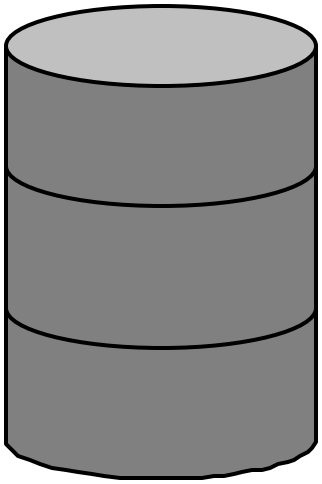
HAZARDOUS MATERIALS PACKAGING



Understanding Performance-Oriented Packaging Standards For Steel Drums

APRIL 2002 -- NINTH EDITION

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Contact the Department of Transportation for formal interpretations of the Hazardous Material Regulations.

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I. PERFORMANCE ORIENTED PACKAGING

BACKGROUND

For over forty years, the Department of Transportation used a specification based regulations system that had become routine for packagers of hazardous materials. Terms such as DOT 17H and DOT 17E indicated to manufacturers how to construct and test a container.

As the world moves toward a global economy, barriers to free trade are being eliminated. The Performance-Oriented Packaging standards embodied in the DOT's Hazardous Material Regulations (HMR) are based on an international system developed in the United Nations with the purpose to promote harmonization in hazardous materials regulations worldwide, thereby reducing obstacles to the free flow of commerce. Countries that operate under this international system are not obligated to, but attempt to, adopt these standard into their national regulations with as little change as possible. Yet, differences among nations do exist and must be monitored.

All phases of hazardous materials shipment are subject to change. This includes: packaging specification, placarding, labeling, manifesting and employee training.

UN RECOMMENDATIONS ON THE TRANSPORT OF DANGEROUS GOODS "ORANGE BOOK"

Developed by the Committee of Experts on the Transport of Dangerous Goods under the authority of the UN's Economic and Social Council, the UN Recommendations are the basis for the U.S. regulations on the transport of hazardous materials by air, ocean vessel, rail, road carrier or intermodal. The Recommendations, authorized in 1957, are revised every two years and are presently formatted as Model Regulations.

HAZARDOUS METERIALS TRANSPORTATION ACT OF 1974

The legislative authority for the U.S. Department of Transportation in the area of hazardous materials regulations. It is usually reauthorized every three years.

TITLE 49, PARTS 100-199, CODE OF FEDERAL REGULATIONS

The body of regulations administered by the Research and Special Programs Administration of the DOT. The Hazardous Materials Regulations are found in Parts 171 – 180. Part 171 is general information, Part 172 is the hazardous materials tables and communications regulations, Part 173 general requirements for shippers and packagings, and Part 178 packaging specifications. Title 49 is revised every October 1.

HM-181

On December 19, 1990 the United States published its final rule in Docket No. HM-181 which adopted UN standards for the packaging a shipping of hazardous materials developed by the UN Committee of Experts in the sixth revision of the UN Orange Book. For the most part, the UN Orange Book recommendations were accepted by the DOT. Several significant changes did appear in the US DOT version due to practices that applied specifically to the United States (i.e. minimum steel thickness requirements, reconditioning provisions, etc.). Certain thickness marking requirements were phased out by HM-215A.

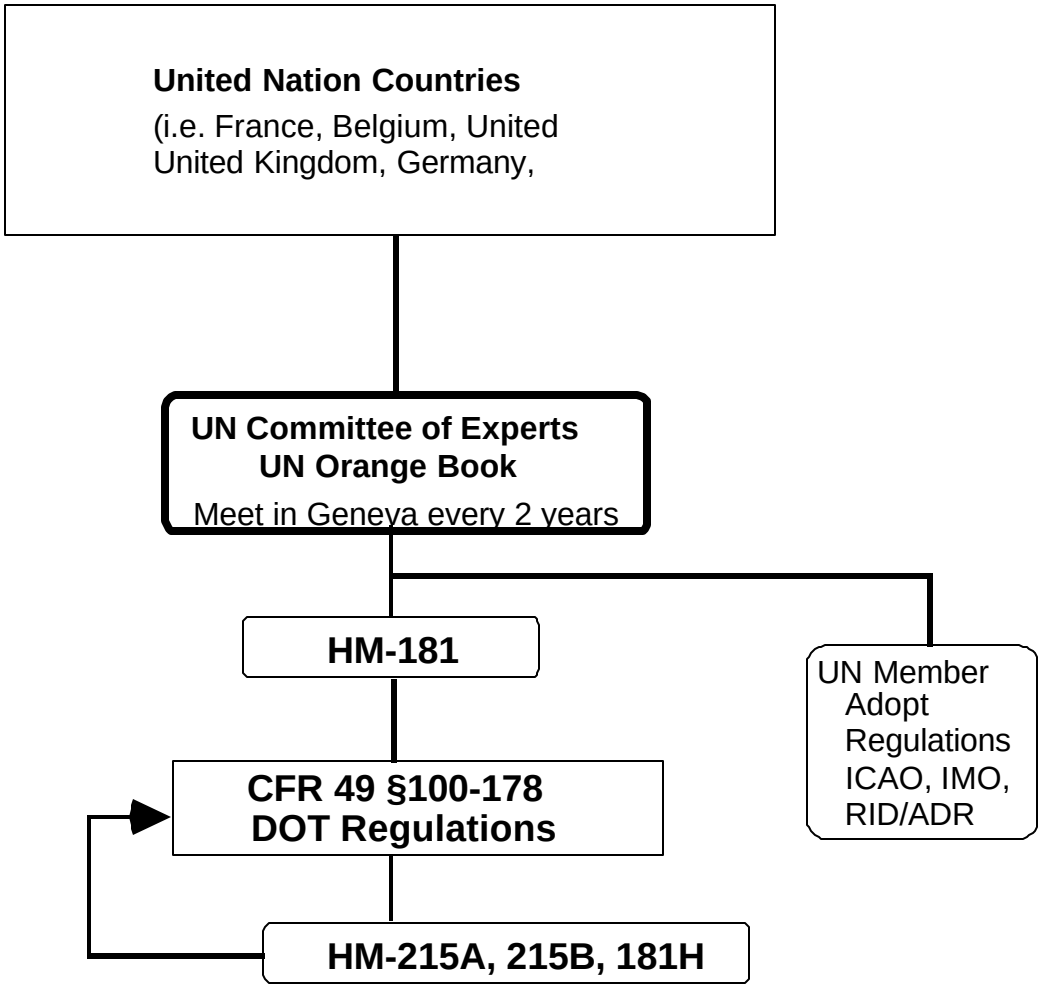
HM-215A

On December 29, 1994 the DOT published its final rule in Docket No. HM-215A, which updated the HM-181 final rule to reflect changes made in the Seventh and Eighth Revised Editions of the UN Orange Book. On May 18, 1995, editorial corrections were made to HM-215A. Provisions for this rule were effective October 1, 1996.

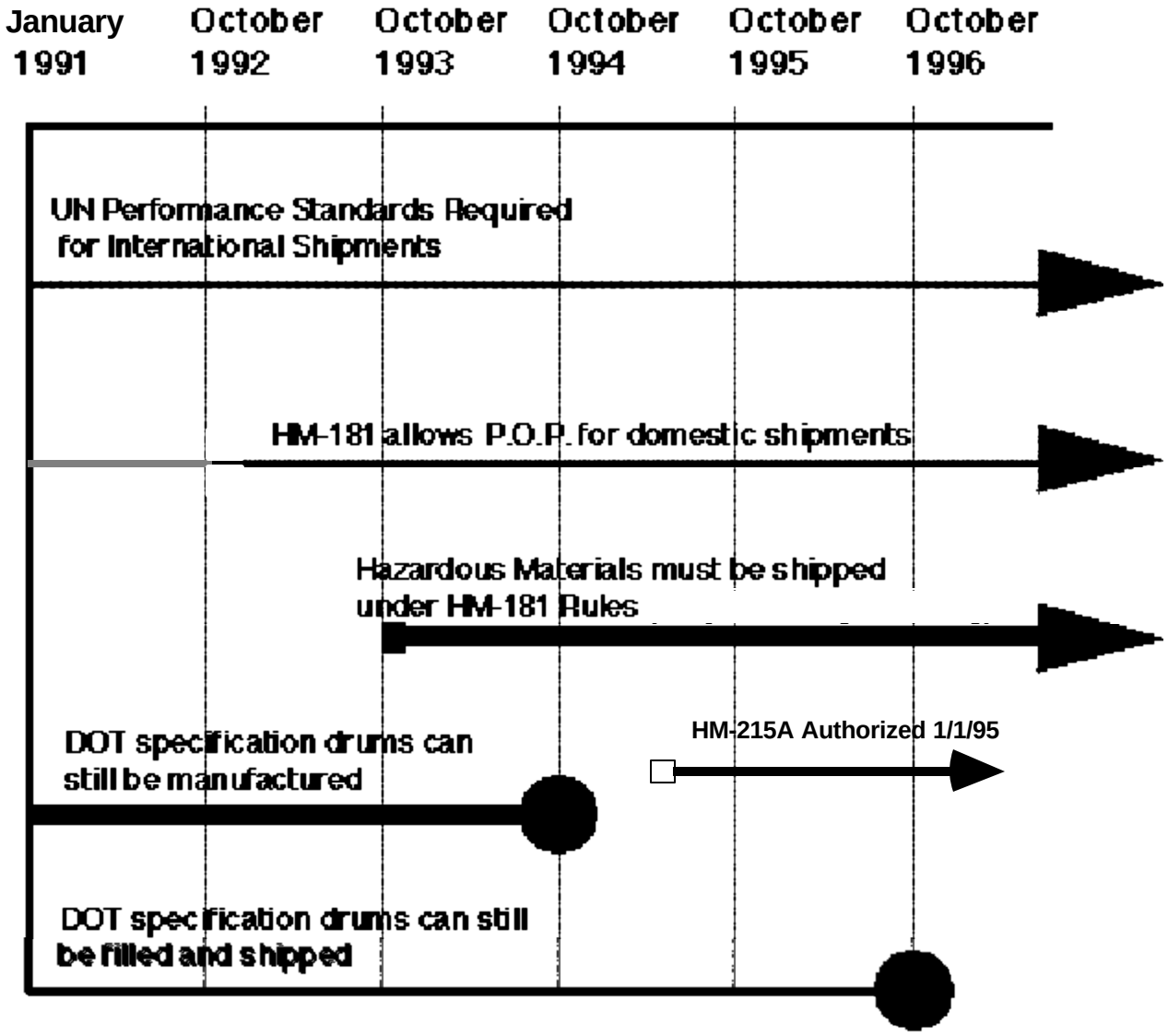
HM-215B AND HM-181H

On May 6, 1997, and September 26, 1996, DOT issued final rules for Dockets HM-215B and HM-181H, respectively. For steel drum users, these primarily affected provisions on salvage drums, minimum thickness, certain transitional provisions, and design type variations. These provisions are included herein.

EVOLUTION OF PERFORMANCE ORIENTED PACKAGING



TIME TABLE



TRANSITION DATES §171.14

OCTOBER 1, 1993

Packagers and shippers of hazardous materials must use the new shipping papers, labeling, emergency response, training and documentation as outlined in 49 CFR §171 et al. New packaging requirements for Poisonous Inhalation Hazard (PIH) materials.

OCTOBER 1, 1994

New placarding requirements. DOT specification drums can no longer be manufactured. This includes:

DOT-17E
DOT-17C
DOT-17H
DOT-37A
DOT-37M
DOT-5B
DOT-6D

JANUARY 1, 1995

Voluntary Compliance with HM-215A

OCTOBER 1, 1996

Mandatory compliance for provisions accepted in HM-215A
Hazardous materials packaged after October 1, 1991 may no longer be shipped in DOT specification drums. (Products packaged prior to October 1, 1991 may be shipped until October 1, 2001.)

