed and for a combination packaging or packaging intended for infectious substances for seven years after the test is successfully performed.
Person performing periodic retesting	Performance test maintained for a single or composite packaging for one year after the test is successfully performed and for a combination packaging or packaging intended for infectious substances for two years after the test is successfully performed.

- (2) The test report must be made available to a user of a packaging or a representative of the Department upon request. The test report, at a minimum, must contain the following information:
- Name and address of test facility;
 - Name and address of applicant (where appropriate);
 - A unique test report identification;
 - Date of the test report;
 - Manufacturer of the packaging;
 - Description of the packaging design type (e.g., dimensions, materials, closures, thickness, *etc.*), including methods of manufacture (e.g., blow molding) and which may include drawing(s) and/or photograph(s);

- (vii) Maximum capacity;
- (viii) Characteristics of test contents, including for plastic packagings subject to the hydrostatic pressure test in [§ 178.605 of this subpart](#), the temperature of the water used;
- (ix) Test descriptions and results; and
- (x) Signed with the name and title of signatory.

§ 178.602 Preparation of packagings and packages for testing.

- (a) Except as otherwise provided in this subchapter, each packaging and package must be closed in preparation for testing and tests must be carried out in the same manner as if prepared for transportation, including inner packagings in the case of combination packagings.
- (b) For the drop and stacking test, inner and single-unit receptacles other than bags must be filled to not less than 95% of maximum capacity (see [§ 171.8 of this subchapter](#)) in the case of solids and not less than 98% of maximum in the case of liquids. Bags containing solids shall be filled to the maximum mass at which they may be used. The material to be transported in the packagings may be replaced by a non-hazardous material, except for chemical compatibility testing or where this would invalidate the results of the tests.
- (c) If the material to be transported is replaced for test purposes by a non-hazardous material, the material used must be of the same or higher specific gravity as the material to be carried, and its other physical properties (grain, size, viscosity) which might influence the results of the required tests must correspond as closely as possible to those of the hazardous material to be transported. Water may also be used for the liquid drop test under the conditions specified in [§ 178.603\(c\) of this subpart](#). It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not affected.
- (e) Except as otherwise provided, each packaging must be closed in preparation for testing in the same manner as if prepared for actual shipment. All closures must be installed using proper techniques and torques.

§ 178.603 Drop test.

- (a) **General.** The drop test must be conducted for the qualification of all packaging design types and performed periodically as specified in [§ 178.601\(e\)](#). For other than flat drops, the center of gravity of the test packaging must be vertically over the point of impact. Where more than one orientation is possible for a given drop test, the orientation most likely to result in failure of the packaging must be used. The number of drops required and the packages' orientations are as follows:

Packaging	No. of tests (samples)	Drop orientation of samples
Steel drums, Aluminum drums, Metal drums (other than steel or aluminum), Steel Jerricans, Plywood drums, Wooden barrels, Fiber drums, Plastic drums and Jerricans, Composite packagings which are in the shape of a drum	Six—(three for each drop)	First drop (using three samples): The package must strike the target diagonally on the chime or, if the packaging has no chime, on a circumferential seam or an edge. Second drop (using the other three samples): The package must strike the target on the weakest part not tested by the first drop, for example a closure or, for some 7 cylindrical drums, the welded longitudinal seam of the drum body.
Boxes of natural wood, Plywood boxes, Reconstituted wood boxes, Fiberboard boxes, Plastic boxes, Steel, aluminum or other metal boxes, Composite packagings that are in the shape of a box	Five—(one for each drop)	First drop: Flat on the bottom (using the first sample). Second drop: Flat on the top (using the second sample). Third drop: Flat on the long side (using the third sample). Fourth drop: Flat on the short side (using the fourth sample). Fifth drop: On a corner (using the fifth sample).
Bags—single-ply with a side seam	Three—(three drops per bag)	First drop: Flat on a wide face (using all three samples). Second drop: Flat on a narrow face (using all three samples). Third drop: On an end of the bag (using all three samples).
Bags—single-ply without a side seam, or multi-ply	Three—(two drops per bag)	First drop: Flat on a wide face (using all three samples). Second drop: On an end of the bag (using all three samples).

- (d) **Target.** The target must be a rigid, non-resilient, flat and horizontal surface.
- (e) **Drop height.** Drop heights, measured as the vertical distance from the target to the lowest point on the package, must be equal to or greater than the drop height determined as follows:
 - (1) For solids and liquids, if the test is performed with the solid or liquid to be transported or with a non-hazardous material having essentially the same physical characteristic, the drop height must be determined according to packing group, as follows:
 - (i) Packing Group I: 1.8 m (5.9 feet).
 - (ii) Packing Group II: 1.2 m (3.9 feet).
 - (iii) Packing Group III: 0.8 m (2.6 feet).
 - (2) For liquids in single packagings and for inner packagings of combination packagings, if the test is performed with water:

- (i) Where the materials to be carried have a specific gravity not exceeding 1.2, drop height must be determined according to packing group, as follows:
 - (A) Packing Group I: 1.8 m (5.9 feet).
 - (B) Packing Group II: 1.2 m (3.9 feet).
 - (C) Packing Group III: 0.8 m (2.6 feet).
- (ii) Where the materials to be transported have a specific gravity exceeding 1.2, the drop height must be calculated on the basis of the specific gravity (SG) of the material to be carried, rounded up to the first decimal, as follows:
 - (A) Packing Group I: $SG \times 1.5$ m (4.9 feet).
 - (B) Packing Group II: $SG \times 1.0$ m (3.3 feet).
 - (C) Packing Group III: $SG \times 0.67$ m (2.2 feet).
- (f) **Criteria for passing the test.** A package is considered to successfully pass the drop tests if for each sample tested—
 - (1) For packagings containing liquid, each packaging does not leak when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings when it is not necessary that the pressures be equalized;
 - (2) For removable head drums for solids, the entire contents are retained by an inner packaging (e.g., a plastic bag) even if the closure on the top head of the drum is no longer sift-proof;
 - (3) For a bag, neither the outermost ply nor an outer packaging exhibits any damage likely to adversely affect safety during transport;
 - (4) The packaging or outer packaging of a composite or combination packaging must not exhibit any damage likely to affect safety during transport. Inner receptacles, inner packagings, or articles must remain completely within the outer packaging and there must be no leakage of the filling substance from the inner receptacles or inner packagings;
 - (5) Any discharge from a closure is slight and ceases immediately after impact with no further leakage; and
 - (6) No rupture is permitted in packagings for materials in Class 1 which would permit spillage of loose explosive substances or articles from the outer packaging.

§ 178.604 Leakproofness test.

- (a) **General.** The leakproofness test must be performed with compressed air or other suitable gases on all packagings intended to contain liquids, except that:
 - (1) The inner receptacle of a composite packaging may be tested without the outer packaging provided the test results are not affected; and
 - (2) This test is not required for inner packagings of combination packagings.
- (b) **Number of packagings to be tested —**
 - (1) **Production testing.** All packagings subject to the provisions of this section must be tested and must pass the leakproofness test:
 - (i) Before they are first used in transportation; and
 - (ii) Prior to reuse, when authorized for reuse by [§ 173.28 of this subchapter](#).
 - (2) **Design qualification and periodic testing.** Three samples of each different packaging must be tested and must pass the leakproofness test. Exceptions for the number of samples used in conducting the leakproofness test are subject to the approval of the Associate Administrator.
- (c) **Special preparation —**
 - (1) For design qualification and periodic testing, packagings must be tested with closures in place. For production testing, packagings need not have their closures in place. Removable heads need not be installed during production testing.
 - (2) For testing with closures in place, vented closures must either be replaced by similar non-vented closures or the vent must be sealed.
- (d) **Test method.** The packaging must be restrained under water while an internal air pressure is applied; the method of restraint must not affect the results of the test. The test must be conducted, for other than production testing, for a minimum time of five minutes. Other methods, at least equally effective, may be used in accordance with [appendix B of this part](#).
- (e) **Pressure applied.** An internal air pressure (gauge) must be applied to the packaging as indicated for the following packing groups:
 - (1) Packing Group I: Not less than 30 kPa (4 psi).
 - (2) Packing Group II: Not less than 20 kPa (3 psi).
 - (3) Packing Group III: Not less than 20 kPa (3 psi).
- (f) **Criteria for passing the test.** A packaging passes the test if there is no leakage of air from the packaging.

§ 178.605 Hydrostatic pressure test.

- (a) **General.** The hydrostatic pressure test must be conducted for the qualification of all metal, plastic, and composite packaging design types intended to contain liquids and be performed periodically as specified in [§ 178.601\(c\)](#). This test is not required for inner packagings of combination packagings. For internal pressure requirements for inner packagings of combination packagings intended for transportation by aircraft, see [§ 173.27\(c\) of this subchapter](#).

- (b) **Number of test samples.** Three test samples are required for each different packaging. For packagings constructed of stainless steel, monel, or nickel, only one sample is required for periodic retesting of packagings. Exceptions for the number of aluminum and steel sample packagings used in conducting the hydrostatic pressure test are subject to the approval of the Associate Administrator.
- (c) **Special preparation of receptacles for testing.** Vented closures must either be replaced by similar non-vented closures or the vent must be sealed.
- (d) **Test method and pressure to be applied.** Metal packagings and composite packagings other than plastic (e.g., glass, porcelain or stoneware), including their closures, must be subjected to the test pressure for 5 minutes. Plastic packagings and composite packagings (plastic material), including their closures, must be subjected to the test pressure for 30 minutes. This pressure is the one to be marked as required in [§ 178.503\(a\)\(5\)](#). The receptacles must be supported in a manner that does not invalidate the test. The test pressure must be applied continuously and evenly, and it must be kept constant throughout the test period. In addition, packagings intended to contain hazardous materials of Packing Group I must be tested to a minimum test pressure of 250 kPa (36 psig). The hydraulic pressure (gauge) applied, taken at the top of the receptacle, and determined by any one of the following methods must be:
- (1) Not less than the total gauge pressure measured in the packaging (*i.e.*, the vapor pressure of the filling material and the partial pressure of the air or other inert gas minus 100 kPa (15 psi)) at 55 °C (131 °F), multiplied by a safety factor of 1.5. This total gauge pressure must be determined on the basis of a maximum degree of filling in accordance with [§ 173.24a\(d\) of this subchapter](#) and a filling temperature of 15 °C (59 °F);
 - (2) Not less than 1.75 times the vapor pressure at 50 °C (122 °F) of the material to be transported minus 100 kPa (15 psi), but with a minimum test pressure of 100 kPa (15 psig); or
 - (3) Not less than 1.5 times the vapor pressure at 55 °C (131 °F) of the material to be transported minus 100 kPa (15 psi), but with a minimum test pressure of 100 kPa (15 psig).
- Packagings intended to contain hazardous materials of Packing Group I must be tested to a minimum test pressure of 250 kPa (36 psig).
- (e) **Criteria for passing the test.** A package passes the hydrostatic test if, for each test sample, there is no leakage of liquid from the package.

