

Reference (1)	Title of document (2)	Requirements the standard complies with (3)	Applicable for new type approvals or for renewals (4)	Latest date for withdrawal of existing type approvals (5)
<i>for design and construction of pressure receptacles or pressure receptacle shells</i>				
Annex I, Parts 1 to 3 to 84/525/EEC	Council directive on the approximation of the laws of the Member States relating to seamless steel gas cylinders, published in the Official Journal of the European Communities No. L300 of 19.11.1984 <i>NOTE: Notwithstanding the repeal of the directives 84/525/EEC, 84/526/EEC and 84/527/EEC as published in the Official Journal of the European Communities No. L300 of 19.11.1984 the annexes of these directives remain applicable as standards for design, construction and initial inspection and test for gas cylinders. These annexes may be found at: https://eur-lex.europa.eu/oj/direct-access.html.</i>	6.2.3.1 and 6.2.3.4	Until further notice	
Annex I, Parts 1 to 3 to 84/526/EEC	Council directive on the approximation of the laws of the Member States relating to seamless, unalloyed aluminium and aluminium alloy gas cylinders, published in the Official Journal of the European Communities No. L300 of 19.11.1984 <i>NOTE: Notwithstanding the repeal of the directives 84/525/EEC, 84/526/EEC and 84/527/EEC as published in the Official Journal of the European Communities No. L300 of 19.11.1984 the annexes of these directives remain applicable as standards for design, construction and initial inspection and test for gas cylinders. These annexes may be found at: https://eur-lex.europa.eu/oj/direct-access.html.</i>	6.2.3.1 and 6.2.3.4	Until further notice	
Annex I, Parts 1 to 3 to 84/527/EEC	Council directive on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders, published in the Official Journal of the European Communities No. L300 of 19.11.1984 <i>NOTE: Notwithstanding the repeal of the directives 84/525/EEC, 84/526/EEC and 84/527/EEC as published in the Official Journal of the European Communities No. L300 of 19.11.1984 the annexes of these directives remain applicable as standards for design, construction and initial inspection and test for gas cylinders. These annexes may be found at: https://eur-lex.europa.eu/oj/direct-access.html.</i>	6.2.3.1 and 6.2.3.4	Until further notice	
EN 1442:1998 + AC:1999	Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) - Design and construction	6.2.3.1 and 6.2.3.4	Between 1 July 2001 and 30 June 2007	31 December 2012
EN 1442:1998 + A2:2005	Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) - Design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2007 and 31 December 2010	

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EN 1442:2006 + A1:2008	Transportable refillable welded steel cylinders for liquefied petroleum gas (LPG) - Design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2009 and 31 December 2020	
EN 1442:2017	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 1800:1998 + AC:1999	Transportable gas cylinders - Acetylene cylinders - Basic requirements and definitions	6.2.1.1.9	Between 1 July 2001 and 31 December 2010	
EN 1800:2006	Transportable gas cylinders - Acetylene cylinders - Basic requirements, definitions and type testing	6.2.1.1.9	Between 1 January 2009 and 31 December 2016	
EN ISO 3807:2013	Gas cylinders – Acetylene cylinders – Basic requirements and type testing <i>NOTE: Fusible plugs shall not be fitted.</i>	6.2.1.1.9	Until further notice	
EN 1964-1:1999	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5 litres up to 150 litres – Part 1: Cylinders made of seamless steel with a Rm value of less than 1 100 MPa	6.2.3.1 and 6.2.3.4	Until 31 December 2014	
EN 1975:1999 (except Annex G)	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0.5 litres up to 150 litres	6.2.3.1 and 6.2.3.4	Until 30 June 2005	
EN 1975:1999 + A1:2003	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0.5 litres up to 150 litres	6.2.3.1 and 6.2.3.4	Between 1 January 2009 and 31 December 2016	
EN ISO 7866:2012 + AC:2014	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing	6.2.3.1 and 6.2.3.4	Between 1 January 2015 and 31 December 2024	
EN ISO 7866:2012 + A1:2020	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing	6.2.3.1 and 6.2.3.4	Until further notice	
EN ISO 11120:1999	Gas cylinders – Refillable seamless steel tubes for compressed gas transport of water capacity between 150 litres and 3 000 litres – Design, construction and testing	6.2.3.1 and 6.2.3.4	Between 1 July 2001 and 30 June 2015	31 December 2015 for tubes marked with the letter "H" in accordance with 6.2.2.7.4 (p)
EN ISO 11120:1999 + A1:2013	Gas cylinders – Refillable seamless steel tubes for compressed gas transport of water capacity between 150 litres and 3 000 litres – Design, construction and testing	6.2.3.1 and 6.2.3.4	Between 1 January 2015 and 31 December 2020	
EN ISO 11120:2015	Gas cylinders - Refillable seamless steel tubes of water capacity between 150 l and 3000 l - Design, construction and testing	6.2.3.1 and 6.2.3.4	Until further notice	

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EN 1964-3:2000	Transportable gas cylinders – Specifications for the design and construction of refillable transportable seamless steel gas cylinders of capacity from 0.5 litre up to 150 litres – Part 3: Cylinders made of seamless stainless steel with an Rm value of less than 1 100 MPa	6.2.3.1 and 6.2.3.4	Until 31 December 2026	
EN 12862:2000	Transportable gas cylinders- Specifications for the design and construction of refillable transportable welded aluminium alloy gas cylinders	6.2.3.1 and 6.2.3.4	Until further notice	
EN 1251-2:2000	Cryogenic vessels – Transportable, vacuum insulated, of not more than 1 000 litres volume – Part 2: Design, fabrication, inspection and testing <i>NOTE: Standards EN 1252-1:1998 and EN 1626 referenced in this standard are also applicable to closed cryogenic receptacles for the carriage of UN No. 1972 (METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGERATED LIQUID).</i>	6.2.3.1 and 6.2.3.4	Until further notice	
EN 12257:2002	Transportable gas cylinders – Seamless, hoop wrapped composite cylinders	6.2.3.1 and 6.2.3.4	Until further notice	
EN 12807:2001 (except Annex A)	Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2005 and 31 December 2010	31 December 2012
EN 12807:2008	Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2009 and 31 December 2022	
EN 12807:2019	LPG equipment and accessories - Transportable refillable brazed steel cylinders for liquefied petroleum gas (LPG) - Design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 1964-2:2001	Transportable gas cylinders – Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0.5 litre up to and including 150 litre – Part 2: Cylinders made of seamless steel with an Rm value of 1 100 MPa and above	6.2.3.1 and 6.2.3.4	Until 31 December 2014	
EN ISO 9809-1:2010	Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1100 MPa	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2022	
EN ISO 9809-1:2019	Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1100 MPa	6.2.3.1 and 6.2.3.4	Until further notice	

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EN ISO 9809-2:2010	Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1100 MPa	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2022	
EN ISO 9809-2:2019	Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1100 MPa	6.2.3.1 and 6.2.3.4	Until further notice	
EN ISO 9809-3:2010	Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing — Part 3: Normalized steel cylinders	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2022	
EN ISO 9809-3:2019	Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes - Part 3: Normalized steel cylinders and tubes	6.2.3.1 and 6.2.3.4	Until further notice	
EN ISO 9809-4:2022	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa <i>NOTE: Small quantities are a batch of cylinders not exceeding 200.</i>	6.2.3.1 and 6.2.3.4	Until further notice	
EN 13293:2002	Transportable gas cylinders – Specification for the design and construction of refillable transportable seamless normalised carbon manganese steel gas cylinders of water capacity up to 0.5 litre for compressed, liquefied and dissolved gases and up to 1 litre for carbon dioxide	6.2.3.1 and 6.2.3.4	Until further notice	
EN 13322-1:2003	Transportable gas cylinders – Refillable welded steel gas cylinders – Design and construction – Part 1: Welded steel	6.2.3.1 and 6.2.3.4	Until 30 June 2007	
EN 13322-1:2003 + A1:2006	Transportable gas cylinders – Refillable welded steel gas cylinders – Design and construction – Part 1: Welded steel	6.2.3.1 and 6.2.3.4	Between 1 January 2007 and 31 December 2026	
EN 13322-1:2024	Transportable gas cylinders – Refillable welded steel gas cylinders – Design and construction – Part 1: Welded steel	6.2.3.1 and 6.2.3.4	Until further notice	
EN 13322-2:2003	Transportable gas cylinders – Refillable welded stainless steel gas cylinders – Design and construction – Part 2: Welded stainless steel	6.2.3.1 and 6.2.3.4	Until 30 June 2007	
EN 13322-2:2003 + A1:2006	Transportable gas cylinders – Refillable welded stainless steel gas cylinders – Design and construction – Part 2: Welded stainless steel	6.2.3.1 and 6.2.3.4	Until further notice	
EN 12245:2002	Transportable gas cylinders – Fully wrapped composite cylinders <i>NOTE: This standard shall not be used for gases classified as LPG.</i>	6.2.3.1 and 6.2.3.4	Until 31 December 2014	31 December 2019, for cylinders and tubes without a liner, manufactured in two parts joined together; 31 December 2023, for cylinders for LPG

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EN 12245:2009 +A1:2011	Transportable gas cylinders – Fully wrapped composite cylinders <i>NOTE 1: This standard shall not be used for cylinders and tubes without a liner, manufactured from two parts joined together.</i> <i>NOTE 2: This standard shall not be used for gases classified as LPG.</i>	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2024	31 December 2019, for cylinders and tubes without a liner, manufactured in two parts joined together; 31 December 2023, for cylinders for LPG
EN 12245:2022	Transportable gas cylinders – Fully wrapped composite cylinders <i>NOTE: This standard shall not be used for gases classified as LPG.</i>	6.2.3.1 and 6.2.3.4	Until further notice	
EN 12205:2001	Transportable gas cylinders – Non refillable metallic gas cylinders	6.2.3.1 and 6.2.3.4	Between 1 January 2005 and 31 December 2017	31 December 2018
EN ISO 11118:2015	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	6.2.3.1, 6.2.3.3 and 6.2.3.4	Between 1 January 2017 and 31 December 2024	
EN ISO 11118:2015 + A1:2020	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods	6.2.3.1, 6.2.3.3 and 6.2.3.4	Until further notice	
EN 13110:2002	Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.3.1 and 6.2.3.4	Until 31 December 2014	
EN 13110:2012	Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2026	
EN 13110:2022	LPG equipment and accessories – Transportable refillable welded aluminium cylinders for liquefied petroleum gas (LPG) – Design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14427:2004	Transportable refillable fully wrapped composite cylinders for liquefied petroleum gases - Design and construction <i>NOTE: This standard applies only to cylinders equipped with pressure relief valves.</i>	6.2.3.1 and 6.2.3.4	Between 1 January 2005 and 30 June 2007	
EN 14427:2004 + A1:2005	Transportable refillable composite cylinders for LPG - Design and construction <i>NOTE 1: This standard applies only to cylinders equipped with pressure relief valves.</i> <i>NOTE 2: In 5.2.9.2.1 and 5.2.9.3.1, both cylinders shall be subject to a burst test when they show damage equal to or worse than the rejection criteria.</i>	6.2.3.1 and 6.2.3.4	Between 1 January 2007 and 31 December 2016	31 December 2023, for cylinders without a liner, manufactured from two parts joined together
EN 14427:2014	LPG Equipment and accessories – Transportable refillable fully wrapped composite cylinders for LPG – Design and construction <i>NOTE: This standard shall not be used for cylinders without a liner, manufactured from two parts joined together.</i>	6.2.3.1 and 6.2.3.4	Between 1 January 2015 and 31 December 2024	31 December 2023, for cylinders without a liner, manufactured from two parts joined together