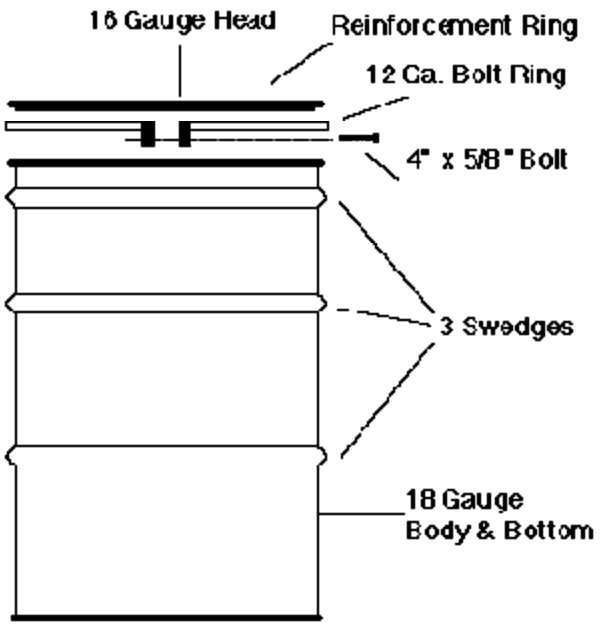
OCTOBER 1, 1999

(Products packaged prior to October 1, 1991 may be shipped until October 1, 2001.) Hazardous materials packaged in DOT specification drums prior to 10/01/96 and never emptied and refilled after that date may no longer be shipped.

OLD SYSTEM - SPECIFICATION BASED PACKAGING

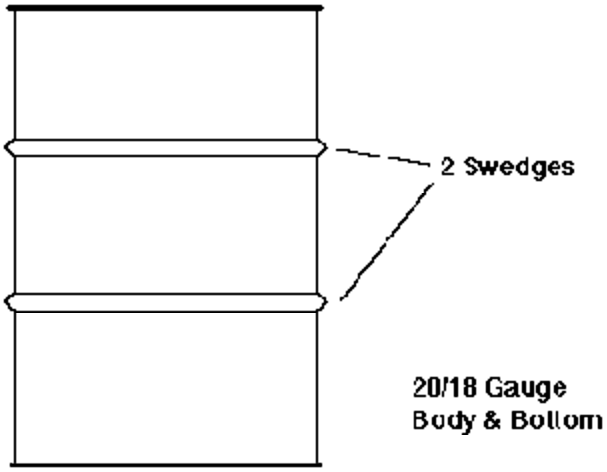
DOT-17H

Ladings
Flammables
Paints
Hazardous Waste



DOT-17E

Ladings
Flammables
Solvents



PERFORMANCE ORIENTED PACKAGING

The new hazardous materials regulations are based on performance oriented packaging. A container can be manufactured in any fashion as long as the resulting package successfully conforms to the test provisions located in §178.600.

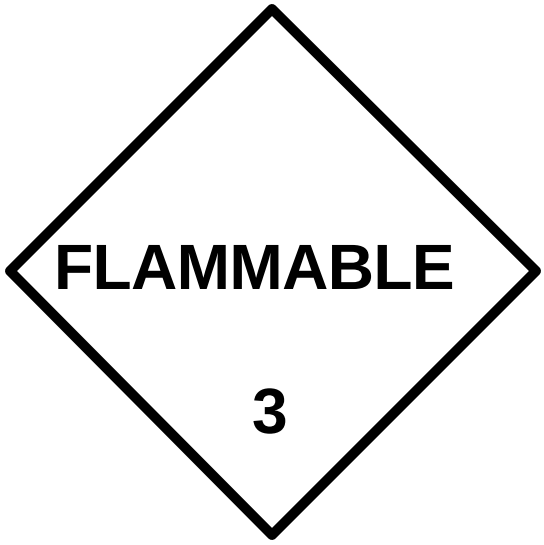
UN 1A1/Y1.8/300/00

The following items are not specified under the regulations:

Capacity
Steel thickness
Height or diameter requirement
Closures

MAJOR CHANGES

SHIPPING PAPERS §172.200
MARKINGS §172.300
LABELING §172.400
PLACARDING §172.500
EMERGENCY RESPONSE §172.600
TRAINING §172.700
SHIPPER'S RESPONSIBILITIES §173.00
MANUFACTURER'S RESPONSIBILITIES §178.00
HAZMAT DEFINITIONS §171.8
HAZMAT TABLE §172.101



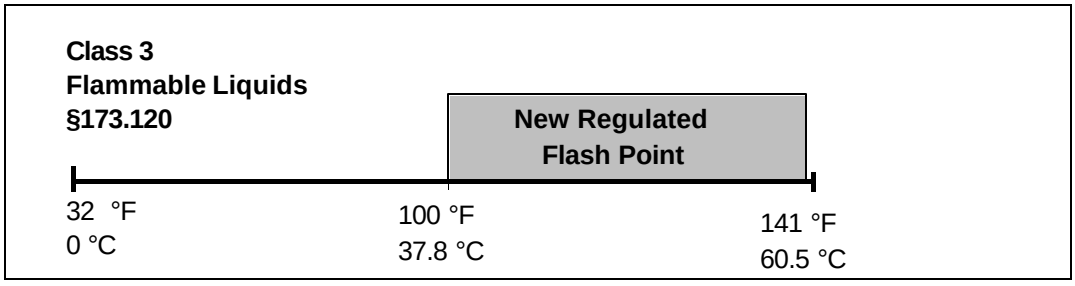
HAZARD CLASSIFICATION CODES

Classification codes replace word descriptions for product categories. For example, Flammable Liquids are now referred to as Class 3 products. Class 9 is used to describe most ORM-E (other regulated materials).

Description	Hazard Code	Reference
Explosives	Class 1	§173.50
Flammable Gases	Class 2, Division 2.1	§173.115
Nonflammable Gases	Class 2, Division 2.2	§173.115
Poisonous Gases	Class 2, Division 2.3	§173.115
Flammable Liquids	Class 3	§173.120
Flammable Solids	Class 4, Division 4.1	§173.124
Spontaneously Combustible	Class 4, Division 4.2	§173.124
Dangerous-When-Wet	Class 4, Division 4.3	§173.124
Oxidizers	Class 5, Division 5.1	§173.127
Organic Peroxides	Class 5, Division 5.2	§173.127
Poisons	Class 6, Division 6.1	§173.132
Infectious Substances	Class 6, Division 6.2	§173.132
Radioactive	Class 7	§173.403
Corrosive	Class 8	§173.136
Misc. Hazards (hazardous waste)	Class 9	§173.140

ADDITIONAL REGULATED PRODUCTS

Some products that previously were considered non-hazardous are now regulated under the new regulations. The flash point has been changed to include products that previously were exempt. It is the responsibility of the packager/shipper to evaluate each lading to determine the correct packaging.



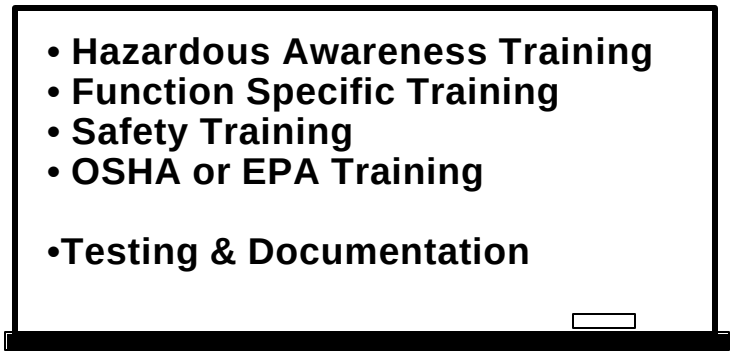
* A flammable liquid with a flashpoint at or above 38°C (100°F) that does not meet the definition of any other hazard class may be reclassified as a combustible liquid. Combustible liquids are those with a flash point above 141°F.

DEDICATED REUSE §173.28

Drums must be inspected, leakproofness tested and marked prior to reuse even if they are filled with the same product.

HAZMAT EMPLOYEE TRAINING §172.700

A Hazmat employee is any person who in the course of their employment directly affects hazardous materials transportation safety. Hazmat employees must receive specific training. Topics include: Hazardous materials handling, emergency response, self-protection, accident prevention, etc. Documented training and testing must have been completed by October 1, 1993 and every three years thereafter. A hazmat employee must be trained within 90 days of starting a new hazardous materials function.



RECONDITIONING REQUIREMENTS FOR HAZARDOUS MATERIALS §173.28

Under HM-181H, drums with a capacity greater than 100 liters (26.5 gallons) may only be reused after proper reconditioning if the steel thickness is a minimum of .92 mm (0.0362 inch). Drums constructed before January 1, 1997 with a minimum of 0.82 mm (0.0323 inch) body and 1.09 mm (0.0429 inch) heads and bottoms may be reused. Drums constructed after January 1, 1997 and intended for reuse must have a minimum of 0.82 mm (0.0323 inch) body and 1.11 mm (0.0437 inch) heads and bottoms.

Salvage Drum Testing §173.3

Two types of salvage drums for hazardous materials are allowed:

(1) 1A2 drum tested and marked for Packing Group III or higher for liquids or solids and a leakproofness test of 20 kPa(3psi).

(2) A 1A2 drum marked "T" in accordance with the UN Recommendations. According to Chapter 6.1 of the UN Orange Book, salvage drums marked "T" shall be tested as Packing Group II packagings for solids where water is the test substance filled to not less than 98% of maximum capacity, and the drums must pass a leakproofness test of 30 kPa.

Myers Container Corporation can produce steel drums to the minimum steel thickness allowed for reconditioning and for reuse with Hazardous Materials. This provides the emptier with the greatest value when sending empty drums to a reconditioner. Myers will emboss drums meeting the 1.11/.82/1.11mm thickness as a nominal marking of 1.2/.9/1.2mm as required by the D.O.T. (see Appendix 1).

DEFINITIONS §171.8

NON-BULK PACKAGING
Maximum capacity of 450 L (119 gallons) or less for liquids.
Maximum net mass of 400 kg (882 pounds) or less for solids.

BULK PACKAGING
Maximum capacity greater than 450 L (119 gallons) for liquids.
Maximum net mass greater than 400 kg (882 pounds) for solids.

COMPOSITE PACKAGING
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.

GROSS MASS
The weight of a packaging plus the weight of the contents.

HAZARD CLASS
The category of hazard assigned to a hazardous material under the definition criteria of Part 173 and the provisions of the hazardous material Table §172.101.

HAZARDOUS MATERIAL
A substance or material, including a hazardous substance, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce.

HAZMAT EMPLOYEE
A person who is employed by a hazmat employer and who in the course of employment directly affects hazardous materials transportation safety.

LIQUID
A material that has a vertical flow of over 2 inches (50 mm) within a three minute period, or a material having one gram or more liquid separation, when determined in accordance with the procedures specified in ASTM D 4359.

PACKING GROUP §172.101

Packing Group	Degree of Danger	Marking
Packing Group I	Great	X
Packing Group II	Medium	Y
Packing Group III	Minor	Z

DEFINITIONS CON'T

FLASH POINT

The minimum temperature at which a substance gives off flammable vapors which, in contact with sparks or flame, will ignite (§173.121).

REGULATORY AGENCIES

DOT	U. S. Department of Transportation
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization

REFERENCE §171.9

METRIC CONVERSIONS

1 kilogram (kg).....	=	2.204622 pounds
1 millimeter (mm).....	=	0.03937008 inches
1 meter	=	39.37008 inches
1 kiloPascal (kPa)	=	0.1450377 PSI
1 liter.....	=	0.2641720 gallons

SPECIFIC GRAVITY (RELATIVE DENSITY)

The ratio of the density of a substance to the density of water. The specific gravity of water is 1.0.

