

Safe Transport of Dangerous Goods by Air

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Safe Transport of Dangerous Goods by Air

Part 6 – Packaging Nomenclature, Marking, Requirements & Tests



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Technical Instructions for the Safe
Transport of Dangerous Goods by Air

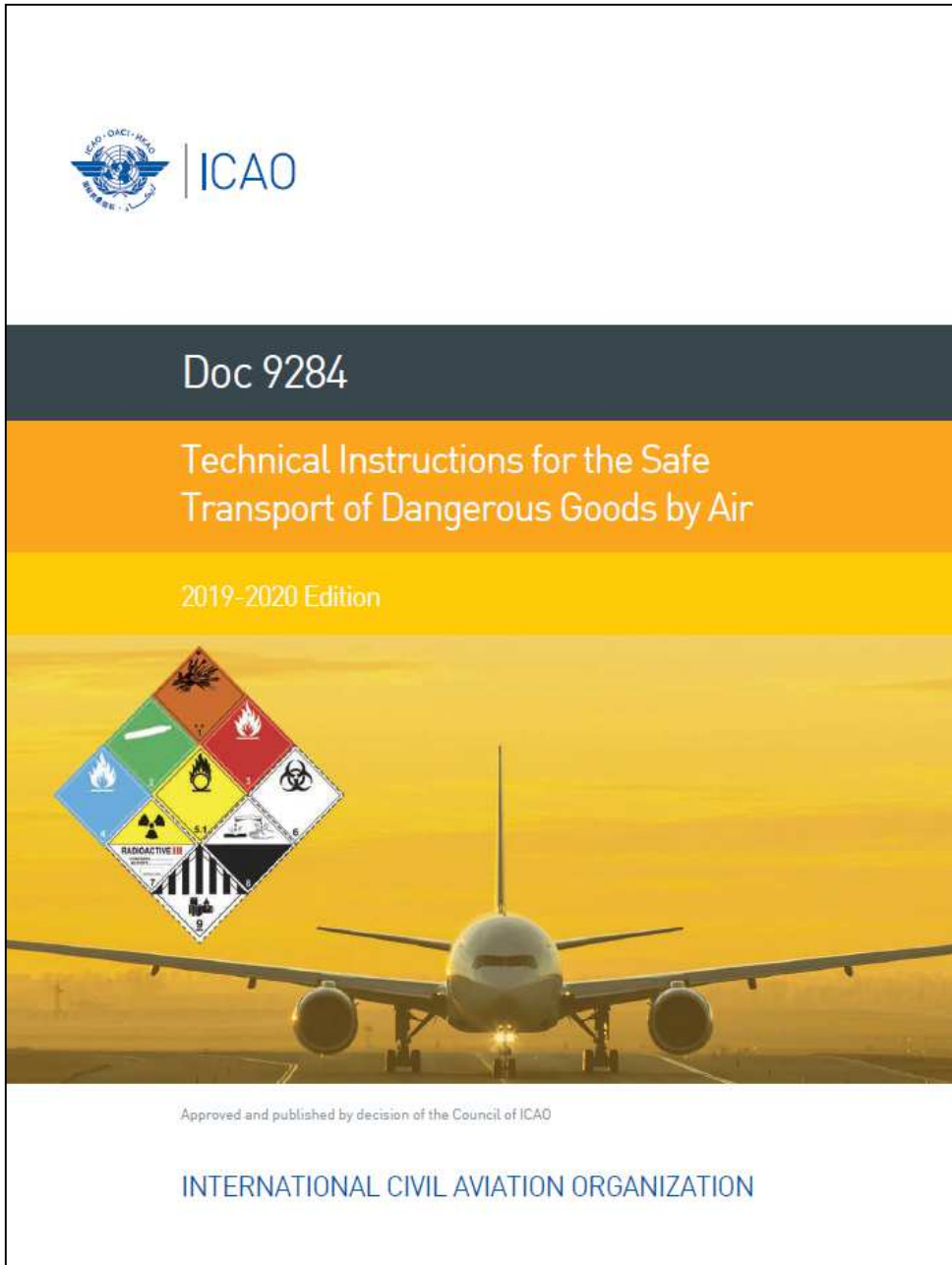
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INTERNATIONAL CIVIL AVIATION ORGANIZATION

