Chapter 3: UN Marking & Packaging

Objectives

- This chapter will elaborate the basic requirement of packaging as well as required DG labels on packaging.
- It also explain the UN standard of packaging code as well as highlight the possible combination of all these codes.
- The different level of packaging strengths in compliance with the packing group will also be stated in this chapter.
- Examples of UN packaging will also be provided.
- Other types of classification and labelling system will be illustrated.

1. Introduction

1.1 Packaging for Dangerous Goods

Dangerous Goods shall be packed in good quality packagings which shall be strong enough to withstand the shocks and loadings normally encountered during transport, including transshipment between cargo transport units and between cargo transport units and warehouses as well as any removal from a pallet or overpack for subsequent manual or mechanical handling.

Packagings shall be constructed and closed so as to prevent any loss of contents when prepared for transport which may be caused under normal conditions of transport, by vibration, or by changes in temperature, humidity or pressure.

Parts of packagings which are in direct contact with dangerous goods
(a) Shall not be affected or significantly weakened by those dangerous goods;
(b) Shall not cause a dangerous effect
(c) Shall not allow permeation of the dangerous goods that could constitute a dangerous under normal conditions of transport

Where necessary, they shall be provided with a suitable inner coating or treatment.

Basically the way the dangerous goods should be packed can be mainly classifed into 3 types.

1. Combination packagings. Combination packagings mean that there is a combination of inner packagings and outer packagings. For example dangerous good in a 30 liter plastic bottle packed into a fiberboard box (4G).

2. Single packagings. Single packagings are individual packaging which can accommodate the transport of dangerous goods by direct handling to the single

packagings without requiring the inner packaging. The example of single packaging is a 200 liter non-removable head steel drum (1A1).

3. Composite packagings. Composite packagings are specifically designed in specialized combination packagings. According to United Nations's standard of packagings, the composite packagings have specific UN packaging codes. The example is plastic receptacle in steel drum (6HA1).

Basic Labelling Requirement

The packaging for Dangerous must not exceed 400 kg or 450 liters per package. In principle, it must contain the label as well as the marking at least as follows:-

(a) Dangerous Goods Label signifying both primary and secondary hazards (if any) (based on United Nation Recommendation on the Transport of Dangerous Goods) in a diamond shape with the size of not smaller than 100 x 100 mm

(b) Proper Shipping Names (PSN)

(c) UN Number

(d) UN Packing Group

(e) Name, address and contact details of the manufacturer

(f) In case of using certified UN packaging for Dangerous Goods, it must contain the UN Symbol to represent the standard and strength of the packaging. The meaning of the certified UN packaging will be elaborated in the next section.

1.2 Certified UN Packaging for Dangerous Goods

Each packaging intended for use shall bear markings which are durable, legible and placed in a location and of such as size relative to the packaging as to be readily visible. The marking shall show:

1. The United Nations packaging symbol  designating that such UN Packaging has passed the required testing methods.

2. The following numerals shall be used for the types of packaging:

1	Drum
2	(Reserved)
3	Jerrican
4	Box
5	Bag
6	Composite packaging

3. The following numerals shall be used for the kinds of packaging:

A	Steel (all types and surface treatments)
B	Aluminium
C	Natural wood
D	Plywood
F	Reconstituted wood
G	Fibreboard
H	Plastics material
L	Textile
M	Paper, multiwall
N	Metal (other than steel or aluminium)
P	Glass, porcelain or stoneware

Note: Plastics materials is taken to include other polymeric materials such as rubber.

4. The English character above will be followed by number 1 or 2 meaning the following:-

1	Removable head (a whole cover can be totally removed)
2	Non-removable head

5. A code in two parts:
(i) a letter designating the packing group(s) for which the design type has been successfully tested.

X for packing groups I, II and III
Y for packing groups II and III
Z for packing group III only

(ii) the relative density, rounded off to the first decimal, for which the design type has been tested for packagings without inner packagings intended to contain liquids; this may be omitted when the relative density does not exceed 1.2. For packagings intended to contain solids or inner packagings, the maximum gross mass in kilograms;

6) Either the letter "S" denoting that the packaging is intended for the transport of solids or inner packagings or, for packagings (other than combination packagings) intended to contain liquids, the hydraulic test pressure which the packaging was shown to withstand in kPa rounded down to the nearest 10kPa;

7) The last two digits of the year during which the packaging was manufactured.

8) The State authorizing the allocation of the mark, indicated by the distinguishing sign for motor vehicles in the international traffic;

8) The name of the manufacturer or other identification of the packaging specified by the competent authority.