VAPOR PRESSURE

The pressure exerted by a vapor that is in equilibrium with its solid or liquid form.

CODE OF FEDERAL REGULATIONS (CFR 49 100-199)

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U.S. Department of Transportation
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Washington, D.C. 20590

AMERICAN NATIONAL STANDARDS INSTITUTE

11 West 42nd Street
New York, NY 10036

II. MARKINGS

DRUM MARKINGS §178.503

The marks must contain the information outlined in Section 178.503 and the inch equivalents of the minimum thicknesses in millimeters listed in table of Section 173.28 are found by dividing the number of millimeters by 25.4. Disregard the inch equivalents shown in parentheses; these are not accurate conversions.

1) NON-BULK STEEL CONTAINERS UP TO 30 KG GROSS MASS

A) Single Trip Containers Only --
- Mark may be durable or permanent but must be “readily visible”. The marking cannot be applied to only a removable cover.

- The mark must include the country of manufacture and the manufacturer's symbol or name and address.

B) Intended For Reuse Or Reconditioning --
- If applying only one mark, it must be permanent and have the country of manufacture and manufacturer’s symbol or name and address. This permanent mark may be applied on the top, side or bottom. However, the marking cannot be applied to only a removable cover.

2) NON-BULK STEEL CONTAINERS ABOVE 30 KG. BUT LESS THAN 100 LITERS

A) Single-Trip Containers --
- Durable or permanent mark must be on the top or the side of the container, whether you mark the bottom or not. However, the marking cannot be applied to only a removable head.

- All marks must include the country of manufacture and the manufacturer's symbol or name and address.

B) Intended For Reuse Or Reconditioning --
- If applying only one mark, it must be permanent and have the country of manufacture and the manufacturer's symbol or name and address. This permanent mark must be applied on the top or side. However, the marking cannot be applied to only a removable head.

- If a durable mark is applied on top or side, then the permanent mark on the bottom need not have the country of manufacture and the manufacturing symbol.

- Nominal thickness mark is required as part of the permanent and durable marks. If the head or the bottom is thinner than the body, then all three nominal thickness marks are required.

Nominal thickness requirement for reuse or reconditioning is 0.7mm (0.63mm minimum) for containers up to and including 20 liters, from 20 to 40 liters the nominal thickness requirement is 0.8mm (0.73mm minimum), from 40 to 100 liters the nominal thickness requirement is 1.0mm (0.92mm minimum). Also, drums with a minimum head and bottom thickness of 1.11mm and body thickness of 0.82mm are allowed.

3) NON-BULK STEEL CONTAINERS ABOVE 100 LITERS

A) Single-Trip Containers --
- Durable mark must be on the top or the side of the container. It must include the country of manufacture and the manufacturer's symbol but need not have the thickness mark. However, the marking cannot be applied to only a removable head.

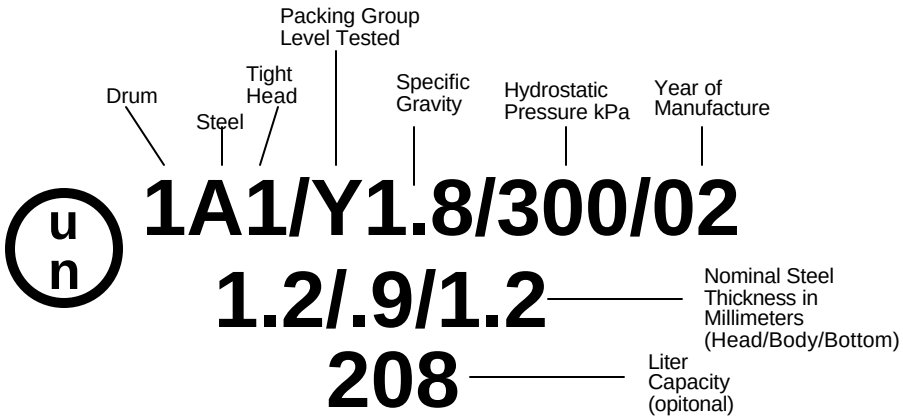
- Permanent mark must be on the bottom. The country of manufacture and the manufacturer's symbol need not be part of the permanent mark. The thickness mark must be included.

- Nominal thickness mark showing the thickness of the body is required. If the head or the bottom is thinner than the body, then all three nominal thickness marks are required (top head/body/bottom head).

B) Intended For Reuse Or Reconditioning --
- Same as above.

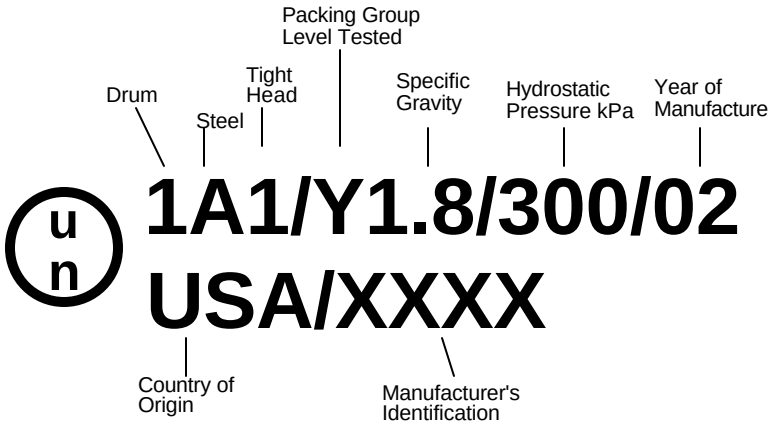
Nominal thickness requirement for reuse or reconditioning is 1.0mm (0.92mm minimum). For containers over 220 liters, the nominal thickness requirement is 1.9mm (1.77mm minimum). Also, drums with a minimum head and bottom thickness of 1.11mm and body thickness of 0.82mm are allowed.

SAMPLE PERMANENT MARKING – TIGHTHEAD-NEW DRUM

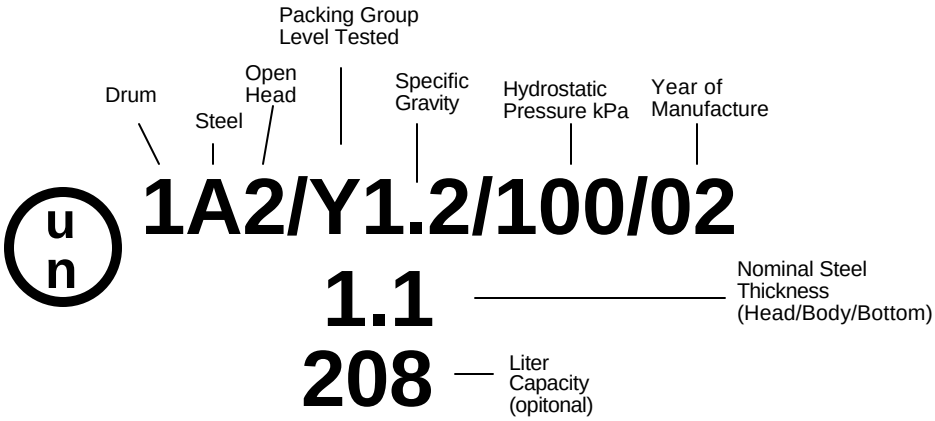


(For embossed metal drums, the letters “UN” may be applied in place of the United Nations symbol. Letter height must be a minimum of 12mm for Containers over 30 liters, or 6mm for containers under 30 liters.)

SAMPLE DURABLE MARKING- TIGHTHEAD- NEW DRUM

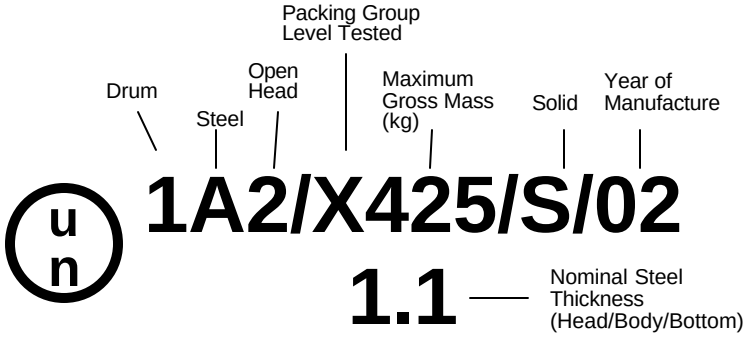


SAMPLE PERMANENT MARKING- OPENHEAD LIQUID- NEW DRUM

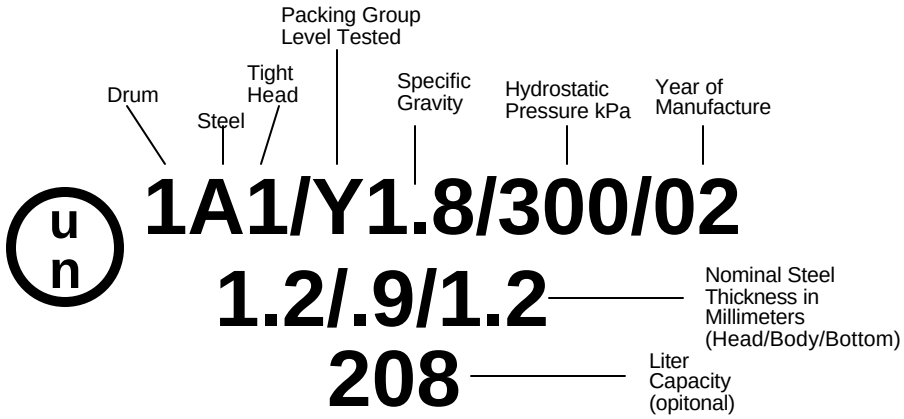


(For embossed metal drums, the letters “UN” may be applied in place of the United Nations symbol. Letter height must be a minimum of 12mm for Containers over 30 liters, or 6mm for containers under 30 liters.)

SAMPLE PERMANENT MARKING- OPENHEAD SOLID-NEW DRUM

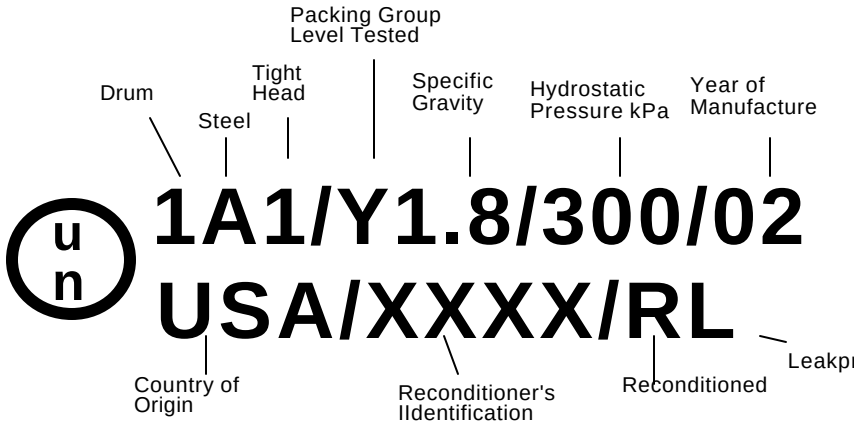


SAMPLE PERMANENT MARKING – TIGHTHEAD-RECONDITIONED DRUM



(For embossed metal drums, the letters “UN” may be applied in place of the United Nations symbol. Letter height must be a minimum of 12mm for Containers over 30 liters, or 6mm for containers under 30 liters.)

SAMPLE DURABLE MARKING- TIGHTHEAD- RECONDITIONED DRUM



III. PACKAGE SELECTION

RESPONSIBILITY § 173.22

It is the responsibility of the packager/shipper, not the container manufacturer, to determine the proper package specification for each lading. The shipper determines that the drum is authorized, assembled and marked for packaging. The shipper may request a certificate of compliance from the manufacturer to demonstrate that each container conforms with the performance testing provisions in §178.600.

