

Recommendations for the packaging of dangerous goods for transport

Committees responsible for this British Standard

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- Aluminium Federation
- Association of Drum Manufacturers
- British Coating Federation
- British Fibreboard Packaging Association
- British Glass Manufacturers' Federation
- British Office Systems and Stationery Federation
- British Paper and Board Industries Federation
- British Plastics Federation
- British Printing Industries Federation
- Chemical Industries Association
- Department of Transport
- Flexible IBC Association
- Freight Transport Association
- Institution of Packaging
- Metal Packaging Manufacturers' Association
- National Materials Handling Centre
- Packaging and Industrial Films Association
- Pira International
- Timber Packaging and Pallet Confederation
- Timber Research and Development Association
- Coopted members

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Foreword

This British Standard has been prepared under the direction of the Packaging and Freight Containers Standards Policy Committee at the request of the Department of Transport. It is intended to assist the implementation in the UK of the international agreement which has been reached within the United Nations (UN) Organization, on Recommendations on the Transport of Dangerous Goods.

It supersedes BS 7569 : 1992 which is withdrawn. The provisions of clauses 0 to 8 of this standard are identical with Chapter 9 of the UN Recommendations [1].¹⁾ The provisions of clause 9 are identical with subclauses 6.13 and 6.14 of Chapter 6 of the UN Recommendations [1]¹⁾, which relate to the packing requirements for infectious substances.

The UN Recommendations have been developed by the United Nations Committee of Experts on the Transport of Dangerous Goods in the light of technical progress, the advent of new substances and materials, the exigencies of modern transport systems and, above all, the requirement to ensure the safety of people, property and the environment. They are addressed to governments and international organizations concerned with the regulation of the transport of dangerous goods. Amongst other aspects, the recommendations cover principles of classification and definition of classes, listing of the principal dangerous goods, general packing requirements, testing procedures, marking, labelling or placarding, and shipping documents. There are in addition special recommendations related to particular classes of goods.

They aim at presenting a basic scheme of provisions that will allow national and international regulations governing the various modes of transport to develop within it in a uniform fashion; yet remain flexible enough to accommodate any special requirements that might have to be met. It is expected that governments, intergovernmental organizations, and other international organizations, when revising or developing regulations for which they are responsible, will follow the principles laid down in the recommendations, thus contributing to worldwide harmonization in this field.

In the UK the functions of the 'competent authority', for the purposes of international legislation concerning the transport of dangerous goods, are undertaken by the Department of Transport. The Department of Transport is responsible for coordinating UK input into the international discussions on the further development of the UN Recommendations underlying this British Standard.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

¹⁾ Recommendations on the Transport of Dangerous Goods (eighth revised edition – 1992) published by the UN, Geneva and obtainable through them and HMSO.

Recommendations

0 Introduction

0.1 The UN Recommendations on the packaging of dangerous goods are based on existing international and national regulations. Account is also taken of a prevailing trend to replace the detailed specification of packagings, which may vary considerably from one country to another, by tests to ensure that packages containing dangerous goods can withstand normal conditions of transport and ensure the desirable level of safety. When drafting the recommendations sight was not lost of improvements and changes that may occur as a result of progress in science and technology. So provisions are made for the use of packagings which, while not complying exactly with the specifications set out in the recommendations, would be nevertheless as satisfactory in every respect as those that do, and would successfully pass the recommended tests when prepared for transport.

0.2 The UN Recommendations do not cover:

- a) packages containing radioactive material, which should comply with the Regulations of the International Atomic Energy Agency (IAEA) [2], (radioactive material with a subsidiary risk should also comply with the IAEA Regulations); except that low specific activity (LSA) material and surface contaminated objects (SCO) may be carried in certain packagings defined in these Recommendations provided that the supplementary provisions set out in the IAEA Regulations are also met;
- b) gas cylinders;
- c) packages whose net mass exceeds 400 kg;
- d) packagings with a capacity exceeding 450 litres.

0.3 Dangerous goods of all classes other than explosives, gases, organic peroxides, infectious substances and radioactive materials have for packing purposes been divided among three groups according to the degree of danger they present, i.e.

- great danger – Packing Group I,
- medium danger – Packing Group II; and
- minor danger – Packing Group III.

