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Technical Instructions for the Safe Transport of Dangerous Goods by Air

Approved and published by
decision of the Council of ICAO

2015 – 2016 Edition

International Civil Aviation Organization

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FOREWORD

RELATIONSHIP TO ANNEX 18 TO THE CHICAGO CONVENTION

The broad principles governing the international transport of dangerous goods by air are contained in Annex 18 to the Convention on International Civil Aviation — *The Safe Transport of Dangerous Goods by Air*. These Technical Instructions amplify the basic provisions of Annex 18 and contain all the detailed instructions necessary for the safe international transport of dangerous goods by air. Interested persons may purchase copies of Annex 18 from ICAO at the following address:

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999 University Street, Montréal, Quebec, Canada, H3C 5H7
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VARIATIONS FROM THE TECHNICAL INSTRUCTIONS

In accordance with the provisions of Annex 18, 2.5, Contracting States are required to notify ICAO of those cases where they have adopted provisions different from those contained in these Instructions. The variations which have been notified by States are listed in Attachment 3, together with notified variations from airline operators.

UPDATING PROCEDURE

It is intended that the Technical Instructions be kept up to date by an ICAO body of experts. For this purpose, the ICAO Dangerous Goods Panel will continue to meet periodically to review comments received from States and interested international organizations, to consider any changed recommendations of the United Nations Subcommittee of Experts on the Transport of Dangerous Goods or the International Atomic Energy Agency, and to prepare revised editions of the Technical Instructions. Amendments recommended by the Dangerous Goods Panel will be reviewed by the Air Navigation Commission. The Council of ICAO will then consider, with a view to approval, the amended version of the Technical Instructions and authorize its publication. Amendments will be made available on www.icao.int/anb/fls/dangerousgoods.

OPERATIONAL USE OF THE TECHNICAL INSTRUCTIONS

≠ This edition of the Technical Instructions is required to be used for operations from 1 January 2015 and will remain valid until 31 December 2016 or until such later time as a new edition becomes valid.

GENERAL PRINCIPLES USED IN DEVELOPING THE PROVISIONS OF THE TECHNICAL INSTRUCTIONS

Dangerous goods can be carried safely by air transport providing certain principles are adopted. These principles have been used in developing these Technical Instructions and are set out below; they are intended to facilitate transport while giving a level of safety such that dangerous goods can be carried without placing an aircraft or its occupants at risk, providing all the requirements are fulfilled. They try to ensure that should an incident occur it cannot lead to an accident.

In general, dangerous goods are divided into various classes or divisions according to the hazard they present. A detailed list of individual commodities is shown which indicates the class or division into which each commodity falls as well as its acceptability for transport by air and under what conditions. Since such a list cannot be exhaustive, it also includes various generic or “not otherwise specified” entries to assist in the transport of those commodities not specifically listed by name.

Some dangerous goods are identified as too dangerous ever to be carried on any aircraft; some are forbidden in normal circumstances but may be carried with specific approval from the States concerned; some are restricted to carriage only on all-cargo aircraft; but most may be carried on both passenger and all-cargo aircraft, subject to meeting the required conditions. Those restricted to all-cargo aircraft are either in larger quantities than allowed on passenger aircraft or are forbidden on such aircraft; their transport is permitted due to their being usually accessible in flight and to the ability of the flight crew to consider a greater range of actions in an emergency than is possible on passenger aircraft.

The provisions are based on material produced by the United Nations, which is contained in the Recommendations on the Transport of Dangerous Goods (ST/SG/AC.10/1), the Recommendations on the Transport of Dangerous Goods: Tests and Criteria (ST/SG/AC.10/11), and, for radioactive materials, the International Atomic Energy Agency Regulations for the Safe Transport of Radioactive Material (TS-R-1 (ST-1, Revised)). Using a United Nations system ensures compatibility between the international modes of transport so a consignment may be carried by more than one mode without intermediate reclassification and repacking. Modifications are made to the system to take account of the peculiarities of air transport, while keeping in mind the need to ensure modal compatibility.

