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**COMMITTEE OF EXPERTS ON THE TRANSPORT  
OF DANGEROUS GOODS**

(Twenty-first session,  
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agenda item 2 (a))

**WORK OF THE SUB-COMMITTEE OF EXPERTS  
ON THE TRANSPORT OF DANGEROUS GOODS**

**Development of provisions for the transport of gases**

**Cryogenic receptacles**

**Transmitted by the Compressed Gas Association (CGA)**

Comments relative to the development of provisions for the transport of cryogenic liquids in gas receptacles are provided in the Annex of this document. These comments are submitted for consideration by the Working Group on Gas Receptacles and Multiple Element Gas Containers (MEGCs).

The comments are based upon current text in the ICAO Technical Instructions.

## Annex

1. In accordance with paragraph 26 of the report of the 17th Session of the Sub-committee held in December 1999 (ST/SG/AC.10/C.3/34), representatives of CGA have completed a review of Packing Instruction 203 of Proposal 3 by the Working Group on Gas Receptacles and Multiple Elements Gas Containers (MEGCs). Proposal 3 lists Requirements for the design, construction and testing of pressure receptacles for gases including pressure receptacles that are elements of MEGCs and include a Packing Instruction for cryogenic receptacles. The CGA agreed to submit recommended text for Proposal 3 based upon current wording in the ICAO Technical Instructions.

The following proposals are submitted:

### 2. **Revise section 6.2.1.1.6**

**6.2.1.1.6** The following general requirements for cryogenic receptacles apply to the construction of closed cryogenic pressure receptacles for refrigerated liquefied gases. These requirements also apply to empty packagings unless all parts are at ambient temperatures.

**6.2.1.1.6.1** The pressure receptacles shall be thermally insulated. The thermal insulation shall be protected against impact by means of continuous sheathing. If the space between the pressure receptacle and the sheathing is airless (vacuum-insulation), the protective sheathing shall be designed to withstand without deformation and external pressure of at least 100 kPa (1 bar). If the sheathing is so closed as to be gas-tight (e.g. in the case of vacuum-insulation), a device shall be provided to prevent any dangerous pressure from developing in the insulating layer in the event of inadequate gas-tightness of the pressure receptacle or its fittings. The device shall prevent moisture from penetrating into the insulation.

**6.2.1.1.6.2** Packagings must be strong enough to withstand all shocks and loadings normally incident to transport and associated handling. Packaging accessories must be protected against damage in handling and must be designed to discourage tampering in transit.

**6.2.1.1.6.3** Packagings must be protected by one or more vent openings or pressure-relief devices to prevent excessive pressure within the packagings. Pressure-relief devices must be designed and located so that they will not malfunction, cause plugging or become detached under conditions normally incident to transport.

*Note: Changes in pressure and temperature can cause malfunction of safety relief devices and plugging of vent lines unless the relief systems are specifically designed for these conditions. Failure of a liquid compartment to vent excess pressure can be prevented by placing safety relief devices to the vapour space on lines connected separately to the liquid compartment, by use of an absolute pressure safety relief device, or by use of a differential pressure relief device preceded by a heat exchanger.*

**6.2.1.1.6.4** Packagings must be designed or packed to strongly discourage loading or handling in any position other than upright.

**6.2.1.1.6.5** The packaging specifications for refrigerated liquefied gases of Packing Instruction P203 shall be met.

**6.2.1.1.6.6** The upright position of each package must be indicated prominently by arrows, or by using the “Package Orientation” label . The arrows or wording “KEEP UPRIGHT” must be placed at 120° intervals around the package or on each side. The package must also be clearly marked “DO NOT DROP – HANDLE WITH CARE”.

Packagings must be classified and marked according to the maximum permissible service pressure for the receptacle.

*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 Regulations 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.*

### **3.       Revise 6.2.1.2.1**

**6.2.1.2.1** The materials of which the pressure receptacles, cryogenic receptacles and their closures are made shall be compatible with the contents and shall not form harmful or dangerous compounds therewith.

**4. Revise Packing Instruction P203 to read as follows:**

P203	PACKING INSTRUCTION	P203
<p>Type of receptacles</p> <p>Cryogenic receptacles, are authorized for the transport of air, argon, carbon dioxide, helium, krypton, neon, nitrogen, nitrous oxide, trifluoromethane and xenon refrigerated.</p> <p>The general packing requirements of Subsection 4.1.3 shall be met.</p> <p>Particular instructions for closed cryogenic receptacles:</p> <p>203(a) For non-flammable, non-toxic refrigerated liquefied gases the degree of filling, at the filling temperature and at a pressure of 0.1 MPa (1 bar) shall not exceed 98% of the capacity.</p> <p>203(b) For flammable refrigerated liquefied gases the degree of filling shall remain below the level at which, if the contents were raised to the temperature at which the vapour pressure equaled the opening pressure of the relief valve, the volume would reach 95% of the capacity at that temperature.</p> <p>203(c) In the case of receptacles intended for the carriage of oxidising gases, the substances used to ensure the leakproofness of the joints or for the maintenance of the closures shall be compatible with the contents.</p> <p>203(d) Receptacles shall be subjected to periodic inspections in accordance with the provisions of 6.2.1.5.</p> <p>203(e) Periodic inspections shall be carried out every 10 years.</p> <p>By derogation from this paragraph, the periodic inspection of receptacles which make use of composite material (composite receptacles) shall be carried out at intervals determined by the competent authority which approved the technical code for the design and construction.</p> <p>203(f) Non-pressurised packagings shall be metal vacuum insulated vessels or flasks vented to the atmosphere to prevent any increase in pressure within the package. The use of safety relief valves, check valves, frangible discs or similar devices in the vent lines is not permitted.</p> <p>203(g) Fill and discharge openings must be protected against the entry of foreign materials which might increase internal pressure.</p> <p>203(h) Non-pressurised packagings are not permitted for air, carbon dioxide, helium, neon and trifluoromethane refrigerated liquids.</p> <p>203(i) Closed packagings shall be designed for and equipped with pressure relief devices set to operate between 100 and 120 percent of the test pressure of the vessel.</p> <p>Particular instructions for open cryogenic receptacles:</p> <p>203(j) The receptacles shall be so insulated that they cannot become coated with dew or hoar-frost.</p> <p>203(k) Open cryogenic receptacles are not allowed for refrigerated liquefied gases which are partially liquid because of their low temperature, carbon dioxide, refrigerated liquid (2187) and its mixtures.</p>		

<b>P203</b>	<b>PACKING INSTRUCTION (cont'd)</b>	<b>P203</b>
	<p>203(l) The receptacles shall be equipped with devices which prevent the liquid from splashing out.</p> <p>203(m) Glass receptacles shall be protected by iron-wire baskets and placed in metal cases. The metal cases for the glass receptacles and the other receptacles shall be fitted with means of handling. Receptacles in glass are not allowed for flammable gases or toxic gases.</p> <p>203(n) The openings of the receptacle shall be fitted with devices allowing gases to escape, preventing any splashing out of the liquid, and so fixed that they cannot fall out.</p> <p>203(o) In the case of refrigerated liquid oxygen (1073) and other refrigerated oxidising gases and mixtures thereof, the devices referred to above and the absorbent insulating material surrounding the glass receptacles shall be made of incombustible materials.</p> <p>Packagings having multiple liquid compartments must have each compartment individually protected. Vent openings and outlets from safety relief devices must be protected by a cover or other suitable means to prevent the entry of snow or water, including water from melted frost.</p> <p>Packages must bear instructions to be followed in the event of an emergency, delay en route, or if the consignment is unclaimed at destination.</p>	

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