



**WORKING PAPER**

**DANGEROUS GOODS PANEL (DGP)**

**TWENTY-SECOND MEETING**

**Montréal, 5 to 16 October 2009**

**Agenda Item 2: Development of recommendations for amendments to the *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) for incorporation in the 2011-2012 Edition**

**DRAFT AMENDMENTS OF THE TECHNICAL INSTRUCTIONS TO ALIGN TO THE UN RECOMMENDATIONS — PART 4**

(Presented by the Secretary)

**SUMMARY**

This working paper contains draft amendments to Part 4 of the Technical Instructions to reflect the decisions taken by the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals at its fourth session (Geneva, 12 December 2008). It also reflects amendments agreed by DGP-WG08 (The Hague, 3 to 7 November 2008) and DGP-WG09 (Auckland, 4 to 8 May 2009).

The DGP is invited to agree to the draft amendments in this working paper.

**Part 4**

**PACKING INSTRUCTIONS**

**INTRODUCTORY NOTES**

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*Note 3.— Pressure variations*

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DGP/22-WP/3, paragraph 3.2.15:

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Due to altitude, the ambient pressure experienced by a package in flight will be lower than standard atmospheric pressure at sea level pressure reductions will be encountered under flight conditions which may in extreme conditions be of the order of 68 kPa. Since receptacles or packagings will generally be filled at normal a standard atmospheric pressure of approximately 100 kPa, this lower ambient pressure will result in a pressure differential between the contents of the receptacle or package and the cargo compartment. For pressurized cargo compartments, the pressure differential may be approximately 25 kPa, while for non-pressurized [or partially pressurized] cargo compartments, the pressure differential may be as much as

~~75 kPa. These~~ This pressure differential reductions will tend to cause discharge of liquid contents or bursting of the receptacles or packagings during flight, unless each receptacle or packaging and its closures meet the packaging test requirements.

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## Chapter 1

### GENERAL PACKING REQUIREMENTS

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#### 1.1 GENERAL REQUIREMENTS APPLICABLE TO ALL CLASSES EXCEPT CLASS 7

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##### 1.1.3 Compatibility requirements

1.1.3.1 Parts of packagings which are in direct contact with dangerous goods:

- a) must not be affected or significantly weakened by those dangerous goods; ~~and~~
- b) must not cause a dangerous effect, e.g. catalyzing a reaction or reacting with the dangerous goods; ~~and~~
- c) must not allow permeation of the dangerous goods that could constitute a danger under normal conditions of transport.

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

1.1.3.2 Shippers must also ensure that any absorbent materials and the materials of intermediate packagings for liquids do not react dangerously with the liquid.

~~1.1.3.23~~ Materials, such as some plastics, which can be significantly softened or rendered brittle or permeable by the temperatures likely to be experienced during transport or because of the chemical action of the contents or the use of a refrigerant, must not be used. Even though certain packagings are specified in individual packing instructions, it is, nevertheless, the responsibility of the shipper to ensure that such packagings are, in every way, compatible with the articles or substances to be contained within such packagings. This particularly applies to corrosivity, permeability, softening, premature aging and embrittlement.

Particular attention should be paid to the following:

- a) the effect of fluorine on glass;
- b) the effects of corrosion on metals such as steel and aluminium; and
- c) consideration of the interaction (such as swelling, permeation, chemical degradation and environmental stress cracking) of substances with polymer materials such as polyethylene and polypropylene.

~~1.1.3.34~~ Shippers must ensure that all appropriate measures have been taken to ensure that the packagings used are compatible with the dangerous goods to be transported. Evidence of such measures or assessments must be made available to the competent authority upon request.

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*Editorial Note.*— Amendments to 1.1.4 below are as agreed by DGP/21 and as presented in Attachment 4 to 2009/2010 Edition of the TIs.

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1.1.4 The body and the closure of any packaging must be so constructed as to be able ~~to~~ adequately to resist the effects of temperature and vibration occurring in normal conditions of transport. ~~Stoppers, corks or other such friction-type closures must be held securely, tightly and effectively in place by positive means~~ secondary means. ~~(for e~~ Examples of such methods include: ~~by the use of adhesive tape, friction sleeves, welding or soldering, positive locking wires, locking rings, induction heat seals and child-resistant closures).~~ The closure device must be so designed that it is unlikely that it can be incorrectly or incompletely closed, ~~and must be such that it may be checked easily to determine that it is completely closed.~~

1.1.4.1 When secondary means of closure cannot be applied to an inner packaging containing liquids, the inner packaging must be securely closed and placed in a leakproof liner and then placed in an outer packaging.

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~~1.1.10 Unless otherwise provided in the packing instructions, liquids in Class 3, 4 or 8, or Division 5.1, 5.2 or 6.1 that are packaged in glass, earthenware, plastic or metal inner packagings must be packaged using absorbent material as follows:~~

~~a) Packing Group I liquids on passenger aircraft must be packaged using material capable of absorbing the entire contents of the inner packagings containing such liquids;~~

~~b) Packing Group I liquids on cargo aircraft and Packing Group II liquids and liquids in Division 5.2 on passenger and cargo aircraft must be packaged using a sufficient quantity of absorbent material to absorb the entire contents of any one of the inner packagings containing such liquids and, where they are of different sizes and quantities, sufficient absorbent material to absorb the contents of the inner packaging with the greatest quantity.~~

~~1.1.10.1 Absorbent material is not required if the inner packagings are so protected that breakage of them and leakage of their contents from the outer packaging will not occur during normal conditions of transport. Where absorbent material is required and an outer packaging is not liquid tight, a means of containing the liquid in the event of a leakage must be provided in the form of a leakproof liner, plastic bag or other equally efficient means of containment.~~

~~1.1.10.2 Absorbent material must not react dangerously with the liquid.~~

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1.1.13 Combination packagings containing liquid dangerous goods, excluding flammable liquids in inner packagings of 120 mL or less, or infectious substances in primary receptacles not exceeding 50 mL, **for hermetically sealed inner packagings each containing not more than 500 mL,** must be packed so that the closures on the inner packagings are upward and the upright position of the package must be indicated on it by the "Package orientation" label shown in 5;3.2.11 b). The words "This side up" or "This end up" may also be displayed on the top cover of the package.

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## Chapter 4

### CLASS 2 — GASES

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4.1.1.8 Valves must be designed and constructed in such a way that they are inherently able to withstand damage without release of the contents or must be protected from damage, which could cause inadvertent release of the contents of the cylinder and closed cryogenic receptacle, by one of the following methods:

- a) Valves are placed inside the neck of the cylinder and closed cryogenic receptacle and protected by a threaded plug or cap;
- b) Valves are protected by caps. Caps must possess vent holes of a sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;
- c) Valves are protected by shrouds or guards;
- d) Not used; or
- e) Cylinders and closed cryogenic receptacles are transported in an outer packaging. The packaging as prepared for transport must be capable of meeting the drop test specified in 6;4.3 at the Packing Group I performance level.