There are packing requirements of a general nature and packing instructions which, together, are intended to ensure that the safety of dangerous goods in air transport is assured by their packagings and the way in which they are packed. The packing requirements apply in almost all circumstances; the packing instructions mostly use UN packagings but sometimes these are not required, for instance when dangerous goods are in limited quantities. There is usually a wide choice of inner and outer packagings and single packagings are often permitted; sometimes, however, very restrictive packagings or only one or two types are permitted, or triple packagings are required. Generally, the quantity which can be put into an inner packaging and a complete package is strictly controlled. This is to minimize the inherent risk presented by the dangerous goods so that if an incident should occur, the situation would not produce an unacceptable hazard or lead to injury or major property damage.

After dangerous goods have been packed, the packages are marked with essential information, including the proper shipping name and UN number, and labels depicting all the potential hazard(s) of the contents are affixed. This is to ensure packages containing dangerous goods can be recognized and warning given of the potential hazard(s) without relying on information on accompanying documents. A dangerous goods transport document accompanies most consignments to provide detailed information about the goods so that, if required, there is a separate means of identifying the contents of packages.

There is generally no restriction on the number of packages of dangerous goods which can be loaded on an aircraft but there are provisions for their stowage. Incompatible dangerous goods are segregated and most are separated from passengers. The pilot-in-command is informed of what is on board an aircraft since, among other things, in an emergency the dangerous goods need to be considered when deciding on action. If an in-flight emergency does occur, the pilot-in-command needs to convey information to the air traffic services, in order to aid the response to such an accident or incident. In the event of an accident or incident, information is provided by the operator to the relevant authority as quickly as possible so as to ensure that any hazard arising from damage to the dangerous goods is minimized.

Dangerous goods accidents and incidents have to be reported so that an investigation by a relevant authority can establish the cause and take action to prevent a recurrence, wherever possible. In particular, any weakness or error in the Technical Instructions has to be identified.

Training is an important aid to achieving an understanding of the philosophy and requirements of the Technical Instructions. There is a need for everyone concerned to receive training on the subject either for general familiarization or to provide detailed knowledge, so that the responsibilities of the individual can be met. Dangerous goods are very unlikely to cause a problem when they are prepared and handled in compliance with the Technical Instructions.

USE OF THE TECHNICAL INSTRUCTIONS

The Technical Instructions are divided into eight Parts and four Attachments, with each Part and Attachment divided into Chapters and each Chapter divided into paragraphs and subparagraphs.

Within each Chapter, the Chapter number is incorporated into all of the paragraph numbers; thus, in Chapter 3, paragraph 2 carries the number “3.2”. When referring to a paragraph, it is necessary to identify the appropriate Part or Attachment; if the above example were located in Part 2, the reference to it would be shown as “2;3.2” (that is, Part 2; Chapter 3, paragraph 3.2). If the above example were located in Attachment 3, the reference would be shown as “A3;3.2” (that is, Attachment 3; Chapter 3, paragraph 3.2).

Figures and Tables are numbered sequentially within the Part or Attachment in which they appear. Thus, the second figure appearing in Part 4 is identified as “Figure 4-2” and the first table appearing in Part 3 is identified as “Table 3-1”. The first table appearing in the Attachments is identified as “Table A-1”.

Use of the Technical Instructions will be facilitated by reference to the detailed Index in Attachment 4.

The detailed content of the Technical Instructions gives all the necessary provisions to enable a consignment of dangerous goods to be correctly prepared for air transport. However, to assist the user of this document, the following step-by-step procedure is given for guidance to ensure all the applicable requirements for classifying, packing, labelling, marking and documenting are met.

It should be noted that the information given below is for guidance only and the relevant sections should be checked to ascertain their relevance to each consignment.

1. Determine the correct technical name or composition of the substance or the description of the article.

2. Ascertain whether the name or composition of the substance or article appears in Table 3-1 and if so what is the proper shipping name.