SAFE TRANSPORT OF DANGEROUS GOODS BY AIR



Part 6 = Packaging nomenclature, marking, requirements and tests

Chapter 1 - Applicability, nomenclature and codes

Chapter 2 - Marking of packagings other than inner packagings

Chapter 3 - Requirements for packagings

Chapter 4 - Packaging performance tests

Chapter 5 - Requirements for the construction and testing of cylinders and closed cryogenic receptacles, aerosol dispensers and small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

Chapter 6 - Packagings for infectious substances of Category A

Chapter 7 - Requirements for the construction, testing and approval of packages and material of Class 7

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

- **Applicability** of **each Chapter** of this Part to the packagings for the various **Classes and Divisions of DG** is **as set out**:

Table 6-1. Applicability of Chapters	
Class or Division	Chapter
Classes 1, 2, 3, 4, 5, 8, 9 and Division 6.1	1 to 5
Division 6.2, infectious substances	2 & 6
Class 7, radioactive material	7

- **Methods** of testing **other than those described** in these Instructions are **acceptable**, provided they are **equivalent**
- **Manufacturers** and subsequent **distributors** of packagings **must provide information** regarding **procedures** followed to **perform the tests**

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

- **Codes** for designating **types** of packagings:
 - ✓ an Arabic **numeral** indicating the **kind** of packaging, e.g. box, drum, jerrican, composite, etc ...
 - ✓ a **capital letter(s)** in Latin characters indicating the **nature** of the **material**, e.g. steel, wood, fibreboard, metal, glass, etc ...
 - ✓ an Arabic **numeral** indicating the **category** of packaging

- for **combination packagings**, **only** the **code number** for the **outer packaging** is used

- for **composite packagings**, **two capital letters** in Latin characters **are used** in sequence in the second position of the code:
 - ✓ the **first** indicates the material of the **inner** receptacle
 - ✓ the **second** that of the **outer** packaging

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ The following **numerals** must be used for the **kinds of packaging**:

- | | | |
|-----------------|---------------------|--------------------------------|
| 1 = Drum | 2 = reserved | 3 = Jerrican |
| 4 = Box | 5 = Bag | 6 = Composite Packaging |

➤ and the following capital **letters** must be used for the **types of material**:

- ✓ **A. Steel (all types and surface treatments)**
- ✓ **B. Aluminium**
- ✓ **C. Natural Wood**
- ✓ **D. Plywood**
- ✓ **F. Reconstituted Wood**
- ✓ **G. Fibreboard**
- ✓ **H. Plastic material**
- ✓ **L. Textile**
- ✓ **M. Paper multiwall**
- ✓ **N. Metal (other than Steel and Aluminium)**
- ✓ **P. Glass, Porcelain or Stoneware (not used in these Instructions)**

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

- **Table 6-2** contains the index of **packagings (other than inner packagings)**:
 - ✓ lists all the packagings (except inner packagings) specified by the United Nations Recommendations
 - ✓ notes those not used in these Instructions for air transport
 - ✓ includes the maximum capacity (L) or maximum net mass (kg)

- **Table 6-3** contains the index of **inner packagings**

- In addition to the listed packagings, intermediate bulk containers are permitted for UN 3077 as shown in Packing Instruction 956

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ Table 6-2 - Packagings (other than inner packagings)

Kind	Code	Category
Steel drums	1A1 1A2	non-removable head removable head
Aluminium drums	1B1 1B2	non-removable head removable head
Metal (other than steel or aluminium) drums	1N1 1N2	non-removable head removable head
Steel jerricans	3A1 3A2	non-removable head removable head
Aluminium jerricans	3B1 3B2	non-removable head removable head
Plywood drums	1D	
Fibre drums	1G	
Plastic drums and jerricans	1H1 1H2 3H1 3H2	drums, non-removable head drums, removable head jerricans, non-removable head jerricans, removable head

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ Table 6-2 (continuous) - Packagings (other than inner packagings)