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(1)	(2)	(3)	(4)	(5)
EN 14427:2022	LPG equipment and accessories – Transportable refillable composite cylinders for LPG – Design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14208:2004	Transportable gas cylinders – Specification for welded pressure drums up to 1000 litres capacity for the transport of gases – Design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14140:2003	Transportable refillable welded steel cylinders for Liquefied Petroleum Gas (LPG) – Alternative design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2005 and 31 December 2010	
EN 14140:2003 + A1:2006	LPG equipment and accessories – Transportable refillable welded steel cylinders for LPG – Alternative design and construction	6.2.3.1 and 6.2.3.4	Between 1 January 2009 and 31 December 2018	
EN 14140:2014 +AC:2015	LPG Equipment and accessories – Transportable refillable welded steel cylinders for LPG – Alternative design and construction	6.2.3.1 and 6.2.3.4	Until further notice	
EN 13769:2003	Transportable gas cylinders – Cylinder bundles – Design, manufacture, identification and testing	6.2.3.1 and 6.2.3.4	Until 30 June 2007	
EN 13769:2003 + A1:2005	Transportable gas cylinders – Cylinder bundles – Design, manufacture, identification and testing	6.2.3.1 and 6.2.3.4	Until 31 December 2014	
EN ISO 10961:2012	Gas cylinders – Cylinder bundles – Design, manufacture, testing and inspection	6.2.3.1 and 6.2.3.4	Between 1 January 2013 and 31 December 2022	
EN ISO 10961:2019	Gas cylinders – Cylinder bundles – Design, manufacture, testing and inspection	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14638-1:2006	Transportable gas cylinders – Refillable welded receptacles of a capacity not exceeding 150 litres – Part 1 Welded austenitic stainless steel cylinders made to a design justified by experimental methods	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14893:2006 + AC:2007	LPG equipment and accessories – Transportable LPG welded steel pressure drums with a capacity between 150 and 1 000 litres	6.2.3.1 and 6.2.3.4	Between 1 January 2009 and 31 December 2016	
EN 14893:2014	LPG equipment and accessories – Transportable LPG welded steel pressure drums with a capacity between 150 and 1 000 litres	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14638-3:2010 + AC:2012	Transportable gas cylinders – Refillable welded receptacles of a capacity not exceeding 150 litres – Part 3: Welded carbon steel cylinders made to a design justified by experimental methods	6.2.3.1 and 6.2.3.4	Until further notice	
EN 17339:2020	Transportable gas cylinders – Fully wrapped carbon composite cylinders and tubes for hydrogen	6.2.3.1 and 6.2.3.4	Until further notice	
<i>for design and construction of closures</i>				
EN 849:1996 (except Annex A)	Transportable gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Until 30 June 2003	31 December 2014

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EN 849:1996 + A2:2001	Transportable gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Until 30 June 2003	31 December 2016
EN ISO 10297:2006	Transportable gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Between 1 January 2009 and 31 December 2018	
EN ISO 10297:2014	Gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Between 1 January 2015 and 31 December 2020	
EN ISO 10297:2014 + A1:2017	Gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Between 1 January 2019 and 31 December 2026	
EN ISO 10297:2024	Gas cylinders – Cylinder valves – Specification and type testing	6.2.3.1 and 6.2.3.3	Until further notice	
EN ISO 14245:2010	Gas cylinders – Specifications and testing of LPG cylinder valves – Self-closing	6.2.3.1 and 6.2.3.3	Between 1 January 2013 and 31 December 2022	
EN ISO 14245:2019	Gas cylinders – Specifications and testing of LPG cylinder valves – Self-closing	6.2.3.1 and 6.2.3.3	Between 1 January 2021 and 31 December 2024	
EN ISO 14245:2021	Gas Cylinders – Specifications and testing of LPG cylinder valves – Self-closing	6.2.3.1 and 6.2.3.3	Until further notice	
EN 13152:2001	Specifications and testing of LPG – Cylinder valves – Self closing	6.2.3.1 and 6.2.3.3	Between 1 January 2005 and 31 December 2010	
EN 13152:2001 + A1:2003	Specifications and testing of LPG – Cylinder valves – Self closing	6.2.3.1 and 6.2.3.3	Between 1 January 2009 and 31 December 2014	
EN ISO 15995:2010	Gas cylinders – Specifications and testing of LPG cylinder valves – Manually operated	6.2.3.1 and 6.2.3.3	Between 1 January 2013 and 31 December 2022	
EN ISO 15995:2019	Gas cylinders – Specifications and testing of LPG cylinder valves – Manually operated	6.2.3.1 and 6.2.3.3	Between 1 January 2021 and 31 December 2024	
EN ISO 15995:2021	Gas Cylinders – Specifications and testing of LPG cylinder valves – Manually operated	6.2.3.1 and 6.2.3.3	Until further notice	
EN 13153:2001	Specifications and testing of LPG – Cylinder valves – Manually operated	6.2.3.1 and 6.2.3.3	Between 1 January 2005 and 31 December 2010	
EN 13153:2001 + A1:2003	Specifications and testing of LPG – Cylinder valves – Manually operated	6.2.3.1 and 6.2.3.3	Between 1 January 2009 and 31 December 2014	
EN ISO 13340:2001	Transportable gas cylinders – Cylinder valves for non-refillable cylinders – Specification and prototype testing	6.2.3.1 and 6.2.3.3	Between 1 January 2011 and 31 December 2017	31 December 2018
EN 13648-1:2008	Cryogenic vessels – Safety devices for protection against excessive pressure – Part 1: Safety valves for cryogenic service	6.2.3.1 and 6.2.3.4	Until further notice	

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(1)	(2)	(3)	(4)	(5)
EN 1626:2008 (except valve category B)	Cryogenic vessels – Valves for cryogenic service <i>NOTE: This standard is also applicable to valves for the carriage of UN No 1972 (METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGERATED LIQUID).</i>	6.2.3.1 and 6.2.3.4	Until further notice	
EN 13175:2014	LPG Equipment and accessories – Specification and testing for Liquefied Petroleum Gas (LPG) pressure vessel valves and fittings	6.2.3.1 and 6.2.3.3	Between 1 January 2017 and 31 December 2022	
EN 13175:2019 (except clause 6.1.6)	LPG Equipment and accessories – Specification and testing for Liquefied Petroleum Gas (LPG) pressure vessel valves and fittings	6.2.3.1 and 6.2.3.3	Between 1 January 2021 and 31 December 2024	
EN 13175:2019 + A1:2020	LPG Equipment and accessories – Specification and testing for Liquefied Petroleum Gas (LPG) pressure vessel valves and fittings	6.2.3.1 and 6.2.3.3	Until further notice	
EN ISO 17871:2015	Gas cylinders – Quick-release cylinder valves - Specification and type testing	6.2.3.1, 6.2.3.3 and 6.2.3.4	Between 1 January 2017 and 31 December 2021	
EN ISO 17871:2015 + A1:2018	Gas cylinders – Quick-release cylinder valves – Specification and type testing	6.2.3.1, 6.2.3.3 and 6.2.3.4	Between 1 January 2019 and 31 December 2024	
EN ISO 17871:2020	Gas cylinders – Quick-release cylinder valves – Specification and type testing	6.2.3.1, 6.2.3.3 and 6.2.3.4	Until further notice	
EN 13953:2015	LPG equipment and accessories – Pressure relief valves for transportable refillable cylinders for Liquefied Petroleum Gas (LPG) <i>NOTE: The final sentence of the scope shall not apply.</i>	6.2.3.1, 6.2.3.3 and 6.2.3.4	Between 1 January 2017 and 31 December 2024	
EN 13953:2020	LPG Equipment and accessories – Pressure relief valves for transportable refillable cylinders for Liquefied Petroleum Gas (LPG)	6.2.3.1, 6.2.3.3 and 6.2.3.4	Until further notice	
EN ISO 14246:2014	Gas cylinders – Cylinder valves – Manufacturing tests and examinations	6.2.3.1 and 6.2.3.4	Between 1 January 2015 and 31 December 2020	
EN ISO 14246:2014 + A1:2017	Gas cylinders – Cylinder valves – Manufacturing tests and examinations	6.2.3.1 and 6.2.3.4	Between 1 January 2019 and 31 December 2024	
EN ISO 14246:2022	Gas cylinders – Cylinder valves – Manufacturing tests and examinations	6.2.3.1 and 6.2.3.4	Until further notice	
EN ISO 17879:2017	Gas cylinders - Self-closing cylinder valves - Specification and type testing	6.2.3.1 and 6.2.3.4	Until further notice	
EN 14129:2014 (except the note in clause 3.11)	LPG Equipment and accessories – Pressure relief valves for LPG pressure vessels <i>NOTE: This standard is applicable to pressure drums.</i>	6.2.3.1, 6.2.3.3 and 6.2.3.4	Until further notice	
EN ISO 23826:2021	Gas cylinders – Ball valves – Specification and testing	6.2.3.1 and 6.2.3.3	Mandatorily from 1 January 2025	

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(1)	(2)	(3)	(4)	(5)
EN 13799:2022	LPG equipment and accessories – Contents gauges for Liquefied Petroleum Gas (LPG) pressure vessels	6.2.3.1 and 6.2.3.3	Until further notice	

6.2.4.2 *Periodic inspection and test*

The standards referenced in the table below shall be applied for the periodic inspection and test of pressure receptacles as indicated in column (3) to meet the requirements of 6.2.3.5. The standards shall be applied in accordance with 1.1.5.

The use of a referenced standard is mandatory.

When a pressure receptacle is constructed in accordance with the provisions of 6.2.5 the procedure for periodic inspection if specified in the type approval shall be followed.

Standards shall be applied in full, unless otherwise specified in the table below. If more than one standard is referenced for the application of the same requirements, only one of them shall be applied.

The scope of application of each standard is defined in the scope clause of the standard unless otherwise specified in the Table below.

Reference	Title of document	Applicable
(1)	(2)	(3)
EN 1251-3:2000	Cryogenic vessels – Transportable, vacuum insulated, of not more than 1 000 litres volume – Part 3: Operational requirements	Until 31 December 2024
EN ISO 21029-2:2015	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1 000 litres volume – Part 2: Operational requirements <i>NOTE: Notwithstanding clause 14 of this standard, pressure relief valves shall be periodically inspected and tested at intervals not exceeding 5 years.</i>	Mandatorily from 1 January 2025
EN ISO 18119:2018	Gas cylinders - Seamless steel and seamless aluminium-alloy gas cylinders and tubes - Periodic inspection and testing <i>NOTE: Notwithstanding clause B.1 of this standard, all cylinders and tubes whose wall thickness is less than the minimum design wall thickness shall be rejected.</i>	Until 31 December 2024
EN ISO 18119:2018 + A1:2021	Gas cylinders – Seamless steel and seamless aluminium-alloy gas cylinders and tubes – Periodic inspection and testing <i>NOTE: Notwithstanding clause B.1 of this standard, all cylinders and tubes whose wall thickness is less than the minimum design wall thickness shall be rejected.</i>	Mandatorily from 1 January 2025
EN ISO 10462:2013 + A1:2019	Gas cylinders - Acetylene cylinders - Periodic inspection and maintenance - Amendment 1	Until further notice
EN ISO 10460:2018	Gas cylinders - Welded aluminium-alloy, carbon and stainless steel gas cylinders - Periodic inspection and testing	Until further notice
EN ISO 11623:2015	Gas cylinders – Composite construction – Periodic inspection and testing	Until 31 December 2026
EN ISO 11623:2023	Gas cylinders – Composite cylinders and tubes – Periodic inspection and testing	Until further notice
EN ISO 22434:2011	Transportable gas cylinders – Inspection and maintenance of cylinder valves	Until 31 December 2024
EN ISO 22434:2022	Gas cylinders – Inspection and maintenance of valves	Mandatorily from 1 January 2025
EN 14876:2007	Transportable gas cylinders – Periodic inspection and testing of welded steel pressure drums	Until 31 December 2024
EN ISO 23088:2020	Gas cylinders – Periodic inspection and testing of welded steel pressure drums – Capacities up to 1 000 l	Mandatorily from 1 January 2025
EN 14912:2015	LPG equipment and accessories – Inspection and maintenance of LPG cylinder valves at time of periodic inspection of cylinders	Until 31 December 2024

Reference (1)	Title of document (2)	Applicable (3)
EN 14912:2022	LPG equipment and accessories – Inspection and maintenance of LPG cylinder valves at time of periodic inspection of cylinders	Mandatorily from 1 January 2025
EN 1440:2016 + A1:2018 + A2:2020 (except Annex C)	LPG equipment and accessories – Transportable refillable traditional welded and brazed steel Liquefied Petroleum Gas (LPG) cylinders – Periodic inspection	Until further notice
EN 16728:2016 + A1:2018 + A2:2020	LPG equipment and accessories – Transportable refillable LPG cylinders other than traditional welded and brazed steel cylinders – Periodic inspection	Until further notice
EN 15888: 2014	Transportable gas cylinders - Cylinder bundles - Periodic inspection and testing	Until 31 December 2024
EN ISO 20475:2020	Gas cylinders – Cylinder bundles – Periodic inspection and testing	Mandatorily from 1 January 2025

6.2.5 Requirements for non-UN pressure receptacles not designed, constructed and tested according to referenced standards

To reflect scientific and technical progress or where no standard is referenced in 6.2.2 or 6.2.4, or to deal with specific aspects not addressed in a standard referenced in 6.2.2 or 6.2.4, the competent authority may recognize the use of a technical code providing the same level of safety.