§ 178.606 Stacking test.

- (a) **General.** All packaging design types other than bags must be subjected to a stacking test.
- (b) **Number of test samples.** Three test samples are required for each different packaging. For periodic retesting of packagings constructed of stainless steel, monel, or nickel, only one test sample is required. Exceptions for the number of aluminum and steel sample packagings used in conducting the stacking test are subject to the approval of the Associate Administrator. Notwithstanding the provisions of [§ 178.602\(a\) of this subpart](#), combination packagings may be subjected to the stacking test without their inner packagings, except where this would invalidate the results of the test.
- (c) **Test method —**
- (1) **Design qualification testing.** The test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport; where the contents of the test sample are non-hazardous liquids with specific gravities different from that of the liquid to be transported, the force must be calculated based on the specific gravity that will be marked on the packaging. The minimum height of the stack, including the test sample, must be 3.0 m (10 feet). The duration of the test must be 24 hours, except that plastic drums, jerricans, and composite packagings 6HH intended for liquids shall be subjected to the stacking test for a period of 28 days at a temperature of not less than 40 °C (104 °F). Alternative test methods which yield equivalent results may be used if approved by the Associate Administrator. In guided load tests, stacking stability must be assessed after completion of the test by placing two filled packagings of the same type on the test sample. The stacked packages must maintain their position for one hour. Plastic packagings must be cooled to ambient temperature before this stacking stability assessment.
 - (2) **Periodic retesting.** The test sample must be tested in accordance with:
 - (i) Section 178.606(c)(1) of this subpart; or
 - (ii) The packaging may be tested using a dynamic compression testing machine. . .
- (d) **Criteria for passing the test.** No test sample may leak. In composite packagings or combination packagings, there must be no leakage of the filling substance from the inner receptacle, or inner packaging. No test sample may show any deterioration which could adversely affect transportation safety or any distortion likely to reduce its strength, cause instability in stacks of packages, or cause damage to inner packagings likely to reduce safety in transportation. For the dynamic compression test, a container passes the test if, after application of the required load, there is no buckling of the sidewalls sufficient to cause damage to its expected contents; in no case may the maximum deflection exceed one inch.

§ 178.608 Vibration standard.

- (a) Each packaging must be capable of withstanding, without rupture or leakage, the vibration test procedure outlined in this section.

(b) Test method.

(5) Other methods, at least equally effective, may be used, if approved by the Associate Administrator.

(c) **Criteria for passing the test.** A packaging passes the vibration test if there is no rupture or leakage from any of the packages. No test sample should show any deterioration which could adversely affect transportation safety or any distortion liable to reduce packaging strength.

§ 178.700 Purpose, scope and definitions.

(a) This subpart prescribes requirements applying to IBCs intended for the transportation of hazardous materials. Standards for these packagings are based on the UN Recommendations.

(b) Terms used in this subpart are defined in [§ 171.8 of this subchapter](#) and in [paragraph \(c\)](#) of this section.

(c) The following definitions pertain to the IBC standards in this subpart.

(1) Body means the receptacle proper (including openings and their closures, but not including service equipment) that has a volumetric capacity of not more than 3 cubic meters (3,000 L, 793 gallons, or 106 cubic feet).

(2) **Service equipment** means filling and discharge, pressure relief, safety, heating and heat-insulating devices and measuring instruments.

(3) **Structural equipment** means the reinforcing, fastening, handling, protective or stabilizing members of the body or stacking load bearing structural members (such as metal cages).

(4) **Maximum permissible gross mass** means the mass of the body, its service equipment, structural equipment and the maximum net mass (see [§ 171.8 of this subchapter](#)).

§ 178.702 IBC codes.

(a) Intermediate bulk container code designations consist of: two numerals specified in [paragraph \(a\)\(1\)](#) of this section; followed by the capital letter(s) specified in [paragraph \(a\)\(2\)](#) of this section; followed, when specified in an individual section, by a numeral indicating the category of intermediate bulk container.

(1) IBC code number designations are as follows:

Type	For solids, discharged		For liquids
	by gravity	Under pressure of more than 10 kPa (1.45 psig)	
Rigid	11	21	31
Flexible	13		

(2) Intermediate bulk container code letter designations are as follows:

“A” means steel (all types and surface treatments).