Kind	Code	Category
Boxes of natural wood	4C1 4C2	ordinary with siftproof walls
Plywood boxes	4D	
Reconstituted wood boxes	4F	
Fibreboard boxes	4G	
Plastic boxes	4H1 4H2	expanded plastic boxes solid plastic boxes
Steel, aluminium or other metal boxes	4A 4B 4N	steel aluminium metal, other than steel or aluminium
Textile bags	5L1 5L2 5L3	without inner liner or coating (not used in TI) siftproof water-resistant
Woven plastic bags	5H1 5H2 5H3	without inner liner or coating (not used in TI) siftproof water-resistant
Plastic film bags	5H4	
Paper bags	5M1 5M2	multiwall multiwall, water-resistant

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ Table 6-2 (continuous) - Packagings (other than inner packagings)

Kind	Code	Category
Composite packaging (plastic material)	6HA1 6HA2 6HB1 6HB2 6HC 6HD1 6HD2 6HG1 6HG2 6HH1 6HH2	plastic receptacle with outer steel drum plastic receptacle with outer steel crate*/or box plastic receptacle with outer aluminium drum plastic plastic receptacle with outer aluminium crate*/or box plastic receptacle with outer wooden box plastic receptacle with outer plywood drum plastic receptacle with outer plywood box plastic receptacle with outer fibre drum plastic receptacle with outer fibreboard box plastic receptacle with outer plastic drum plastic receptacle with outer solid plastic box
Composite packagings (glass, porcelain or stoneware) Not used in these Instructions	 6PA1 6PA2 6PB1 6PB2 6PC 6PD1 6PD2 6PG1 6PG2 6PH1 6PH2 	 receptacle with outer steel drum receptacle with outer steel crate*/or box receptacle with outer aluminium drum plastic receptacle with outer aluminium crate*/or box receptacle with outer wooden box receptacle with outer plywood drum receptacle with outer wickerwork hamper receptacle with outer fibre drum receptacle with outer fibreboard box receptacle with outer expanded plastic packaging receptacle with outer solid plastic packaging
* Crates are outer packagings with incomplete surfaces. For air transport, crates may not be used as outer packagings of composite packagings		

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ **Codes** for designating **types** of packagings:

✓ letters “T” or “U” or “V” or “W” may follow the packaging code:

– “T” signifies a **salvage** packaging

– “U” signifies a **special** packaging (provision regarding requirements for performance and frequency of tests for **certain** packagings)

– “V” signifies a **special** packaging (provisions regarding performance and tests criteria for **certain outer packagings** to contain articles or inner packagings)

– “W” signifies that the packaging, although of the same type indicated by the code, is **manufactured to a different specification** (considered as an **equivalent**)

PART 6 – APPLICABILITY, NOMENCLATURE AND CODES

➤ Table 6-3 – Inner Packagings

Kind	Code
Glass	
Plastic	
Metal cans, tins or tubes	
Paper bags	
Plastic bags	
Fibre cans or boxes	
Metal receptacles (aerosols), non-refillable	IP.7
Metal receptacles (aerosols), non-refillable	IP.7A
Metal receptacles (aerosols), non-refillable	IP.7B
Plastic receptacle (aerosols), non-refillable	IP.7C
Metal or plastic flexible tubes	

PART 6 – MARKING

➤ Packagings (other than inner packagings)

✓ must bear **durable, legible** markings, placed in a **location** and of such a **size** relative to the packaging as to be **readily visible**, and **must show**:

→ **UN** symbol

→ a **code** in two parts:

– **letter** designating the **packing group(s)**

X for Packing Groups **I**, **II** and **III**

Y for Packing Groups **II** and **III**

Z for Packing Group **III** only

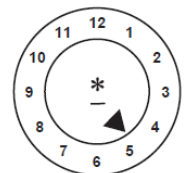
– for packagings intended to contain **solids or inner packagings**: the **maximum gross mass**, in **kilograms**, followed by **letter “S”**

for **single** packagings intended to contain **liquids**: the **relative density**, followed by the **hydraulic test pressure** in **kPa**