3. If the substance or article does not appear in Table 3-1, determine the class or division into which it falls by comparing its known properties with the definitions for the various classes, which are given in Part 2, Chapters 1 to 9. If the properties are not known, tests should be carried out to determine the appropriate class or division. If the article or substance is not listed by name in Table 3-1 and does not meet the definition of any of the classes, it is not subject to these requirements for the transport of dangerous goods. For substances or articles with multiple hazards, the provisions of Part 2, Introductory Chapter should be followed. Once all the properties of the substance or article are known, determine whether it is forbidden for transport under any circumstance according to the provisions of 1;2.1. If the substance or article does not come within the provisions of 1;2.1, determine the proper shipping name from the most appropriate of the n.o.s. entries in Table 3-1. Information on n.o.s. entries is given in Part 2, Introductory Chapter.

4. If it is desired to transport the substance or article under the provisions for excepted quantities, all the requirements of 3;5 must be met. The substance or article will then not be subject to any of the other requirements of the Technical Instructions other than those listed in 3;5.1.1.

5. If it is desired to transport the substance or article under the provisions for limited quantities, all the requirements of 3;4 must be met and also all the applicable requirements of the Technical Instructions, except where otherwise provided for in 3;4.

6. If the substance or article is not to be transported as an excepted quantity or a limited quantity, determine whether it is desired to transport it on passenger or cargo aircraft.

7. From the information given in columns 10 to 13 of Table 3-1, ascertain whether or not the substance or article is forbidden for transport on passenger aircraft or on both passenger and cargo aircraft.

8. If the substance or article is shown as forbidden for transport on either passenger aircraft or both passenger and cargo aircraft, ascertain whether it could be subject to an exemption under the provisions of 1;1.1.2, by consulting the appropriate national authority. If the substance or article is forbidden for transport on passenger aircraft, determine whether it can be transported on cargo aircraft.

9. If it is desired to transport the substance or article on passenger aircraft and this is not forbidden and the quantity per package does not exceed the permitted maximum net quantity per package given in column 11 of Table 3-1, determine the packing instruction number, quantity limitation, special provisions and any State or operator variations as shown in Tables 3-1 and 3-2 and Attachment 3.

10. If it is desired to transport the substance or article on a cargo aircraft or if it can only be carried on such aircraft, determine the packing instruction number, quantity limitation, special provisions and any State or operator variations as shown in Tables 3-1 and 3-2 and Attachment 3.

11. Determine the packing details from the relevant information or packing instruction in Part 4 and any special requirements from Part 2, Chapters 1 to 9 and Part 5, Chapter 1.

12. Select, where permitted, a method of packing from the packing instruction, or ascertain the provisions of the instruction and ensure the packagings to be used meet all the relevant requirements of Part 4, Chapter 1 and Part 6.

13. Prepare the consignment in accordance with all the relevant requirements of paragraphs 9 to 12 above.

14. Ensure all the appropriate labels and markings are affixed to or printed on the packages according to Part 5, Chapters 2 and 3.

15. Make any appropriate advance arrangements in accordance with Part 5, Chapter 1.

16. Prepare the transport documents and complete and sign the dangerous goods transport document in accordance with Part 5, Chapter 4.

17. Offer the complete consignment for transport by air.

THE SUPPLEMENT TO THE TECHNICAL INSTRUCTIONS

A Supplement to the Technical Instructions provides information on the safe transport of dangerous goods by air that is primarily of interest to States. Publishing this information in a separate document eliminates from the Technical Instructions material which the average user has neither the need nor the desire to know. The size and complexity of the Technical Instructions is thereby reduced and its comprehensibility enhanced. Examples of the subjects dealt with in the Supplement are guidance for the issue of certain exemptions or approvals by States and the reporting of dangerous goods accidents and incidents to ICAO by Contracting States.

The Supplement is published at the same time as the Technical Instructions and is distributed to the aviation administrations of all the Contracting States of ICAO. However, it is recognized that there may be occasions when the information in the Supplement might be helpful to other readers. Copies can be purchased from the Regional Offices of ICAO or from the Headquarters of ICAO using the following address:

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THE 2015-2016 EDITION

The Technical Instructions have been amended to make them as up to date as possible and to clarify, where necessary, the intent of the requirements. Account has been taken of comments received from users throughout the world. This has resulted in numerous minor changes in all parts of the book.

