

# Ordering Drums for Hazardous or Non Hazardous Material Transportation

## Introduction

Selecting the proper steel drum for your company's needs requires a thorough understanding of the product(s) to be shipped, the transportation environment, applicable regulatory requirements, material handling procedures and the container's viability for reuse.

Steel drums are highly dependable forms of packaging, with many decades of proven performance. When used for the transport of hazardous materials they must meet rigorous performance standards, including; stack, drop, and leakproofness, vibration, and hydrostatic pressure tests that simulate key aspects of the transportation and storage environment. Since the tests represent minimum construction requirements, shippers looking for an extra margin of safety should recognize this fact when formulating their drum specifications.

## Understanding Performance Marks

The Department of Transportation requires all steel drums with a capacity greater than 100 liters (i.e., 26.42 gallons) used for the transportation of hazardous materials to be performance marked on the bottom and either side or the top head. Nearly all major industrialized nations including the United States have replaced their individual, domestic hazardous materials regulations to comply with the United Nations Recommendations.

In the United Nations Recommendations, all hazardous materials are assigned to one of the three relative levels of hazard. These levels of hazard are called "Packing Groups" and are indicated by Roman numerals as follows:

Packing Group I: Great danger (high hazard level) X

Packing Group II: Medium danger (medium level) Y

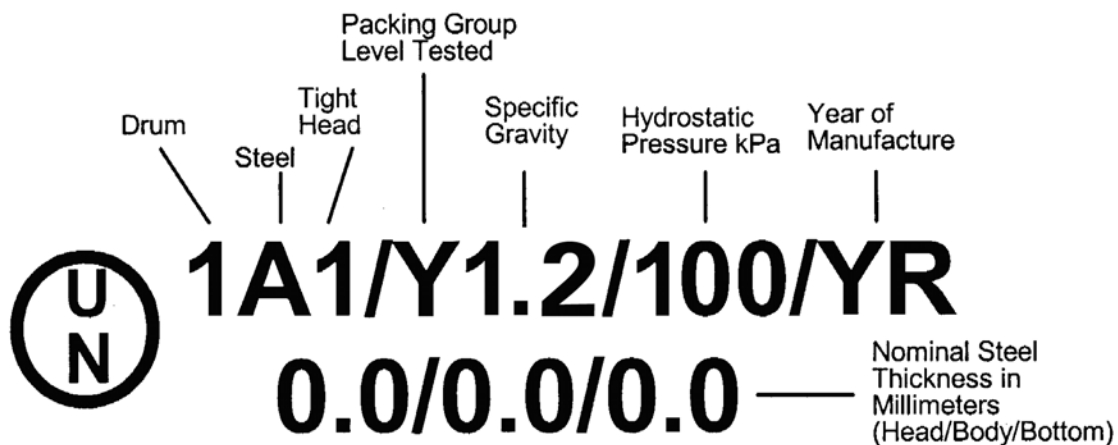
Packing Group III: Minor danger (low hazard level) Z

The marks on the drum bottom, a sample of which appears below, must be permanent (e.g., embossed). These marks, which remain with the drum throughout its useful life, are known in the drum industry as the "birth certificate" because they indicate the drum's original performance capability, plus the nominal thickness of the metal expressed in millimeters.

# UN-Markings



Each package that is manufactured and tested in accordance with the performance oriented packaging standards of HM-181 must include a marking on the unit which indicates that the item in fact has been UN tested. The next section describes each portion of the UN marking and what it means.



(For embossed metal drums, the letters "UN" may be applied in place of the United Nations symbol. Letter height must be a minimum of 12 mm)

Example 2: **4G/X3/S/99/USA/M000** Example of UN Marking for Solid Hazardous Materials: Single or Composite Packaging or Combination Packagings for all materials.

The UN symbol in the circle indicates that this container has been UN tested and certified.

The DOT packaging regulations requiring *Performance-Oriented Packaging* (POP), are based on the UN recommendations on the shipment of hazardous materials.

With the passage of HM-181 in 1992, the U.S. DOT has, for the most part, done away with construction specifications of packaging and has converted to performance-oriented methods, whereby a package is required to pass a series of tests to determine its suitability to package certain materials.