Since the test for the old specification testing and the new performance standard testing are not the same, it is necessary to perform complete testing for each marking appearing on the container. Some container specifications that have been used for years may become obsolete under the new performance standard testing requirements. There is no conversion chart to look up the equivalent UN marking for a DOT-17E.

ASSEMBLY NOTIFICATION §178.601(B) & §178.2 (C)

It is the shipper's responsibility to assemble the container for shipment in accordance with the manufacturer's instructions.

Please see our website for complete information or refer to the Appendix herein entitled “UN Drum Assembly Instructions”.

PACKAGE SELECTION

To order UN marked packaging, purchasers of steel drums must supply the following information to their drum manufacturer found in the Hazardous Material Table (§172.101)

• *PACKING GROUP §172.101*

Packing Group	Marking
Packing Group I	X
Packing Group II	Y
Packing Group III	Z

• *SPECIFIC GRAVITY (LIQUIDS ONLY) §178.503 (A)(4)(I)*

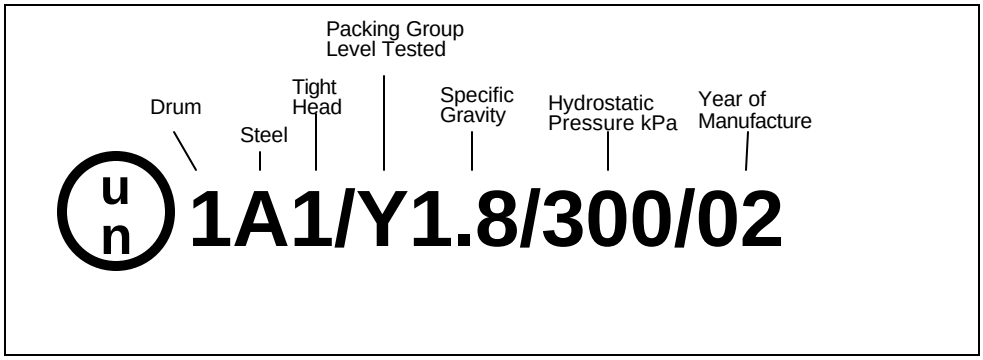
Relative density of the material, rounded up to the first decimal.

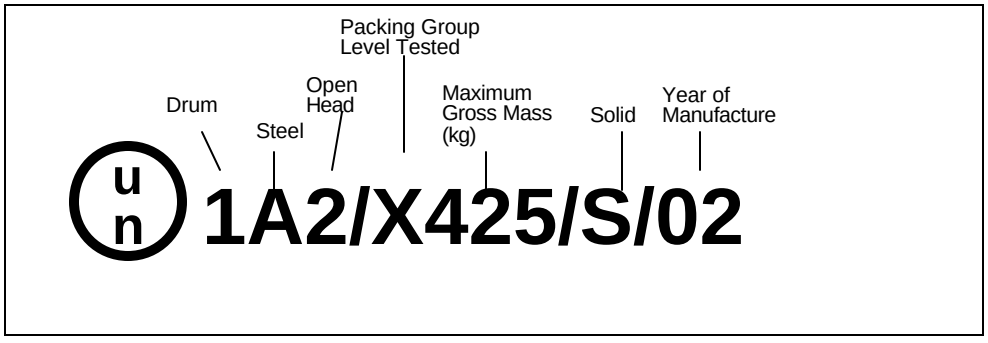
• *NET MASS (SOLIDS ONLY) §178.503 (A)(4)(II)*

The total weight, in kilograms, of the material placed in the drum. Drum must be marked with the maximum gross mass.

• *HYDROSTATIC PRESSURE TEST (LIQUIDS ONLY) §173.24(A)*

The pressure in kiloPascals (kPa) that the packaging must be capable of withstanding, which relates to the vapor pressure of the lading at certain reference temperatures.





SINGLE PRODUCT CHARACTERISTICS §172.101

To determine packaging requirements for pure products, such as acetone, reference the Hazardous Material Table located in the Code of Federal Regulations.

MULTIPLE PRODUCT CHARACTERISTICS §173.2A

To determine packaging requirements for a mixture of chemicals (i.e. formulations, hazardous waste, etc.) reference the Precedence of Hazard Table. Laboratory testing must be performed to determine the characteristics of the formulation. In some cases, animal testing may be necessary.

Packagers should contact their suppliers or trade associations for assistance in determining the proper packaging requirements.

UN PERFORMANCE ORIENTED PACKAGING SPECIFICATION SHEET

Product Name _____

Classification

Items 1 through 5 below are from the CFR 49 172.101 Hazardous Materials Table

1. Hazardous materials description and proper shipping name (Column 2) _____
2. Hazardous class/division (Column 3) _____
3. UN Identification Number (Column 4) _____
4. Packing Group (I,II,III) (Column 5) _____
5. Special Provisions (Column 7) _____

Container Testing/Marking Data

Specific Gravity _____ (Solids Only)

Material Consistency (check one)
Liquid _____ Solid _____
See ASTM D4359-90
(Liquids Only)

Net weight in Kilograms _____

Product Vapor Pressure ____ kPa @ 55 C

Type of Container

Openhead ____ Tighthead _____

Capacity _____ US Gallons

Fittings required _____

UN MARKING: _____

IV. TESTING §178.600

It is the responsibility of the container manufacturer to perform and document design qualification testing, periodic retesting and production testing in accordance with Subpart M - Testing of Non-Bulk Packagings and Packagers. Each manufacturer must certify the packaging is capable of passing the prescribed tests (§178.601(b)). All records are to be kept at each location where the packaging is manufactured and at each location where design qualification tests are conducted for as long as the packaging is produced and for at least two years thereafter. All records must be made available to the Department of Transportation upon inspection.

Each container must be manufactured and assembled so as to be capable of successfully passing the prescribed tests. The DOT secures containers randomly to determine compliance.

Container manufacturers may use a DOT approved third party testing facility to perform the design qualification and the periodic retests.

DESIGN TYPE §178.601(C)(4)

This is the description that represents each unique container.

For steel drums with a capacity greater than 50 L (13 Gallons), a change in any one of the following design elements constitutes a different drum design type requiring full design qualification testing [§178.601(g)(8)]:

(1) the packaging type and category, i.e. 1A1 or 1A2;
(2) the style, i.e. straight-sided or tapered;
(3) the rated capacity and outside dimensions (except if the change is 25% or less than the original type);
(4) the physical state for which the packaging was originally approved, e.g. for solids or liquids;
(5) an increase in the marked level of performance (i.e. to a higher packaging group, hydrostatic test pressure and specific gravity);
(6) type of side seam welding;
(7) type of steel;
(8) an increase of greater than 10% or any decrease in steel thickness of the head, body or bottom;
(9) end seam type, e.g. triple or double seam;
(10) a reduction in the number of rolling hoops which equal or exceed the diameter over the chimes;

(11) the location, type or size, and material of closures (other than the cover of UN 1A2 drums); and

(12) for UN 1A2 drums:
- (a) gasket material or properties affecting the performance of the gasket;
- (b) configuration or dimensions of the gasket;
- (c) closure ring style including bolt size (e.g. square or round back, 0.625" bolt); and
- (d) closure ring thickness.

The design qualification test is applicable for containers shorter than the original design as long as all other construction is identical. For example, a certification for a 208 liter (55 gallon) drum is valid for a 197 liter (52 gallon) drum made on the same diameter. §178.601 (c)(4)(v).

DESIGN QUALIFICATION TESTING §178.601 (C) (1)

To determine the capabilities of a container, design qualification testing is performed on the initial design type. No UN marking may appear on the container.

- Drop Test
- Stack Test
- Hydrostatic Test
- Leakproofness Test (closures in place)
- Vibration Standard *

(*§178.608 states that each packaging must be capable of withstanding the vibration test procedure.)

PERIODIC RETESTING §178.601 (C) (2)

To ensure integrity of the design qualification test results, periodic retesting is performed on an annual basis. Each container must be embossed with the UN marking to which it is being tested.

- Drop Test
- Stack Test
- Hydrostatic Test
- Leakproofness Test (closures in place)

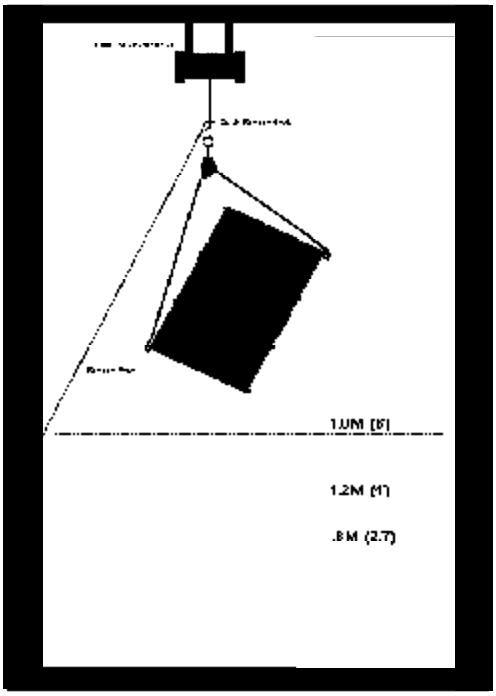
PRODUCTION TESTING §178.601 (C) (3)

Must be performed on every container produced.

- Leakproofness Testing
- Chime Cut Retains* (each design change)

(*Required only if the solution over partial seams test method is used. Part 178 Appendix B, Option 4.)

DROP TEST §178.603



Design Qualification and Periodic Retest

The drop test for containers to contain liquids is a vented drop, i.e. the plugs must be vented after dropping the drum to equalize the internal and external pressures. The container must be at least 98 percent full with liquid and dropped from the height determined by the packing group designation.

The drop test for containers to contain solids must be filled to at least 95 percent capacity with a material having physical properties (grain, size, viscosity) similar to the intended lading. Drop height is determined by the packing group designation.

The container is to be dropped using the orientation most likely to result in failure.

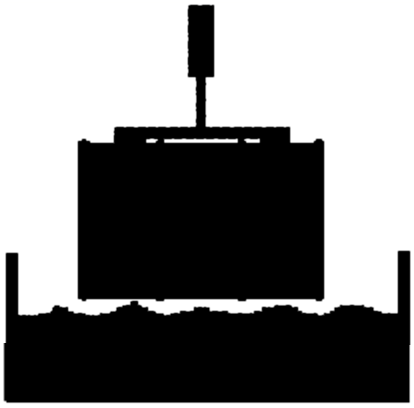
Drop Heights

Packing Group	Solids/Liquids	Liquids (SG > 1.2)
Packing Group I	1.8 m (5.9 feet)	SG x 1.5 m (4.9 feet)
Packing Group II	1.2 m (3.9 feet)	SG x 1.0 m (3.3 feet)
Packing Group III	.8 m (2.6 feet)	SG x .67 m (2.2 feet)

Criteria for Passing

There is no leakage of the filling substance from the drum.

LEAKPROOFNESS TEST §178.604



Design Qualification and Periodic Retest

Containers must be tested with closures in place. Once filled with the pressure listed below, containers must be restrained under water for a minimum of five (5) minutes time to pressurize the interior of the packaging and determine if there is any air leakage from the container. Alternative methods outlined in Appendix B to Part 178 are also authorized.

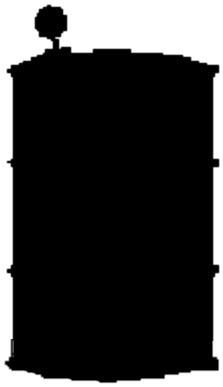
Test Pressures

Packing Group	Manufacturing	Reconditioning
Packing Group I	30 kPa (4 PSI)	48 kPa (7 PSI)
Packing Group II	20 kPa (3 PSI)	20 kPa (3 PSI)
Packing Group III	20 kPa (3 PSI)	20 kPa (3 PSI)

Criteria for Passing

There is no leakage of air from the container.