“B” means aluminum.

“C” means natural wood.

“D” means plywood.

“F” means reconstituted wood.

“G” means fiberboard.

“H” means plastic.

“L” means textile.

“M” means paper, multiwall.

“N” means metal (other than steel or aluminum).

(b) For composite IBCs, two capital letters are used in sequence following the numeral indicating IBC design type. The first letter indicates the material of the IBC inner receptacle. The second letter indicates the material of the outer IBC. For example, 31HA1 is a composite IBC with a plastic inner receptacle and a steel outer packaging.

§ 178.703 Marking of IBCs.

(a) The manufacturer shall:

(1) Mark every IBC in a durable and clearly visible manner. The marking may be applied in a single line or in multiple lines provided the correct sequence is followed with the information required by this section in letters, numerals and symbols of at least 12 mm in height. This minimum marking size applies only to IBCs manufactured after October 1, 2001). The following information is required in the sequence presented:

(i) Except as provided in [§ 178.503\(e\)\(1\)\(ii\)](#), the United Nations symbol as illustrated in [§ 178.503\(e\)\(1\)\(i\)](#). For metal IBCs on which the marking is stamped or embossed, the capital letters “UN” may be applied instead of the symbol.

(ii) The code number designating IBC design type according to [§ 178.702\(a\)](#). The letter “W” must follow the IBC design type identification code on an IBC when the IBC differs from the requirements in [subpart N of this part](#), or is tested using

methods other than those specified in this subpart, and is approved by the Associate Administrator in accordance with the provisions in [§ 178.801\(i\)](#).

- (iii) A capital letter identifying the performance standard under which the design type has been successfully tested, as follows:
 - (A) X—for IBCs meeting Packing Group I, II and III tests;
 - (B) Y—for IBCs meeting Packing Group II and III tests; and
 - (C) Z—for IBCs meeting only Packing Group III tests.
 - (iv) The month (designated numerically) and year (last two digits) of manufacture.
 - (v) The country authorizing the allocation of the mark. The letters 'USA' indicate that the IBC is manufactured and marked in the United States in compliance with the provisions of this subchapter.
 - (vi) The name and address or symbol of the manufacturer or the approval agency certifying compliance with [subparts N and O of this part](#). Symbols, if used, must be registered with the Associate Administrator.
 - (vii) The stacking test load in kilograms (kg). For IBCs not designed for stacking, the figure "0" must be shown.
 - (viii) The maximum permissible gross mass in kg.
- (2) The following are examples of symbols and required markings:
- (i) For a metal IBC containing solids discharged by gravity made from steel:



11A/Y/02 92/USA/ABC/5500/1500

- (ii) For a flexible IBC containing solids discharged by gravity and made from woven plastic with a liner:
- (iii) For a rigid plastic IBC containing liquids, made from plastic with structural equipment withstanding the stack load and with a manufacturer's symbol in place of the manufacturer's name and address:
- (iv) For a composite IBC containing liquids, with a rigid plastic inner receptacle and an outer steel body and with the symbol of a DOT approved third-party test laboratory:

(b) **Additional marking.** In addition to markings required in [paragraph \(a\)](#) of this section, each IBC must be marked as follows in a place near the markings required in [paragraph \(a\)](#) of this section that is readily accessible for inspection. Where units of measure are used, the metric unit indicated (e.g., 450 L) must also appear.

- (1) For each rigid plastic and composite IBC, the following markings must be included:
 - (i) Rated capacity in L of water at 20 °C (68 °F);



13H3/Z/03 92/USA/ABC/0/1500

- (ii) Tare mass in kilograms;
- (iii) Gauge test pressure in kPa;
- (iv) Date of last leakproofness test, if applicable (month and year); and



31H1/Y/04 93/USA/M9399/10800/1200

- (v) Date of last inspection (month and year).
- (2) For each metal IBC, the following markings must be included on a metal corrosion-resistant plate:



31HA1/Y/05 93/USA/+ZT1235/10800/1200

- (i) Rated capacity in L of water at 20 °C (68 °F);
- (ii) Tare mass in kilograms;
- (iii) Date of last leakproofness test, if applicable (month and year);
- (iv) Date of last inspection (month and year);
- (v) Maximum loading/discharge pressure, in kPa, if applicable;

- (vi) Body material and its minimum thickness in mm; and
- (vii) Serial number assigned by the manufacturer.
- (3) Markings required by [paragraph \(b\)\(1\)](#) or [\(b\)\(2\)](#) of this section may be preceded by the narrative description of the marking, e.g. “Tare Mass: * * *” where the “* * *” are replaced with the tare mass in kilograms of the IBC.
- (6) For each composite IBC . . .
- (7) The symbol applicable to an IBC designed for stacking or not designed for stacking, as appropriate, must be marked on all IBCs manufactured, repaired or remanufactured after January 1, 2011 as follows:
 - (i)