The Packing Group to which a substance is assigned is defined in the Road Traffic (Carriage of Dangerous Substances in Packages, etc.) Regulations 1986 SI 1951 (as amended) [3]¹⁾

0.4 Because of the special nature of explosives, the varying degree of hazard they present according to the manner in which they are packed, and the desirability of improving the uniformity of their packing, detailed recommendations are included in the UN Recommendations on the way in which individual explosive substances and articles, or groups thereof, should be packed (see the Packaging of Explosives for Carriage Regulations 1991 SI 2097 [4]¹⁾). Unless specific provision to the contrary is made in the individual recommendations, the packagings used for goods of Class 1 (explosives) should comply with the requirements for the medium danger (Packing Group II) category mentioned in **0.3**.

0.5 For similar reasons, recommendations are included on the way in which organic peroxides and some self-reactive substances should be packed, the maximum quantities, the indication of the subsidiary risk of explosion and, for those which should be carried at a control temperature, that temperature (Approved Code of Practice Classification and Labelling of Dangerous substances for carriage by road in tankers, tank containers and packages [5]¹⁾). The packagings used for organic peroxides and self-reactive substances should comply with the requirements for the medium danger category (Packing Group II) mentioned in **0.3**.

0.6 Provisions of this standard which apply to packagings for infectious substances are those in clauses **2**, **3** (except in **3.3**, **3.9** to **3.12** and **3.15**) and **9**.

0.7 It is recognized that certain substances, for example flammable liquids with a high viscosity, are transported in packagings which do not meet all the performance tests in this standard. It may be appropriate for provisions to be made for such substances and/or packagings in relation to individual modes of transport on a regional basis.

¹⁾ Obtainable from HMSO.

1 Scope

This British Standard provides recommendations on the packaging of dangerous goods for transport.

NOTE. The introduction to this standard is based on clause 9.1 of Chapter 9 of the UN Recommendations on the Transport of Dangerous Goods. Clauses 2 to 8 of the standard are identical with subclauses 9.2 to 9.8 of Chapter 9. Clause 9 of the standard is identical with subclauses 6.13 and 6.14 of Chapter 6 of the UN Recommendations.

2 Definitions

2.1 For the purposes of the recommendations in this standard:

bags are flexible packagings made of paper, plastics film, textiles, woven material or other suitable materials;

boxes are packagings with complete rectangular or polygonal faces, made of metal, wood, plywood, reconstituted wood, fibreboard, plastics or other suitable material. Small holes for purposes such as ease of handling or opening or to meet classification requirements are permitted as long as they do not compromise the integrity of the packaging during transport;

closures are devices which close an opening in a receptacle;

combination packagings are a combination of packagings for transport purposes, consisting of one or more inner packagings secured in an outer packaging in accordance with 3.5;

composite packagings are packagings 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, transported and emptied as such;

crates are outer packagings with incomplete surfaces;

drums are flat-ended or convex-ended cylindrical packagings made of metal, fibreboard, plastics, plywood or other suitable materials. This definition also includes packagings of other shapes, e.g. round taper-necked packagings, or pail-shaped packagings. Wooden barrels or jerricans are not covered by this definition;

inner packagings are packagings for which an outer packaging is required for transport;

inner receptacles are receptacles which require an outer packaging in order to perform their containment function;

jerricans are metal or plastics packagings of rectangular or polygonal cross section;

maximum capacity as used in clause 6 is the maximum inner volume of receptacles or packagings expressed in litres;

maximum net mass is the maximum net mass of contents in a single packaging or maximum combined mass of inner packagings and the contents thereof and is expressed in kg;

outer packaging is the outer protection of a composite or combination packaging together with any absorbent materials, cushioning and any other components necessary to contain and protect inner receptacles or inner packagings;

packages are the complete product of the packing operation, consisting of the packaging and its contents prepared for transport;

packagings are receptacles and any other components or materials necessary for the receptacle to perform its containment function;

receptacles are containment vessels for receiving and holding substances or articles, including any means of closing;

re-conditioned packagings include the following:

metal drums that are:

- i) cleaned to original materials of construction, with all former contents, internal and external corrosion, and external coatings and labels removed;
- ii) restored to original shape and contour, with chimes (if any) straightened and sealed, and all non-integral gaskets replaced;
- iii) inspected after cleaning but before painting, with rejection of packagings with visible pitting, significant reduction in material thickness, metal fatigue, damaged threads or closures, or other significant defects;

re-manufactured packagings include metal drums that:

- i) are produced as a UN type from a non-UN type;
- ii) are converted from one UN type to another UN type; or
- iii) undergo the replacement of integral structural components (such as non-removable heads).