For cylinders and closed cryogenic receptacles with valves as described in b) and c), the requirements of ISO 11117:1998 must be met; for valves with inherent protection, the requirements of Annex ~~BA~~ of ISO 10297:1999 **2006** must be met. **For metal hydride storage systems, the valve protection requirements specified in ISO 16111:2008 must be met.**

4.1.1.9 Non-refillable cylinders and closed cryogenic receptacles must:

- a) be transported in an outer packaging, such as a box, or crate, or in shrink-wrapped trays or stretch-wrapped trays;
- b) not used;
- c) not be repaired after being put into service.

4.1.1.10 Refillable cylinders, other than closed cryogenic receptacles, must be periodically inspected according to the provisions of 6;5.1.6 and Packing Instruction 200 or 214. Cylinders and closed cryogenic receptacles must not be filled after they become due for periodic inspection but may be transported after the expiry of the time limit.

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## 4.2 PACKING INSTRUCTIONS

200	PACKING INSTRUCTION 200	200
<p>For cylinders, the general packing requirements of 1.1 and 4.1.1 must be met.</p> <p>...</p>		
<hr/> <p><i>Editorial Note.—</i> Moved from below. <i>Delete “)”</i> at left margin below:</p> <hr/>		
<p>4) Gas mixtures containing any of the following gases must not be offered for transport in aluminium alloy cylinders unless approved by the appropriate national authority of the State of Origin and the State of the Operator:</p> <ul style="list-style-type: none"> <li>UN 1037 <b>Ethyl chloride</b></li> <li>UN 1063 <b>Methyl chloride</b></li> <li>UN 1063 <b>Refrigerant gas R 40</b></li> <li>UN 1085 <b>Vinyl bromide, stabilized</b></li> <li>UN 1086 <b>Vinyl chloride, stabilized</b></li> <li>UN 1860 <b>Vinyl fluoride, stabilized</b></li> <li>UN 1912 <b>Methyl chloride and methylene chloride mixture</b></li> </ul>		
<p>4) Keys for the column “Special packing provisions”:</p> <p>Material compatibility</p> <ul style="list-style-type: none"> <li>a) Aluminium alloy cylinders are forbidden.</li> <li>b) Copper valves are forbidden.</li> <li>c) Metal parts in contact with the contents must not contain more than 65 per cent copper.</li> <li>d) When steel cylinders are used, only those bearing the “H” mark are permitted.</li> </ul> <p>Gas specific provisions:</p> <ul style="list-style-type: none"> <li>l) UN 1040 <b>Ethylene oxide</b> may also be packed in hermetically sealed glass ampoules (IP.8) or metal inner packagings (IP.3 and IP.3A) suitably cushioned in fibreboard, wooden or metal boxes meeting the Packing Group I performance level. The maximum quantity permitted in any glass inner packaging is 30 g, and the maximum quantity permitted in any metal inner packaging is 200 g. After filling, each inner packaging must be determined to be leak-tight by placing the inner packaging in a hot water bath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55°C is achieved. The maximum net mass in any outer packaging must not exceed 2.5 kg. When cylinders are used, they must be of the seamless or welded steel types that are equipped with suitable pressure relief devices. Each cylinder must be tested for leakage with an inert gas before each refilling and must be insulated with three coats of heat retardant paint or in any equally efficient manner. The maximum net quantity per cylinder must not exceed 25 kg.</li> <li>m) Cylinders must be filled to a working pressure not exceeding 5 bar.</li> <li>o) In no case must the working pressure or filling ratio shown in the table be exceeded.</li> <li>p) For UN 1001 <b>Acetylene, dissolved</b>, and UN 3374 <b>Acetylene, solvent free</b>: cylinders must be filled with a homogeneous monolithic porous mass; the working pressure and the quantity of acetylene must not exceed the values prescribed in the approval or in ISO 3807-1:2000 or ISO 3807-2:2000, as applicable.</li> </ul> <p>For UN 1001 <b>Acetylene, dissolved</b>, cylinders must contain a quantity of acetone or suitable solvent as specified in the approval (see ISO 3807-1:2000 or ISO 3807-2:2000, as applicable); cylinders fitted with pressure relief devices must be transported vertically.</p> <p>The test pressure of 52 bar applies only to cylinders conforming to ISO 3807-2:2000.</p>		

ra) This gas may also be packed in capsules under the following conditions:

- a) the mass of gas must not exceed 150 g per capsule;
- b) the capsules must be free from faults liable to impair their strength;
- c) the leakproofness of the closure must be ensured by an additional device (cap, crown, seal, binding, etc.) capable of preventing any leakage of the closure during transport;
- d) the capsules must be placed in an outer packaging of sufficient strength. A package must not weigh more than 75 kg.]

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**Table 2. LIQUEFIED GASES AND DISSOLVED GASES**

UN No.	Name and description	Class or Division	Subsidiary risk	LC <sub>50</sub> ml/m <sup>3</sup>	Cylinders	Test period, years	Test pressure, bar	Filling ratio	Special packing provisions
1037	<b>Ethyl chloride</b>	2.1			X	10	10	0.80	a, [ra.] w

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**202**

**PACKING INSTRUCTION 202**

**202**

This instruction applies to Class 2 refrigerated liquefied gases in open and closed cryogenic receptacles.

Requirements for closed cryogenic receptacles have been moved from the bottom of Packing Instruction 202.

**Requirements for ~~C~~losed cryogenic receptacles**

~~1) For closed cryogenic receptacles, the general requirements of 4;1 and 4;4.1 must be met.~~

~~2) The requirements of 6;5 must be met.~~

~~Closed cryogenic receptacles constructed as specified in 6;5 are authorized for the transport of refrigerated liquefied gases.~~

3) The closed cryogenic receptacles must be so insulated that they do not become coated with frost.

[Air, argon, carbon dioxide, helium, krypton, neon, nitrogen, nitrous oxide, oxygen, trifluoromethane and xenon refrigerated liquids may be carried to the extent permitted in these Instructions and in packagings meeting the requirements as set. These requirements also apply to empty packagings unless all parts are at ambient temperatures.]

**44) Test pressure**

Refrigerated liquids must be filled in closed cryogenic receptacles with the following minimum test pressures:

- a) For closed cryogenic receptacles with vacuum insulation, the test pressure must not be less than 1.3 times the sum of the maximum internal pressure of the filled receptacle, including during filling and discharge, plus 100 kPa (1 bar);
- b) For other closed cryogenic receptacles, the test pressure must be not less than 1.3 times the maximum internal pressure of the filled receptacle, taking into account the pressure developed during filling and discharge.

**27) Degree of filling**

For non-flammable, non-toxic refrigerated liquefied gases, the volume of liquid phase at the filling temperature and at a pressure of 100 kPa (1 bar) must not exceed 98 per cent of the water capacity of the pressure receptacle.

For flammable refrigerated liquefied gases the degree of filling must remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equalled the opening pressure of the relief valve, the volume of the liquid phase would reach 98 per cent of the water capacity at that temperature.