≠ It is intended, for the time being, to continue issuing new versions of the Technical Instructions biennially. This is the fifteenth biennial edition of the Technical Instructions and it will be valid for two years, i.e. from 1 January 2015 to 31 December 2016 or until such later time as a new edition becomes valid.

≠ The requirements have been amended so as to align them, as far as possible, with the Eighteenth Revised Edition of the United Nations *Recommendations on the Transport of Dangerous Goods* and the *International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material,* as incorporated therein.

≠ The amendments include the following:

— revisions to general provisions including:

  — addition of new exceptions related to ice jam control and landslide clearance (1;1.1.5.1 c));
  — addition of new exceptions for lamps containing dangerous goods (1;2.6) and consequential revisions to Special Provision A69 (3;3);
  — addition of new definitions for Large salvage packagings, Management system for the transport of radioactive material, Neutron radiation detector, and Radiation detection system (1;3);
  — revision of definition for net quantity (1;3);
  — addition of flight operations office and flight dispatcher to Tables 1-4 and 1-5 and renumbering of categories of staff in Table 1-5 (1;4);

— revisions to classification criteria including:

  — clarification that articles are not assigned to packing groups (2;Introductory Chapter, 2.4);
  — alternative classification criteria for Division 5.1 (2;5.2);
  — addition of new exception for samples drawn in connection with tissue or organ transplantation (2;6.3.2.3.7);
  — addition of new requirements for refrigerated or frozen specimens (2;6.3.2.3.8 e));
  — revision to the exception for medical devices or equipment (2;6.3.2.3.9.1);

— addition of new entries in Table 3-1 including:

  — **Refrigerant gas R 1113** (UN 1082);
  — **Hay**, **Straw** or **Bhusa** (UN 1327);
  — **Fibres, animal** or **vegetable** (UN 1372);
  — **Fish scrap, unstabilized** or **Fish meal, unstabilized** (UN 1374);
  — **Wool waste, wet** (UN 1387);
  — **Rags, oily** (UN 1856);
  — **Textile waste, wet** (UN 1857);
  — **Fish meal, stabilized** or **Fish scrap, stabilized** (UN 2216);
  — **Fumigated cargo transport unit** (UN 3359);
  — **Fibres, vegetable, dry** (UN 3360);
  — **Batteries, nickel-metal hydride** (UN 3496);
  — **Krill meal** (UN 3497);
  — **Uranium hexafluoride, radioactive material, excepted package** (UN 3507)
  — **Capacitor, asymmetric** (UN 3508);
  — **Packagings discarded, empty, uncleaned** (UN 3509);

— revisions to proper shipping names including:

  — replacement of **Air bag inflators**, **Air bag modules** and **Seat-belt pretensioners** with **Safety devices, pyrotechnic** (UN 0503)
  — replacement of **Air bag inflators, Air bag modules** and **Seat-belt pretensioners** with **Safety devices** (UN 3268)
  — replacement of **Blue asbestos** and **Brown asbestos** with **Asbestos, amphibole** (UN 2212)
  — replacement of **White asbestos** with **Asbestos, chrysotile** (UN 2590);

— revisions to special provisions including:

  — Special Provisions A4 and A5: new requirement for special provision code to be noted on dangerous goods transport document;
  — Special Provision A18: removal of exception for mercurous chloride;
  — Special Provision A19: new requirement for fire extinguishers and new provisions for large fire extinguishers;
  — Special Provision A28: revision to exception for **Dichloroisocyanuric acid, dry (**UN 2465) and **Dichloroisocyanuric acid salts (**UN 2465);
  — Special Provisions A32, A56 and A115: alignment with new proper shipping names for UN 0503 and UN 3268;
  — Special Provision A64: clarification that UN test series 2 applies;
  — Special Provision A75: new exception from pressure differential test and venting prohibition;
  — Special Provision A186: new transitional provisions for marking of energy storage capacity requirement on electric double layer capacitors;
  — Special Provision A187: clarification that chemicals under pressure containing components forbidden for transport by air must not be transported by air;
  — Special Provision A190: revision to provisions for neutron radiation detectors containing non-pressurized boron trifluoride;