In the type approval the issuing body shall specify the procedure for periodic inspections if the standards referenced in 6.2.2 or 6.2.4 are not applicable or shall not be applied.

As soon as a standard newly referenced in 6.2.2 or 6.2.4 can be applied, the competent authority shall withdraw its recognition of the relevant technical code. A transitional period ending no later than the date of entry into force of the next edition of ADR may be applied.

The competent authority shall transmit to the secretariat of UNECE a list of the technical codes that it recognises and shall update the list if it changes. The list should include the following details: name and date of the code, purpose of the code and details of where it may be obtained. The secretariat shall make this information publicly available on its website.

A standard which has been adopted for reference in a future edition of the ADR may be approved by the competent authority for use without notifying the secretariat of UNECE.

The requirements of 6.2.1, 6.2.3 and the following requirements however shall be met.

NOTE: For this section, the references to technical standards in 6.2.1 shall be considered as references to technical codes.

6.2.5.1 Materials

The following provisions contain examples of materials that may be used to comply with the requirements for materials in 6.2.1.2:

- (a) Carbon steel for compressed, liquefied, refrigerated liquefied gases and dissolved gases as well as for substances not in Class 2 listed in Table 3 of packing instruction P200 of 4.1.4.1;
- (b) Alloy steel (special steels), nickel, nickel alloy (such as monel) for compressed, liquefied, refrigerated liquefied gases and dissolved gases as well as for substances not in Class 2 listed in Table 3 of packing instruction P200 of 4.1.4.1;
- (c) Copper for:
 - (i) Gases of classification codes 1A, 1O, 1F and 1TF, whose filling pressure referred to a temperature of 15 °C does not exceed 2 MPa (20 bar);
 - (ii) Gases of classification code 2A and also UN No. 1033 dimethyl ether; UN No. 1037 ethyl chloride; UN No. 1063 methyl chloride; UN No. 1079 sulphur dioxide;

UN No. 1085 vinyl bromide; UN No. 1086 vinyl chloride; and UN No. 3300 ethylene oxide and carbon dioxide mixture with more than 87 % ethylene oxide;

- (iii) Gases of classification codes 3A, 3O and 3F;
- (d) Aluminium alloy: see special requirement "a" of packing instruction P200 (10) of 4.1.4.1;
- (e) Composite material for compressed, liquefied, refrigerated liquefied gases and dissolved gases;
- (f) Synthetic materials for refrigerated liquefied gases; and
- (g) Glass for the refrigerated liquefied gases of classification code 3A other than UN No. 2187 carbon dioxide, refrigerated, liquid or mixtures thereof, and gases of classification code 3O.

6.2.5.2 *Service equipment*

(Reserved)

6.2.5.3 *Metal cylinders, tubes, pressure drums and bundles of cylinders*

At the test pressure, the stress in the metal at the most severely stressed point of the pressure receptacle shell shall not exceed 77 % of the guaranteed minimum yield stress (Re).

"Yield stress" means the stress at which a permanent elongation of 2 per thousand (i.e. 0.2 %) or, for austenitic steels, 1 % of the gauge length on the test-piece, has been produced.

NOTE: In the case of sheet-metal the axis of the tensile test-piece shall be at right angles to the direction of rolling. The permanent elongation at fracture, shall be measured on a test-piece of circular cross-section in which the gauge length "l" is equal to five times the diameter "d" ($l = 5d$); if test pieces of rectangular cross-section are used, the gauge length "l" shall be calculated by the formula:

$$l = 5.65 \sqrt{F_0}$$

where F_0 indicates the initial cross-sectional area of the test-piece.

Pressure receptacles shall be made of suitable materials which shall be resistant to brittle fracture and to stress corrosion cracking between -20°C and $+50^{\circ}\text{C}$.

Welds shall be skilfully made and shall afford the fullest safety.

6.2.5.4 *Additional provisions relating to aluminium-alloy pressure receptacles for compressed gases, liquefied gases, dissolved gases and non pressurized gases subject to special requirements (gas samples) as well as articles containing gas under pressure other than aerosol dispensers and small receptacles containing gas (gas cartridges)*

6.2.5.4.1 The materials of aluminium-alloy pressure receptacle shells which are to be accepted shall satisfy the following requirements:

	A	B	C	D
Tensile strength, R_m , in MPa ($= \text{N/mm}^2$)	49 to 186	196 to 372	196 to 372	343 to 490
Yield stress, R_e , in MPa ($= \text{N/mm}^2$) (permanent set $\lambda = 0.2 \%$)	10 to 167	59 to 314	137 to 334	206 to 412
Permanent elongation at fracture ($l = 5d$), in %	12 to 40	12 to 30	12 to 30	11 to 16
Bend test (diameter of former $d = n \times e$, where e is the thickness of the test piece)	$n = 5$ ($R_m \leq 98$) $n = 6$ ($R_m > 98$)	$n = 6$ ($R_m \leq 325$) $n = 7$ ($R_m > 325$)	$n = 6$ ($R_m \leq 325$) $n = 7$ ($R_m > 325$)	$n = 7$ ($R_m \leq 392$) $n = 8$ ($R_m > 392$)
Aluminium Association Series Number ^a	1 000	5 000	6 000	2 000

^a See "Aluminium Standards and Data", Fifth edition, January 1976, published by the Aluminium Association, 750 Third Avenue, New York.

The actual properties will depend on the composition of the alloy concerned and on the final treatment of the pressure receptacle shell, but whatever alloy is used the thickness of the pressure receptacle shell shall be calculated by one of the following formulae:

$$e = \frac{P_{MPa} D}{\frac{2Re}{1.3} + P_{MPa}} \quad \text{or} \quad e = \frac{P_{bar} D}{\frac{20Re}{1.3} + P_{bar}}$$

where

e = minimum thickness of pressure receptacle wall, in mm
 P_{MPa} = test pressure, in MPa
 P_{bar} = test pressure, in bar
 D = nominal external diameter of the pressure receptacle, in mm and
 Re = guaranteed minimum proof stress with 0.2 % proof stress, in MPa (= N/mm²)

In addition, the value of the minimum guaranteed proof stress (Re) introduced into the formula is in no case to be greater than 0.85 times the guaranteed minimum tensile strength (Rm), whatever the type of alloy used.

NOTE 1: The above characteristics are based on previous experience with the following materials used for pressure receptacles:

Column A: Aluminium, unalloyed, 99.5 % pure;
 Column B: Alloys of aluminium and magnesium;
 Column C: Alloys of aluminium, silicon and magnesium, such as ISO/R209-Al-Si-Mg (Aluminium Association 6351);
 Column D: Alloys of aluminium, copper and magnesium.

NOTE 2: The permanent elongation at fracture is measured by means of test-pieces of circular cross-section in which the gauge length "l" is equal to five times the diameter "d" ($l = 5d$); if test-pieces of rectangular section are used the gauge length shall be calculated by the formula:

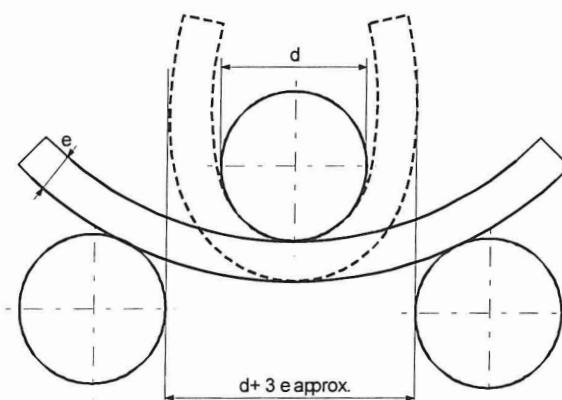
$$l = 5.65 \sqrt{F_o}$$

where F_o is the initial cross-section area of the test-piece.

NOTE 3:

- (a) The bend test (see diagram) shall be carried out on specimens obtained by cutting into two equal parts of width $3e$, but in no case less than 25 mm, an annular section of a cylinder. The specimens shall not be machined elsewhere than on the edges;
- (b) The bend test shall be carried out between a mandrel of diameter (d) and two circular supports separated by a distance of $(d + 3e)$. During the test the inner faces shall be separated by a distance not greater than the diameter of the mandrel;
- (c) The specimen shall not exhibit cracks when it has been bent inwards around the mandrel until the inner faces are separated by a distance not greater than the diameter of the mandrel;
- (d) The ratio (n) between the diameter of the mandrel and the thickness of the specimen shall conform to the values given in the table.

Diagram of bend test



6.2.5.4.2 A lower minimum elongation value is acceptable on condition that an additional test approved by the competent authority of the country in which the pressure receptacles are made proves that safety of carriage is ensured to the same extent as in the case of pressure receptacles constructed to comply with the characteristics given in the table in 6.2.5.4.1 (see also EN ISO 7866:2012 + A1:2020).

6.2.5.4.3 The wall thickness of the pressure receptacles at the thinnest point shall be the following:

- Where the diameter of the pressure receptacle is less than 50 mm: not less than 1.5 mm;
- Where the diameter of the pressure receptacle is from 50 to 150 mm: not less than 2 mm; and
- Where the diameter of the pressure receptacle is more than 150 mm: not less than 3 mm.

6.2.5.4.4 The ends of the pressure receptacles shall have a semicircular, elliptical or "basket-handle" section; they shall afford the same degree of safety as the body of the pressure receptacle.

6.2.5.5 *Pressure receptacles in composite materials*

For composite cylinders, tubes, pressure drums and bundles of cylinders which make use of composite materials, the construction shall be such that a minimum burst ratio (burst pressure divided by test pressure) is:

- 1.67 for hoop wrapped pressure receptacles;
- 2.00 for fully wrapped pressure receptacles.

6.2.5.6 *Closed cryogenic receptacles*

The following requirements apply to the construction of closed cryogenic receptacles for refrigerated liquefied gases:

6.2.5.6.1 If non-metallic materials are used, they shall resist brittle fracture at the lowest working temperature of the pressure receptacle and its fittings.

6.2.5.6.2 The pressure relief devices shall be so constructed as to work perfectly even at their lowest working temperature. Their reliability of functioning at that temperature shall be established and checked by testing each device or a sample of devices of the same type of construction.

6.2.5.6.3 The vents and pressure relief devices of pressure receptacles shall be so designed as to prevent the liquid from splashing out.

6.2.6 *General requirements for aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas*

6.2.6.1 *Design and construction*

6.2.6.1.1 Aerosol dispensers (UN No.1950 aerosols) containing only a gas or a mixture of gases, and small receptacles containing gas (gas cartridges) (UN No. 2037), shall be made of metal. This requirement shall not apply to aerosols and small receptacles containing gas (gas cartridges) with a maximum capacity of 100 ml for UN No. 1011 butane. Other aerosol dispensers (UN No.1950 aerosols) shall be made of metal, synthetic material or glass. Receptacles made of metal and having an outside diameter of not less than 40 mm shall have a concave bottom.

6.2.6.1.2 The capacity of receptacles made of metal shall not exceed 1 000 ml; that of receptacles made of synthetic material or of glass shall not exceed 500 ml.

6.2.6.1.3 Each model of receptacles (aerosol dispensers or cartridges) shall, before being put into service, satisfy a hydraulic pressure test carried out in conformity with 6.2.6.2.

6.2.6.1.4 The release valves and dispersal devices of aerosol dispensers (UN No.1950 aerosols) and the valves of UN No. 2037 small receptacles containing gas (gas cartridges) shall ensure that the receptacles are so closed as to be leakproof and shall be protected against accidental opening. Valves and dispersal devices which close only by the action of the internal pressure are not to be accepted.

6.2.6.1.5 The internal pressure of aerosol dispensers at 50 °C shall not exceed 1.2 MPa (12 bar) when using flammable liquefied gases, 1.32 MPa (13.2 bar) when using non-flammable liquefied gases, and 1.5

MPa (15 bar) when using non-flammable compressed or dissolved gases. In case of a mixture of several gases, the stricter limit shall apply. They shall be so filled that at 50 °C the liquid phase does not exceed 95 % of their capacity. Small receptacles containing gas (gas cartridges) shall meet the test pressure and filling requirements of packing instruction P200 of 4.1.4.1. In addition, the product of test pressure and water capacity shall not exceed 30 bar-litres for liquefied gases or 54 bar-litres for compressed gases and the test pressure shall not exceed 250 bar for liquefied gases or 450 bar for compressed gases.