HYDROSTATIC PRESSURE TEST §178.605

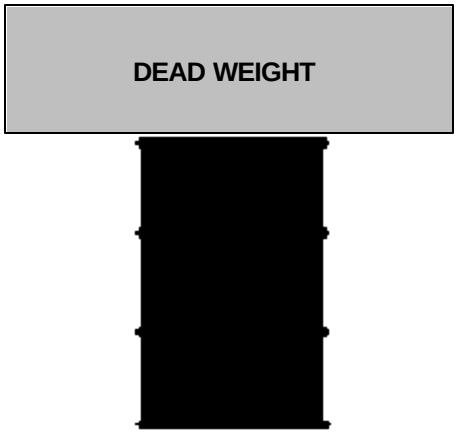


Design Qualification and Periodic Retest
Containers are filled with water and pressurized according to §178.605 (d)(1-3). Containers must be tested for a minimum of five (5) minutes.

Packing Group I must be tested to a minimum test pressure of 250 kPa (36 PSI).

Criteria for Passing
There is no leakage of liquid from the container.

STACKING TEST §178.606



Design Qualification and Periodic Retest
Filled as for shipment, containers must be subjected to a force applied to the top surface of the drum for twenty-four hours equal to the total weight of identical packages which might be stacked on it during transport. Minimum stack height is three meters.

Criteria for Passing
There is no leakage of substance from the container; no distortion or deformation.

Name and Date:_____

STEEL DRUM SCHOOL - HAZ MAT EXAM

(For Compliance With HM-126F)

1) What is a Haz Mat Employee?

2) What does “DOT” stand for?

3) What five tests are required for Design Qualification Testing?

4) Who is responsible for the final assembly of a package for hazardous transport?

5) What does kPa stand for?

6) What is the minimum steel thickness and nominal marking required for reconditioning a drum for hazardous shipments?

7) What are the three requirements for having a drum prepared for reconditioning?

8) Does an empty drum meeting the three above requirements require a manifest for shipment to a drum reconditioner?

9) What is ISO 9002?

10) Name three advantages of a steel drum.

11) Sample: UN 1A1/Y1.2/100

What does UN stand for? _____
What does 1A1 stand for? _____
What does Y stand for? _____
What does 1.2 stand for? _____
What does 100 stand for? _____

STEEL DRUM SCHOOL - HAZ MAT EXAM ANSWERS

(For compliance with HM-126F)

1) What is a Haz Mat employee?
Anyone who, during the course of their job, may influence the safety of transporting, storing or using hazardous materials.

2) What does "DOT" stand for?
Department of Transportation

3) What five tests are required for Design Qualification Testing?
Stack, Leakproofness, Drop, Hydrostatic and Vibration

4) Who is responsible for the final assemlby of a package for hazardous transport?
The final person offering the package for shipment.

5) What does kPa stand for?
Kilopascal - the metric measure for internal pressure. Relates to PSI (Pounds per Square Inch)

6) What is the minimum steel thickness required for reconditioning a drum for hazardous shipments?
Minimum 1.11/.82/1.11mm, Nominal 1.2/0.9/1.2mm

7) What are the three requirements for having a drum prepared for reconditioning?
Drip Dry, Label Intact, Closures Secure

8) Does an empty drum meeting the three above requirements require a manifest for shipment to a drum reconditioner?
No, a legally empty steel drum that meets the criteria in #7 is considered "empty" and does not have to be manifested when sent to a licensed reconditioner.

9) What is ISO 9002?
A quality management system that documents all processes. Simply put, "Say what you do, do what you say."

10) Name three advantages of a steel drum.
100% Recyclable, Vermin Proof, Stacking Strength, Fire Protection, Lower Insurance Rates, etc.

11) Sample: UN 1A1/Y1.2/100

What does UN stand for?	United Nations
What does 1A1 stand for?	Tighthead Steel Drum
What does Y stand for?	Packing Group II - Moderate Hazard
What does 1.2 stand for?	Specific Gravity
What does 100 stand for?	Kilopascal Pressure Rating

UN Test Summary

Non-Bulk Steel Packagings

Myers Container Corporation
UN Testing Laboratory
900 Brookside Drive
San Pablo, CA 94806

As required by 49 CFR 178

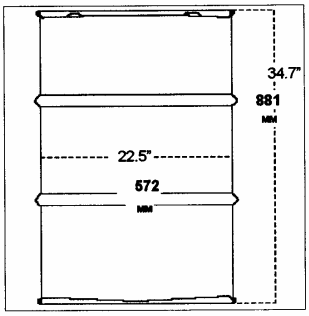
5501 *Design Number*

4/8/02 *Test Date* | **Design Qualification** | **930** *UNUM#*

Style	1A1			
Condition	NEW			
Capacity	208	liters	55	gal
Overflow	221	liters	58.4	gal
Tare	17.0	kg	37.5	lbs
Height	881	mm	34.7"	in
Diameter	572	mm	22.5"	in
Steel-Head	1.2	mm		
Steel-Body	0.900	mm		
Steel-Bottom	1.2	mm		
Special Construction				

End Seam	TRIPLE
Side Seam	WELDED
Swedges	2
Head Fittings	2" X 3/4"
Body Fittings	
Fitting Gasket	
Covers	
Gasket	
Gasket Diameter	
Ring Gage	
Closure Ring	
Bolt Size	

55-TH



*Dimension tolerance **NOMINAL**

Drop Test - Liquid (§178.603)

Six samples are filled to >= 98% capacity with water. Each sample is dropped from the indicated height onto a solid surface using various attitudes. Drums are vented after each drop. Weakest Part: Tight-heads, second drop is flat on side seam. Open-heads second drop diagonal on head.

2.1 Meters

Sample	Attitude	Result
1	Chime Diagonal	No Leak
2	Chime Diagonal	No Leak
3	Chime Diagonal	No Leak
4	Weakest Part *	No Leak
5	Weakest Part *	No Leak
6	Weakest Part *	No Leak

Leakproofness Test - Liquid (§178.604)

Three samples, with all closures in place, are subjected to the following internal pressure and restrained under water for a minimum of five minutes.

30 kPa

Sample	Result
1	No Leak
2	No Leak
3	No Leak

Hydrostatic Pressure Test - Liquid (§178.605)

Three samples are filled to >= 98% capacity with water and subjected to the following internal hydraulic pressure for five minutes.

300 kPa

Sample	Result
1	No Leak
2	No Leak
3	No Leak

Stacking Test - Liquid (§178.606)

Three samples are filled to >= 98% capacity with water and subjected to a force applied to the top surface of the drum for 24 hours equal to the total weight of identical packages which might be stacked on it during transport. Minimum stack height is 3 m.

2234 Kilograms

Sample	Result
1	No Deformation
2	No Deformation
3	No Deformation

Drop Test - Solid (§178.603)

Six samples are filled to 95% capacity with a small grain lading. Each sample is dropped from the indicated height onto a solid surface using various attitudes.

Packing Group I	Packing Group II	Packing Group III
1.8 Meters	1.2 Meters	.8 Meters

Gross Mass - Kilograms Indicated Above — Net Mass - Kilograms = Gross Mass less Tare Weight

Sample	Attitude	Result	Sample	Attitude	Result	Sample	Attitude	Result
1	Chime Diagonal	No Leak	1	Chime Diagonal	No Leak	1	Chime Diagonal	No Leak
2	Chime Diagonal	No Leak	2	Chime Diagonal	No Leak	2	Chime Diagonal	No Leak
3	Chime Diagonal	No Leak	3	Chime Diagonal	No Leak	3	Chime Diagonal	No Leak
4	Closure Diagonal	No Leak	4	Closure Diagonal	No Leak	4	Closure Diagonal	No Leak
5	Closure Diagonal	No Leak	5	Closure Diagonal	No Leak	5	Closure Diagonal	No Leak
6	Closure Diagonal	No Leak	6	Closure Diagonal	No Leak	6	Closure Diagonal	No Leak

Stacking Test - Solid (§178.606)

Three samples are filled to 95% capacity with a small grain lading and subjected to a force applied to the top surface of the drum for 24 hours equal to the total weight of identical packages which might be stacked on it during transport. Minimum stack height is 3 m.

Kilograms

Sample	Result
1	No Deformation
2	No Deformation
3	No Deformation

Liquid Rating	Solid Rating
UN 1A1/X1.4/300	-
UN 1A1/Y2.1/300	-
UN 1A1/Z3.0/300	-

Vibration Standard - (§178.608) This packaging is capable of withstanding, without rupture or leakage, the vibration test outlined in this section.

General Requirements - (§173.24, §173.24a, §178.601) This packaging complies with the general requirements for packagings and packages.

Package Assembly Instructions - For correct package assembly see assembly instructions provided with your order, or visit our website at "www.myerscontainer.com" and click on UN Assembly Instructions.

drums were assembled for testing as specified in the current version of the Drum Assembly Instructions

Test Type	Date:	UN Testing Lab Coordinator - Dana Zanone
DESIGN QUALIFICATION	4/8/02	Sean Reynolds

Document # UFORM003	Issue Date: 5/23/2001	Revision # 7	Authority: Sean Reynolds	Page 1 of 1

Myers Container Corporation
UN Testing Laboratory
900 Brookside Drive
San Pablo, CA 94806

UN Test Summary
Non-Bulk Steel Packagings

As required by 49 CFR 178

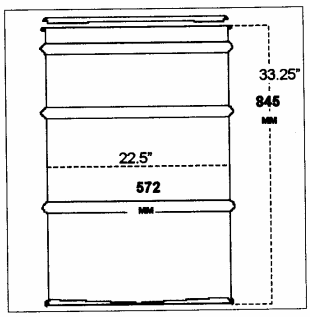
2/28/02 *Test Date* | **Design Qualification** | **926** *UNUM#* | **5585** *Design Number*

Style	1A2			
Condition	NEW			
Capacity	208	liters	55	gal
Overflow	212	liters	56	gal
Tare	21.3	kg	47	lbs
Height	845	mm	33.25"	in
Diameter	572	mm	22.5"	in
Steel-Head	1.4	mm		
Steel-Body	1.100	mm		
Steel-Bottom	1.1	mm		

Special Construction: **Cargile curl, DOT 7-A compliant with 4-10 mil bag, UNUM 609**

End Seam	TRIPLE
Side Seam	WELDED
Swedges	3
Head Fittings	2" X 3/4"
Body Fittings	
Fitting Gasket	Poly or Buna
Covers	2 Re-enforce Ring
Gasket	EPDM
Gasket Diameter	7/16"
Ring Gage	12
Closure Ring	V-BACK
Bolt Size	5/8"

55-OH



*Dimension tolerance **NOMINAL**

Drop Test - Liquid (§178.603)

Six samples are filled to >= 98% capacity with water. Each sample is dropped from the indicated height onto a solid surface using various attitudes. Drums are vented after each drop. Weakest Part: Tight-heads, second drop is flat on side seam. Open-heads second drop diagonal on head.

1.7 Meters

Sample	Attitude	Result
1	Chime Diagonal	No Leak
2	Chime Diagonal	No Leak
3	Chime Diagonal	No Leak
4	Weakest Part *	No Leak
5	Weakest Part *	No Leak
6	Weakest Part *	No Leak

Leakproofness Test - Liquid (§178.604)

Three samples, with all closures in place, are subjected to the following internal pressure and restrained under water for a minimum of five minutes.

20 kPa

Sample	Result
1	No Leak
2	No Leak
3	No Leak

Hydrostatic Pressure Test - Liquid (§178.605)

Three samples are filled to >= 98% capacity with water and subjected to the following internal hydraulic pressure for five minutes.