Re-manufactured drums are subject to the same requirements of this standard that apply to a new drum of the same type.

re-used packagings are packagings to be refilled which have been examined and found free of defects affecting their ability to withstand the performance tests: the term includes those which are refilled with the same or similar compatible contents and are transported within distribution chains controlled by the consignor of the product;

wooden barrels are packagings made of natural wood, of round cross-section, having convex walls, consisting of staves and heads and fitted with hoops.

2.2 The following explanations and examples are meant to assist in clarifying the use of the terms defined in **2.1**.

2.2.1 The definitions in **2.1** are consistent with the use of the defined terms throughout the UN Recommendations. However, many national and international regulations, based on the UN Recommendations, currently use some of the defined terms in other ways. This is particularly evident in respect of the term 'inner receptacle' which has often been used to describe the 'inner' of a combination packaging.

2.2.2 The 'inner' of 'combination packagings' are always termed 'inner packagings' not 'inner receptacles'. A glass bottle is an example of such an 'inner packaging'.

2.2.3 The 'inner' of 'composite packagings' are normally termed 'inner receptacles'. For example the 'inner' of a 6HA1 composite packaging (plastics material) is such an 'inner receptacle' since it is normally not designed to perform a containment function without its 'outer packaging' and is not therefore an 'inner packaging'.

3 General packing requirements applicable to the packing of dangerous goods of all classes other than Class 2 and Class 7

3.1 Dangerous goods should be packed in packagings of good quality which should be constructed and closed so as to prevent the package as prepared for transport from any leakage which might be caused under normal conditions of transport by vibration, by changes in temperature, humidity or pressure (resulting from altitude, for example). No harmful quantity of a dangerous substance should adhere to the outside of packages. These provisions apply both to new and to reused packagings.

3.2 Parts of packaging which are in direct contact with dangerous substances should not be affected by chemical or other action of those substances. Where necessary, they should be provided with a suitable inner coating or treatment. Such parts of packagings should not incorporate constituents liable to react dangerously with the contents so as to form hazardous products, or to weaken them significantly.

3.3 Each packaging, except inner packagings of combination packagings, should conform to a design type successfully tested in accordance with the requirements laid down in clause 7.

3.4 When filling packagings with liquids sufficient ullage (outage) should be left to ensure that neither leakage nor permanent distortion of the packaging occurs as a result of expansion of the liquid by the temperatures likely to occur during transport. Unless specific requirements are contained in national or international regulations, liquids should not completely fill a packaging at a temperature of 55 °C.

3.4.1 For air transport packagings intended to contain liquids should also be capable of withstanding a pressure differential without leakage as specified in the international regulations for air transport.

3.5 Inner packagings should be packed in an outer packaging in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the outer packaging. Inner packagings that are liable to break or be punctured easily, such as those made of glass, porcelain or stoneware or of certain plastics materials, etc., should be secured in outer packagings with suitable cushioning material. Any leakage of the contents should not substantially impair the protective properties of the cushioning material or of the outer packaging.

3.6 Dangerous goods should not be packed together in the same outer packaging with dangerous or other goods if they react dangerously with each other and cause:

- a) combustion and/or evolution of considerable heat;
- b) evolution of flammable, toxic or asphyxiant gases;
- c) the formation of corrosive substances; or
- d) the formation of unstable substances.

3.7 The closures of packagings containing wetted or diluted substances should be such that the percentage of liquid (water, solvent or phlegmatizer) does not fall below the prescribed limits during transport.

3.8 Where pressure may develop in a package by the emission of gas from the contents (as a result of temperature increase or other cause), the packaging may be fitted with a vent provided that the gas emitted will not cause danger on account of its toxicity, its flammability, the quantity released, etc. The vent should be so designed that, when the packaging is in the attitude in which it is intended to be transported, leakages of liquid and the penetration of foreign substances are prevented under normal conditions of transport. Venting of the package should not be permitted for air transport.