6.2.6.2 *Hydraulic pressure test*

6.2.6.2.1 The internal pressure to be applied (test pressure) shall be 1.5 times the internal pressure at 50 °C, with a minimum pressure of 1 MPa (10 bar).

6.2.6.2.2 The hydraulic pressure tests shall be carried out on at least five empty receptacles of each model:

- (a) Until the prescribed test pressure is reached, by which time no leakage or visible permanent deformation shall have occurred; and
- (b) Until leakage or bursting occurs; the dished end, if any, shall yield first and the receptacle shall not leak or burst until a pressure 1.2 times the test pressure has been reached or passed.

6.2.6.3 *Tightness (leakproofness) test*

Each filled aerosol dispenser or gas cartridge or fuel cell cartridge shall be subjected to a test in a hot water bath in accordance with 6.2.6.3.1 or an approved water bath alternative in accordance with 6.2.6.3.2.

6.2.6.3.1 *Hot water bath test*

6.2.6.3.1.1 The temperature of the water bath and the duration of the test shall be such that the internal pressure reaches that which would be reached at 55 °C (50 °C if the liquid phase does not exceed 95 % of the capacity of the aerosol dispenser, gas cartridge or the fuel cell cartridge at 50 °C). If the contents are sensitive to heat or if the aerosol dispensers, gas cartridges or the fuel cell cartridges are made of plastics material which softens at this test temperature, the temperature of the bath shall be set at between 20 °C and 30 °C but, in addition, one aerosol dispenser, gas cartridge or the fuel cell cartridge in 2 000 shall be tested at the higher temperature.

6.2.6.3.1.2 No leakage or permanent deformation of an aerosol dispenser, gas cartridge or the fuel cell cartridge may occur, except that a plastic aerosol dispenser, gas cartridge or the fuel cell cartridge may be deformed through softening provided that it does not leak.

6.2.6.3.2 *Alternative methods*

With the approval of the competent authority alternative methods that provide an equivalent level of safety may be used provided that the requirements of 6.2.6.3.2.1 and, as appropriate, 6.2.6.3.2.2 or 6.2.6.3.2.3 are met.

6.2.6.3.2.1 *Quality system*

Aerosol dispenser, gas cartridge or the fuel cell cartridge fillers and component manufacturers shall have a quality system. The quality system shall implement procedures to ensure that all aerosol dispensers, gas cartridges or the fuel cell cartridges that leak or that are deformed are rejected and not offered for transport.

The quality system shall include:

- (a) A description of the organizational structure and responsibilities;
- (b) The relevant inspection and test, quality control, quality assurance, and process operation instructions that will be used;
- (c) Quality records, such as inspection reports, test data, calibration data and certificates;
- (d) Management reviews to ensure the effective operation of the quality system;
- (e) A process for control of documents and their revision;

- (f) A means for control of non-conforming aerosol dispensers, gas cartridges or the fuel cell cartridges;
- (g) Training programmes and qualification procedures for relevant personnel; and
- (h) Procedures to ensure that there is no damage to the final product.

An initial audit and periodic audits shall be conducted to the satisfaction of the competent authority. These audits shall ensure the approved system is and remains adequate and efficient. Any proposed changes to the approved system shall be notified to the competent authority in advance.

6.2.6.3.2.2 Aerosol dispensers

6.2.6.3.2.2.1 Pressure and leak testing of aerosol dispensers before filling

Each empty aerosol dispenser shall be subjected to a pressure equal to or in excess of the maximum expected in the filled aerosol dispensers at 55 °C (50 °C if the liquid phase does not exceed 95 % of the capacity of the receptacle at 50 °C). This shall be at least two-thirds of the design pressure of the aerosol dispenser. If any aerosol dispenser shows evidence of leakage at a rate equal to or greater than 3.3×10^{-2} mbar·l·s⁻¹ at the test pressure, distortion or other defect, it shall be rejected.

6.2.6.3.2.2.2 Testing of the aerosol dispensers after filling

Prior to filling the filler shall ensure that the crimping equipment is set appropriately and the specified propellant is used.

Each filled aerosol dispenser shall be weighed and leak tested. The leak detection equipment shall be sufficiently sensitive to detect at least a leak rate of 2.0×10^{-3} mbar·l·s⁻¹ at 20 °C.

Any filled aerosol dispenser that shows evidence of leakage, deformation or excessive mass shall be rejected.

6.2.6.3.2.3 Gas cartridges and fuel cell cartridges

6.2.6.3.2.3.1 Pressure testing of gas cartridges and fuel cell cartridges

Each gas cartridge or fuel cell cartridge shall be subjected to a test pressure equal to or in excess of the maximum expected in the filled receptacle at 55 °C (50 °C if the liquid phase does not exceed 95 % of the capacity of the receptacle at 50 °C). This test pressure shall be that specified for the gas cartridge or fuel cell cartridge and shall not be less than two thirds the design pressure of the gas cartridge or fuel cell cartridge. If any gas cartridge or fuel cell cartridge shows evidence of leakage at a rate equal to or greater than 3.3×10^{-2} mbar·l·s⁻¹ at the test pressure or distortion or any other defect, it shall be rejected.

6.2.6.3.2.3.2 Leak testing gas cartridges and fuel cell cartridges

Prior to filling and sealing, the filler shall ensure that the closures (if any), and the associated sealing equipment are closed appropriately and the specified gas is used.

Each filled gas cartridge or fuel cell cartridge shall be checked for the correct mass of gas and shall be leak tested. The leak detection equipment shall be sufficiently sensitive to detect at least a leak rate of 2.0×10^{-3} mbar·l·s⁻¹ at 20 °C.

Any gas cartridge or fuel cell cartridge that has gas masses not in conformity with the declared mass limits or shows evidence of leakage or deformation, shall be rejected.

6.2.6.3.3 With the approval of the competent authority, aerosols and receptacles, small, are not subject to 6.2.6.3.1 and 6.2.6.3.2, if they are required to be sterile but may be adversely affected by water bath testing, provided:

- (a) They contain a non-flammable gas and either
 - (i) Contain other substances that are constituent parts of pharmaceutical products for medical, veterinary or similar purposes;
 - (ii) Contain other substances used in the production process for pharmaceutical products; or

.....

(iii) Are used in medical, veterinary or similar applications;

(b) An equivalent level of safety is achieved by the manufacturer's use of alternative methods for leak detection and pressure resistance, such as helium detection and water bathing a statistical sample of at least 1 in 2000 from each production batch; and

(c) For pharmaceutical products according to (a) (i) and (iii) above, they are manufactured under the authority of a national health administration. If required by the competent authority, the principles of Good Manufacturing Practice (GMP) established by the World Health Organization (WHO)³ shall be followed.

6.2.6.4 *Reference to standards*

The requirements of this section are deemed to be met if the following standards are complied with:

- For aerosol dispensers (UN No. 1950 aerosols): Annex to Council Directive 75/324/EEC⁴ as amended and applicable at the date of manufacture;
- For UN No. 2037, small receptacles containing gas (gas cartridges) containing UN No. 1965, hydrocarbon gas mixture n.o.s, liquefied: EN 417:2012 Non-refillable metallic gas cartridges for liquefied petroleum gases, with or without a valve, for use with portable appliances - Construction, inspection, testing and marking;
- For UN No. 2037 small receptacles containing gas (gas cartridges) containing non-toxic, non-flammable compressed or liquefied gases: EN 16509:2014 Transportable gas cylinders - Non-refillable, small transportable, steel cylinders of capacities up to and including 120 ml containing compressed or liquefied gases (compact cylinders) – Design, construction, filling and testing. In addition to the marks required by this standard the gas cartridge shall be marked "UN 2037/EN 16509".

³ WHO Publication: "Quality assurance of pharmaceuticals. A compendium of guidelines and related materials. Volume 2: Good manufacturing practices and inspection".

⁴ Council Directive 75/324/EEC of 20 May 1975 on the approximation of the laws of the Member States relating to aerosol dispensers, published in the Official Journal of the European Communities No. L 147 of 9.06.1975.

CHAPTER 6.3

REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF PACKAGINGS FOR CLASS 6.2 INFECTIOUS SUBSTANCES OF CATEGORY A (UN Nos. 2814 AND 2900)

NOTE: The requirements of this Chapter don't apply to packagings used for the carriage of Class 6.2 substances according to packing instruction P621 of 4.1.4.1.

6.3.1 General

6.3.1.1 The requirements of this Chapter apply to packagings intended for the carriage of infectious substances of Category A, UN Nos. 2814 and 2900.

6.3.2 Requirements for packagings

6.3.2.1 The requirements for packagings in this section are based on packagings, as specified in 6.1.4, currently used. In order to take into account progress in science and technology, there is no objection to the use of packagings having specifications different from those in this Chapter provided that they are equally effective, acceptable to the competent authority and able to successfully fulfil the requirements described in 6.3.5. Methods of testing other than those described in ADR are acceptable provided they are equivalent, and are recognized by the competent authority.

6.3.2.2 Packagings shall be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each packaging meets the requirements of this Chapter.

NOTE: ISO 16106:2020 "Transport packages for dangerous goods – Dangerous goods packagings, intermediate bulk containers (IBCs) and large packagings – Guidelines for the application of ISO 9001" provides acceptable guidance on procedures which may be followed.

6.3.2.3 Manufacturers and subsequent distributors of packagings shall provide information regarding procedures to be followed and a description of the types and dimensions of closures (including required gaskets) and any other components needed to ensure that packages as presented for carriage are capable of passing the applicable performance tests of this Chapter.

6.3.3 Code for designating types of packagings

6.3.3.1 The codes for designating types of packagings are set out in 6.1.2.7.

6.3.3.2 The letters "U" or "W" may follow the packaging code. The letter "U" signifies a special packaging conforming to the requirements of 6.3.5.1.6. The letter "W" signifies that the packaging, although, of the same type indicated by the code is manufactured to a specification different from that in 6.1.4 and is considered equivalent under the requirements of 6.3.2.1.

6.3.4 Marking

NOTE 1: The marks indicate that the packaging which bears them corresponds to a successfully tested design type and that it complies with the requirements of this Chapter which are related to the manufacture, but not to the use, of the packaging.

NOTE 2: The marks are intended to be of assistance to packaging manufacturers, reconditioners, packaging users, carriers and regulatory authorities.

NOTE 3: The marks do not always provide full details of the test levels, etc., and these may need to be taken further into account, e.g. by reference to a test certificate, to test reports or to a register of successfully tested packagings.

6.3.4.1 Each packaging intended for use according to ADR shall bear marks which are durable, legible and placed in a location and of such a size relative to the packaging as to be readily visible. For packages with a gross mass of more than 30 kg, the marks or a duplicate thereof shall appear on the top or on a side of the packaging. Letters, numerals and symbols shall be at least 12 mm high, except for packagings of 30 l capacity or less or of 30 kg maximum net mass, when they shall be at least 6 mm in height and except for packagings of 5 l capacity or less or of 5 kg maximum net mass when they shall be of an appropriate size.

6.3.4.2 A packaging that meets the requirements of this section and of 6.3.5 shall be marked with:

(a) The United Nations packaging symbol

This symbol shall not be used for any purpose other than certifying that a packaging, a flexible bulk container, a portable tank or a MEGC complies with the relevant requirements in Chapter 6.1, 6.2, 6.3, 6.5, 6.6, 6.7 or 6.11;

- (b) The code designating the type of packaging according to the requirements of 6.1.2;
- (c) The text "CLASS 6.2";
- (d) The last two digits of the year of manufacture of the packaging;
- (e) The state authorizing the allocation of the mark, indicated by the distinguishing sign used on vehicles in international road traffic¹;
- (f) The name of the manufacturer or other identification of the packaging specified by the competent authority;
- (g) For packagings meeting the requirements of 6.3.5.1.6, the letter "U", inserted immediately following the mark required in (b) above.

6.3.4.3 Marks shall be applied in the sequence shown in 6.3.4.2 (a) to (g); each mark required in these sub-paragraphs shall be clearly separated, e.g. by a slash or space, so as to be easily identifiable. For examples, see 6.3.4.4.

Any additional marks authorized by a competent authority shall still enable the marks required in 6.3.4.1 to be correctly identified.