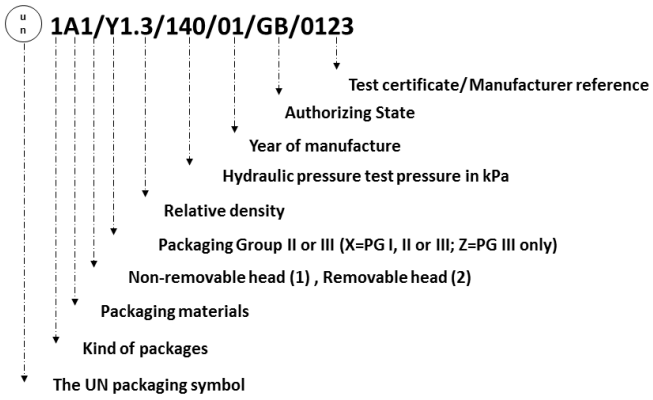

Figure 3-1: The Meaning of certified UN packaging for Dangerous Goods

The following table indicates the codes to be used for designating types of packagings depending on the kind of packagings, the material used for their construction and their category; it also refers to the paragraphs to be consulted for the appropriate requirements:

Kind	Material	Category	Code	Paragraph
1. Drums	A. Steel	non-removable head	1A1	6.1.4.1
		removable head	1A2	
	B. Aluminium	non-removable head	1B1	6.1.4.2
		removable head	1B2	
	D. Plywood		1D	6.1.4.5
	G. Fibre		1G	6.1.4.7
	H. Plastics	non-removable head	1H1	6.1.4.8
		removable head	1H2	
	N. Metal, other than steel or aluminium	non-removable head	1N1	6.1.4.3
		removable head	1N2	
2. (Reserved)				
3. Jerricans	A. Steel	non-removable head	3A1	6.1.4.4
		removable head	3A2	
	B. Aluminium	non-removable head	3B1	6.1.4.4
		removable head	3B2	
	H. Plastics	non-removable head	3H1	6.1.4.8
		removable head	3H2	
4. Boxes	A. Steel		4A	6.1.4.14
	B. Aluminium		4B	6.1.4.14
	C. Natural wood	Ordinary	4C1	6.1.4.9
		with sift-proof walls	4C2	
	D. Plywood		4D	6.1.4.10
	F. Reconstituted wood		4F	6.1.4.11
	G. Fibreboard		4G	6.1.4.12
	H. Plastics	expanded	4H1	6.1.4.13
		Solid	4H2	
	N. Metal, other than steel or aluminium		4N	6.1.4.14
5. Bags	H. Woven plastics	without inner liner or coating	5H1	6.1.4.16
		sift-proof	5H2	
		water resistant	5H3	
	H. Plastics film		5H4	6.1.4.17
	L. Textile	without inner liner or coating	5L1	6.1.4.15
		sift proof	5L2	
		water resistant	5L3	
	M. Paper	multiwall	5M1	6.1.4.18
		multiwall, water resistant	5M2	

Kind	Material	Category	Code	Paragraph
6.Composite packagings	H. Plastics receptacle	in steel drum	6HA1	6.1.4.19
		in steel crate or box	6HA2	6.1.4.19
		in aluminium drum	6HB1	6.1.4.19
		in aluminium crate or box	6HB2	6.1.4.19
		in wooden box	6HC	6.1.4.19
		in plywood drum	6HD1	6.1.4.19
		in plywood box	6HD2	6.1.4.19
		in fibre drum	6HG1	6.1.4.19
		in fibreboard box	6HG2	6.1.4.19
		in plastics drum	6HH1	6.1.4.19
		in solid plastics box	6HH2	6.1.4.19
	P. Glass, porcelain or stoneware receptacle	in steel drum	6PA1	6.1.4.20
		in steel crate or box	6PA2	6.1.4.20
		in aluminium drum	6PB1	6.1.4.20
		in aluminium crate or box	6PB2	6.1.4.20
		in wooden box	6PC	6.1.4.20
		in plywood drum	6PD1	6.1.4.20
		in wickerwork hamper	6PD2	6.1.4.20
		in fibre drum	6PG1	6.1.4.20
		in fibreboard box	6PG2	6.1.4.20
		in expanded plastics packaging	6PH1	6.1.4.20
		in solid plastics packaging	6PH2	6.1.4.20

Figure 3-2: The Table indicateing the Combination of Codes for Designating Types of Packagings

UN	4G/Yl45/S/02 NL/VL823	as in 6.1.3.1 (a), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g)	For a new fibreboard box
UN	1Al/Y1.4/150/98 NL/VL824	as in 6.1.3.1 (a), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g)	For a new steel drum to contain liquids
UN	1A2/Y150/S/01 NL/VL825	as in 6.1.3.1 (a), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g)	For a new steel drum to contain solids, or inner packagings
UN	4HW/Y136/S/98 NL/VL826	as in 6.1.3.1 (a), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g)	For a new plastics box of equivalent specification
UN	1A2/Y/100/01 USA/MM5	as in 6.1.3.1 (a), (b), (c), (d) and (e) as in 6.1.3.1 (f) and (g)	For a remanufactured steel drum to contain liquids