**38) Pressure-relief devices**

Every closed cryogenic receptacle, having a nominal capacity in excess of 550 L, must be provided with at least 2 pressure-relief devices. The pressure-relief device must be of the type that will resist dynamic forces including surge.

Closed cryogenic receptacles, having a nominal capacity of 550 L or less, must be provided with at least 1 pressure-relief device, and may in addition have a frangible disc in parallel with the spring loaded device in order to meet the requirements of 6;5.1.3.6.5. The pressure-relief device must be of the type that will resist dynamic forces including surge.

*Note.— The pressure-relief devices must meet the requirements of 6;5.1.3.6.4 and 6;5.1.3.6.5.*

**49) Compatibility**

Materials used to ensure the leakproofness of the joints or for the maintenance of the closures must be compatible with the contents. In the case of receptacles intended for the transport of oxidizing gases (i.e. with a subsidiary risk of 5.1), these materials must not react with these gases in a dangerous manner.

*Note.— Insulated packagings containing refrigerated liquid nitrogen fully absorbed in a porous material and intended for transport, at low temperature, of non-dangerous products are not subject to these Instructions provided the design of the insulated packaging would not allow the build-up of pressure within the container and would not permit the release of any refrigerated liquid nitrogen irrespective of the orientation of the insulated packaging.*

**Requirements for open cryogenic receptacles**

Only the following non-oxidizing refrigerated liquefied gases of Division 2.2 may be transported in open cryogenic receptacles: UN Nos. 1913, 1951, 1963, 1970, 1977, 2591, 3136 and 3158.

Open cryogenic receptacles must be constructed to meet the following requirements:

1. The receptacles must be designed, manufactured, tested and equipped in such a way as to withstand all conditions, including fatigue, to which they will be subjected during their normal use and during normal conditions of transport.
- 52.** The maximum water capacity for metal receptacles is 50 litres and for glass receptacles it is 5 litres.
3. The receptacle must have a double wall construction with the space between the inner and outer wall being evacuated (vacuum insulation). The insulation must prevent the formation of hoar frost on the exterior of the receptacle.
4. The materials of construction must have suitable mechanical properties at the service temperature.
5. Materials which are in direct contact with the dangerous goods must not be affected or weakened by the dangerous goods intended to be transported and must not cause a dangerous effect, e.g. catalysing a reaction or reacting with the dangerous goods.
- 76.** The glass vessel or flask must be protected by shock absorbent material or structure and placed in a strong outer packaging that permits the release of the gas. The package must be designed so that the upright position of the glass vessel or flask is guaranteed under normal conditions of transport. Packagings must conform to the requirements of 6;3.1 and meet Packing Group II performance test requirements in accordance with 6;4 and be marked in compliance with 6;2.

- ~~67.~~ The ~~open~~ receptacle must ~~have a secure base and~~ must be designed so that it will ~~to~~ remain ~~stable~~ in an upright position and will not topple under normal conditions of during transport (e.g. have a base whose smaller horizontal dimension is greater than the height of the centre of gravity when filled to capacity or be mounted on gimbals).
- ~~48.~~ Open cryogenic R Receptacles must be metal or glass vacuum insulated vessels or flasks vented to the atmosphere to prevent any increase in pressure within the package and the openings must be ~~designed and constructed to permit the release of the gas~~ fitted with devices allowing gases to escape, preventing any splashing out of liquid and so configured that they remain in place during transport.
- ~~3.~~ Receptacles must be equipped with devices which prevent the release of liquid.
9. Open cryogenic receptacles must bear the following marks permanently affixed e.g. by stamping, engraving or etching:
- the manufacturer's name and address;
  - the model number or name;
  - the serial or batch number;
  - the UN number and proper shipping name of gases for which the receptacle is intended;
  - the capacity of the receptacle in litres.
- ~~210.~~ The use of safety relief valves, check valves, frangible discs or similar devices in the vent lines is not permitted.
- ~~411.~~ Fill and discharge openings must be protected against the entry of foreign materials which might increase the internal pressure.
12. Open cryogenic receptacles are permitted for nitrogen, argon, krypton and xenon refrigerated liquids.]

**214**

**PACKING INSTRUCTION 214**

**214**

This Instruction applies to storage systems containing hydrogen absorbed in a metal hydride (UN 3468) individually or when contained in equipment and apparatus when transported on cargo aircraft.

~~The storage systems must be constructed and marked by the manufacturer indicating they meet the requirements of Annex B of IEC PAS 62282-6-1.~~

~~Storage systems employing cylinders other than UN marked and certified cylinders may be used if the design, construction, testing, approval and markings conform to the requirements of the appropriate national authority of the State in which they are approved and filled.~~

~~Storage systems for which prescribed periodic tests have become due must not be filled and offered for transport until such retests have been successfully completed.~~

[Storage systems with a water capacity of less than 1 L must be packaged in rigid outer packagings constructed of suitable material of adequate strength and design in relation to the packaging capacity and its intended use. They must be adequately secured or cushioned so as to prevent damage during normal conditions of transport.]

~~Storage systems must be filled in accordance with procedures provided by the manufacturer of the system in accordance with clause B4.17.2 of IEC PAS 62282-6-1.~~

1) For metal hydride storage systems, the general packing requirements of 4;4.1 must be met.

2) Only cylinders not exceeding 150 L in water capacity and having a maximum developed pressure not exceeding 25 MPa are covered by this packing instruction.

3) Metal hydride storage systems meeting the applicable requirements of 6;5 for the construction and testing of cylinders containing gas may be used for the transport of hydrogen only.

4) When steel cylinders or composite cylinders with steel liners are used, only those bearing the "H" mark, in accordance with 6;5.2.9 j) are permitted.

- 5) Metal hydride storage systems must meet the service conditions, design criteria, rated capacity, type tests, batch tests, routine tests, test pressure, rated charging pressure and provisions for pressure relief devices for transportable metal hydride storage systems specified in ISO 16111:2008 and their conformity and approval must be assessed in accordance with 6:5.2.5.
- 6) Metal hydride storage systems must be filled with hydrogen at a pressure not exceeding the rated charging pressure shown in the permanent markings on the system as specified by ISO 16111:2008.
- 7) The periodic test requirements for a metal hydride storage system must be in accordance with ISO 16111:2008 and carried out in accordance with 6:5.2.6, and the interval between periodic inspections must not exceed five years.

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## Chapter 5

### CLASS 3 — FLAMMABLE LIQUIDS

#### 5.1 PACKING INSTRUCTIONS

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DGP/22-WP/2, paragraph 3.2.6:

#### **Packing Instruction 377**

Passenger and cargo aircraft for Chlorosilanes

##### **General requirements**

Part 4, Chapter 1 requirements must be met, including:

##### **1) Compatibility requirements**

- Substances must be compatible with their packagings as required by 4:1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion.

##### **2) Closure requirements**

- Closures must meet the requirements of 4:1.1.4.