6.3.4.4 Example of marking



4G/CLASS 6.2/06

as in 6.3.4.2 (a), (b), (c) and (d)

S/SP-9989-ERIKSSON

as in 6.3.4.2 (e) and (f)

6.3.5 Test requirements for packagings

6.3.5.1 Performance and frequency of tests

6.3.5.1.1 The design type of each packaging shall be tested as provided in this section in accordance with procedures established by the competent authority allowing the allocation of the mark and shall be approved by this competent authority.

6.3.5.1.2 Each packaging design type shall successfully pass the tests prescribed in this Chapter before being used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes packagings which differ from the design type only in their lesser design height.

6.3.5.1.3 Tests shall be repeated on production samples at intervals established by the competent authority.

6.3.5.1.4 Tests shall also be repeated after each modification which alters the design, material or manner of construction of a packaging.

6.3.5.1.5 The competent authority may permit the selective testing of packagings that differ only in minor respects from a tested type, e.g. smaller sizes or lower net mass of primary receptacles; and packagings such as drums and boxes which are produced with small reductions in external dimension(s).

¹ *Distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, e.g. in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.*

6.3.5.1.6 Primary receptacles of any type may be assembled within a secondary packaging and carried without testing in the rigid outer packaging under the following conditions:

- (a) The rigid outer packaging shall have been successfully tested in accordance with 6.3.5.2.2 with fragile (e.g. glass) primary receptacles;
- (b) The total combined gross mass of primary receptacles shall not exceed one half the gross mass of primary receptacles used for the drop test in (a) above;
- (c) The thickness of cushioning between primary receptacles and between primary receptacles and the outside of the secondary packaging shall not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single primary receptacle was used in the original test, the thickness of cushioning between primary receptacles shall not be less than the thickness of cushioning between the outside of the secondary packaging and the primary receptacle in the original test. When either fewer or smaller primary receptacles are used (as compared to the primary receptacles used in the drop test), sufficient additional cushioning material shall be used to take up the void spaces;
- (d) The rigid outer packaging shall have successfully passed the stacking test in 6.1.5.6 while empty. The total mass of identical packages shall be based on the combined mass of packagings used in the drop test in (a) above;
- (e) For primary receptacles containing liquids, an adequate quantity of absorbent material to absorb the entire liquid content of the primary receptacles shall be present;
- (f) If the rigid outer packaging is intended to contain primary receptacles for liquids and is not leakproof, or is intended to contain primary receptacles for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage shall be provided in the form of a leakproof liner, plastics bag or other equally effective means of containment;
- (g) In addition to the marks prescribed in 6.3.4.2 (a) to (f), packagings shall be marked in accordance with 6.3.4.2 (g).

6.3.5.1.7 The competent authority may at any time require proof, by tests in accordance with this section, that serially-produced packagings meet the requirements of the design type tests.

6.3.5.1.8 Provided the validity of the test results is not affected and with the approval of the competent authority, several tests may be made on one sample.

6.3.5.2 Preparation of packagings for testing

6.3.5.2.1 Samples of each packaging shall be prepared as for carriage, except that a liquid or solid infectious substance shall be replaced by water or, where conditioning at -18°C is specified, by water/antifreeze. Each primary receptacle shall be filled to not less than 98 % of its capacity.

NOTE: The term water includes water/antifreeze solution with a minimum specific gravity of 0.95 for testing at -18°C .

6.3.5.2.2 Tests and number of samples required

Tests required for packaging types

Type of packaging ^a		Tests required						
Rigid outer packaging	Primary receptacle		Water spray 6.3.5.3.5.1	Cold conditioning 6.3.5.3.5.2	Drop 6.3.5.3	Additional drop 6.3.5.3.5.3	Puncture 6.3.5.4	Stack 6.1.5.6
	Plastics	Other	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples	No. of samples
Fibreboard box	x		5	5	10	Required on one sample when the packaging is intended to contain dry ice.	2	Required on three samples when testing a "U"-marked packaging as defined in 6.3.5.1.6 for specific provisions.
		x	5	0	5		2	
Fibreboard drum	x		3	3	6		2	
		x	3	0	3		2	
Plastics box	x		0	5	5		2	
		x	0	5	5		2	
Plastics drum/jerrican	x		0	3	3		2	
		x	0	3	3		2	
Boxes of other material	x		0	5	5		2	
		x	0	0	5		2	
Drums/jerricans of other material	x		0	3	3		2	
		x	0	0	3		2	

^a "Type of packaging" categorizes packagings for test purposes according to the kind of packaging and its material characteristics.

NOTE 1: In instances where a primary receptacle is made of two or more materials, the material most liable to damage determines the appropriate test.

NOTE 2: The material of the secondary packagings are not taken into consideration when selecting the test or conditioning for the test.

Explanation for use of the table:

If the packaging to be tested consists of a fibreboard outer box with a plastics primary receptacle, five samples must undergo the water spray test (see 6.3.5.3.5.1) prior to dropping and another five must be conditioned to –18 °C (see 6.3.5.3.5.2) prior to dropping. If the packaging is to contain dry ice then one further single sample shall be dropped in accordance with 6.3.5.3.5.3.

Packagings prepared as for carriage shall be subjected to the tests in 6.3.5.3 and 6.3.5.4. For outer packagings, the headings in the table relate to fibreboard or similar materials whose performance may be rapidly affected by moisture; plastics which may embrittle at low temperature; and other materials such as metal whose performance is not affected by moisture or temperature.

6.3.5.3 Drop test

6.3.5.3.1 Drop height and target

Samples shall be subjected to free-fall drops from a height of 9 m onto a non-resilient, horizontal, flat, massive and rigid surface in conformity with 6.1.5.3.4.

6.3.5.3.2 Number of test samples and drop orientation

Where the samples are in the shape of a box, five shall be dropped one in each of the following orientations:

- (a) Flat on the base;
- (b) Flat on the top;

- (c) Flat on the longest side;
- (d) Flat on the shortest side;
- (e) On a corner.

6.3.5.3.2.2 Where the samples are in the shape of a drum or a jerrican, three shall be dropped one in each of the following orientations:

- (a) Diagonally on the top edge, with the centre of gravity directly above the point of impact;
- (b) Diagonally on the base edge;
- (c) Flat on the body or side.

6.3.5.3.3 While the sample shall be released in the required orientation, it is accepted that for aerodynamic reasons the impact may not take place in that orientation.

6.3.5.3.4 Following the appropriate drop sequence, there shall be no leakage from the primary receptacle(s) which shall remain protected by cushioning/absorbent material in the secondary packaging.

6.3.5.3.5 *Special preparation of test sample for the drop test*

6.3.5.3.5.1 Fibreboard - Water spray test

Fibreboard outer packagings: The sample shall be subjected to a water spray that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour. It shall then be subjected to the test described in 6.3.5.3.1.

6.3.5.3.5.2 Plastics material – Cold conditioning

Plastics primary receptacles or outer packagings: The temperature of the test sample and its contents shall be reduced to –18 °C or lower for a period of at least 24 hours and within 15 minutes of removal from that atmosphere the test sample shall be subjected to the test described in 6.3.5.3.1. Where the sample contains dry ice, the conditioning period shall be reduced to 4 hours.

6.3.5.3.5.3 Packagings intended to contain dry ice – Additional drop test

Where the packaging is intended to contain dry ice, a test additional to that specified in 6.3.5.3.1 and, when appropriate, in 6.3.5.3.5.1 or 6.3.5.3.5.2 shall be carried out. One sample shall be stored so that all the dry ice dissipates and then that sample shall be dropped in one of the orientations described in 6.3.5.3.2.1 or 6.3.5.3.2.2, as appropriate, which shall be that most likely to result in failure of the packaging.

6.3.5.4 **Puncture test**

6.3.5.4.1 *Packagings with a gross mass of 7 kg or less*

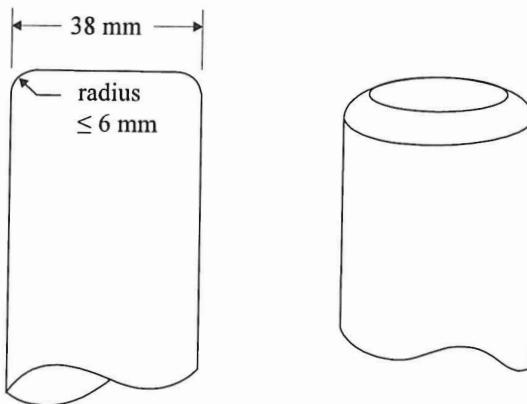
Samples shall be placed on a level hard surface. A cylindrical steel rod with a mass of at least 7 kg, a diameter of 38 mm and whose impact end edges have a radius not exceeding 6 mm (see Figure 6.3.5.4.2), shall be dropped in a vertical free fall from a height of 1 m, measured from the impact end to the impact surface of the sample. One sample shall be placed on its base. A second sample shall be placed in an orientation perpendicular to that used for the first. In each instance the steel rod shall be aimed to impact the primary receptacle. Following each impact, penetration of the secondary packaging is acceptable, provided that there is no leakage from the primary receptacle(s).

6.3.5.4.2 *Packagings with a gross mass exceeding 7 kg*

Samples shall be dropped on to the end of a cylindrical steel rod. The rod shall be set vertically in a level hard surface. It shall have a diameter of 38 mm and the edges of its upper end shall have a radius not exceeding 6 mm (see Figure 6.3.5.4.2). The rod shall protrude from the surface a distance at least equal to that between the centre of the primary receptacle(s) and the outer surface of the outer packaging with a minimum of 200 mm. One sample shall be dropped with its top face lowermost in a vertical free fall from a height of 1 m, measured from the top of the steel rod. A second sample shall be dropped from the same height in an orientation perpendicular to that used for the first. In each instance, the packaging shall be so orientated that the steel rod would be capable of penetrating the primary

receptacle(s). Following each impact, penetration of the secondary packaging is acceptable provided that there is no leakage from the primary receptacle(s).

Figure 6.3.5.4.2



6.3.5.5 *Test report*

6.3.5.5.1 A written test report containing at least the following particulars shall be drawn up and shall be available to the users of the packaging:

1. Name and address of the test facility;
2. Name and address of applicant (where appropriate);
3. A unique test report identification;
4. Date of the test and of the report;
5. Manufacturer of the packaging;
6. Description of the packaging design type (e.g. dimensions, materials, closures, thickness, etc.), including method of manufacture (e.g. blow moulding) and which may include drawing(s) and/or photograph(s);
7. Maximum capacity;
8. Test contents;
9. Test descriptions and results;
10. The test report shall be signed with the name and status of the signatory.

6.3.5.5.2 The test report shall contain statements that the packaging prepared as for carriage was tested in accordance with the appropriate requirements of this Chapter and that the use of other packaging methods or components may render it invalid. A copy of the test report shall be available to the competent authority.

CHAPTER 6.4

REQUIREMENTS FOR THE CONSTRUCTION, TESTING AND APPROVAL OF PACKAGES FOR RADIOACTIVE MATERIAL AND FOR THE APPROVAL OF SUCH MATERIAL

6.4.1 *(Reserved)*

6.4.2 General requirements

6.4.2.1 The package shall be so designed in relation to its mass, volume and shape that it can be easily and safely carried. In addition, the package shall be so designed that it can be properly secured in or on the vehicle during carriage.

6.4.2.2 The design shall be such that any lifting attachments on the package will not fail when used in the intended manner and that, if failure of the attachments should occur, the ability of the package to meet other requirements of this Annex would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.

6.4.2.3 Attachments and any other features on the outer surface of the package which could be used to lift it shall be designed either to support its mass in accordance with the requirements of 6.4.2.2 or shall be removable or otherwise rendered incapable of being used during carriage.

6.4.2.4 As far as practicable, the packaging shall be so designed that the external surfaces are free from protruding features and can be easily decontaminated.

6.4.2.5 As far as practicable, the outer layer of the package shall be so designed as to prevent the collection and the retention of water.

6.4.2.6 Any features added to the package at the time of carriage which are not part of the package shall not reduce its safety.

6.4.2.7 The package shall be capable of withstanding the effects of any acceleration, vibration or vibration resonance which may arise under routine conditions of carriage without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole. In particular, nuts, bolts and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.

6.4.2.8 The design of the package shall take into account ageing mechanisms.

6.4.2.9 The materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of their behaviour under irradiation.

6.4.2.10 All valves through which the radioactive contents could escape shall be protected against unauthorized operation.

6.4.2.11 The design of the package shall take into account ambient temperatures and pressures that are likely to be encountered in routine conditions of carriage.