3.9 New, re-manufactured, re-used or re-conditioned packagings should be capable of passing the performance tests prescribed in clause 7. Before being filled and handed over for transport, every packaging should be inspected to ensure that it is free from corrosion, contamination or other damage. Any packaging which shows signs of reduced strength as compared with the approved design type should no longer be used or should be so reconditioned that it is able to withstand the design-type tests.

3.10 Liquids should be filled only into packagings which have an appropriate resistance to the internal pressure that may be developed under normal conditions of transport. Packagings marked with the hydraulic test pressure prescribed in 5.1d) should be filled only with a liquid having a vapour pressure:

- a) such that the total gauge pressure in the packaging (i.e. the vapour pressure of the filling substance plus the partial pressure of air or other inert gases, less 100 kPa) at 55 °C, determined on the basis of a maximum degree of filling in accordance with 3.4 and a filling temperature of 15 °C, will not exceed two-thirds of the marked test pressure; or
- b) at 50 °C less than four-sevenths of the sum of the marked test pressure plus 100 kPa; or
- c) at 55 °C less than two-thirds of the sum of the marked test pressure plus 100 kPa.

Examples of required marked test pressures calculated as in 3.10c):

UN No.	Name	Class	Packing Group	V_{p55} (kPa)	$V_{p55} \times 1.5$ (kPa)	$(V_{p55} \times 1.5)$ minus 100 (kPa)	Required minimum test pressure (gauge) under 7.5.4c) (kPa)	Minimum test pressure (gauge) to be marked on the packaging (kPa)
2056	Tetrahydrofuran	3	II	70	105	5	100	100
2247	<i>n</i> -decane	3	III	1.4	2.1	– 97.9	100	100
1593	Dichloromethane	6.1	III	164	246	146	146	150
1155	Diethyl ether	3	I	199	299	199	199	250

NOTES.

- For pure liquids the vapour pressure at 55 °C (V_{p55}) can often be obtained from scientific tables.
- The maximum vapour pressures 3.10 b) and c) refer to the basis of the formula.
- The table refers to the use of 3.10 c) only, which means that the marked test pressure should exceed 1.5 times the vapour pressure at 55 °C less 100 kPa. When, for example, the test pressure for *n*-decane is determined according to 7.5.4 a) the minimum marked test pressure may be lower.
- For diethyl ether the required minimum test pressure under 7.5.5 is 250 kPa.

3.11 An empty packaging that has contained a dangerous substance should be treated in the same manner as is required by these recommendations for a filled packaging until it has been purged of the residue of that dangerous substance.

3.12 Every packaging intended to contain liquids should successfully undergo a suitable leakproofness test and be capable of meeting the appropriate test level indicated in **7.4.3**:

- a) before it is first used for transport;
- b) after remanufacturing or reconditioning, before it is reused for transport.

For this test, packagings need not have their own closures fitted.

The inner receptacle of composite packagings may be tested without the outer packaging provided the test results are not affected.

This test is not necessary for inner packagings of combination packagings.

3.13 Packagings used for solids which may become liquid at temperatures likely to be encountered in transport should also be capable of containing the substance in a liquid state.

3.14 The packagings should be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each manufactured packaging meets the requirements of this standard.

3.15 The requirements for packagings in clause **6** are based on packagings currently used. In order to take into account progress in science and technology, there is no objection to the use of packagings having specifications different from those in clause **6**, provided that they are equally effective, acceptable to the competent authority and able successfully to withstand the tests described in **3.12** and clause **7**. Methods of testing other than those described in the recommendations are acceptable, provided they are equivalent.

4 Code for designating types of packagings

4.1 The code should consist of:

- an Arabic numeral indicating the type of packaging, e.g. drum, jerrican, etc., followed by
- a capital letter(s) in Latin characters indicating the nature of the material, e.g. steel, wood, etc., followed where necessary by
- an Arabic numeral indicating the category of packaging within the kind to which the packaging belongs.

4.2 In the case of composite packagings, two capital letters in Latin characters should be used in sequence in the second position of the code. The first should indicate the material of the inner receptacle and the second that of the outer packaging.