<u>UN number</u>	<u>Inner packaging (see 6:3.2)</u>	<b><u>COMBINATION PACKAGINGS</u></b>				<b><u>SINGLE PACKAGINGS</u></b>	
		<u>Net quantity per inner packaging — passenger</u>	<u>Net quantity per inner packaging — cargo</u>	<u>Total quantity per package — passenger</u>	<u>Total quantity per package — cargo</u>	<u>Passenger</u>	<u>Cargo</u>
<u>UN 1162, UN 1196,</u>	<u>Glass</u>	<u>1.0 L</u>	<u>1.0 L</u>	<u>1.0 L</u>	<u>5.0 L</u>	<u>No</u>	<u>5.0 L</u>
<u>UN 1250, UN 1298,</u>	<u>Plastic</u>	<u>Forbidden</u>	<u>Forbidden</u>				
<u>UN 1305, UN 2985</u>	<u>Steel</u>	<u>1.0 L</u>	<u>5.0 L</u>				



**OUTER PACKAGINGS OF COMBINATION PACKAGINGS**

Boxes

- Fibreboard (4G)
- Natural wood (4C1, 4C 2)
- Plastic (4H1, 4H2)
- Plywood (4D)
- Reconstituted wood (4F)
- Steel (4A)

Drums

- Fibre (1G)
- Plastic (1H2)
- Plywood (1D)
- Steel (1A2)

**SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY**

Composites

Plastic receptacle in steel drum (6HA1)

Cylinders

See 4:2.7

Drums

Steel (1A1)

Jerricans

Steel (3A1)

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**Chapter 8**

**CLASS 6 — TOXIC AND INFECTIOUS SUBSTANCES**

**8.1 PACKING INSTRUCTIONS**

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602	PACKING INSTRUCTION 602	602
<p>This packing instruction applies to UN 2814 and UN 2900.</p> <p>The following packagings are authorized provided the special packing provisions are met.</p> <p>Packagings meeting the requirements of 6:6 and approved accordingly consisting of:</p> <p>a) inner packagings comprising:</p> <ol style="list-style-type: none"> <li>1) leakproof primary receptacle(s);</li> <li>2) a leakproof secondary packaging;</li> <li>3) other than for solid infectious substances, an absorbent material in sufficient quantity to absorb the entire contents placed between the primary receptacle(s) and the secondary packaging; if multiple fragile primary receptacles are placed in a single secondary packaging, they <del>shall</del> <b>must</b> be either individually wrapped or separated so as to prevent contact between them;</li> </ol> <p>...</p> <p><del>f) Other dangerous goods must not be packed in the same packaging as Division 6.2 infectious substances unless they are necessary for maintaining the viability, stabilizing or preventing degradation or neutralizing the hazards of the infectious substances. A quantity of 30 ml or less of dangerous goods included in Class 3, 8 or 9 may be packed in each primary receptacle containing infectious substances provided these substances meet the requirements of 3:5. These small quantities of dangerous goods of Class 3, 8 or 9 are not subject to any additional requirements of these Instructions when packed in accordance with this packing instruction.</del></p> <p>fg) Alternative packagings for the transport of animal material may be authorized by the competent authority in accordance with the provisions of 4:2.8.</p> <p><del>g) A quantity of 30 ml or less of dangerous goods included in Class 3, 8 or 9 may be packed in each primary receptacle containing infectious substances provided these substances meet the requirements of 3:5.</del></p> <p>...</p>		

**622****PACKING INSTRUCTION 622****622**

The general packing requirements of 4;1 except 1.1.20 must be met.

Consignments must be prepared in such a manner that they arrive at their destination in good condition and present no hazard to persons or animals during transport.

Consignments must be packed in steel drums (1A2), aluminium drums (1B2), plywood drums (1D), fibre drums (1G), plastic drums (1H2), steel jerricans (3A2), plastic jerricans (3H2), wooden boxes (4C1, 4C2), plywood boxes (4D), reconstituted wood boxes (4F) or fibreboard boxes (4G). Packagings must meet Packing Group II requirements.

The packaging tests may be those appropriate for solids when there is sufficient absorbent material to absorb the entire amount of liquid present and the packaging is capable of retaining liquids.

In all other circumstances, the packaging tests must be those appropriate for liquids.

Packagings intended to contain sharp objects such as broken glass and needles must be resistant to puncture and retain liquids under the performance test conditions for the packaging.

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DGP/22-WP/2, paragraph 3.2.6:

**Packing Instruction 681**Passenger and cargo aircraft for Chlorosilanes**General requirements**

Part 4, Chapter 1 requirements must be met, including:

**1) Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion.

**2) Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

<u>UN number</u>	<u>Inner packaging (see 6;3.2)</u>	<b><u>COMBINATION PACKAGINGS</u></b>				<b><u>SINGLE PACKAGINGS</u></b>	
		<u>Net quantity per inner packaging — passenger</u>	<u>Net quantity per inner packaging — cargo</u>	<u>Total quantity per package — passenger</u>	<u>Total quantity per package — cargo</u>	<u>Passenger</u>	<u>Cargo</u>
<u>UN 3361, UN 3362</u>	<u>Glass</u>	<u>1.0 L</u>	<u>1.0 L</u>	<u>1.0 L</u>	<u>30.0 L</u>	<u>No</u>	<u>30.0 L</u>
	<u>Plastic</u>	<u>Forbidden</u>	<u>Forbidden</u>				
	<u>Steel</u>	<u>1.0 L</u>	<u>5.0 L</u>				

**OUTER PACKAGINGS OF COMBINATION PACKAGINGS**

Boxes

Fibreboard (4G)  
Natural wood (4C1, 4C2)  
Plastic (4H1, 4H2)  
Plywood (4D)  
Reconstituted wood (4F)  
Steel (4A)

Drums

Fibre (1G)  
Plastic (1H2)  
Plywood (1D)  
Steel (1A2)

**SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY**

Composites

Plastic receptacle in steel drum (6HA1)

Cylinders

See 4:2.7

Drums

Steel (1A1)

Jerricans

Steel (3A1)

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**Chapter 9**

**CLASS 7 — RADIOACTIVE MATERIAL**

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**9.1 GENERAL**

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**9.3 PACKAGES CONTAINING FISSILE MATERIAL**

Unless not classified as fissile in accordance with 2;7.2.3.5, packages containing fissile material must not contain:

- a) a mass of fissile material (or mass of each fissile nuclide for mixtures when appropriate) different from that authorized for the package design;
- b) any radionuclide or fissile material different from those authorized for the package design; or
- c) contents in a form or physical or chemical state, or in a spatial arrangement, different from those authorized for the package design;

as specified in their certificates of approval, where appropriate.