- (ii) Display the symbol in a durable and visible manner.
- (iii) The symbol must be a square with each side being not less than 100 mm (3.9 inches) by 100 mm (3.9 inches) as measured from the corner printer marks shown on the figures in [paragraph \(b\)\(7\)\(i\)](#) of this section. Where dimensions are not specified, all features must be in approximate proportion to those shown.
 - (A) **Transitional exception.** A marking in conformance with the requirements of this paragraph in effect on December 31, 2014, may continue to be applied to all IBCs manufactured, repaired or remanufactured between January 1, 2011 and December 31, 2016.
 - (B) For domestic transportation, an IBC marked prior to January 1, 2017 and in conformance with the requirements of this paragraph in effect on December 31, 2014, may continue in service until the end of its useful life.
- (iv) For IBCs designed for stacking, the maximum permitted stacking load applicable when the IBC is in transportation must be displayed with the symbol. The mass in kilograms (kg) marked above the symbol must not exceed the load imposed during the design test, as indicated by the marking in [paragraph \(a\)\(1\)\(vii\)](#) of this section, divided by 1.8. The letters and numbers indicating the mass must be at least 12 mm (0.48 inches).

§ 178.704 General IBC standards.

- (a) Each IBC must be resistant to, or protected from, deterioration due to exposure to the external environment. IBCs intended for solid hazardous materials must be sift-proof and water-resistant.
- (b) All service equipment must be so positioned or protected as to minimize potential loss of contents resulting from damage during IBC handling and transportation.
- (c) Each IBC, including attachments, and service and structural equipment, must be designed to withstand, without loss of hazardous materials, the internal pressure of the contents and the stresses of normal handling and transport. An IBC intended for stacking must be designed for stacking. Any lifting or securing features of an IBC must be of sufficient strength to withstand the normal conditions of handling and transportation without gross distortion or failure and must be positioned so as to cause no undue stress in any part of the IBC.
- (d) An IBC consisting of a packaging within a framework must be so constructed that:
 - (1) The body is not damaged by the framework;
 - (2) The body is retained within the framework at all times; and
 - (3) The service and structural equipment are fixed in such a way that they cannot be damaged if the connections between body and frame allow relative expansion or motion.
- (e) Bottom discharge valves must be secured in the closed position and the discharge system suitably protected from damage. Valves having lever closures must be secured against accidental opening. The open or closed position of each valve must be readily apparent. For each IBC containing a liquid, a secondary means of sealing the discharge aperture must also be provided, e.g., by a blank flange or equivalent device.
- (f) IBC design types must be constructed in such a way as to be bottom-lifted or top-lifted as specified in [§§ 178.811](#) and [178.812](#).

§ 178.705 Standards for metal IBCs.

- (a) The provisions in this section apply to metal IBCs intended to contain liquids and solids. Metal IBC types are designated:
 - (1) 11A, 11B, 11N for solids that are loaded or discharged by gravity.
 - (2) 21A, 21B, 21N for solids that are loaded or discharged at a gauge pressure greater than 10 kPa (1.45 psig).
 - (3) 31A, 31B, 31N for liquids.
- (b) Definitions for metal IBCs:
 - (1) **Metal IBC** means an IBC with a metal body, together with appropriate service and structural equipment.
 - (2) **Protected** means providing the IBC body with additional external protection against impact and abrasion. For example, a multi-layer (sandwich) or double wall construction or a frame with a metal lattice-work casing.

(c) Construction requirements for metal IBCs are as follows:

- (1) **Body.** The body must be made of ductile metal materials. Welds must be made so as to maintain design type integrity of the receptacle under conditions normally incident to transportation.
 - (i) The use of dissimilar metals must not result in deterioration that could affect the integrity of the body.
 - (ii) Aluminum IBCs intended to contain flammable liquids must have no movable parts, such as covers and closures, made of unprotected steel liable to rust, which might cause a dangerous reaction from friction or percussive contact with the aluminum.
 - (iii) Metals used in fabricating the body of a metal IBC must meet the following requirements . . .
 - (iv) **Minimum wall thickness.** For metal IBCs with a capacity of more than 1500 liters, the minimum wall thickness must be determined as follows. . .
 - (2) **Pressure relief.** The following pressure relief requirements apply to IBCs intended for liquids . . .
- (d) Metal IBCs may not have a volumetric capacity greater than 3,000 L (793 gallons) or less than 450 L (119 gallons).

§ 178.801 General requirements.