— addition of the following new special provisions:

  — Special Provision A192: use of paint related material or printing ink related material as a proper shipping name;
  — Special Provision A195: articles containing a small pressure receptacle with a release device;
  — Special Provision A196: new UN No. 3508, **Capacitor, asymmetric**;
  — Special Provision A197: exceptions for small quantities of environmentally hazardous substances;
  — Special Provision A198: exceptions for UN 1327, **Hay** or **Straw** or **Bhusa** when not wet, damp or contaminated;
  — Special Provision A199: exceptions for UN 3496, **Batteries, nickel-metal hydride**;
  — Special Provision A200: prohibition on the transport by air of UN 3509, **Packagings discarded, empty, uncleaned**;
  — Special Provision A201: provision for the transport of a consignment of UN 3090 — **Lithium metal batteries** on passenger aircraft (see revisions to lithium battery provisions listed below);

— revisions to marking and labelling requirements including:

  — clarification of the minimum dimensions and format of dangerous goods marks and labels (3;4, 3;5, Packing Instructions 650 and 959, 5;2, 5;3; 6;2);
  — addition of minimum height requirement for salvage packaging and overpack marking (5;1.5 and 5;2.4.10);

— revisions to packing requirements including:

  — addition of provisions allowing for the use of supplemental packaging to provide additional protection (4;1.1.10.2);
  — clarification of testing requirements for outer packagings in Packing Instructions 203 and Y203 (4;4);
  — new provisions for large fire extinguishers to be transported unpackaged in Packing Instruction 213 (4;4);
  — addition of provisions to allow for limited venting of oxygen in the case of specialized peroxyacetic acid packagings in Packing Instruction 570;
  — addition of references to general provisions for lithium batteries in Packing Instructions 950, 951 and 952 (4;11);
  — addition of requirements for life-saving appliances containing batteries in Packing Instruction 955 (4;11);
  — clarification of criteria for passing the drop test in Packing Instruction Y963 (4;11);
  — addition of new UN 3508, **Capacitor, asymmetric** to Packing Instruction 971 (4;11);
  — removal of provisions for overpacks containing dangerous goods permitted on cargo aircraft only (5;1.1 e));

— revisions to packaging marking and test requirements:

  — addition of provisions for marking on UN tested packagings to allow greater flexibility on how last two digits of the year of manufacture must be displayed (6;2.1.1);
  — addition of transition provisions for ISO Standards for the construction and testing of UN cylinders and closed cryogenic receptacles (6;5);
  — addition of hot water bath test alternatives for small receptacles containing gas and fuel cell cartridges (6;5.4);