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## Chapter 10

## CLASS 8 — CORROSIVE SUBSTANCES

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DGP/22-WP/2, paragraph 3.2.6:

**Packing Instruction 876**Cargo aircraft only for Chlorosilanes**General requirements**

Part 4, Chapter 1 requirements must be met, including:

**1) Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion.

**2) Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

<b><u>COMBINATION PACKAGINGS</u></b>				<b><u>SINGLE PACKAGINGS</u></b>	
<u>UN number</u>	<u>Inner packaging (see 6:3.2)</u>	<u>Net quantity per inner packaging — cargo</u>	<u>Total quantity per package — cargo</u>	<u>Passenger</u>	<u>Cargo</u>
<u>UN 1724, UN 1728, UN 1747, UN 1753, UN 1762, UN 1763, UN 1766, UN 1767, UN 1769, UN 1771, UN 1781, UN 1784, UN 1799, UN 1800, UN 1801, UN 1804, UN 1816, UN 1818, UN 2434, UN 2437, UN 2986, UN 2987</u>	<u>Glass</u>	<u>1.0 L</u>	<u>30.0 L</u>	<u>No</u>	<u>30.0 L</u>
	<u>Plastic</u>	<u>Forbidden</u>			
	<u>Steel</u>	<u>5.0 L</u>			

**OUTER PACKAGINGS OF COMBINATION PACKAGINGS**Boxes

Fibreboard (4G)  
Natural wood (4C1, 4C2)  
Plastic (4H1, 4H2)  
Plywood (4D)  
Reconstituted wood (4F)  
Steel (4A)

Drums

Fibre (1G)  
Plastic (1H2)  
Plywood (1D)  
Steel (1A2)

**SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY**CompositesPlastic receptacle in steel drum (6HA1)CylindersSee 4:2.7DrumsSteel (1A1)JerricansSteel (3A1)

...

## Chapter 11

### CLASS 9 — MISCELLANEOUS DANGEROUS GOODS

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#### Packing Instruction 954

Passenger and cargo aircraft for UN 1845 only

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#### ADDITIONAL PACKING REQUIREMENTS

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Dry ice used for other than dangerous goods may be shipped in a unit load device or other type of pallet prepared by a single shipper provided that:

- a) the shipper has made prior arrangements with the operator;

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DGP/22-WP/2, paragraph 3.2.30:

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- b) the unit load device, or other type of pallet, must allow the venting of the carbon dioxide gas to prevent a dangerous build-up of pressure (the marking requirements of 5:2 and the labelling requirements of 5:3 do not apply to the unit load device); and
- c) the shipper must provide the operator with written documentation stating the total quantity of the dry ice contained in the unit load device or other type of pallet.

#### Packing Instruction 955

Passenger and cargo aircraft for UN 2990 and UN 3072 only

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#### ADDITIONAL PACKING REQUIREMENTS

The description "Life-saving appliances, self-inflating" (UN 2990) is intended to apply to life-saving appliances that present a hazard if the self-inflating device is activated accidentally.

Life-saving appliances, such as life rafts, life vests, aircraft survival kits or aircraft evacuation slides, may only contain the dangerous goods listed below:

- a) Division 2.2 gases, must be contained in cylinders which conform to the requirements of the appropriate national authority of the country in which they are approved and filled. Such cylinders may be connected to the life-saving appliance. These cylinders may include installed actuating cartridges (cartridges, power device of Division 1.4C and 1.4S) provided the aggregate quantity of deflagrating (propellant) explosives does not exceed 3.2 grams per unit. When the cylinders are shipped separately, they ~~shall~~ must be classified as appropriate for the Division 2.2 gas contained and need not be marked, labelled or described as explosive articles;

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## Packing Instruction 959

Passenger and cargo aircraft for UN 3245 only

### General requirements

Part 4, Chapter 1 and 2 requirements must be met, including:

#### 1) Compatibility requirements

- Substances must be compatible with their packagings as required by 4;1.1.3.

#### 2) Closure requirements

- Closures must meet the requirements of 4;1.1.4.

The following packagings are authorized:

1) Packagings meeting the provisions of 4;1.1.1, 4;1.1.3.1, 4;1.1.5 and 4;2 and so designed that they meet the construction requirements of 6;3. Outer packagings constructed of suitable material of adequate strength and designed in relation to the packaging capacity and its intended use must be used. Where this packing instruction is used for the transport of inner packagings of combination packagings the packaging must be designed and constructed to prevent inadvertent discharge during normal conditions of transport.

2) Packagings, which need not conform to the packaging test requirements of Part 6, but conforming to the following:

a) an inner packaging comprising:

- 1) primary receptacle(s) and a secondary packaging, the primary receptacle(s) or the secondary packaging must be leakproof for liquids or siftproof for solids;
- 2) for liquids, absorbent material placed between the primary receptacle(s) and the secondary packaging. The absorbent material must be in a quantity sufficient to absorb the entire contents of the primary receptacle(s) so that any release of the liquid substance will not compromise the integrity of the cushioning material or of the outer packaging;
- 3) if multiple fragile primary receptacles are placed in a single secondary packaging they must be individually wrapped or separated to prevent contact between them;

b) An outer packaging must be strong enough for its capacity, mass and intended use, and with a smallest external dimension of at least 100 mm.

For transport, the mark illustrated below must be displayed on the external surface of the outer packaging on a background of a contrasting colour and must be clearly visible and legible. The mark must be in the form of a square set at an angle of 45° (diamond-shaped) with each side having a length of at least 50 mm; the width of the line must be at least 2 mm and the letters and numbers must be at least 6 mm high.

Insert new figure:



UN number and proper shipping name	State	Inner packaging (see 6:3.2)	Quantity — passenger	Quantity — cargo	SINGLE PACKAGINGS
UN 3245 Genetically modified organisms	Liquid	100 mL	No limit	No limit	No
	Solid	100 g	No limit	No limit	

**ADDITIONAL PACKING REQUIREMENTS**

- The packaging must comply with all the requirements of Packing instruction 602.
- When dry ice or liquid nitrogen is used, all applicable requirements of these Instructions must be met. When used, ice or dry ice must be placed outside the secondary packagings or in the outer packaging or an overpack. Interior supports must be provided to secure the secondary packagings in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack must be leakproof. If dry ice is used, the requirements in Packing Instruction 954 must be met.
- The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

**Packing Instruction 960**

Passenger and cargo aircraft for UN 3316 only

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**ADDITIONAL PACKING REQUIREMENTS**

DGP/22-WP/2, paragraph 3.2.16:

- Kits may contain dangerous goods which require segregation according to Table 7-1. ~~The packing group assigned to the kit as a whole must be the most stringent packing group assigned to any individual substance contained in the kit.~~
- Kits must not be packed with other dangerous goods in the same outer packaging, with the exception of dry ice. If dry ice is used, the requirements in Packing Instruction 954 must be met.

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**Packing Instruction 962**

Passenger and cargo aircraft for UN 3363 only

**General requirements**

Part 4, Chapter 1 requirements must be met (except that the requirements of 4;1.1.2, 4;1.1.8, 4;1.1.10, 4;1.1.13 and 4;1.1.16 do not apply), including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

DGP/22-WP/2, paragraph 3.2.29:

This entry only applies to apparatus or machinery containing dangerous goods as a residue or as an integral element of the machinery or apparatus. It must not be used for apparatus or machinery for which a proper shipping name exists in Table 3-1. For other than fuel system components, apparatus or machinery may only contain one or more of the following dangerous goods permitted under 3;4.1.2, or UN 2807 or and gases of Division 2.2 without subsidiary risk but excluding refrigerated liquefied gases.