Figure 3-3: The Examples of UN Marking for Dangerous Goods

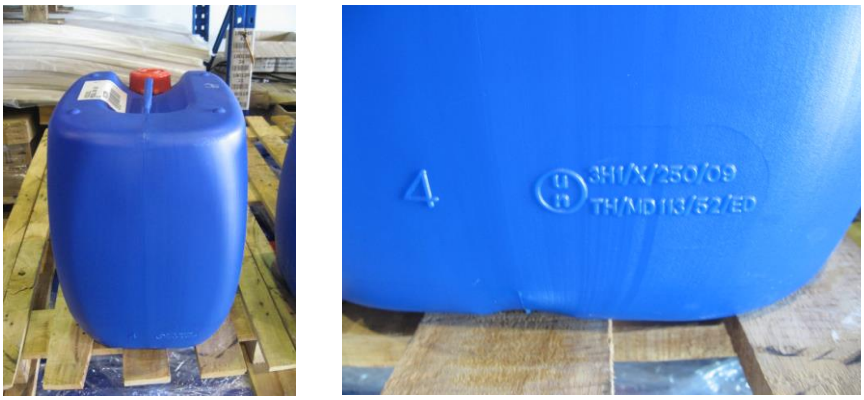

Figure 3-4: The Example of UN Marking on Dangerous Goods Package

1.3 Other DG Labelling Systems

In the global chemical industries, there is presently a number of existing Dangerous Goods Classification systems being implemented. Some of them are emerging into a

new Globally Harmonized System of Classification and Labelling (GHS)[1]. However these systems remain in transition period and are still applicable on the label of Dangerous Goods packages. As a quick reference, this chapter touches a little bit on the comprehensive summary of these systems.

EU Labelling System (Directive 67/548/EEC)

This EU labelling system is practically implemented in The European Union under the Directive 67/548/EEC. This hazard classification and communication system is currently under transition period and will no longer exist in the market for both single substances and mixtures (preparations) after June 2015 onwards.

The EU has enacted another directive to enforce GHS-like system so called Classification, Labelling and Packaging (CLP) to gradually replace the existing EU labelling system.

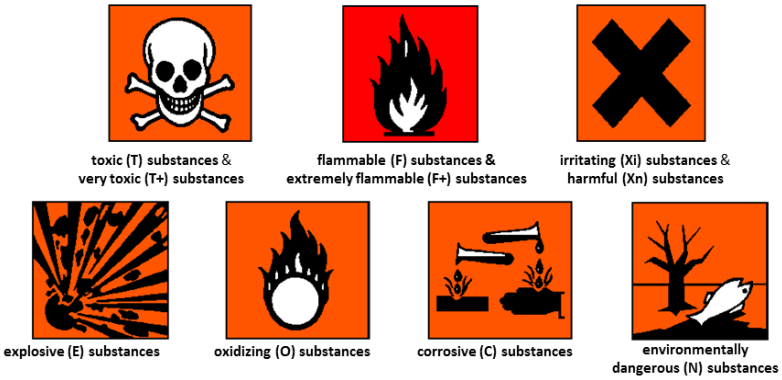

Figure 3-5: EU Labelling System (Directive 67/548/EEC)

US National Fire Protection Association (US NFPA) Hazard Identification System

NFPA 704

NFPA 704 is a standard system for the identification of the hazards of materials for emergency response. This standard presents a simple, readily recognized, and easily understood system of markings (commonly referred to as the "NFPA hazard diamond") that provides an immediate general sense of the hazards of a material and the severity of these hazards as they relate to emergency response.

NFPA 704 provides criteria for assessing the health, flammability instability, and related hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. A number rating system of 0-4 is provided to rate each of the four hazards and is placed on a placard and provide emergency responders with the information they need to determine the immediate actions to be taken in an emergency. Tables in the standard provide the criteria for

[1] More reference can be obtained in Chapter 5: Basic Understanding about GHS (Globally Harmonized System of Classification and Labelling of Chemicals)

the ratings and placard specifications such as letter size and arrangement of numbers and colors are provided in the standard.[2]

Figure 3-6: NFPA Hazard Identification System

2. Conclusion

Selecting the right packaging which can withstand and contain the Dangerous Goods inside is extremely important. The failure in doing so may result in spillage or leakage of dangerous goods which may further endanger the human health, damage properties and environment. Therefore the basic concept under this Chapter is to ensure that the readers understand the UN standard of packagings which are necessary to be used as Dangerous Goods Packagings. As these certified UN packagings have passed the necessary testings (drop test, water absorption test, stack test, pressure test, leak test, etc.), it can be assured that the Dangerous Goods packed for multimodal transport are safe.

It is also necessary to learn the basic labelling requirement as well as other labelling systems of chemicals in addition to the GHS (which shall be elaborated in details in Chapter 5). These EU labelling system and NFPA hazard identification system are practically implemented and exists in the current trade of chemicals around the globe. As a matter of fact, having the basic understanding to these systems will be beneficial to the transport sectors who regularly handle Dangerous Goods on a daily basis. More specific and detailed information can also be referred to the additional references in the last part of this Chapter.

[2] More specific and detailed meaning of NFPA Hazard Identification System can be referred to the following web link:-
http://www.fvarc.org/sites/default/files/NFPA%20Hazard%20Identification%20System.pdf

References

1. United Nations Economic and Social Council's Committee of Experts (UNECE) (2013) Recommendations on the Transport of Dangerous Goods Model Regulations: Volume I & II 18th Revised Edition, New York and Geneva: United Nations
2. http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=704
3. http://www.fvarc.org/sites/default/files/NFPA%20Hazard%20Identification%20System.pdf