- revisions to operator responsibilities including:
  - guidance for operator acceptance staff in recognizing globally harmonized system GHS pictograms (7;1.1.2);
  - removal of provisions for overpacks containing dangerous goods permitted on cargo aircraft only (7;1.3.1);
  - timing of acceptance checks (7;1.3);
  - addition of requirement for information on unit load device identification tags to be legible and visible (7;2.8);
  - removal of segregation requirements for toxic and infectious substances (7;2.9);
  - removal of requirement for technical name to appear with the information to the pilot-in-command (7;4.1.1);
  - clarification of requirements for providing dangerous goods information to passengers (7;5.1);
  - update to indicative list of items with potential to include dangerous goods (7;6);
- revisions to provisions for radioactive material including:
  - radioactive material in the mail (1;2.3.2 c));
  - general provisions (1;6);
  - new provisions for uranium hexafluoride, radioactive material, excepted package (2; Introductory Chapter, 2;4.2, 2;7, Table 3-1 (UN 3507) (3;2), Special Provisions A193 and A194 (3;2), Packing Instruction 877);
  - new requirements criteria for fissile material (2;7);
  - revision to definitions for design, exclusive use and freight container (2;7.1.3);
  - revisions to provisions for determination of activity level (2;7.2.2);
  - revisions to exceptions for specimens of special form radiation that comprise or simulate radioactive material enclosed in a sealed capsule (2;7.2.3.3.6);
  - revisions to criteria for classifying packages as excepted packages (2;7.2.4)
  - addition of new exception from “RADIOACTIVE” marking for UN 2911 — **Radioactive material, excepted package — instruments** (2;7.2.4.1.1.3);
  - clarification of provisions for the transport of empty Type B(U) or Type B(M) packages (2;7.2.4.1.1.7, 5;2.4.5.4 and 5;4.1.5.7);
  - revisions to documentation and package marking requirements in Special Provision A78 (3;2);
  - revisions to packing requirements (4;9)
  - new requirements related to certificates issued by the competent authority (5;1.2.2);
  - new documentation requirements for excepted packages (5;1.2.4);
  - revisions to package testing requirements (6;7);
  - revisions to operator responsibilities (7;2.9);
- addition of new provisions for adsorbed gases including:
  - new definition (2;2.1.2 e));
  - new entries in Table 3-1 (UN Nos. 3510-3526) (3;2);
  - new Packing Instruction 219 (4;4);
  - new design, construction, inspection and testing requirements for UN cylinders (6;5.2.1.7);
- revisions to lithium battery provisions including:
  - prohibition on transport of lithium metal batteries as cargo on passenger aircraft (Table 3-1, Special Provision A201 and Packing Instruction 968);
  - clarification of testing requirements for lithium batteries (2;9.3);
  - addition of requirement for a transport document in Section IB of Packing Instructions 965 and 968;
  - replacement of references to gross quantity limits with net quantity limits in Section IB of Packing Instructions 965 and 968 (4;11);
  - clarification of the limit on the number of batteries permitted in a package when packed with equipment (Packing Instructions 966 and 969 (4;11));
  - new requirement prohibiting sound or light alarms from devices during transport (Packing Instructions 967 and 970 (4;11));
  - removal of redundancies from Packing Instructions 965 to 970 (4;11);
- revisions to list of dangerous goods permitted to be carried by passengers or crew (Table 8-1):
  - new provisions for medical devices other than radioisotopic cardiac pacemakers (Table 8-1, Item 4));
  - new provisions for portable medical electronic devices containing lithium batteries exceeding current limits (Table 8-1, Item 8));
  - expansion of provision for small cartridges fitted into a self-inflating life-jacket to include other types of self-inflating personal safety devices (Table 8-1, Item 18));
  - clarification to distinguish between devices containing batteries and spare batteries (Table 8-1, Item 19));

ABBREVIATIONS AND SYMBOLS

The abbreviations and symbols in the following table are used throughout the Instructions, or in the particular sections indicated, and have the meanings shown below.

Abbreviation or symbol	*Meaning*
A/m	amperes per metre
Bq	becquerel
cm	centimetre
°C	degree Celsius
G	gross mass as prepared for transport (as used in column 11 of Table 3-1)
g/m^2	grams per square metre
Gy	gray
Hz	hertz
IAEA	International Atomic Energy Agency
IP	inner packaging
ISO	the International Organization for Standardization
J/g	joules per gram
J/kg	joules per kilogram
K	kelvin
kg	kilogram
kgf	kilogram-force
kPa	kilopascal
L	litre
LC	lethal concentration
LD	lethal dose
L/kg	litres per kilogram
m	metre
mL	millilitre
mm	millimetre
mS/m	millisiemens per metre
N	newton
n.o.s.	not otherwise specified
Ω/m	ohm per metre
SI	the International System of Units developed by the General Conference of Weights and Measures (Système international d'unités)
Sv	sievert
UN	the United Nations Committee of Experts on the Transport of Dangerous Goods
W/m^2	watts per square metre
W/m/K	Watts per metre per Kelvin
µm	micrometre

≠	this symbol indicates changed text
+	this symbol indicates new or relocated text
>	this symbol indicates deleted text