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DGP/22-WP/3, paragraph 3.2.10:

**Y910963**

**PACKING INSTRUCTION Y910963**

**Y910963**

Consumer commodities are materials that are packaged and distributed in a form intended or suitable for retail sale for purposes of personal care or household use. These include items administered or sold to patients by doctors or medical administrations. Except as otherwise provided below, dangerous goods packed in accordance with this packing instruction do not need to comply with 4;1 or Part 6 of these Instructions; they must, however, comply with all other applicable requirements.

- a) Each packaging must be designed and constructed to prevent leakage that may be caused by changes in altitude and temperature during air transport.
- b) Inner packagings that are breakable (such as earthenware, glass or brittle plastic) must be packed to prevent breakage and leakage under conditions normally incident to transport. These completed packagings must be capable of withstanding a 1.2 m drop on solid concrete in the position most likely to cause damage. Each package offered for transport must be capable of withstanding, without breakage or leakage of any inner packaging and without significant reduction of effectiveness, a force applied to the top surface for a duration of 24 hours equivalent to the total weight of identical packages if stacked to a height of 3 m (including the test sample).
- c) When filling receptacles for liquids, sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the receptacle will occur as a result of an expansion of the liquid caused by temperatures likely to prevail during transport. Unless specific requirements are prescribed in national rules or international agreements, liquids must not completely fill a receptacle at a temperature of 55°C. At this temperature a minimum ullage of 2 per cent should be left. The primary packaging (which may include composite packaging), for which retention of the liquid is a basic function, must be capable of withstanding, without leakage, an internal pressure which produces a pressure differential of not less than 75 kPa or a pressure related to the vapour pressure of the liquid to be conveyed, whichever is the greater. The pressure related to the vapour pressure must be determined by the method shown in 4;1.1.6. Tests on sample receptacles must be carried out to demonstrate the capability of the primary packaging to withstand the above pressure.
- d) Stoppers, corks or other such friction-type closures must be held securely, tightly and effectively in place by positive means. The closure device must be so designed that it is extremely improbable that it can be incorrectly or incompletely closed and must be such that it may be easily checked to determine that it is completely closed.
- e) Inner packagings must be tightly packed in strong outer packagings and must be so packed, secured or cushioned as to prevent any breakage, puncture or leakage of contents into the outer packaging(s) during normal conditions of transport. Absorbent material must be provided for glass or earthenware inner packaging(s) containing consumer commodities in Class 2 or 3 or liquids of Division 6.1, in sufficient quantity to absorb the liquid contents of the largest of such inner packagings contained in the outer packaging. Absorbent and cushioning material must not react dangerously with the contents of the inner packagings. Notwithstanding the above, absorbent material may not be required if the inner packagings are so protected that breakage of the inner packagings and leakage of their contents from the outer packaging will not occur during normal conditions of transport.
- f) Inner packagings containing liquids, excluding flammable liquids in inner packagings of 120 mL or less, must be packed with their closures upward and the upright position of the package must be indicated by "Package orientation" labels (Figure 5-26). These labels, or pre-printed package orientation labels meeting the same specification as either Figure 5-26 or ISO Standard 780-1997, must be affixed to, or printed on, at least two opposite vertical sides of the package with the arrows pointing in the correct direction.
- g) Each completed package as prepared for shipment must not exceed a gross mass of 30 kg G.



- h) Class 2 substances must be further limited to aerosol products containing non-toxic compressed or liquefied gas(es) that are necessary to expel liquids, powders or pastes, packed in inner non-refillable non-metal receptacles not exceeding 120 mL capacity each, or in inner non-refillable metal receptacles not exceeding 820 mL capacity each (except that flammable aerosols must not exceed 500 mL capacity each), subject in either case to the following provisions:
- 1) the pressure in the aerosol must not exceed 1 500 kPa at 55°C and each receptacle must be capable of withstanding without bursting a pressure of at least 1.5 times the equilibrium pressure of the contents at 55°C;
  - 2) if the pressure in the aerosol exceeds 970 kPa at 55°C but does not exceed 1 105 kPa at 55°C, an inner IP.7, IP.7A or IP.7B metal receptacle must be used;
  - 3) if the pressure in the aerosol exceeds 1 105 kPa at 55°C but does not exceed 1 245 kPa at 55°C, an IP.7A or IP.7B metal receptacle must be used;
  - 4) if the pressure in the aerosol exceeds 1 245 kPa at 55°C, an IP.7B metal receptacle must be used;
  - 5) IP.7B metal receptacles having a minimum burst pressure of 1 800 kPa may be equipped with an inner capsule charged with a non-flammable, non-toxic compressed gas to provide the propellant function. In this case, the pressures indicated in 1), 2), 3) or 4) do not apply to the pressure within the capsule. The quantity of gas contained in the capsule must be so limited such that the minimum burst pressure of the receptacle would not be exceeded if the entire gas content of the capsule were released into an aerosol;
  - 6) the liquid contents must not completely fill the closed receptacle at 55°C;
  - 7) each aerosol exceeding 120 mL capacity must have been heated until the pressure in the aerosol is equivalent to the equilibrium pressure of the contents at 55°C, without evidence of leakage, distortion or other defect; and
  - 8) the valves must be protected by a cap or other suitable means during transport.
- i) For aerosols containing a biological or medical preparation which will be deteriorated by a heat test and which are non-toxic and non-flammable, packed in inner non-refillable receptacles not exceeding 575 mL capacity each, the following provisions are applicable:
- 1) the pressure in the aerosol must not exceed 970 kPa at 55°C;
  - 2) the liquid contents must not completely fill the closed receptacle at 55°C;
  - 3) one aerosol out of each lot of 500 or less must be heated until the pressure in the aerosol is equivalent to the equilibrium pressure of the contents at 55°C, without evidence of leakage, distortion or other defect; and
  - 4) the valves must be protected by a cap or other suitable means during transport.
- j) Except for aerosols, inner packagings must not exceed:
- 1) 500 mL for liquids; and
  - 2) 500 g for solids.
- k) Consumer commodities shipped according to these provisions may be shipped in a unit load device or other type of pallet prepared by a single shipper provided they contain no other dangerous goods. The shipper must provide the operator with written documentation stating the number of packages of consumer commodities contained in each unit load device or other type of pallet.
- l) The gross mass on the dangerous goods transport document must be shown as:
- 1) for one package, the actual gross mass of the package;
  - 2) for more than one package, either the actual gross mass of each package or as the average mass of the packages. (For example, if there are 10 packages and the total gross mass of them is 100 kg, the dangerous goods transport document may show this as “average gross mass per package 10 kg”.)
- m) Packages prepared in accordance with these provisions must be durably and legibly marked with the mark shown in Figure 5-3.

*Editorial Note.*— All Lithium battery packing instructions (965 – 970) have been reproduced in their entirety in order to facilitate discussion by the panel.