6.4.2.12 A package shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of carriage and with the maximum radioactive contents that the package is designed to contain, the dose rate at any point on the external surface of the package would not exceed the values specified in 2.2.7.2.4.1.2, 4.1.9.1.11 and 4.1.9.1.12, as applicable, with account taken of 7.5.11 CV33 (3.3) (b) and (3.5).

6.4.2.13 For radioactive material having other dangerous properties the package design shall take into account those properties; see 2.1.3.5.3 and 4.1.9.1.5.

6.4.2.14 Manufacturers and subsequent distributors of packagings shall provide information regarding procedures to be followed and a description of the types and dimensions of closures (including required gaskets) and any other components needed to ensure that packages as presented for carriage are capable of passing the applicable performance tests of this Chapter.

6.4.3 *(Reserved)*

6.4.4 Requirements for excepted packages

An excepted package shall be designed to meet the requirements specified in 6.4.2.1 to 6.4.2.13 and, in addition, the requirements of 6.4.7.2 if it contains fissile material allowed by one of the provisions of 2.2.7.2.3.5 (a) to (f).

6.4.5 Requirements for Industrial packages

6.4.5.1 Types IP-1, IP-2, and IP-3 packages shall meet the requirements specified in 6.4.2 and 6.4.7.2.

6.4.5.2 A Type IP-2 package shall, if it were subjected to the tests specified in 6.4.15.4 and 6.4.15.5, prevent:

- (a) Loss or dispersal of the radioactive contents; and
- (b) More than a 20 % increase in the maximum dose rate at any external surface of the package.

6.4.5.3 A Type IP-3 package shall meet all the requirements specified in 6.4.7.2 to 6.4.7.15.

6.4.5.4 Alternative requirements for Types IP-2 and IP-3 packages

6.4.5.4.1 Packages may be used as Type IP-2 package provided that:

- (a) They satisfy the requirements of 6.4.5.1;
- (b) They are designed to satisfy the requirements prescribed for packing group I or II in Chapter 6.1; and
- (c) When subjected to the tests required for packing groups I or II in Chapter 6.1, they would prevent:
 - (i) Loss or dispersal of the radioactive contents; and
 - (ii) More than a 20 % increase in the maximum dose rate at any external surface of the package.

6.4.5.4.2 Portable tanks may also be used as Types IP-2 or IP-3 packages, provided that:

- (a) They satisfy the requirements of 6.4.5.1;
- (b) They are designed to satisfy the requirements prescribed in Chapter 6.7 and are capable of withstanding a test pressure of 265 kPa; and
- (c) They are designed so that any additional shielding which is provided shall be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of carriage and of preventing more than a 20 % increase in the maximum dose rate at any external surface of the portable tanks.

6.4.5.4.3 Tanks, other than portable tanks, may also be used as Types IP-2 or IP-3 packages for carrying LSA-I and LSA-II as prescribed in Table 4.1.9.2.5, provided that:

- (a) They satisfy the requirements of 6.4.5.1;
- (b) They are designed to satisfy the requirements prescribed in Chapter 6.8; and
- (c) They are designed so that any additional shielding which is provided shall be capable of withstanding the static and dynamic stresses resulting from handling and routine conditions of carriage and of preventing more than a 20 % increase in the maximum dose rate at any external surface of the tanks.

6.4.5.4.4 Containers with the characteristics of a permanent enclosure may also be used as Types IP-2 or IP-3 packages, provided that:

- (a) The radioactive contents are restricted to solid materials;

- (b) They satisfy the requirements of 6.4.5.1; and
- (c) They are designed to conform to ISO 1496-1:1990: "Series 1 Containers - Specifications and Testing - Part 1: General Cargo Containers" and subsequent amendments 1:1993, 2:1998, 3:2005, 4:2006 and 5:2006, excluding dimensions and ratings. They shall be designed such that if subjected to the tests prescribed in that document and the accelerations occurring during routine conditions of carriage they would prevent:
 - (i) Loss or dispersal of the radioactive contents; and
 - (ii) More than a 20 % increase in the maximum dose rate at any external surface of the containers.

6.4.5.4.5 Metal intermediate bulk containers may also be used as Types IP-2 or IP-3 packages provided that:

- (a) They satisfy the requirements of 6.4.5.1; and
- (b) They are designed to satisfy the requirements prescribed in Chapter 6.5 for packing group I or II, and if they were subjected to the tests prescribed in that Chapter, but with the drop test conducted in the most damaging orientation, they would prevent:
 - (i) Loss or dispersal of the radioactive contents; and
 - (ii) More than a 20 % increase in the maximum dose rate at any external surface of the intermediate bulk container.

6.4.6

Requirements for packages containing uranium hexafluoride

6.4.6.1

Packages designed to contain uranium hexafluoride shall meet the requirements which pertain to the radioactive and fissile properties of the material prescribed elsewhere in ADR. Except as allowed in 6.4.6.4, uranium hexafluoride in quantities of 0.1 kg or more shall also be packaged and carried in accordance with the provisions of ISO 7195:2005 "Nuclear Energy – Packaging of uranium hexafluoride (UF₆) for transport", and the requirements of 6.4.6.2 and 6.4.6.3.

6.4.6.2

Each package designed to contain 0.1 kg or more of uranium hexafluoride shall be designed so that the package would meet the following requirements:

- (a) Withstand without leakage and without unacceptable stress, as specified in ISO 7195:2005, the structural test as specified in 6.4.21.5 except as allowed in 6.4.6.4;
- (b) Withstand without loss or dispersal of the uranium hexafluoride the free drop test specified in 6.4.15.4; and
- (c) Withstand without rupture of the containment system the thermal test specified in 6.4.17.3 except as allowed in 6.4.6.4.

6.4.6.3

Packages designed to contain 0.1 kg or more of uranium hexafluoride shall not be provided with pressure relief devices.

6.4.6.4

Subject to multilateral approval, packages designed to contain 0.1 kg or more of uranium hexafluoride may be carried if the packages are designed:

- (a) To international or national standards other than ISO 7195:2005 provided an equivalent level of safety is maintained; and/or
- (b) To withstand without leakage and without unacceptable stress a test pressure of less than 2.76 MPa as specified in 6.4.21.5; and/or
- (c) To contain 9 000 kg or more of uranium hexafluoride and the packages do not meet the requirement of 6.4.6.2 (c).

In all other respects the requirements specified in 6.4.6.1 to 6.4.6.3 shall be satisfied.

6.4.7

Requirements for Type A packages

6.4.7.1

Type A packages shall be designed to meet the general requirements of 6.4.2 and of 6.4.7.2 to 6.4.7.17.

6.4.7.2 The smallest overall external dimension of the package shall not be less than 10 cm.

6.4.7.3 The outside of the package shall incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that it has not been opened.

6.4.7.4 Any tie-down attachments on the package shall be so designed that, under normal and accident conditions of carriage, the forces in those attachments shall not impair the ability of the package to meet the requirements of ADR.

6.4.7.5 The design of the package shall take into account temperatures ranging from -40°C to +70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.

6.4.7.6 The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.

6.4.7.7 The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise within the package.

6.4.7.8 Special form radioactive material may be considered as a component of the containment system.

6.4.7.9 If the containment system forms a separate unit of the package, the containment system shall be capable of being securely closed by a positive fastening device which is independent of any other part of the packaging.

6.4.7.10 The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.

6.4.7.11 The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

6.4.7.12 All valves, other than pressure relief valves, shall be provided with an enclosure to retain any leakage from the valve.

6.4.7.13 A radiation shield which encloses a component of the package specified as a part of the containment system shall be so designed as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield shall be capable of being securely closed by a positive fastening device which is independent of any other packaging structure.

6.4.7.14 A package shall be so designed that if it were subjected to the tests specified in 6.4.15, it would prevent:

- Loss or dispersal of the radioactive contents; and
- More than a 20 % increase in the maximum dose rate at any external surface of the package.

6.4.7.15 The design of a package intended for liquid radioactive material shall make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.

Type A packages to contain liquids

6.4.7.16 A Type A package designed to contain liquid radioactive material shall, in addition:

- Be adequate to meet the conditions specified in 6.4.7.14 (a) above if the package is subjected to the tests specified in 6.4.16; and
- Either
 - Be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material shall be suitably positioned so as to contact the liquid in the event of leakage; or
 - Be provided with a containment system composed of primary inner and secondary outer containment components designed to enclose the liquid contents completely and ensure

their retention, within the secondary outer containment components, even if the primary inner components leak.

Type A packages to contain gas

6.4.7.17 A Type A package designed for gases shall prevent loss or dispersal of the radioactive contents if the package were subjected to the tests specified in 6.4.16, except for a Type A package designed for tritium gas or for noble gases.

6.4.8 Requirements for Type B(U) packages

6.4.8.1 Type B(U) packages shall be designed to meet the requirements specified in 6.4.2, and of 6.4.7.2 to 6.4.7.15, except as specified in 6.4.7.14 (a), and, in addition, the requirements specified in 6.4.8.2 to 6.4.8.15.

6.4.8.2 A package shall be so designed that, under the ambient conditions specified in 6.4.8.5 and 6.4.8.6, heat generated within the package by the radioactive contents shall not, under normal conditions of carriage, as demonstrated by the tests in 6.4.15, adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for a period of one week. Particular attention shall be paid to the effects of heat, which may cause one or more of the following:

- (a) Alteration of the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt;
- (b) Lessening of the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material;
- (c) Acceleration of corrosion when combined with moisture.

6.4.8.3 A package shall be so designed that, under the ambient condition specified in 6.4.8.5 and in the absence of insolation, the temperature of the accessible surfaces of a package shall not exceed 50 °C, unless the package is carried under exclusive use.

6.4.8.4 The maximum temperature of any surface readily accessible during carriage of a package under exclusive use shall not exceed 85 °C in the absence of insolation under the ambient conditions specified in 6.4.8.5. Account may be taken of barriers or screens intended to give protection to persons without the need for the barriers or screens being subject to any test.

6.4.8.5 The ambient temperature shall be assumed to be 38 °C.

6.4.8.6 The solar insolation conditions shall be assumed to be as specified in Table 6.4.8.6.

Table 6.4.8.6: Insolation data

Case	Form and location of surface	Insolation for 12 hours per day (W/m ²)
1	Flat surfaces carried horizontally-downward facing	0
2	Flat surfaces carried horizontally-upward facing	800
3	Surfaces carried vertically	200 ^a
4	Other downward facing (not horizontal) surfaces	200 ^a
5	All other surfaces	400 ^a

^a Alternatively, a sine function may be used, with an absorption coefficient adopted and the effects of possible reflection from neighbouring objects neglected.

6.4.8.7 A package which includes thermal protection for the purpose of satisfying the requirements of the thermal test specified in 6.4.17.3 shall be so designed that such protection will remain effective if the package is subjected to the tests specified in 6.4.15 and 6.4.17.2 (a) and (b) or 6.4.17.2 (b) and (c), as appropriate. Any such protection on the exterior of the package shall not be rendered ineffective by ripping, cutting, skidding, abrasion or rough handling.

6.4.8.8 A package shall be so designed that, if it were subjected to:

- (a) The tests specified in 6.4.15, it would restrict the loss of radioactive contents to not more than 10^{-6} A₂ per hour; and
- (b) The tests specified in 6.4.17.1, 6.4.17.2 (b), 6.4.17.3, and 6.4.17.4 and either the test in
 - (i) 6.4.17.2 (c), when the package has a mass not greater than 500 kg, an overall density not greater than 1 000 kg/m³ based on the external dimensions, and radioactive contents greater than 1 000 A₂ not as special form radioactive material, or
 - (ii) 6.4.17.2 (a), for all other packages,

it would meet the following requirements:

- Retain sufficient shielding to ensure that the dose rate at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and
- Restrict the accumulated loss of radioactive contents in a period of one week to not more than 10 A₂ for krypton-85 and not more than A₂ for all other radionuclides.

Where mixtures of different radionuclides are present, the provisions of 2.2.7.2.2.4 to 2.2.7.2.2.6 shall apply except that for krypton-85 an effective A_{2(i)} value equal to 10 A₂ may be used. For case (a) above, the assessment shall take into account the external non-fixed contamination limits of 4.1.9.1.2.