Packaging for hazardous materials is now dependent on the hazard classification of a *product* and its physical attributes. The "UN" marking on the *package* indicates the level to which the package is tested and passed.

### **How to Read a UN Number or Marking**

The marking that is applied to a UN certified package indicates the type of package and the levels to which the packaging has been approved. The following describes the sequence of numbers and letters that appear in a UN marking and what they designate.

## Contents of UN Markings

The markings associated with performance criteria indicate the type of package and the levels to which the package has been approved. Each set of information is separated by a slash mark (/). The following explains each set of numbers and letters in the sequence.

**UN Indication** - The package must be marked with a UN Symbol, or just the letters UN are required on embossed metal containers.

**Packaging Identification Code** - This code identifies the type of packaging, the material of construction, and a category within the type when applicable.

**Packaging Identification Table**

Type of Package	Material	Category
1 - Drums	A - Steel	<b><u>A, B, or H Drums-Jerricans</u></b> 1 - Closed Head
2 - Barrels	B - Aluminum	2 - Open Head
3 - Jerricans	C - Natural Wood	<b><u>A or B Boxes</u></b> 1 - Ordinary A or B
4 - Boxes	D - Plywood	2 - A or B w/inner lining or coating
5 - Bags	F - Reconstituted Wood	<b><u>C Boxes</u></b> 1 - Ordinary
6 - Composite Packagings	G - Fiberboard	2 - w/sift proof walls
	H - Plastic	<b><u>H Boxes</u></b> 1 - Expanded Plastic
	L - Textile	2 - Solid Plastic
	M - Paper, Multiwall	<b><u>L Bags</u></b> 2 - Sift proof
	N - Metal other than Steel or Aluminum	3 - Water Resistant
	P - Glass, Porcelain or Stoneware	<b><u>M Bags</u></b> 2 - Multi-wall, Water Resistant

**Example:** The Packaging Identification code 1A1 would indicate a drum, made of steel, with a closed-head configuration.

**Performance Standard Code** - This code identifies the packing group(s) that the package has been tested and approved for.

X for Packing Groups I, II, and III  
Y for Packing Groups II, and, III  
Z for Packing Group III only

**Relative Density (Specific Gravity) or Gross Mass** - A designation of Specific Gravity or Gross Mass for which the packaging has been successfully tested should follow the Performance Standard Code.

- a) Stand alone packagings intended to contain liquids must be marked with the specific gravity rounded down to the first decimal.
- b) Packagings intended for solids or that have inner packagings must be marked with the maximum gross mass (weight) in kilograms.

**Designation of "S" for Solids or the Hydrostatic Pressure Test Rating in Kilopascals** - An "S" in upper case should follow the gross mass to designate that the package is only intended for solids or inner packagings. Single or Composite packagings intended for liquids should reflect the Hydrostatic test pressure in kPa (kilopascals), rounded down to the nearest 10 kPa.

**Year of Manufacture** - The last two digits of data indicate the year the packaging was manufactured.

## Examples of UN Markings

*Open Head Steel Drum*



1A2/Y1.8/200/94  
USA/AA0000

3 =	Jerrican (square container)	<b>Type of Package</b>
H =	Plastic	<b>Material</b>
1 =	Closed-Head	<b>Category</b>
Y =	Packing Group (II)	<b>Performance Standard Code</b>
1.8 =	Maximum Specific Gravity of Product	<b>Relative Density</b>
200 =	Kilopascals (kPa), also referred to as PSI	<b>Hydrostatic Pressure Rating</b>
94 =	Year container was produced	<b>Year of Manufacture</b>
USA =	Marked under authority of USA	
+AA0000 =	Testing lab identification and test number of container	

*Round Openhead Steel Pail*



UN1A2/Y23/S/93  
USA/AA1234

1 =	Drum (round)	<b>Type of Package</b>
A =	Steel	<b>Material</b>
2 =	Open-Head	<b>Category</b>

Y =	Packing Group (II)	<b>Performance Standard Code</b>
23 =	Weight in kilograms	<b>Gross Mass</b>
S =	Tested for Solids	<b>Solids</b>
93 =	Year container was produced	<b>Year of Manufacture</b>
USA =	Marked under authority of USA	
+AA1234 =	Testing lab identification and test number of container	