## Packing Instruction 965

Passenger and cargo aircraft for UN 3480

This entry applies to lithium ion or lithium polymer batteries in Class 9 (Section I) and lithium ion or lithium polymer batteries subject to specific requirements of these Instructions (Section II).

### SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the *UN Manual of Tests and Criteria*, Part III, section 38.3; and

DGP/22-WP/3, paragraph 3.5.1.15:

[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

### General requirements

Part 4;1 requirements must be met.

<i>Contents</i>	<i>Package quantity (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium ion cells and batteries	5 kg G	35 kg G

### ADDITIONAL PACKING REQUIREMENTS

- Lithium ion cells and batteries must be protected against short circuits.
- Packagings must meet the Packing Group II performance requirements.
- Lithium ion batteries with a mass of 12 kg or greater and having a strong, impact-resistant outer casing, or assemblies of such batteries, may be transported when packed in strong outer packagings and protective enclosures not subject to the requirements of Part 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.
- Batteries manufactured after 31 December 2011 must be marked with the Watt hour rating on the outside case.

**OUTER PACKAGINGS**

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

**SECTION II**

Lithium ion cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium ion cells and batteries may be offered for transport if they meet the following:

- 1) for lithium ion cells, the Watt-hour rating (see Attachment 2) is not more than 20 Wh;
- 2) for lithium ion batteries, the Watt-hour rating is not more than 100 Wh;
  - the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010;
- 3) each cell or battery is of the type proven to meet the requirements of each test in the *UN Manual of Tests and Criteria*, Part III, section 38.3.

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DGP/22-WP/3, paragraph 3.5.1.15:

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*[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]*

**General requirements**

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

<i>Contents</i>	<i>Package quantity (Section II)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium ion cells and batteries	10 kg G	10 kg G

**ADDITIONAL PACKING REQUIREMENTS**

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium ion cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;

- special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

**OUTER PACKAGINGS**

*Boxes*

*Drums*

*Jerricans*

Strong outer packagings

**Packing Instruction 966**

Passenger and cargo aircraft for UN 3481 (packed with equipment) only

This entry applies to lithium ion or lithium polymer batteries packed with equipment in Class 9 (Section I) and lithium ion or lithium polymer batteries packed with equipment subject to specific requirements of these Instructions (Section II).

**SECTION I**

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the *UN Manual of Tests and Criteria*, Part III, section 38.3; and

DGP/22-WP/3, paragraph 3.5.1.15:

**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

**General requirements**

Part 4;1 requirements must be met.

<i>Contents</i>	<i>Package quantity (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Quantity of lithium ion cells and batteries per overpack, excluding equipment	5 kg	35 kg

**ADDITIONAL PACKING REQUIREMENTS**

- Lithium ion cells and batteries must be protected against short circuits.
- The completed package for the cells or batteries must meet the Packing Group II performance requirements.
- The equipment and the packages of lithium cells or batteries must be placed in an overpack. The overpack must bear applicable marks and labels as set out in Part 5;1 and 5;2.4.10.
- For the purpose of this packing instruction, “equipment” means apparatus requiring the lithium ion batteries with which it is packed for its operation.
- Batteries manufactured after 31 December 2011 must be marked with the Watt hour rating on the outside case.

**OUTER PACKAGINGS**

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

**SECTION II**

Lithium ion cells and batteries (including lithium polymer) packed with equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium ion cells and batteries may be offered for transport if they meet the following:

- 1) for lithium ion cells, the Watt-hour rating (see Attachment 2) is not more than 20 Wh;
- 2) for lithium ion batteries, the Watt-hour rating is not more than 100 Wh;
  - the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010;
- 3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

DGP/22-WP/3, paragraph 3.5.1.15:

[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]

**General requirements**

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

**ADDITIONAL PACKING REQUIREMENTS**

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- The maximum number of batteries in each package must be the minimum number required to power the equipment, plus two spares.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium ion cells or batteries;

- the package must be handled with care and that a flammability hazard exists if the package is damaged;
- special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
- a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

#### OUTER PACKAGINGS

*Boxes*

*Drums*

*Jerricans*

Strong outer packagings

### Packing Instruction 967

Passenger and cargo aircraft for UN 3481 (contained in equipment) only

This entry applies to lithium ion or lithium polymer batteries contained in equipment in Class 9 (Section I) and lithium ion or lithium polymer batteries contained in equipment subject to specific requirements of these Instructions (Section II).

#### SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3; and

DGP/22-WP/3, paragraph 3.5.1.15:

**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

#### General requirements

Part 4;1 requirements must be met.

<i>Contents</i>	<i>Net quantity per piece of equipment (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium ion batteries contained in equipment	5 kg	35 kg

#### ADDITIONAL PACKING REQUIREMENTS

- Outer packaging must be waterproof or made waterproof through the use of a liner, such as a plastic bag unless the equipment is made waterproof by nature of its construction.
- The equipment must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.
- **Batteries manufactured after 31 December 2011 must be marked with the Watt hour rating on the outside case.**

**OUTER PACKAGINGS**

*Boxes*

*Drums*

*Jerricans*

Strong outer packagings

**SECTION II**

Lithium ion cells and batteries (including lithium polymer) contained in equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium ion cells and batteries may be offered for transport if they meet the following:

- 1) for lithium ion cells ,the Watt-hour rating (see Attachment 2) is not more than 20 Wh;
- 2) for lithium ion batteries, the Watt-hour rating is not more than 100 Wh;
  - the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2009, which may be transported in accordance with the provisions of this section and without the marking until 31 December 2010;
- 3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

DGP/22-WP/3, paragraph 3.5.1.15:

*[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]*

**General requirements**

Equipment must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

**ADDITIONAL PACKING REQUIREMENTS**

- The equipment must be equipped with an effective means of preventing accidental activation.
- Cells and batteries must be protected so as to prevent short circuits.
- The equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained.
- Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label (Figure 5-31) *(except button cell batteries installed in equipment (including circuit boards))*.
- Each consignment with packages bearing the lithium battery handling label must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium ion cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
  - a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

**OUTER PACKAGINGS**

*Boxes*

*Drums*

*Jerricans*

Strong outer packagings

## Packing Instruction 968

Passenger and cargo aircraft for UN 3090

This entry applies to lithium metal or lithium alloy batteries in Class 9 (Section I) and lithium metal or lithium alloy batteries subject to specific requirements of these Instructions (Section II).

### SECTION I

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3; and

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DGP/22-WP/3, paragraph 3.5.1.15:

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**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

### General requirements

Part 4;1 requirements must be met.

Contents	<i>Package quantity (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium metal cells and batteries	2.5 kg G	35 kg G

### ADDITIONAL PACKING REQUIREMENTS

- Lithium metal cells and batteries must be protected against short circuits.
- Packagings must meet the Packing Group II performance requirements.
- Lithium batteries with a mass of 12 kg or greater and having a strong, impact-resistant outer casing, or assemblies of such batteries, may be transported when packed in strong outer packagings and protective enclosures not subject to the requirements of Part 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.
- For lithium metal cells and batteries prepared for transport on passenger aircraft as Class 9:
  - Cells and batteries offered for transport on passenger aircraft must be packed in intermediate or outer rigid metal packaging.
  - Cells and batteries must be surrounded by cushioning material that is non-combustible and non-conductive, and placed inside an outer packaging.