- 6.4.8.9 A package for radioactive contents with activity greater than 10^5 A₂ shall be so designed that if it were subjected to the enhanced water immersion test specified in 6.4.18, there would be no rupture of the containment system.
- 6.4.8.10 Compliance with the permitted activity release limits shall depend neither upon filters nor upon a mechanical cooling system.
- 6.4.8.11 A package shall not include a pressure relief system from the containment system which would allow the release of radioactive material to the environment under the conditions of the tests specified in 6.4.15 and 6.4.17.
- 6.4.8.12 A package shall be so designed that if it were at the maximum normal operating pressure and it were subjected to the tests specified in 6.4.15 and 6.4.17, the level of strains in the containment system would not attain values which would adversely affect the package in such a way that it would fail to meet the applicable requirements.
- 6.4.8.13 A package shall not have a maximum normal operating pressure in excess of a gauge pressure of 700 kPa.
- 6.4.8.14 A package containing low dispersible radioactive material shall be so designed that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging shall not adversely affect the performance of the low dispersible radioactive material.
- 6.4.8.15 A package shall be designed for an ambient temperature range from -40 °C to +38 °C.

6.4.9 Requirements for Type B(M) packages

- 6.4.9.1 Type B(M) packages shall meet the requirements for Type B(U) packages specified in 6.4.8.1, except that for packages to be carried solely within a specified country or solely between specified countries, conditions other than those given in 6.4.7.5, 6.4.8.4 to 6.4.8.6, and 6.4.8.9 to 6.4.8.15 above may be assumed with the approval of the competent authorities of these countries. The requirements for Type B(U) packages specified in 6.4.8.4 and 6.4.8.9 to 6.4.8.15 shall be met as far as practicable.
- 6.4.9.2 Intermittent venting of Type B(M) packages may be permitted during carriage, provided that the operational controls for venting are acceptable to the relevant competent authorities.

6.4.10 Requirements for Type C packages

6.4.10.1 Type C packages shall be designed to meet the requirements specified in 6.4.2 and of 6.4.7.2 to 6.4.7.15, except as specified in 6.4.7.14 (a), and of the requirements specified in 6.4.8.2 to 6.4.8.6, 6.4.8.10 to 6.4.8.15, and, in addition, of 6.4.10.2 to 6.4.10.4.

6.4.10.2 A package shall be capable of meeting the assessment criteria prescribed for tests in 6.4.8.8 (b) and 6.4.8.12 after burial in an environment defined by a thermal conductivity of $0.33 \text{ W}\cdot\text{m}^{-1}\cdot\text{K}^{-1}$ and a temperature of 38°C in the steady state. Initial conditions for the assessment shall assume that any thermal insulation of the package remains intact, the package is at the maximum normal operating pressure and the ambient temperature is 38°C .

6.4.10.3 A package shall be so designed that, if it were at the maximum normal operating pressure and subjected to:

- The tests specified in 6.4.15, it would restrict the loss of radioactive contents to not more than 10^{-6} A_2 per hour; and
- The test sequences in 6.4.20.1,
 - It would retain sufficient shielding to ensure that the dose rate at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and
 - It would restrict the accumulated loss of radioactive contents in a period of 1 week to not more than 10 A_2 for krypton-85 and not more than A_2 for all other radionuclides.

Where mixtures of different radionuclides are present, the provisions of 2.2.7.2.2.4 to 2.2.7.2.2.6 shall apply except that for krypton-85 an effective A_2 (i) value equal to 10 A_2 may be used. For case (a) above, the assessment shall take into account the external contamination limits of 4.1.9.1.2.

6.4.10.4 A package shall be so designed that there will be no rupture of the containment system following performance of the enhanced water immersion test specified in 6.4.18.

6.4.11 Requirements for packages containing fissile material

6.4.11.1 Fissile material shall be carried so as to:

- Maintain sub-criticality during routine, normal and accident conditions of carriage; in particular, the following contingencies shall be considered:
 - Water leaking into or out of packages;
 - The loss of efficiency of built-in neutron absorbers or moderators;
 - Rearrangement of the contents either within the package or as a result of loss from the package;
 - Reduction of spaces within or between packages;
 - Packages becoming immersed in water or buried in snow; and
 - Temperature changes; and
- Meet the requirements:
 - Of 6.4.7.2 except for unpackaged material when specifically allowed by 2.2.7.2.3.5 (e);
 - Prescribed elsewhere in ADR which pertain to the radioactive properties of the material;
 - Of 6.4.7.3 unless the material is excepted by 2.2.7.2.3.5;
 - Of 6.4.11.4 to 6.4.11.14, unless the material is excepted by 2.2.7.2.3.5, 6.4.11.2 or 6.4.11.3.

6.4.11.2 Packages containing fissile material that meet the provisions of subparagraph (d) and one of the provisions of (a) to (c) below are excepted from the requirements of 6.4.11.4 to 6.4.11.14.

(a) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 10 cm;

(ii) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 5 \times \left(\frac{\text{Mass of U-235 in package (g)}}{Z} + \frac{\text{Mass of other fissile nuclides* in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

where the values of Z are taken from Table 6.4.11.2;

(iii) The CSI of any package does not exceed 10;

(b) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 30 cm;

(ii) The package, after being subjected to the tests specified in 6.4.15.1 to 6.4.15.6:

- Retains its fissile material contents;
- Preserves the minimum overall outside dimensions of the package to at least 30 cm;
- Prevents the entry of a 10 cm cube;

(iii) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \left(\frac{\text{Mass of U-235 in package (g)}}{Z} + \frac{\text{Mass of other fissile nuclides* in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

where the values of Z are taken from Table 6.4.11.2;

(iv) The criticality safety index of any package does not exceed 10;

(c) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 10 cm;

(ii) The package, after being subjected to the tests specified in 6.4.15.1 to 6.4.15.6:

- Retains its fissile material contents;
- Preserves the minimum overall outside dimensions of the package to at least 10 cm;
- Prevents the entry of a 10 cm cube;

(iii) The CSI of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \left(\frac{\text{Mass of U-235 in package (g)}}{450} + \frac{\text{Mass of other fissile nuclides* in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

(iv) The total mass of fissile nuclides in any package does not exceed 15 g;

(d) The total mass of beryllium, hydrogenous material enriched in deuterium, graphite and other allotropic forms of carbon in an individual package shall not be greater than the mass of fissile nuclides in the package except where the total concentration of these materials does not exceed 1 g in any 1 000 g of material. Beryllium incorporated in copper alloys up to 4 % in weight of the alloy does not need to be considered.

Table 6.4.11.2 Values of Z for calculation of criticality safety index in accordance with 6.4.11.2

Enrichment ^a	Z
Uranium enriched up to 1.5 %	2200
Uranium enriched up to 5 %	850
Uranium enriched up to 10 %	660
Uranium enriched up to 20 %	580
Uranium enriched up to 100 %	450

^a If a package contains uranium with varying enrichments of U-235, then the value corresponding to the highest enrichment shall be used for Z.

6.4.11.3 Packages containing not more than 1 000 g of plutonium are excepted from the application of 6.4.11.4 to 6.4.11.14 provided that:

(a) Not more than 20 % of the plutonium by mass is fissile nuclides;

(b) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \frac{\text{mass of plutonium(g)}}{1000}$$

(c) If uranium is present with the plutonium, the mass of uranium shall be no more than 1 % of the mass of the plutonium.

6.4.11.4 Where the chemical or physical form, isotopic composition, mass or concentration, moderation ratio or density, or geometric configuration is not known, the assessments of 6.4.11.8 to 6.4.11.13 shall be performed assuming that each parameter that is not known has the value which gives the maximum neutron multiplication consistent with the known conditions and parameters in these assessments.

6.4.11.5 For irradiated nuclear fuel the assessments of 6.4.11.8 to 6.4.11.13 shall be based on an isotopic composition demonstrated to provide either:

(a) The maximum neutron multiplication during the irradiation history; or

(b) A conservative estimate of the neutron multiplication for the package assessments. After irradiation but prior to shipment, a measurement shall be performed to confirm the conservatism of the isotopic composition.

6.4.11.6 The package, after being subjected to the tests specified in 6.4.15, shall:

(a) Preserve the minimum overall outside dimensions of the package to at least 10 cm; and

(b) Prevent the entry of a 10 cm cube.

6.4.11.7 The package shall be designed for an ambient temperature range of -40°C to + 38°C unless the competent authority specifies otherwise in the certificate of approval for the package design.

6.4.11.8 For a package in isolation, it shall be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features shall include either of the following:

- (a) Multiple high standard water barriers, not less than two of which would remain watertight if the package were subject to the tests prescribed in 6.4.11.13 (b), a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment; or
- (b) For packages containing uranium hexafluoride only, with maximum enrichment of 5 mass percent uranium-235:
 - (i) Packages where, following the tests prescribed in 6.4.11.13 (b), there is no physical contact between the valve or the plug and any other component of the packaging other than at its original point of attachment and where, in addition, following the test prescribed in 6.4.17.3 the valves and the plug remain leaktight; and
 - (ii) A high degree of quality control in the manufacture, maintenance and repair of packagings coupled with tests to demonstrate closure of each package before each shipment.

6.4.11.9 It shall be assumed that the confinement system is closely reflected by at least 20 cm of water or such greater reflection as may additionally be provided by the surrounding material of the packaging. However, when it can be demonstrated that the confinement system remains within the packaging following the tests prescribed in 6.4.11.13 (b), close reflection of the package by at least 20 cm of water may be assumed in 6.4.11.10 (c).

6.4.11.10 The package shall be subcritical under the conditions of 6.4.11.8 and 6.4.11.9 with the package conditions that result in the maximum neutron multiplication consistent with:

- (a) Routine conditions of carriage (incident free);
- (b) The tests specified in 6.4.11.12 (b);
- (c) The tests specified in 6.4.11.13 (b).

6.4.11.11 *(Reserved)*

6.4.11.12 For normal conditions of carriage a number "N" shall be derived, such that five times "N" packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

- (a) There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water; and
- (b) The state of the packages shall be their assessed or demonstrated condition if they had been subjected to the tests specified in 6.4.15.

6.4.11.13 For accident conditions of carriage a number "N" shall be derived, such that two times "N" packages shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

- (a) Hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water; and
- (b) The tests specified in 6.4.15 followed by whichever of the following is the more limiting:
 - (i) The tests specified in 6.4.17.2 (b) and, either 6.4.17.2 (c) for packages having a mass not greater than 500 kg and an overall density not greater than 1 000 kg/m³ based on the external dimensions, or 6.4.17.2 (a) for all other packages; followed by the test specified in 6.4.17.3 and completed by the tests specified in 6.4.19.1 to 6.4.19.3; or
 - (ii) The test specified in 6.4.17.4; and

(c) Where any part of the fissile material escapes from the containment system following the tests specified in 6.4.11.13 (b), it shall be assumed that fissile material escapes from each package in the array and all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.

6.4.11.14 The criticality safety index (CSI) for packages containing fissile material shall be obtained by dividing the number 50 by the smaller of the two values of N derived in 6.4.11.12 and 6.4.11.13 (i.e. $CSI = 50/N$). The value of the criticality safety index may be zero, provided that an unlimited number of packages is subcritical (i.e. N is effectively equal to infinity in both cases).

6.4.12 Test procedures and demonstration of compliance

6.4.12.1 Demonstration of compliance with the performance standards required in 2.2.7.2.3.3.1, 2.2.7.2.3.3.2, 2.2.7.2.3.4.1, 2.2.7.2.3.4.2, 2.2.7.2.3.4.3, and 6.4.2 to 6.4.11 must be accomplished by any of the methods listed below or by a combination thereof:

- (a) Performance of tests with specimens representing special form radioactive material, or low dispersible radioactive material or with prototypes or samples of the packaging, where the contents of the specimen or the packaging for the tests shall simulate as closely as practicable the expected range of radioactive contents and the specimen or packaging to be tested shall be prepared as presented for carriage;
- (b) Reference to previous satisfactory demonstrations of a sufficiently similar nature;
- (c) Performance of tests with models of appropriate scale incorporating those features which are significant with respect to the item under investigation when engineering experience has shown results of such tests to be suitable for design purposes. When a scale model is used, the need for adjusting certain test parameters, such as penetrator diameter or compressive load, shall be taken into account;
- (d) Calculation, or reasoned argument, when the calculation procedures and parameters are generally agreed to be reliable or conservative.

6.4.12.2 After the specimen, prototype or sample has been subjected to the tests, appropriate methods of assessment shall be used to assure that the requirements for the test procedures have been fulfilled in compliance with the performance and acceptance standards prescribed in 2.2.7.2.3.3.1, 2.2.7.2.3.3.2, 2.2.7.2.3.4.1, 2.2.7.2.3.4.2, 2.2.7.2.3.4.3, and 6.4.2 to 6.4.11.