– the **last two digits of the year of manufacture**

*plastic drums (1H& & 1H2) and plastic jerricans (3H& & 3H2) must also be appropriately marked with the **month** of manufacture*

appropriate method proposed



PART 6 – MARKING

➤ Packagings (other than inner packagings)

✓ must bear **durable, legible** markings, placed in a **location** and of such a **size** relative to the packaging as to be **readily visible**, and **must show**:

→ **State authorizing** the allocation of the mark

→ **name** of the **manufacturer** or **other identification** of the packaging specified by the appropriate national authority

✓ Marking must be **applied as previously described**, and **clearly separated**, e.g. by a **slash** or **space**, so as to be **easily identified**

✓ *Special packaging provisions:*

– for *infectious substances* (text "CLASS 6.2")

– *manufactured with recycled plastic material* (mark "REC")

– for *reconditioning* ones, State in which the reconditioning was carried out, name of the reconditioner, year of reconditioning, letter "R" (letter "L" if leakproofness test needed)


– for *salvage* packagings

PART 6 – MARKING


➤ Packagings (other than inner packagings)

✓ examples:

→ *for a new fibreboard box*

 **4G/Y45/S/12**
NL/AB1233


→ *for a new steel drum to contain solids, or inner packagings*

 **1A2/X150/S/11**
USA/EF789

→ *for a fibreboard box to contain infectious substances*

 **4G/CLASS 6.2/10**
F/BVT654

→ *for a new steel drum to contain liquids*

 **1A1/Y1.4/150/09**
GB/CD456


→ *for a new plastic box or equivalent specs.*

 **4HW/Y112/S/14**
DK/GH321

→ *for a reconditioned packaging*

 **1A1/Y1.2/85/07**
SP/RB/12/RL

→ *for a salvage packaging*

 **1A2T/Y200/S/12**
BE/abcd

PART 6 - REQUIREMENTS FOR PACKAGINGS

- All general requirements for **packagings, other than inner packagings**, are found in **chapter 3.1** (material for construction, opening/closing, thickness/strength, coating/treatment, protection, sealing, resistance, maximum net mass or maximum net capacity, etc ...)
- ✓ packing performance **tests** are developed in **chapter 4**
- **Chapter 5** is dedicated for construction and testing of **cylinders** and **closed cryogenic receptacles, aerosols dispensers** and **small receptacles** containing **gas (gas cartridges)** and **fuel cell cartridges** containing **liquefied flammable gas**
- **Chapter 6** is dedicated for **Infectious Substances of Category A**
- **Chapter 7** is dedicated for construction, testing & approval of packages for **Radioactive Material**
- Requirements for **inner packaging** are found in **chapter 3.2**
- ✓ they have to comply with construction requirements
- ✓ only **aerosols (IP.7, IP.7A, IP.7B, IP.7C)** must comply with **test requirements**

PART 6 – PACKAGINGS PERFORMANCE TESTS

- All (or a part of) these tests **apply to**:
 - ✓ **single** packagings
 - ✓ **composite** packagings, including their inner receptacle
 - ✓ **combination** packagings, including inner packaging used in
 - ✓ **salvage** packagings

- They must be carried on **production samples** packagings prepared as for transport

- 4 types of tests :
 - ✓ **Drop** test
 - ✓ **Leakproofness** tests
 - ✓ **Internal pressure** (hydraulic) tests
 - ✓ **Stacking** tests

PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Drop Test

➤ Each packaging tested must **comply** with fixed **criteria** (number of test samples, drop orientation, leakproof, damage, discharge, rupture, ...)

✓ drop **height**

1 - for **solids** and **liquids**, test is performed with the solid or liquid to be transported or with another substance having essentially the same physical characteristics, and

2 - for **liquids** in **single** packagings and for **inner** packagings of **combination** packagings, test is performed with water, and where the substances have a relative **density not exceeding 1.2**

Packing Group I	Packing Group II	Packing Group III
1.8 m	1.2 m	0.8 m



PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Drop Test

➤ Each packaging tested must **comply** with fixed **criteria** (number of test samples, drop orientation, leakproof, damage, discharge, rupture, ...)