- (a) **General.** The test procedures prescribed in this subpart are intended to ensure that IBCs containing hazardous materials can withstand normal conditions of transportation and are considered minimum requirements. Each packaging must be manufactured and assembled so as to be capable of successfully passing the prescribed tests and of conforming to the requirements of [§ 173.24 of this subchapter](#) at all times while in transportation.
- (b) **Responsibility.** It is the responsibility of the IBC manufacturer to assure that each IBC is capable of passing the prescribed tests. To the extent that an IBC assembly function, including final closure, is performed by the person who offers a hazardous material for transportation, that person is responsible for performing the function in accordance with [§§ 173.22](#) and [178.2 of this subchapter](#).
- (c) **Definitions.** For the purpose of this subpart:
 - (1) **IBC design type** refers to an IBC that does not differ in structural design, size, material of construction, wall thickness, manner of construction and representative service equipment.
 - (2) **Design qualification testing** is the performance of the drop, leakproofness, hydrostatic pressure, stacking, bottom-lift or top-lift, tear, topple, righting and vibration tests, as applicable, prescribed in this subpart, for each different IBC design type, at the start of production of that packaging.
 - (3) **Periodic design requalification test** is the performance of the applicable tests specified in [paragraph \(c\)\(2\)](#) of this section on an IBC design type, in order to requalify the design for continued production at the frequency specified in [paragraph \(e\)](#) of this section.
 - (4) **Production inspection** is the inspection that must initially be conducted on each newly manufactured IBC.
 - (5) **Production testing** is the performance of the leakproofness test in accordance with [paragraph \(f\)](#) of this section on each IBC intended to contain solids discharged by pressure or intended to contain liquids.
 - (6) **Periodic retest and inspection** is performance of the applicable test and inspections on each IBC at the frequency specified in [§ 180.352 of this subchapter](#).
 - (7) **Different IBC design type** is one that differs from a previously qualified IBC design type in structural design, size, material of construction, wall thickness, or manner of construction, but does not include:
 - (i) A packaging which differs in surface treatment;
 - (ii) A rigid plastic IBC or composite IBC which differs with regard to additives used to comply with [§§ 178.706\(c\)](#), [178.707\(c\)](#) or [178.710\(c\)](#);
 - (iii) A packaging which differs only in its lesser external dimensions (*i.e.*, height, width, length) provided materials of construction and material thicknesses or fabric weight remain the same;
 - (iv) A packaging which differs in service equipment.
- (d) **Design qualification testing.** The packaging manufacturer shall achieve successful test results for the design qualification testing at the start of production of each new or different IBC design type. The service equipment selected for this design qualification testing shall be representative of the type of service equipment that will be fitted to any finished IBC body under the design. Application of the certification mark by the manufacturer shall constitute certification that the IBC design type passed the prescribed tests in this subpart.
- (e) **Periodic design requalification testing.**
 - (1) Periodic design requalification must be conducted on each qualified IBC design type if the manufacturer is to maintain authorization for continued production. The IBC manufacturer shall achieve successful test results for the periodic design requalification at sufficient frequency to ensure each packaging produced by the manufacturer is capable of passing the design qualification tests. Design requalification tests must be conducted at least once every 12 months.
 - (2) Changes in the frequency of design requalification testing specified in [paragraph \(e\)\(1\)](#) of this section are authorized if approved by the Associate Administrator. These requests must be based on:
 - (i) Detailed quality assurance programs that assure that proposed decreases in test frequency maintain the integrity of originally tested IBC design types; and

- (ii) Demonstrations that each IBC produced is capable of withstanding higher standards (e.g., increased drop height, hydrostatic pressure, wall thickness, fabric weight).

(f) **Production testing and inspection.**

- (1) Production testing consists of the leakproofness test prescribed in [§ 178.813 of this subpart](#) and must be performed on each IBC intended to contain solids discharged by pressure or intended to contain liquids. For this test:
- (i) The IBC need not have its closures fitted, except that the IBC must be fitted with its primary bottom closure.
- (ii) The inner receptacle of a composite IBC may be tested without the outer IBC body, provided the test results are not affected.
- (2) Applicable inspection requirements in [§ 180.352 of this subchapter](#) must be performed on each IBC initially after production.
- (k) **Coatings.** If an inner treatment or coating of an IBC is required for safety reasons, the manufacturer shall design the IBC so that the treatment or coating retains its protective properties even after withstanding the tests prescribed by this subpart.
- (l) **Record retention.** Following each design qualification test and each periodic retest on an IBC, a test report must be prepared.
- (1) The test report must be maintained at each location where the packaging is manufactured, certified, and a design qualification test or periodic retest is conducted as follows:

Responsible party	Duration
Person manufacturing the packaging	As long as manufactured and two years thereafter.
Person performing design testing	Design test maintained for a single or composite packaging for six years after the test is successfully performed and for a combination packaging or packaging intended for infectious substances for seven years after the test is successfully performed.
Person performing periodic retesting	Performance test maintained for a single or composite packaging for one year after the test is successfully performed and for a combination packaging or packaging intended for infectious substances for two years after the test is successfully performed.

- (2) The test report must be made available to a user of a packaging or a representative of the Department upon request. The test report, at a minimum, must contain the following information:
- (i) Name and address of test facility;
- (ii) Name and address of the person certifying the IBC;
- (iii) A unique test report identification;
- (iv) Date of test report;
- (v) Manufacturer of the IBC;
- (vi) Description of the IBC design type (e.g., dimensions, materials, closures, thickness, representative service equipment, etc.);
- (vii) Maximum IBC capacity;
- (viii) Characteristics of test contents, including for rigid plastics and composite IBCs subject to the hydrostatic pressure test in [§ 178.814 of this subpart](#), the temperature of the water used;
- (ix) Test descriptions and results (including drop heights, hydrostatic pressures, tear propagation length, etc.); and
- (x) The signature of the person conducting the test, and name of the person responsible for testing.