150 kPa

Sample	Result
1	No Leak
2	No Leak
3	No Leak

Stacking Test - Liquid (§178.606)

Three samples are filled to >= 98% capacity with water and subjected to a force applied to the top surface of the drum for 24 hours equal to the total weight of identical packages which might be stacked on it during transport. Minimum stack height is 3 m.

2600 Kilograms

Sample	Result
1	No Deformation
2	No Deformation
3	No Deformation

Drop Test - Solid (§178.603)

Six samples are filled to 95% capacity with a small grain lading. Each sample is dropped from the indicated height onto a solid surface using various attitudes.

Packing Group I	Packing Group II	Packing Group III
1.8 Meters	1.2 Meters	.8 Meters
420	**420**	**420**

Gross Mass - Kilograms Indicated Above — Net Mass - Kilograms = Gross Mass less Tare Weight

Sample	Attitude	Result	Sample	Attitude	Result	Sample	Attitude	Result
1	Chime Diagonal	No Leak	1	Chime Diagonal	No Leak	1	Chime Diagonal	No Leak
2	Chime Diagonal	No Leak	2	Chime Diagonal	No Leak	2	Chime Diagonal	No Leak
3	Chime Diagonal	No Leak	3	Chime Diagonal	No Leak	3	Chime Diagonal	No Leak
4	Closure Diagonal	No Leak	4	Closure Diagonal	No Leak	4	Closure Diagonal	No Leak
5	Closure Diagonal	No Leak	5	Closure Diagonal	No Leak	5	Closure Diagonal	No Leak
6	Closure Diagonal	No Leak	6	Closure Diagonal	No Leak	6	Closure Diagonal	No Leak

Stacking Test - Solid (§178.606)

Three samples are filled to 95% capacity with a small grain lading and subjected to a force applied to the top surface of the drum for 24 hours equal to the total weight of identical packages which might be stacked on it during transport. Minimum stack height is 3 m.

2600 Kilograms

Sample	Result
1	No Deformation
2	No Deformation
3	No Deformation

Liquid Rating	Solid Rating
-	UN 1A2/X420/S
UN 1A2/Y1.7/150	UN 1A2/Y420/S
UN 1A2/Z2.5/150	UN 1A2/Z420/S

Vibration Standard - (§178.608) This packaging is capable of withstanding, without rupture or leakage, the vibration test outlined in this section.

General Requirements - (§173.24, §173.24a, §178,601) This packaging complies with the general requirements for packagings and packages.

Package Assembly Instructions - For correct package assembly see assembly instructions provided with your order, or visit our website at "www.myerscontainer.com" and click on UN Assembly Instructions.

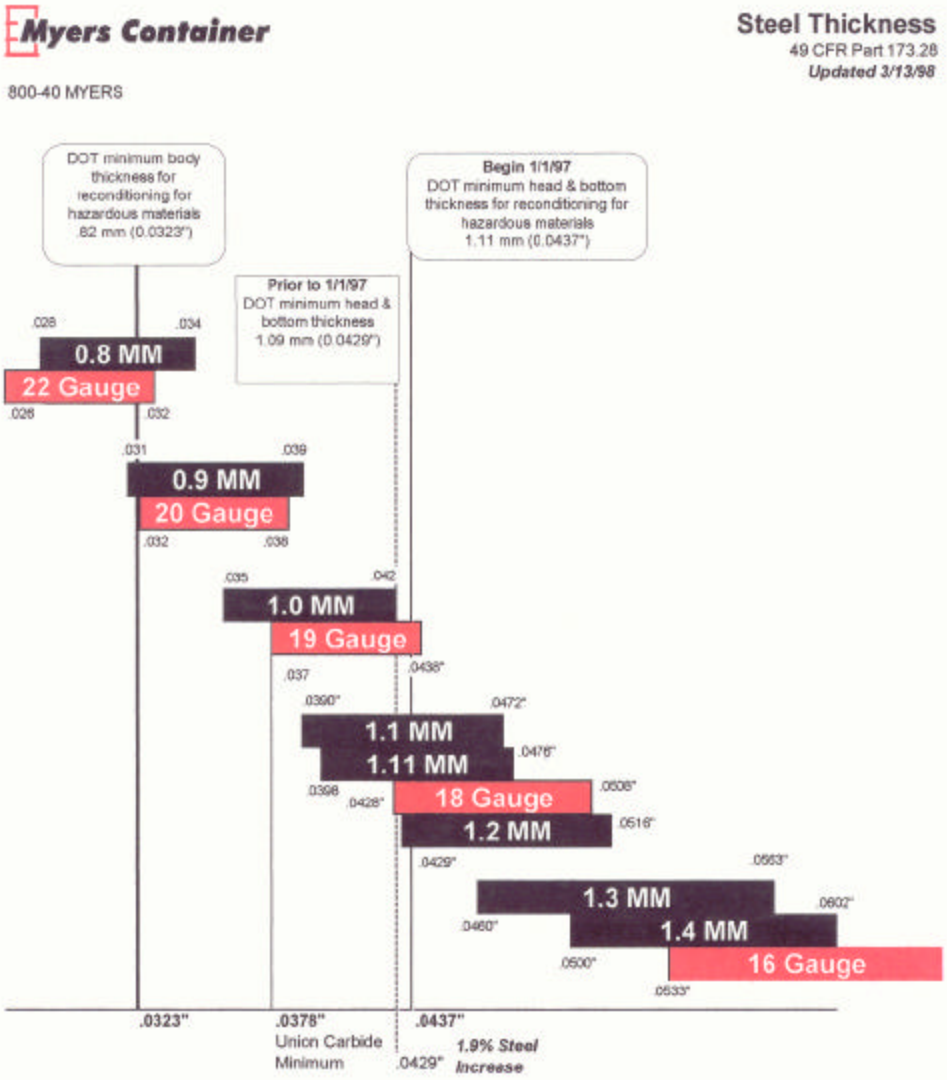
drums were assembled for testing as specified in the current version of the Drum Assembly Instructions

Test Type: **DESIGN QUALIFICATION**

Date: **2/28/02**

UN Testing Lab Coordinator - Dana Zanone
Sean Reynolds

Document # UFORM003	Issue Date: 5/23/2001	Revision # 7	Authority: Sean Reynolds	Page 1 of 1



Final Rule HM-181H: DOT ruled that it would increase the minimum head thickness regulatory requirement for reconditioning of "20/18" drums from 1.09 mm (.0429") to 1.11 mm (.0437"). This minimum thickness requirement is mandatory on January 1, 1997.

Myers Container
A Customer-Driven Company

Customer Service: 800-406-9377 Edited: 06/07/99

UN Drum Assembly Instructions

In order for your Myers Container drum to safely perform to its rated ability, these assembly instructions need to be strictly adhered to. Any other method of assembly, or the use of any drum components (rings, gaskets, or fittings) that are not specified in this design type will immediately invalidate the UN and DOT performance rating of the drum.


Fig. 1


Fig. 2


Fig. 3


Fig. 4


Fig. 5

1.0 Bolt Ring Installation

a. Place the cover on the drum, making sure the cover gasket is seated against the lip of the drum opening (the curl) and the gasket recess on the cover. The gasket should not protrude beyond the cover or the drum curl (Fig. 1).

b. Place the bolt ring onto the drum. Make sure that the bolt ring is oriented so that the lugs are positioned below the top surface of the drum. You will be required to pound on the cover with your palm, or a rubber mallet, or use a head press to make sure it is centered on the drum curl. Check to see that the cover and drum curl are pinched together and within the recess of the ring (Fig. 2).

c. Thread the bolt into the lugs, with lock nut between lugs, and tighten to 60 ft-lb of torque. It is necessary to hammer around the circumference of the ring while torquing in order to further seat the head onto the drum (Fig. 3) . Continue hammering on the ring circumference and torquing the bolt until the torque is stabilized at 60 ft-lb, and does not loosen when further hammering on the ring circumference is performed (Fig. 4). The lock nut must be placed on the bolt, between the drum ring lugs, and tightened against the un-threaded lug (Fig. 5).

2.0 Fitting Installations

The table below shows the proper torque (in foot-pounds) that must be applied to each drum fitting to assure proper container performance.

	Type I (Trisure Style) Octagon Base, Round Head Plug			Type II (Ricke Style) Serrated Base, Hexagon Head Plug		
	Steel Plugs		Poly Plugs	Steel Plugs		Poly Plugs
Plug Size	Rubber Gasket	Poly Gasket		Rubber Gasket	Poly Gasket	
2"	20	30	12	30	40	20
3/4"	12	20	5	15	20	9

3.0 Cap Seals

Cap seals must be installed by filler when non-metal flanges are used.

4.0 Bags and Liners

- If a bag is required by the drum design type it must be installed into the drum and the top tied closed in a horse-tail fashion before installing the drum cover and ring.
- If a liner is required by the drum design type it must be installed into the drum, extended over the top drum curl, making sure there are no overlaps in the liner as it goes over the drum curl.

TWENTY QUESTIONS ABOUT PERFORMANCE-ORIENTED PACKAGING

1. Does the "UN" symbol applied as part of the durable mark by manufacturers and reconditioners have to be circled?

Yes, the symbol must be the lower-case "un" in a circle. The upper-case "UN" initials, without the circle, only are authorized when embossed in steel. [Section 178.503(a)(1)]

2. How big does the UN marking have to be?

On drums larger than 30 liters (7.9 gallons), DOT-required markings on drums, including the circled UN symbol, have to be at least 12 mm (1/2 inch) high. [Section 178.3(a)(4)]

3. Can a drum marked for liquids be used for solids?

Yes. [Section 173.24(b)(3)]

4. When a drum is marked for liquids, but is going to be used to ship solids, how is the authorized gross mass of the package determined?

The authorized gross mass of the filled package may be determined by multiplying the rated capacity of the container in liters (e.g., 220) by the specific gravity in the UN mark on the packaging, or 1.2 if it is not shown, plus the mass of the empty drum in kilos. [Section 173.24a(b)(3)]

5. Can a drum marked "Y" for Packing Group II materials be used to ship "Z" materials in Packing Group III?

Yes. [Section 178.503(a)(3)]

6. Can a drum marked "Y" for Packing Group II liquids be used to ship "Z" solids in Packing Group III and, if so, how is the authorized gross mass determined?

When putting a lower Packing Group solid in a drum marked for liquids, multiply the rated capacity of the container in liters by the specific gravity shown in the UN mark (or 1.2 if not shown), by 1.5, plus the net mass of the container. *For example, 220 liters x 1.2 x 1.5 + 15 kg = 411 kg.* [Section 173.24a(b)(3)]

7. Can a drum marked for solids be used to ship liquids?

No. A drum for liquids must be hydrostatically and leakproofness tested. A drum marked for solids, by showing an "S" in the mark, only has been design qualified by a drop and stacking test. Thus, a drum bearing an "S" mark would have to be remanufactured, including performance of required tests for liquids and application of a remanufacturer's markings. [Section 178.503(a)(5)(ii)]

8. What are the upper limits on the size of "non-bulk" packagings?

A non-bulk packaging like a drum can contain no more than 450 liters (119 gallons) of a liquid hazardous material, or 400 kilos (882 pounds) of a solid material. [Section 171.8]

9. What if the liquid that will be shipped in a drum has a net mass of more than 400 kilos?

DOT has said that the 400 kg limitation applies to both liquids and solids, but this informal answer is contradicted by the UN and reality. To illustrate, 450 liters of water has a net mass of 450 kg. [Section 178.504(b)(8) and (9)]

10. If a drum has a thickness mark of "0.8", is it reconditionable?

No, not without more information. A drum of a single steel thickness must have a minimum thickness of at least 0.92mm. For a 20/18-style drum, it is possible that the "0.8" mark means the sidewall is thick enough. It also is possible, however, that it is not. Furthermore, a single mark, while authorized by DOT regulation, does not say anything about the minimum thickness of the heads, which must be known before a 20/18-style drum is reused or reconditioned. [Section 173.28(b)(4) Table, and ISO Standard 3574, referenced in Section 178.503(a)(9)(I) and Appendix C to Part 178]

11. What thickness marks unquestionably communicate that a 20/18-style drum is authorized for reuse or reconditioning?

"1.2/0.9/1.2"

12. What if I have seen a letter from the manufacturer saying that their "1.1" marking means their 20/18-style drum is reconditionable?