4 =	Box	<b>Type of Package</b>
G =	Fiberboard	<b>Material</b>
Y =	Packing Group (II)	<b>Performance Standard Code</b>
10.4 =	Weight in Kilograms	<b>Gross Mass</b>
S =	Designates Inner Packagings	<b>Solids or Inner Packagings</b>
94 =	Year package was produced	<b>Year of Manufacture</b>
USA =	Marked under authority of USA	
+AX 1259 =	Testing lab identification and test number of container	

## Shipper's Responsibilities

It is the responsibility of the packager/shipper to determine the proper packaging specification for each lading, and that the packaging is compatible with the lading. The shipper determines that the packaging is authorized, properly manufactured, assembled, and marked.

It is the shipper's responsibility to ensure that the package is assembled, closed, or otherwise prepared for transport in full compliance with the specification standard under which the packaging was manufactured, including any instructions or conditions set forth by the manufacturer.

If the shipper assembles a package, fills it with a hazardous material and closes it, and does not depart from the manner in which the manufacturer certifies the package for use, the shipper can safely assume the package is capable of meeting UN standards. The shipper may not alter or amend a package design or specification without assuming full responsibility for doing so.

The shipper may request copies of the manufacturer's certification for compliance to demonstrate that each container conforms with the performance testing of CFR 49, Part 178.600.

## **Important Dates**

- January 1991: UN Performance Standards required for international shipments.
- October 1, 1992: HM-181 allows Performance Oriented Packaging for domestic shipments.
- October 1, 1993: Hazardous Materials must be shipped under HM-181 rules (i.e. placarding, labeling).
- October 1, 1994: DOT specification packaging can no longer be manufactured.
- October 1, 1996: Hazardous Materials can no longer be packaged and shipped in DOT specification packagings. For products packaged before October 1, 1996, the date is extended to October 1, 2001.

## **Testing Requirements**

The packaging manufacturer is responsible for performing and documenting design qualification testing and periodic retesting in accordance with Part 178, Subpart M for all packaging manufactured to U.S. standards (refer to 178.601 through 178.609). All test records are to be kept at each location where the packagings are manufactured and at each location where design qualification tests are performed. Records are to be kept as long as the packaging is produced and for at least two years thereafter.

## Design Qualification Testing

Design qualification testing is performed to determine the capabilities of a packaging. The following are the required tests for Performance Oriented Packaging:

***Drop Test*** - To ensure and protect against Hazardous Materials from leaking or escaping if the package is dropped during conditions of transport.

Packages as prepared for transportation are dropped from the appropriate height onto a rigid, horizontal and flat surface. The number and type of drops depend on the packaging being tested. The drop height will depend on the Packing Group and Specific Gravity of the material for which the packaging may be used.

***Leakproofness Test*** - To ensure that the package will not leak or permit liquids to escape as a result of the normal build up of air pressure within the packaging under conditions of transport. This test must be performed on all packagings intended to contain liquids, except the inner packagings of combination packagings. It must also be performed during production of each packaging before its intended initial use for the containment and transport of hazardous materials.

The packaging being tested will be placed under water and restrained. A minimum internal pressure will be applied to the packaging that is appropriate for the Packing Group for which it is being tested.

***Hydrostatic Pressure Test*** - To ensure that the packaging will not leak under pressure.

Packagings to be tested are filled with water or other suitable liquids so as to eliminate all air pockets. The appropriate amount of pressure is applied internally through a fitting that has been installed on the packaging for this purpose. The pressure must be maintained for 5 minutes for metal and composite glass, porcelain, or stoneware, and for 30 minutes for plastic and composite packagings of plastic material.

***Stack Test*** - To ensure the ability of the packaging to remain intact and hold its contents under normal stacking conditions during transport.

Test samples are to be subject to a force applied to the surface of the sample equivalent to the total weight of identical packages which may be stacked on it during transport. The minimum stack height is no less than 3 meters (10 ft.).

***Vibration Test*** - In addition to the forementioned tests, non-bulk packagings must be capable of withstanding the vibration test specified under (178.601).