§ 178.803 Testing and certification of IBCs.

Tests required for the certification of each IBC design type are specified in the following table. The letter X indicates that one IBC (except where noted) of each design type must be subjected to the tests in the order presented:

Performance test	IBC type					
	Metal IBCs	Rigid plastic IBCs	Composite IBCs	Fiber-board IBCs	Wooden IBCs	Flexible IBCs
Vibration	⁶ X	⁶ X	⁶ X	⁶ X	⁶ X	^{1,5} X
Bottom lift	² X	X	X	X	X	
Top lift	² X	² X	² X			^{2,5} X
Stacking	⁷ X	⁷ X	⁷ X	⁷ X	⁷ X	⁵ X
Leakproofness	³ X	³ X	³ X			
Hydrostatic	³ X	³ X	³ X			
Drop	⁴ X	⁴ X	⁴ X	⁴ X	⁴ X	⁵ X
Topple						⁵ X
Righting						^{2,5} X
Tear						⁵ X

¹ Flexible IBCs must be capable of withstanding the vibration test.

² This test must be performed only if IBCs are designed to be handled this way. For metal IBCs, at least one of the bottom lift or top lift tests must be performed.

³ The leakproofness and hydrostatic pressure tests are required only for IBCs intended to contain liquids or intended to contain solids loaded or discharged under pressure.

⁴ Another IBC of the same design type may be used for the drop test set forth in [§ 178.810 of this subchapter](#).

⁵ Another different flexible IBC of the same design type may be used for each test.

⁶ The vibration test may be performed in another order for IBCs manufactured and tested under provisions of an exemption before October 1, 1994 and for non-DOT specification portable tanks tested before October 1, 1994, intended for export.

⁷ This test must be performed only if the IBC is designed to be stacked.

§ 178.810 Drop test.

- (a) **General.** The drop test must be conducted for the qualification of all IBC design types and performed periodically as specified in [§ 178.801\(e\) of this subpart](#).
- (b) **Special preparation for the drop test.**
- (1) Metal, rigid plastic, and composite IBCs intended to contain solids must be filled to not less than 95 percent of their maximum capacity, or if intended to contain liquids, to not less than 98 percent of their maximum capacity. Pressure relief devices must be removed and their apertures plugged or rendered inoperative.
 - (4) Rigid plastic IBCs and composite IBCs with plastic inner receptacles must be conditioned for testing by reducing the temperature of the packaging and its contents to -18°C (0°F) or lower. Test liquids must be kept in the liquid state, if necessary, by the addition of anti-freeze. Water/anti-freeze solutions with a minimum specific gravity of 0.95 for testing at -18°C (0°F) or lower are considered acceptable test liquids, and may be considered equivalent to water for test purposes. IBCs conditioned in this way are not required to be conditioned in accordance with [§ 178.802](#).
- (c) **Test method.**
- (1) Samples of all IBC design types must be dropped onto a rigid, non-resilient, smooth, flat and horizontal surface. The point of impact must be the most vulnerable part of the base of the IBC being tested. Following the drop, the IBC must be restored to the upright position for observation.
 - (2) IBC design types with a capacity of 0.45 cubic meters (15.9 cubic feet) or less must be subject to an additional drop test. The same IBC or a different IBC of the same design may be used for each drop.
- (d) **Drop height.**
- (1) For all IBCs, drop heights are specified as follows:
 - (i) Packing Group I: 1.8 m (5.9 feet).
 - (ii) Packing Group II: 1.2 m (3.9 feet).
 - (iii) Packing Group III: 0.8 m (2.6 feet).
 - (2) Drop tests are to be performed with the solid or liquid to be transported or with a non-hazardous material having essentially the same physical characteristics.
 - (3) The specific gravity and viscosity of a substituted non-hazardous material used in the drop test for liquids must be similar to the hazardous material intended for transportation. Water also may be used for the liquid drop test under the following conditions:
 - (i) Where the substances to be carried have a specific gravity not exceeding 1.2, the drop heights must be those specified in [paragraph \(d\)\(1\)](#) of this section for each IBC design type; and
 - (ii) Where the substances to be carried have a specific gravity exceeding 1.2, the drop heights must be as follows:
 - (A) Packing Group I: $\text{SG} \times 1.5$ m (4.9 feet).
 - (B) Packing Group II: $\text{SG} \times 1.0$ m (3.3 feet).
 - (C) Packing Group III: $\text{SG} \times 0.67$ m (2.2 feet).
- (e) **Criteria for passing the test.** For all IBC design types, there may be no damage which renders the IBC unsafe to be transported for salvage or for disposable, and no loss of contents. The IBC shall be capable of being lifted by an appropriate means until clear of the floor for five minutes. A slight discharge from a closure upon impact is not considered to be a failure of the IBC provided that no further leakage occurs. A slight discharge (e.g., from closures or stitch holes) upon impact is not considered a failure of the flexible IBC provided that no further leakage occurs after the IBC has been raised clear of the ground.

§ 178.811 Bottom lift test.

- (a) **General.** The bottom lift test must be conducted for the qualification of all IBC design types designed to be lifted from the base.

§ 178.812 Top lift test.