4.3 In the case of combination packagings, only the code number for the outer packaging should be used.

4.4 The letters 'W' or 'V' may follow the packaging code. The letter 'V' designates a special packaging, see **7.1.7**. The letter 'W' signifies that the packaging although of the same type indicated by the code, is manufactured to a specification different to that in clause **6** and is considered equivalent under the provisions of **3.15**.

4.5 The following numerals show the kind of packaging:

1. Drum
2. Wooden barrel
3. Jerrican
4. Box
5. Bag
6. Composite packaging
7. Pressure receptacle

4.6 The following letters show the material of which the packaging is made:

- 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

4.7 The following kinds and codes of packaging are assigned:

Kind	Material	Category	Code	Subclause
1. Drums	A. Steel	non-removable head	1A1	6.1
		removable head	1A2	
	B. Aluminium	non-removable head	1B1	6.2
		removable head	1B2	
	D. Plywood	—	1D	6.4
	G. Fibre	—	1G	6.6
	H. Plastics	non-removable head	1H1	6.7
		removable head	1H2	
2. Barrels	C. Wooden	bung type	2C1	6.5
		removable head	2C2	
3. Jerricans	A. Steel	non-removable head	3A1	6.3
		removable head	3A2	
	H. Plastics	non-removable head	3H1	6.7
		removable head	3H2	
4. Boxes	A. Steel	—	4A	6.13
	B. Aluminium	—	4B	6.13
		with inner liner or coating	4B2	
	C. Natural wood	ordinary	4C1	6.8
		with sift-proof walls	4C2	
	D. Plywood	—	4D	6.9
	F. Reconstituted wood	—	4F	6.10
	G. Fibreboard	—	4G	6.11
	H. Plastics	expanded	4H1	6.12
		solid	4H2	

Kind	Material	Category	Code	Subclause
5. Bags	H. Woven plastics	without inner lining or coating	5H1	6.15
		sift-proof	5H2	
		water resistant	5H3	
	H. Plastics film	—	5H4	6.16
	L. Textile	without inner lining or coating	5L1	6.14
		sift-proof	5L2	
		water resistant	5L3	
	M. Paper	multiwall	5M1	6.17
		multiwall, water resistant	5M2	
6. Composite packagings	H. Plastics receptacle	in steel drum	6HA1	6.18
		in steel crate or box	6HA2	6.18
		in aluminium drum	6HB1	6.18
		in aluminium crate or box	6HB2	6.18
		in wood box	6HC	6.18
		in plywood drum	6HD1	6.18
		in plywood box	6HD2	6.18
		in fibre drum	6HG1	6.18
		in fibreboard box	6HG2	6.18
		in plastics drum	6HH1	6.18
		in solid plastics box	6HH2	6.18
	P. Glass, porcelain or stoneware receptacle	in steel drum	6PA1	6.19
		in steel crate or box	6PA2	6.19
		in aluminium drum	6PB1	6.19
		in aluminium crate or box	6PB2	6.19
		in wooden box	6PC	6.19
		in plywood drum	6PD1	6.19
		in wickerwork hamper	6PD2	6.19
		in fibre drum	6PG1	6.19
		in fibreboard box	6PG2	6.19
		in expanded plastics packaging	6PH1	6.19
		in solid plastics packaging	6PH2	6.19

5 Marking

5.0 General

The marking indicates that the packaging which bears it corresponds to a successfully tested design type and that it complies with the provisions of this standard which are related to the manufacture, but not to the use, of the packaging. In itself, therefore, the mark does not necessarily confirm that the packaging may be used for any substance; generally the type of packaging (e.g. steel drum), its maximum capacity and/or mass, and any special requirements are specified for each substance in the regulations for each mode of transport.

The marking is intended to be of assistance to packaging manufacturers, reconditioners, packaging users, carriers and regulatory authorities. In relation to the use of a new packaging, the original marking is a means for its manufacturer(s) to identify the type and to indicate those performance test recommendations that have been met.

The marking does not always provide full details of the test levels, etc., and these may need to be taken further into account, e.g. by reference to a test certificate, test reports or register of successfully tested packagings. For example, a packaging having an X or Y marking may be used for substances to which a