The packaging is placed on a vibrating platform and restrained from horizontal movement, but free to bounce, rotate, and move vertically. The test must be performed for one hour and at a frequency that causes the package to be raised from the platform in such a manner that a piece of material such as steel strapping or paperboard can be passed between the bottom of the package and the platform. After the test, the package must be checked for leaks.



## **Periodic Retesting**

Periodic retesting must be done at intervals of sufficient frequency to ensure that the packaging produced by the manufacturer is capable of passing the design qualification tests. For single or composite packagings, the periodic retest is to be done no less than once each 12 months. For combination packagings the retesting must be done no less than once each 24 months. The requirements of the periodic retest are the drop, leakproofness, hydrostatic pressure, and stacking tests.

## **Limited Quantities**

As used in 49 CFR the term *Limited Quantity* means a material that is packaged in accordance with a "limited quantity" paragraph or sub paragraph contained within the Packaging Section to which you are referred to column (8A) of the Hazardous Materials Table.

Shipments eligible to be shipped as limited quantities are generally excepted from one or more of the requirements of 49 CFR such as labeling, DOT Specification Packaging, Placarding, etc. These exceptions can result in substantial cost savings and increased transportation efficiency.

It should be noted that although the packaging does not have to be in a UN Specification Packaging, all *packagings* and *packages*, including those for which there is an exception, must meet the general packaging requirements contained in Subpart B of Part 173.

## **Disclaimer**

The information appearing in this catalog has been provided to give our customers, particularly those that are unfamiliar with UN Packaging Regulations, a brief overview of what UN packaging is all about, and some of the basic requirements. Mid America Steel rum Company, Inc. or the author does not make any warranty or representation, either express or implied, with respect to the completeness or absolute accuracy of this information; nor does either assume any liability of any kind resulting from the use of, or reliance upon, any information, conclusion, procedure, or opinion contained in this section. Furthermore, they assume no responsibility for maintaining or notifying of changes, additions or terminations.

Contact the Department of Transportation for formal interpretations of the regulations governing the Transportation of Hazardous Materials.

## Ordering Reconditioned Drums

Title 49 CFR clearly states that it is the shipper's/packager's responsibility to determine what markings need to be part of the container that is being used for each product (Part 173.222, "Shipper's Responsibility"). You should obtain a copy of the 49 CFR, Part 100-199 and have the appropriate person within your company review it thoroughly prior to specifying your packaging needs. The following steps take you through this process.

**Step 1-**Determine what type of container you require. Pail/Drum(1); Intermediate Bulk Container(31) ; Composite(6), etc \_\_\_\_\_

**Step 2-**Confirm the following information about your selection:

A. Material: Steel(A); Plastic(H)\_\_\_\_\_

B. Style: Closed Head(1); Open Head(2)\_\_\_\_\_

**Step 3-**What is the capacity of the container? (This must be in metric, so you may have to convert U.S. gallons to liters by multiplying by 3.754.)\_\_\_\_\_

**Step 4-**You must indicate what closures or fittings you require as this may have an impact upon what manufacturer will have to provide you the requires performance levels:\_\_\_\_\_

**Step 5-**Next you must determine the Hazard Class of your product. In order to do this, you will need to reference/review 49CFR, Part 172.101 of the "Hazardous Materials Table."

A. Find the Hazardous Material Description and proper shipping name located in the column #2:\_\_\_\_\_

B. Obtain the Hazard Class of Division (Column #3):\_\_\_\_\_

C. Confirm the UN Identification Number (Column #4):\_\_\_\_\_

D. Note which Packaging Group (I, II, or III) covers your product (Column #5). You may have to use 49 CFR, Part 173.121 (Assignment of Packing Group) if all three Packing Groups are listed in Column #5. If so, you will have to use the flashpoint information for your product to determine the appropriate Packing Group.\_\_\_\_\_

**Step 6-**What is the specific gravity of your product? \_\_\_\_\_(This information should be available from your product's MSDS.

**Step 7-**If your product is a solid, list the total weight of your packaged product. This should be in metric; to convert pounds to kilograms, simply multiply by 0.454:\_\_\_\_\_

**Step 8-**If your product is a liquid, you must also determine the Vapor Pressure (must be noted in kPA at 55 degrees C). Your container will be marked with a Hydrostatic Pressure indicating the test level it performed to for water (in kPA).\_\_\_\_\_kPA