- (a) **General.** The top lift test must be conducted for the qualification of all IBC design types designed to be lifted from the top or, for flexible IBCs, from the side.

§ 178.813 Leakproofness test.

- (a) **General.** The leakproofness test must be conducted for the qualification of all IBC design types and on all production units intended to contain solids that are loaded or discharged under pressure or intended to contain liquids.
- (b) **Special preparation for the leakproofness test.** Vented closures must either be replaced by similar non-vented closures or the vent must be sealed. For metal IBC design types, the initial test must be carried out before the fitting of any thermal insulation equipment. The inner receptacle of a composite IBC may be tested without the outer packaging provided the test results are not affected.

- (c) **Test method and pressure applied.** The leakproofness test must be carried out for a suitable length of time using air at a gauge pressure of not less than 20 kPa (2.9 psig). Leakproofness of IBC design types must be determined by coating the seams and joints with a heavy oil, a soap solution and water, or other methods suitable for the purpose of detecting leaks. Other methods, if at least equally effective, may be used in accordance with [appendix B of this part](#), or if approved by the Associate Administrator, as provided in [§ 178.801\(i\)](#).
- (d) **Criterion for passing the test.** For all IBC design types intended to contain solids that are loaded or discharged under pressure or intended to contain liquids, there may be no leakage of air from the IBC.

§ 178.814 Hydrostatic pressure test.

- (a) **General.** The hydrostatic pressure test must be conducted for the qualification of all metal, rigid plastic, and composite IBC design types intended to contain solids that are loaded or discharged under pressure or intended to contain liquids.
- (b) **Special preparation for the hydrostatic pressure test.** For metal IBCs, the test must be carried out before the fitting of any thermal insulation equipment. For all IBCs, pressure relief devices and vented closures must be removed and their apertures plugged or rendered inoperative.
- (c) **Test method.** Hydrostatic gauge pressure must be measured at the top of the IBC. The test must be carried out for a period of at least 10 minutes applying a hydrostatic gauge pressure not less than that indicated in [paragraph \(d\)](#) of this section. The IBCs may not be mechanically restrained during the test.
- (d) **Hydrostatic gauge pressure applied.**
- (1) For metal IBC design types, 31A, 31B, 31N: 65 kPa gauge pressure (9.4 psig).
 - (2) For metal IBC design types 21A, 21B, 21N, 31A, 31B, 31N: 200 kPa (29 psig). For metal IBC design types 31A, 31B and 31N, the tests in [paragraphs \(d\)\(1\)](#) and [\(d\)\(2\)](#) of this section must be conducted consecutively.
 - (3) For metal IBCs design types 21A, 21B, and 21N, for Packing Group I solids: 250 kPa (36 psig) gauge pressure.
 - (4) For rigid plastic IBC design types 21H1 and 21H2 and composite IBC design types 21HZ1 and 21HZ2: 75 kPa (11 psig).
 - (5) For rigid plastic IBC design types 31H1 and 31H2 and composite IBC design types 31HZ1 and 31HZ2: whichever is the greater of . . .
- (e) **Criteria for passing the test(s).**
- (1) For metal IBCs, subjected to the 65 kPa (9.4 psig) test pressure specified in [paragraph \(d\)\(1\)](#) of this section, there may be no leakage or permanent deformation that would make the IBC unsafe for transportation.
 - (2) For metal IBCs intended to contain liquids, when subjected to the 200 kPa (29 psig) and the 250 kPa (36 psig) test pressures specified in [paragraphs \(d\)\(2\)](#) and [\(d\)\(3\)](#) of this section, respectively, there may be no leakage.
 - (3) For rigid plastic IBC types 21H1, 21H2, 31H1, and 31H2, and composite IBC types 21HZ1, 21HZ2, 31HZ1, and 31HZ2, there may be no leakage and no permanent deformation which renders the IBC unsafe for transportation.

§ 178.815 Stacking test.

- (a) **General.** The stacking test must be conducted for the qualification of all IBC design types intended to be stacked.

§ 178.816 Topple test.

§ 178.817 Righting test.

§ 178.818 Tear test.

§ 178.819 Vibration test.

- (a) **General.** The vibration test must be conducted for the qualification of all rigid IBC design types. Flexible IBC design types must be capable of withstanding the vibration test.
- (b) **Test method.**
- (1) A sample IBC, selected at random, must be filled and closed as for shipment. IBCs intended for liquids may be tested using water as the filling material for the vibration test.
 - (2) The sample IBC must be placed on a vibrating platform with a vertical or rotary double-amplitude (peak-to-peak displacement) of one inch. The IBC must be constrained horizontally to prevent it from falling off the platform, but must be left free to move vertically and bounce.
 - (3) The test must be performed for one hour at a frequency that causes the package to be raised from the vibrating platform to such a degree that a piece of material of approximately 1.6-mm (0.063-inch) thickness (such as steel strapping or paperboard) can be passed between the bottom of the IBC and the platform. Other methods at least equally effective may be used (see [§ 178.801\(i\)](#)).
- (c) **Criteria for passing the test.** An IBC passes the vibration test if there is no rupture or leakage.