✓ drop **height**

2- for **liquids** in **single** packagings and for **inner** packagings of **combination** packagings, test is performed with water, and where the substances have a relative **density exceeding 1.2**, the drop height must be calculated on the **basis** of the relative **density (d)** of the substance to be carried, rounded up to the first decimal

Packing Group I	Packing Group II	Packing Group III
$d \times 1.5 \text{ m}$	$d \times 1.0 \text{ m}$	$d \times 0.67 \text{ m}$



PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Drop Test

➤ Criteria for passing the test (non-exhaustive list)

- ✓ each packaging containing **liquid** must be **leakproof** ...
- ✓ a packaging for solids **shall retain** the **entire contents** ...
- ✓ the packaging or outer packaging of a composite or combination packaging **must not exhibit any damage** liable to affect safety during transport, and inner receptacles/packagings or articles **must remain completely within** the outer packaging and there must be **no leakage** of the filling substance ...
- ✓ the outermost ply of a bag nor an outer packaging **may exhibit any damage** liable to affect safety during transport ...
- ✓ a **slight discharge** from the **closure(s)** upon impact is not considered to be a failure of the packaging **provided** that **no further leakage** occurs
- ✓ **no rupture** is **permitted** in packagings for goods of **Class 1** which would permit the **spillage** of **loose explosive substances or articles** from the outer packaging

PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Leakproofness Test

- ✓ must be performed on **all** design types of **packagings intended to contain liquids** (not required for the inner packagings of combination packagings)
- ✓ duration **5 minutes** while an internal air pressure is applied

Packing Group I	Packing Group II	Packing Group III
Not less than 30 kPa (0.3 bar)	Not less than 20 kPa (0.2 bar)	Not less than 20 kPa (0.2 bar)

→ Criterion for passing the test:
there must be **no leakage**



PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Internal Pressure (Hydraulic) Test

✓ must be carried out on **all** design types of metal, plastic and **composite packagings** intended to contain **liquids** (not required for the inner packagings of combination packagings)

✓ duration: - **metal** packagings for **5 minutes**

- **plastic** and **composite** packagings (plastic material) for **30 minutes**

➤ Hydraulic pressure (gauge) applied, must be **not less than**:

✓ $PT = (PM55 \times 1.5)$ kPa with minima of 95 or 75 kPa

✓ $PT = (Vp50 \times 1.75) - 100$ kPa with a minimum of 100 kPa

✓ $PT = (Vp55 \times 1.5) - 100$ kPa with a minimum of 100 kPa

where "PT" = Test pressure in kPa (gauge),

"PM55" = Pressure measured in the filled packaging

at a temperature of 55°C,

"Vp50" = Vapour pressure at 50°C,

"Vp55" = Vapour pressure at 55°C



➤ In addition, packagings intended to contain liquids of **Packing Group I** must be tested to a minimum test pressure of 250 kPa for a test period of 5 or 30 minutes depending upon the material of construction of the packaging

→ **Criteria** for passing the test: **no** packaging may **leak**

PART 6 – PACKAGINGS PERFORMANCE TESTS

➤ Stacking Test

- ✓ carried on **all design types** of packagings **other than bags**
- ✓ a **force is applied** to the **top surface** of the test sample **equivalent** to the **total weight of identical packages**
- ✓ **minimum height** of the stack including the test sample must be **3 m**
- ✓ **duration** of the test must be **24 hours**

(except **plastic drums, jerricans** and **composite packagings** (6HH1 and 6HH2) intended for **liquids**, test period is **28 days** at a **temperature of not less than 40°C**)

→ **Criteria** for passing the test:
no test sample may leak, or
show any deterioration



➤ Test Report

- ✓ **A test report must be drawn up and must be available to the users of the packaging (see chapter 4.7 for details to be include in)**
- ✓ **The test report must contain statements that the packaging prepared as for transport was tested in accordance with the appropriate provisions of these Instructions or the equivalent provisions of Chapter 6 of the United Nations Recommendations on the Transport of Dangerous Goods**
- ✓ **A copy of the test report must be made available to the appropriate national authority**

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