The enforceable mark required by the regulations does not tell you the drum may be reconditioned. Correspondence, however, only has the significance you choose to accord to it based on the source; it has no regulatory meaning. [Part 178]

13. Does a remanufacturer have to have an "M" number from the DOT?

No, the remanufacturer can put its full name and address in the UN marking, rather than a symbol. In addition, if a symbol is going to be used, DOT advises that a reconditioner's "R" number can be used as a remanufacturer's symbol as well. It may be wise getting and using an "M" number, however, in order to distinguish between drums that are remanufactured and those that only are reconditioned.

14. Does the thickness mark have to be embossed by a new drum manufacturer?

Technically, it is not required for drums that will be limited to domestic ground transportation, until October 1, 1996. Until that time, a manufacturer could leave it and any other permanent marking off the drum on the rationale that the drum was not "liable to be reconditioned". For international trade, however, as well as domestic water and air shipments, permanent embossment on the bottom of the "first line" information and an indication of nominal thickness is required. [Section 171.14(b)(1)]

15. Does a remanufacturer have to emboss the thickness as part of his permanent mark on the remanufactured drum?

No, unless the remanufacturer has changed the thickness of the steel from that shown by the original manufacturer on the bottom of the drum. [Section 178.503(d)]

16. Does a reconditioner have to mark a UN drum with the month and year of reconditioning?

No, DOT removed this requirement in Docket No. HM-215A. Reconditioners only need mark the year of reconditioning. [Section 178.503(c)(1)(iii)]

17. How can a drum supplier tell customers what hydrostatic test pressure is adequate for their products?

The drum supplier is unable to determine this for the customer because it depends upon the vapor pressure of the customer's intended contents at certain reference temperatures.

18. Can I install a plastic insert in an open head steel drum if the insert extends over the bead?

Installation of such an insert is authorized, but DOT has said that it makes that drum a "different packaging", i.e. a new design type requiring design qualification testing and compliance with all provisions applicable to a remanufacturer. [Section 178.601(c)(4)]

19. Does DOT require "hazmat employee" training, testing and certification for employees who put RCRA-empty drums on or take them off a trailer?

Yes, both require training. The regulations specifically say that anyone who loads, unloads or handles hazardous materials in transportaiton must be trained. "Transportation" is defined to include the loading, unloading and storage incident to transportation. An RCRA-empty drum is still a DOT-regulated hazardous material because it has not been cleaned and purged. Training is required to be repeated, including retesting and recertification, every 24 months. [Section 171.8 and Subpart H to Part 172]

20. Does an IBC that contains less than 0.3% of its capacity, i.e. is RCRA-empty, have to be described on shipping papers when sent to a reconditioner?

Yes, because the relief from DOT shipping papers for packaging sent for reuse or reconditioning is limited to non-bulk packagings (119 gallons or less). [Section 173.29(c)]

Non-Hazardous Packaging Requirements

UNIFORM FREIGHT CLASSIFICATION RULE 40 AND ITEM 260

This section explains the regulations that govern the transportation of non-hazardous materials.

RULE 40

SUPPLEMENT 12 TO UNIFORM FREIGHT CLASSIFICATION 6000-K

RULE	SUBJECT	APPLICATION		
(PA) 40	SHIPPING CONTAINERS	(Cancels Rule 40, Section 5 on Pages 323 to 325 of Classification) BARRELS, DRUMS, KITS OR PAILS, ALUMINUM OR STEEL SECTION 5.–Except as otherwise provided in separate descriptions of articles, following definitions will govern aluminum barrels or drums, and steel barrels, drums, kits or pails, as freight shipping containers, empty or filled: (a) Barrels or drums: Containers of 5 gallons capacity or over, with or without bails. Drums exceeding 165 gallons capacity will not be accepted as freight shipping containers. (b) Kits or pails: Containers of less than 5 gallons capacity with bails, except filled containers need not have bails, see Note 2. (c) Barrels, drums, kits or pails, when authorized in separate descriptions of articles as shipping containers, must comply with the following requirements, except as single trip containers as provided in Paragraph (d). Regulations of the Department of Transportation, Agent C.L. Keller's Tariff No. BOE 6000-series for the transportation of explosives and other hazardous materials and specifications for shipping containers thereof must be observed:		
		Rated (Marked) Capacity of Steel Barrels, Drums, Kits or Pails, see Paragraph (h)	Minimum Thickness of Steel, U.S. Standard Gauge No. For dry or solid articles other than single trip, see Note 1	 For other than dry or solid articles see Note 1
		Under 5 gallons capacity (kits or pails only)	28 gauge	26 gauge
		5 gallons to and including 7 gallons capacity	26 gauge	26 gauge
		Over 7 gallons to and including 10 gallons capacity	26 gauge	22 gauge
		Over 10 gallons to and including 20 gallons capacity	24 gauge	20 gauge
		Over 20 gallons to and including 35 gallons capacity	23 gauge	20 gauge
		Over 35 gallons to and including 57 gallons capacity	22 gauge see Note 5	18 gauge (see Notes 3, 4 and 5)
		Over 57 gallons to and including 75 gallons capacity	20 gauge	16 gauge
		Over 75 gallons to and including 110 gallons capacity	20 gauge	14 gauge
		Over 110 gallons but not exceeding 165 gallons capacity	18 gauge	12 gauge
		All steel barrels, drums, kits or pails for other than dry or solid articles must have side seams welded.		
		Capacity of Aluminum Barrels or Drums, with or without Steel Jackets	Minimum Thickness of Aluminum, B.&S. Gauge No. Sides	 Ends
		5 gallons to and including 10 gallons capacity	16 gauge	16 gauge
		Over 10 gallons to and including 35 gallons capacity	14 gauge	14 gauge
		Over 35 gallons to and including 55 gallons capacity	10 gauge	10 gauge
		Over 55 gallons to and including 110 gallons capacity	8 gauge	8 gauge

(Rule 40 continued on next page)

SUPPLEMENT 12 TO UNIFORM FREIGHT CLASSIFICATION 6000-K

RULE	SUBJECT	APPLICATION
(PA) 40 (Continued)	SHIPPING CONTAINERS	BARRELS, DRUMS, KITS OR PAILS, ALUMINUM OR STEEL (Continued) NOTE 1. The term "dry or solid" is defined as referring only to articles which are dry or solid at a temperature of 100 degrees Fahrenheit. NOTE 2. A bail is a handle extending completely across top of container and attached to sides. NOTE 3. Steel barrels or drums, having from 18 to 20 gauge sides and ends may be used as containers for other than dry or solid articles, see Note 1, provided that containers have two or more expanded rolling hoops in the sidewall and a center bottom clearance of 1/8 inch from the floor when empty. NOTE 4. Closed-head steel drums, of rated (marked) capacities over 35 to and including 57 gallons, may be used as containers for other than dry or solid articles, see Note 1, when made of steel not thinner than 24 gauge, providing that continuous, parallel, geometrically similar, circumferential beads are so expanded in the entire height of the sidewall that the surface length of the steel in the axial direction does not change more than 1 percent. Heads and bottoms must be without corrugation or beading and without convexity. Each chime must be reinforced with an 18 gauge steel band that is an integral part of the double seam, resulting in a chime cross section containing eight layers of steel. The reinforcing band shall follow and support knuckle radius of the head and bottom with the inside edge upturned so that it does not contact the adjacent portions of the head or bottom. Drums may not be loaded more than single tier high. NOTE 5. Top (head or cover) may be constructed of injection molded high density polyethylene, or polypropylene homopolymer or copolymer and have a minimum thickness of .090 inch. Top covers must have at least two concentric rings of not less than 3/16 inch depth, except when cover is of a minimum thickness of .125 inch, cover may have one concentric ring. For liquids or articles in liquids, covers must effect a liquid tight seal. Cover must be securely closed by lever or bolted locking ring, or endless band rolled to bond sidewall and cover at chime, the band and ring must not be thinner than 22 gauge metal. SINGLE TRIP CONTAINERS (d) Single trip aluminum or steel barrels, drums, kits or pails may be used as shipping containers only for dry or solid articles, see Note 1, for single movement and, when so used, minimum and maximum capacities of containers per Paragraphs (a) and (b) must be observed, but no thickness of metal is prescribed, and they must bear the initials "STC" to signify that they are single trip containers and are not to be again used as shipping containers after contents have been removed, following initial shipment. Single trip containers complying with the specifications for such containers in Agent C.L. Keller's Tariff No. BOE 6000-series, may be used for more than a single movement of liquid, dry or solid articles not subject to the Department of Transportation Regulations for transportation of explosives and other hazardous materials provided they comply with the requirements of Section 5 of this rule. FASTENING OF CAPS, COVERS, PLUGS OR TOPS (e) Caps, covers, plugs or tops must be made of metal or synthetic plastic and must be securely fastened, and filled packages must be proof against leakage or sifting. Closure caps no greater than 3½ inches in diameter may be of metal thinner than prescribed for head of container. On drums over 20 gallons to and including 57 gallons, lug cover closures no greater than 11¼" diameter may be of metal thinner than prescribed for head of container provided that they are equipped with gasket seal, not less than 16 lugs, and are manufactured of steel not less than 20 gauge thickness. NAME, ETC., OF MANUFACTURER TO BE SHOWN (f) All shipping barrels, drums, kits, or pails, for use as freight containers, must bear the manufacturer's name, or an identifying symbol or trade-mark of manufacturer in lieu of the manufacturer's name and which symbol or trade-mark must be registered with the National Railroad Freight Committee, the gauge of metal in its thinnest part, capacity of container and year of manufacture—these may be abbreviated and then must appear in order specified, for example, 18-55-56, which will signify that the container is made of 18 gauge metal, is 55 gallons capacity and made in the year 1956. When gauge of metal in body differs from that in head, both must be indicated with slanting line between and with gauge of body indicated first, for example 20/18-55-56 for body 20 gauge and head 18 gauge. (Optionally, the thickness of metal used may be expressed in millimeters and marked as closely to the English equivalent as possible, and year of manufacture. These marks may be abbreviated and then must appear in order specified, for example, 1.1 94, which will signify that the container is made of steel with a thickness of 1.1 millimeters, and is made in the year 1994. When the thickness of metal in body differs from that in head and in bottom, all three thicknesses must be indicated with a slash mark between and with the thickness of the head indicated first, for example 1.1/.8/1.0 94 for body of .8 millimeter thickness head of 1.1 millimeter thickness, and bottom of 1.0 millimeter thickness.) The inscription must be plainly and durably marked on container or on a plate securely brazed, welded or soldered thereto in letters that are legible and are not less than one-fourth inch in height. These requirements will not be necessary for steel shipping barrels, drums, kits, or pails when manufactured in foreign countries, but shipping orders and bills of lading must bear the following certificate: "The steel shipping barrels, drums, kits, or pails used for this shipment are of foreign manufacture and conform to construction requirements of Rule 40, Section 5." (g) When a steel drum or barrel has been reconditioned for further use as a shipping container and in the reconditioning process changes are made which alter the original construction, the party making such changes must indicate his name or an identifying symbol or trade-mark on such containers which symbol or trade-mark must be registered with the National Railroad Freight Committee. The marking must be plainly and durably made by painting, stenciling or similar means or must be on a plate securely brazed, welded or soldered thereto, in letters that are legible and are not less than one-fourth inch in height. Identifying names, symbols or trade-marks of manufacturer or previous reconditioner must be removed or obliterated unless such names, symbols or identifying marks are embossed or affixed to a plate in such manner that removal or obliteration is not practicable. (Rule 40 continued on next page)

RULES

ITEM 258—Concluded

Sec. 3. Performance Requirements:

1. Pails must be filled to marked capacity with commodity, or other material that remains liquid at 0° F., for a minimum of 4 hours. Drop tests must be performed with the pail flat on its side and also at a 45-degree angle on the bottom chime onto solid concrete from a height of 48 inches. No container shall be required to withstand more than one drop. A minimum of three containers must be tested at each of the above-mentioned areas without failure.