**OUTER PACKAGINGS**

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

**SECTION II**

Lithium metal or lithium alloy cells and batteries offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium metal or lithium alloy cells and batteries may be offered for transport if they meet the following:

- 1) for a lithium metal cell, the lithium content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;
- 3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

DGP/22-WP/3, paragraph 3.5.1.15:

**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

**General requirements**

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

<i>Contents</i>	<i>Package quantity (Section II)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium metal cells and batteries	2.5 kg G	2.5 kg G

**ADDITIONAL PACKING REQUIREMENTS**

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium metal cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
  - a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

**OUTER PACKAGINGS***Boxes**Drums**Jerricans*

Strong outer packagings

**Packing Instruction 969**

Passenger and cargo aircraft for UN 3091 (packed with equipment) only

This entry applies to lithium metal or lithium alloy batteries packed with equipment in Class 9 (Section I) and lithium metal or lithium alloy batteries packed with equipment subject to specific requirements of these Instructions (Section II).

**SECTION I**

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3; and

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DGP/22-WP/3, paragraph 3.5.1.15:

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**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

**General requirements**

Part 4;1 requirements must be met.

<i>Contents</i>	<i>Package quantity (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Quantity of lithium metal cells and batteries per overpack, excluding equipment	5 kg	35 kg

**ADDITIONAL PACKING REQUIREMENTS**

- Lithium metal cells and batteries must be protected against short circuits.
- The completed package for the cells or batteries must meet the Packing Group II performance requirements.
- Each completed package containing lithium cells or batteries must be marked and labelled in accordance with the applicable requirements of 5;1, 5;2 and 5;3.

- The equipment and the packages of lithium cells or batteries must be placed in an overpack. The overpack must bear applicable marks and labels as set out in 5;1 and 5;2.4.10.
- For the purpose of this packing instruction, “equipment” means apparatus requiring the lithium batteries with which it is packed for its operation.
- For lithium metal cells and batteries prepared for transport on passenger aircraft as Class 9:
  - Cells and batteries offered for transport on passenger aircraft must be packed in intermediate or outer rigid metal packaging surrounded by cushioning material that is non-combustible and non-conductive and placed inside an outer packaging.

#### OUTER PACKAGINGS

<i>Boxes</i>	<i>Drums</i>	<i>Jerricans</i>
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastic (3H2)
Natural wood (4C1, 4C2)	Plastic (1H2)	Steel (3A2)
Plastic (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

#### SECTION II

Lithium metal cells and batteries packed with equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium metal cells and batteries may be offered for transport if they meet the following:

- 1) for a lithium metal cell, the lithium content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g;
- 3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

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DGP/22-WP/3, paragraph 3.5.1.15:

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*[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]F*

#### General requirements

Batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

#### ADDITIONAL PACKING REQUIREMENTS

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery.
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- The maximum number of batteries in each package must be the minimum number required to power the equipment, plus two spares.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be labelled with a lithium battery handling label (Figure 5-31).
- Each consignment must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium metal cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
  - a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

**OUTER PACKAGINGS***Boxes**Drums**Jerricans*

Strong outer packagings

**Packing Instruction 970**

Passenger and cargo aircraft for UN 3091 (contained in equipment) only

This entry applies to lithium metal or lithium alloy batteries contained in equipment in Class 9 (Section I) and lithium metal or lithium alloy batteries contained in equipment subject to specific requirements of these Instructions (Section II).

**SECTION I**

Section I requirements apply to each cell or battery type that has been determined to meet the criteria for assignment to Class 9.

Each cell or battery must:

- 1) be of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3; and

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DGP/22-WP/3, paragraph 3.5.1.15:

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**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

- 2) incorporate a safety venting device or be designed to preclude a violent rupture under conditions normally incident to transport and be equipped with an effective means of preventing external short circuits.

Each battery containing cells or a series of cells connected in parallel must be equipped with an effective means, as necessary, to prevent dangerous reverse current flow (e.g. diodes, fuses).

Cells, and batteries containing one or more cells, with a liquid cathode containing sulphur dioxide, sulphuryl chloride or thionyl chloride which have been discharged to the extent that the open circuit voltage is less than the lower of:

- a) two volts; or
- b) two-thirds of the voltage of the undischarged cell;

are forbidden from transport.

**General requirements**

Part 4;1 requirements must be met.

<i>Package contents</i>	<i>Net quantity per piece of equipment (Section I)</i>	
	<i>Passenger</i>	<i>Cargo</i>
Lithium metal batteries	5 kg	35 kg

**ADDITIONAL PACKING REQUIREMENTS**

- Outer packaging must be waterproof or made waterproof through the use of a liner, such as a plastic bag unless the equipment is made waterproof by nature of its construction.
- The equipment must be secured against movement within the outer packaging and be packed so as to prevent accidental operation during air transport.
- The quantity of lithium metal contained in any piece of equipment must not exceed 12 g per cell and 500 g per battery.

**OUTER PACKAGINGS**

*Boxes*

*Drums*

*Jerricans*

Strong outer packaging

**SECTION II**

Lithium metal cells and batteries contained in equipment offered for transport are not subject to other additional requirements of these Instructions if they meet the requirements of this section.

Lithium batteries, identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (e.g. those being returned to the manufacturer for safety reasons).

Lithium metal cells and batteries may be offered for transport if they meet the following:

- 1) for a lithium metal cell, the lithium content is not more than 1 g;
- 2) for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g.
- 3) each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3.

DGP/22-WP/3, paragraph 3.5.1.15:

**[Note.— Batteries are subject to these tests irrespective of whether the cells of which they are composed have been so tested.]**

**General requirements**

Equipment containing batteries must be packed in strong outer packagings that conform to Part 4;1.1.1, 1.1.3.1 and 1.1.9 (except 1.1.9.1).

**ADDITIONAL PACKING REQUIREMENTS**

- The equipment must be equipped with an effective means of preventing accidental activation.
- Cells and batteries must be protected so as to prevent short circuits.
- The equipment must be packed in strong outer packagings constructed of suitable material of adequate strength and design in relation to the packaging's capacity and its intended use unless the battery is afforded equivalent protection by the equipment in which it is contained.
- Each package containing more than four cells or more than two batteries installed in equipment must be labelled with a lithium battery handling label (Figure 5-31) **(except button cell batteries installed in equipment (including circuit boards)).**
- Each consignment with packages bearing the lithium battery handling label must be accompanied with a document such as an air waybill with an indication that:
  - the package contains lithium metal cells or batteries;
  - the package must be handled with care and that a flammability hazard exists if the package is damaged;
  - special procedures should be followed in the event the package is damaged, to include inspection and repacking if necessary; and
  - a telephone number for additional information.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

**OUTER PACKAGINGS**

*Boxes*

*Drums*

*Jerricans*

Strong outer packagings

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