2. Three pails must be filled with commodity to marked capacity, conditioned at 130 degrees F., for 4 hours, stacked 3 high and vibrated for one hour at 1 "G" to a vertical linear motion. Each pail must perform without failure.

3. Pails filled with commodity to marked capacity must withstand a static load of 600 pounds for a period of 48 hours without defect or damage.

Failure will be defined as the leaking or spillage of contents.

Manufacturers may perform the above test using water in lieu of commodity, providing the viscosity of the commodity does not exceed 5,000 centipoise units; or sand if viscosity of commodity exceeds 5,000 centipoise units.

Pail manufacturers will be required to register with the National Classification Committee an initial certified test report indicating compliance with the above performance requirements, testing with both water and sand. Additional testing may be required at a later date upon request by the National Classification Committee staff.

ITEM 260

SPECIFICATIONS FOR ALUMINUM BARRELS OR DRUMS AND STEEL BARRELS, DRUMS, BUCKETS, FIRKINS, KITS OR PAILS

(a) Barrels, buckets, firkins, drums, kits or pails must comply with the following requirements, except single trip containers as provided in paragraph (b). Regulations of the DOT for the transportation of explosives and other dangerous articles (see CFR) by freight and the specifications of the shipping containers thereof must be observed.

Rated (marked) capacity of steel barrels, drums buckets, firkins, kits or pails See Note 5	MINIMUM THICKNESS OF STEEL, U.S. STANDARD GAUGE	
	For dry or solid articles other than single trip, Note 1	For other than dry or solid articles Note 1
Under 5 gallons capacity	26 gauge	26 gauge (Note 7)
6 gallons to and including 7 gallons capacity (Note 2), Item 256	26 gauge	26 gauge (Notes 4 and 7)
Over 7 gallons to and including 10 gallons capacity	26 gauge	22 gauge (Note 4)
Over 10 gallons to and including 20 gallons capacity	24 gauge	20 gauge (Note 4)
Over 20 gallons to and including 35 gallons capacity	23 gauge	20 gauge (Note 4)
Over 35 gallons to and including 57 gallons capacity	22 gauge	20/18 gauge (Notes 2, 3, 4 and 6)
Over 57 gallons to and including 75 gallons capacity	20 gauge	18 gauge (Note 6)
Over 75 gallons to and including 110 gallons capacity	20 gauge	14 gauge
Over 110 gallons but not exceeding 166 gallons capacity	18 gauge	12 gauge
All steel drums, buckets, firkins, kits, or pails for other than dry or solid articles must have side seams welded.		

Capacity of aluminum barrels or drums with or without steel jackets	MINIMUM THICKNESS OF ALUMINUM, B & S GAUGE	
	Sides	Ends
To and including 10 gallons capacity	16 gauge	16 gauge
Over 10 gallons to and including 35 gallons capacity	14 gauge	14 gauge
Over 35 gallons to and including 55 gallons capacity	10 gauge	10 gauge
Over 55 gallons to and including 110 gallons capacity	8 gauge	8 gauge

(b) Single trip aluminum or steel barrels, drums, buckets, firkins, kits or pails, other than as referred to below, may be used as shipping containers only for dry or solid articles (Note 1) for single movement, and when so used, maximum capacity of single containers per paragraph (a) must be observed, but no thickness of metal is prescribed and they must bear the initials "STC" to signify that they are single trip containers and are not to be used again as shipping containers after contents have been removed following initial shipment, except when containers and closing devices are in such condition that they will afford reasonable and proper protection of contents in further shipment to an ultimate destination.

Single trip containers complying with the specifications for such containers in the Code of Federal Regulations (CFR), Title 49 for the shipment of hazardous materials, may be used for more than a single movement of liquid, dry or solid articles not subject to the DOT regulations for transportation of explosives and other dangerous articles by freight, provided they comply with the requirements of paragraph (a), and provided they will afford reasonable and proper protection of contents.

(Continued on following page)

RULES

ITEM 260—Continued

(c) Covers, ends, heads or tops of aluminum drums or steel drums, buckets, firkins, kits or pails when of metal must be of same material and not less than same thickness as sidewalls except as otherwise specifically provided. They must be securely fastened, and filled packages must be proof against leakage or sifting.

Top covers may be constructed of injection molded high density polyethylene or polypropylene homopolymer or copolymer and have a minimum thickness of .090 inch. Top covers must have at least two concentric rings of not less than ¾ inch depth, except when cover is of a minimum thickness of .125 inch cover may have one concentric ring. Closure must be effected by a liquid-tight gasket and a lever locking ring or an endless band rolled to bond sidewall and cover at chime. Ring or band must not be thinner than 22 gauge metal.

Bungs or plugs or bung or plug closure caps, covers or seals may be made of metal, plastic or rubber and must be securely fastened, and must be proof against leakage or sifting. Metal bungs or plugs must be not less than same thickness as sidewall requirements, and metal bung closure caps, covers or seals may be made of metal thinner than that prescribed for container.

(d) All aluminum or steel barrels or drums, manufactured for use as freight containers must bear:

1. The manufacturer's name or an identifying symbol or trademark of manufacturer in lieu of the manufacturer's name and which symbol or trademark must be registered with the National Classification Committee.

2. The U.S. Standard or B & S gauges of metal used, the capacity of the container, and the year of manufacture, abbreviated and shown in the order specified in examples (a) and (b):

(a) 18-55-95, indicating that the container is made of 18 gauge metal; is 55 gallons capacity; and made in the year 1995.

(b) 20/18-55-95, indicating that the container body is made of 20 gauge metal; heads made of 18 gauge metal; is 55 gallons capacity; and made in the year 1995.

Optionally, the thickness of metal used may be expressed in millimeters and marked as closely to the English equivalent as possible, and year of manufacture. These marks may be abbreviated and then must appear in the order specified, for example: 1.1-95, which will signify that the container is made of steel with a thickness of 1.1 millimeters and is made in the year 1995. When the thickness of metal in the body differs from that in the head and in the bottom, all three thicknesses must be indicated with a slash mark between and with the thickness of the head indicated first, for example: 1.1/.8/1.0-95 for a body of .8 millimeter thickness, a head of 1.1 millimeter thickness, and bottom of 1.0 millimeter thickness.

The inscription must be plainly and durably marked on containers, or on a plate securely bronzed, welded or soldered thereto, in letters that are legible and are not less than one-fourth inch in height. These requirements will not be necessary for steel shipping barrels, drums, kits or pails when manufactured in foreign countries, but shipping orders and bills of lading must bear the following certificate: *'The steel shipping barrels, drums, kits or pails used in this shipment are of foreign manufacture and conform to construction requirements of Item 260.'*

(e) When a steel drum or barrel has been reconditioned for further use as a shipping container and in the reconditioning process changes are made which alter the original construction, the party making such changes must indicate his name or an identifying symbol or trademark on such containers, which symbol or trademark must be registered with the National Classification Committee. The marking must be plainly and durably made by painting, stenciling or similar means or must be on a plate securely brazed, welded or soldered thereto, in letters that are legible and are not less than one-fourth inch in height. Identifying names, symbols or trademarks of manufacturer or previous reconditioner must be removed or obliterated unless such names, symbols or identifying marks are embossed or affixed in such manner that removal or obliteration is not practicable.

Note 1— The term 'dry or solid' is defined as referring only to articles which are dry or solid at a temperature of 100° F (38° C).

Note 2— Steel drums over 30 gallons to and including 57 gallons rated (marked) capacity, see Note 5, other than full open head type, manufactured from steel not less than .0239 inch in thickness may be used providing that contiguous, parallel, geometrically similar, circumferential beads are so expanded in the entire height of the sidewall that the surface length of the steel in the axial direction does not change more than 1 percent. Heads and bottoms must be without corrugation or beading and without convexity. Each chime must be reinforced with an 18 gauge steel band that is an integral part of the double seam, resulting in a chime cross section containing eight layers of steel. The reinforcing band shall follow and support the knuckle radius of the head and bottom with the inside edge upturned so that it does not contact the adjacent portions of the head or bottom;

OR

Steel drums over 30 gallons to and including 57 gallons rated (marked) capacity, see Note 5, other than full open head type, manufactured from steel not less than .0239 inch in thickness for the bodies and not less than .0324 inch in thickness for the top and bottom heads may be used providing that contiguous, parallel, geometrically similar, circumferential beads are so expanded in the entire height of the sidewall that the surface length of the steel in the axial direction does not change more than one percent, and provided that top and bottom heads are seamed to bodies by a process which results in chimes with seven overlapping layers formed from the parent head and body steel.

Note 3— Steel drums over 35 gallons to and including 57 gallons rated (marked) capacity, see Note 5, having 20 gauge sides and 20 gauge ends may be used as shipping containers for other than dry or solid articles, see Note 1. Drums must have two or more expanded rolling hoops in the sidewall. New empty steel drums manufactured after July 1, 1980 over 35 gallons to and including 57 gallons capacity having 18 gauge to 20 gauge ends when used as shipping containers for other than dry or solid articles shall have a center bottom nominal clearance of ¼ inch from the floor when empty.

Note 4— Steel drums with molded one piece polyethylene inserts for liquids and articles in liquid:

The requirements, limitations and specifications set forth in the table in this section for the numbered types shown therein must be observed. The minimum requirements in the table for steel drum overpack body, bottom, and top head or cover are governed by either the weight of contents in the first column or by the capacity in the second column, whichever limitation calls for the higher minimum requirements. Gallonage capacity are net, but sufficient outage must be provided, and they must bear the initials 'STC' to signify they are single trip containers.

These drums must not be used again for shipments of liquids or articles in liquids after contents have been removed, except when container, closing devices, and required inner protection are in such condition that they will protect contents as efficiently as new containers.

Drums filled to net capacity with water must withstand without leakage a tipover fall on concrete on the cover chime followed by a diagonal drop on the bottom chime sufficient to provide at least 500 foot-pounds impact, except that maximum height of drop shall not exceed two feet, and the minimum height of drop not less than one foot.

(Continued on following page)

How To Write A Proper Drum Specification

Establishing a clear specification provides the following:

1. Consistent packaging at all locations
2. Reliable quotations from vendors
3. Protection from regulations
4. Quality Assurance controls

The following form is a guide to writing a packaging specification that will ensure you receive exactly what you want from your supplier.

DRUM SPECIFICATION

Company _____

Location _____
Date _____
Authorized By _____

Specification _____

Condition ☐ New ☐ Reconditioned
Type ☐ Tighthead ☐ Openhead

	Rated	Maximum	Minimum
Capacity			

Overall Height	
Overall Diameter	

	Head	Body	Bottom
Minimum Steel Thickness (mm)			

Minimum Tare Weight	
Minimum UN Performance Level	
UN Embossment	
Steel Thickness Embossment	
Swedges	

Fittings	Type	Size	Material	Plug Gasket
Head				
Body				

Cover Gasket Material	
Closure Device (ring)	
Chime Type	

Material To Be Packaged ☐ Liquid ☐ Solid
Particle Size (solid only) ☐ Powder ☐ Grit ☐ Sand ☐ Gravel ☐ Bag

This drum must be manufactured so that it can be reconditioned for reuse with hazardous materials: ☐ YES ☐ NO

Other Comments: _____