6.4.12.3 All specimens shall be inspected before testing in order to identify and record faults or damage including the following:

- (a) Divergence from the design;
- (b) Defects in manufacture;
- (c) Corrosion or other deterioration; and
- (d) Distortion of features.

The containment system of the package shall be clearly specified. The external features of the specimen shall be clearly identified so that reference may be made simply and clearly to any part of such specimen.

6.4.13 Testing the integrity of the containment system and shielding and evaluating criticality safety

After each test or group of tests or sequence of the applicable tests, as appropriate, specified in 6.4.15 to 6.4.21:

- (a) Faults and damage shall be identified and recorded;
- (b) It shall be determined whether the integrity of the containment system and shielding has been retained to the extent required in 6.4.2 to 6.4.11 for the package under test; and
- (c) For packages containing fissile material, it shall be determined whether the assumptions and conditions used in the assessments required by 6.4.11.1 to 6.4.11.14 for one or more packages are valid.

6.4.14**Target for drop tests**

The target for the drop tests specified in 2.2.7.2.3.3.5 (a), 6.4.15.4, 6.4.16 (a), 6.4.17.2 and 6.4.20.2 shall be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

6.4.15**Tests for demonstrating ability to withstand normal conditions of carriage****6.4.15.1**

The tests are: the water spray test, the free drop test, the stacking test and the penetration test. Specimens of the package shall be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements of 6.4.15.2 are fulfilled.

6.4.15.2

The time interval between the conclusion of the water spray test and the succeeding test shall be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval shall be taken to be two hours if the water spray is applied from four directions simultaneously. No time interval shall elapse, however, if the water spray is applied from each of the four directions consecutively.

6.4.15.3

Water spray test: The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour.

6.4.15.4

Free drop test: The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested.

- (a) The height of the drop, measured from the lowest point of the specimen to the upper surface of the target, shall be not less than the distance specified in Table 6.4.15.4 for the applicable mass. The target shall be as defined in 6.4.14;
- (b) For rectangular fibreboard or wood packages not exceeding a mass of 50 kg, a separate specimen shall be subjected to a free drop onto each corner from a height of 0.3 m;
- (c) For cylindrical fibreboard packages not exceeding a mass of 100 kg, a separate specimen shall be subjected to a free drop onto each of the quarters of each rim from a height of 0.3 m.

Table 6.4.15.4: Free drop distance for testing packages to normal conditions of carriage

Package mass (kg)	Free drop distance (m)
Package mass < 5 000	1.2
5 000 ≤ Package mass < 10 000	0.9
10 000 ≤ Package mass < 15 000	0.6
15 000 ≤ Package mass	0.3

6.4.15.5

Stacking test: Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 h, to a compressive load equal to the greater of the following:

- (a) The equivalent of 5 times the maximum weight of the package;
- (b) The equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would typically rest.

6.4.15.6

Penetration test: The specimen shall be placed on a rigid, flat, horizontal surface which will not move significantly while the test is being carried out.

- (a) A bar of 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, onto the centre of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance;
- (b) The height of the drop of the bar, measured from its lower end to the intended point of impact on the upper surface of the specimen, shall be 1 m.

6.4.16**Additional tests for Type A packages designed for liquids and gases**

A specimen or separate specimens shall be subjected to each of the following tests unless it can be demonstrated that one test is more severe for the specimen in question than the other, in which case one specimen shall be subjected to the more severe test.

- (a) Free drop test: The specimen shall drop onto the target so as to suffer the maximum damage in respect of containment. The height of the drop measured from the lowest part of the specimen to the upper surface of the target shall be 9 m. The target shall be as defined in 6.4.14;
- (b) Penetration test: The specimen shall be subjected to the test specified in 6.4.15.6 except that the height of drop shall be increased to 1.7 m from the 1 m specified in 6.4.15.6 (b).

6.4.17**Tests for demonstrating ability to withstand accident conditions in carriage****6.4.17.1**

The specimen shall be subjected to the cumulative effects of the tests specified in 6.4.17.2 and 6.4.17.3, in that order. Following these tests, either this specimen or a separate specimen shall be subjected to the effect(s) of the water immersion test(s) as specified in 6.4.17.4 and, if applicable, 6.4.18.

6.4.17.2

Mechanical test: The mechanical test consists of three different drop tests. Each specimen shall be subjected to the applicable drops as specified in 6.4.8.8 or 6.4.11.13. The order in which the specimen is subjected to the drops shall be such that, on completion of the mechanical test, the specimen shall have suffered such damage as will lead to the maximum damage in the thermal test which follows.

- (a) For drop I, the specimen shall drop onto the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target shall be 9 m. The target shall be as defined in 6.4.14;
- (b) For drop II, the specimen shall drop onto a bar rigidly mounted perpendicularly on the target so as to suffer the maximum damage. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar shall be 1 m. The bar shall be of solid mild steel of circular cross-section, (15.0 cm \pm 0.5 cm) in diameter and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage shall be used. The upper end of the bar shall be flat and horizontal with its edge rounded off to a radius of not more than 6 mm. The target on which the bar is mounted shall be as described in 6.4.14;
- (c) For drop III, the specimen shall be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 m onto the specimen. The mass shall consist of a solid mild steel plate 1 m by 1 m and shall fall in a horizontal attitude. The lower face of the steel plate shall have its edges and corners rounded off to a radius of not more than 6 mm. The height of the drop shall be measured from the underside of the plate to the highest point of the specimen. The target on which the specimen rests shall be as defined in 6.4.14.

6.4.17.3

Thermal test: The specimen shall be in thermal equilibrium under conditions of an ambient temperature of 38 °C, subject to the solar insulation conditions specified in Table 6.4.8.6 and subject to the design maximum rate of internal heat generation within the package from the radioactive contents. Alternatively, any of these parameters are allowed to have different values prior to and during the test, providing due account is taken of them in the subsequent assessment of package response.

The thermal test shall then consist of:

- (a) Exposure of a specimen for a period of 30 minutes to a thermal environment which provides a heat flux at least equivalent to that of a hydrocarbon fuel/air fire in sufficiently quiescent ambient conditions to give a minimum average flame emissivity coefficient of 0.9 and an average temperature of at least 800 °C, fully engulfing the specimen, with a surface absorptivity coefficient of 0.8 or that value which the package may be demonstrated to possess if exposed to the fire specified, followed by;
- (b) Exposure of the specimen to an ambient temperature of 38 °C, subject to the solar insulation conditions specified in Table 6.4.8.6 and subject to the design maximum rate of internal heat generation within the package by the radioactive contents for a sufficient period to ensure that temperatures in the specimen are decreasing in all parts of the specimen and/or are approaching

initial steady state conditions. Alternatively, any of these parameters are allowed to have different values following cessation of heating, providing due account is taken of them in the subsequent assessment of package response.

During and following the test the specimen shall not be artificially cooled and any combustion of materials of the specimen shall be permitted to proceed naturally.

6.4.17.4 Water immersion test: The specimen shall be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions.

6.4.18 Enhanced water immersion test for Type B(U) and Type B(M) packages containing more than 10^5 A₂ and Type C packages

Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions.

6.4.19 Water leakage test for packages containing fissile material

6.4.19.1 Packages for which water in-leakage or out-leakage to the extent which results in greatest reactivity has been assumed for purposes of assessment under 6.4.11.8 to 6.4.11.13 shall be excepted from the test.

6.4.19.2 Before the specimen is subjected to the water leakage test specified below, it shall be subjected to the tests in 6.4.17.2 (b), and either 6.4.17.2 (a) or (c) as required by 6.4.11.13, and the test specified in 6.4.17.3.

6.4.19.3 The specimen shall be immersed under a head of water of at least 0.9 m for a period of not less than 8 hours and in the attitude for which maximum leakage is expected.

6.4.20 Tests for Type C packages

6.4.20.1 Specimens shall be subjected to the effects of each of the following test sequences in the orders specified:

- (a) The tests specified in 6.4.17.2 (a), 6.4.17.2 (c), 6.4.20.2 and 6.4.20.3; and
- (b) The test specified in 6.4.20.4.

Separate specimens are allowed to be used for each of the sequences (a) and (b).

6.4.20.2 Puncture/tearing test: The specimen shall be subjected to the damaging effects of a vertical solid probe made of mild steel. The orientation of the package specimen and the impact point on the package surface shall be such as to cause maximum damage at the conclusion of the test sequence specified in 6.4.20.1 (a).

- (a) The specimen, representing a package having a mass less than 250 kg, shall be placed on a target and subjected to a probe having a mass of 250 kg falling from a height of 3 m above the intended impact point. For this test the probe shall be a 20 cm diameter cylindrical bar with the striking end forming a frustum of a right circular cone with the following dimensions: 30 cm height and 2.5 cm in diameter at the top with its edge rounded off to a radius of not more than 6 mm. The target on which the specimen is placed shall be as specified in 6.4.14;
- (b) For packages having a mass of 250 kg or more, the base of the probe shall be placed on a target and the specimen dropped onto the probe. The height of the drop, measured from the point of impact with the specimen to the upper surface of the probe shall be 3 m. For this test the probe shall have the same properties and dimensions as specified in (a) above, except that the length and mass of the probe shall be such as to incur maximum damage to the specimen. The target on which the base of the probe is placed shall be as specified in 6.4.14.

6.4.20.3 Enhanced thermal test: The conditions for this test shall be as specified in 6.4.17.3, except that the exposure to the thermal environment shall be for a period of 60 minutes.

6.4.20.4 Impact test: The specimen shall be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target shall be as defined in 6.4.14, except that the target surface may be at any orientation as long as the surface is normal to the specimen path.

6.4.21 Inspections for packagings designed to contain 0.1 kg or more of uranium hexafluoride

6.4.21.1 Every manufactured packaging and its service and structural equipment shall, either jointly or separately, undergo an inspection initially before being put into service and periodically thereafter. These inspections shall be performed and certified by the competent authority.

6.4.21.2 The initial inspection shall consist of a check of the design characteristics, a structural test, a leakproofness test, a water capacity test and a check of satisfactory operation of the service equipment.

6.4.21.3 The periodic inspections shall consist of a visual examination, a structural test, a leakproofness test and a check of satisfactory operation of the service equipment. The maximum intervals for periodic inspections shall be five years. Packagings which have not been inspected within this five-year period shall be examined before carriage in accordance with a programme approved by the competent authority. They shall not be refilled before completion of the full programme for periodic inspections.

6.4.21.4 The check of design characteristics shall demonstrate compliance with the design type specifications and the manufacturing programme.

6.4.21.5 For the initial structural test, packagings designed to contain 0.1 kg or more of uranium hexafluoride shall be tested hydraulically at an internal pressure of at least 1.38 MPa but, when the test pressure is less than 2.76 MPa, the design shall require multilateral approval. For retesting packagings, any other equivalent non-destructive testing may be applied subject to multilateral approval.

6.4.21.6 The leakproofness test shall be performed in accordance with a procedure which is capable of indicating leakages in the containment system with a sensitivity of 0.1 Pa·l/s (10^{-6} bar·l/s).

6.4.21.7 The water capacity of the packagings shall be established with an accuracy of $\pm 0.25\%$ at a reference temperature of 15 °C. The volume shall be stated on the plate described in 6.4.21.8.

6.4.21.8 A plate made of non-corroding metal shall be durably attached to every packaging in a readily accessible place. The method of attaching the plate must not impair the strength of the packaging. The following particulars, at least, shall be marked on the plate by stamping or by any other equivalent method:

- Approval number;
- Manufacturer's serial number;
- Maximum working pressure (gauge pressure);
- Test pressure (gauge pressure);
- Contents: uranium hexafluoride;
- Capacity in litres;
- Maximum permissible filling mass of uranium hexafluoride;
- Tare mass;
- Date (month, year) of the initial test and the most recent periodic test;
- Stamp of the expert who performed the tests.

6.4.22 Approvals of package designs and materials

6.4.22.1 The approval of designs for packages containing 0.1 kg or more of uranium hexafluoride requires that:

- (a) Each design that meets the requirements of 6.4.6.4 shall require multilateral approval;
- (b) Each design that meets the requirements of 6.4.6.1 to 6.4.6.3 shall require unilateral approval by the competent authority of the country of origin of the design, unless multilateral approval is otherwise required by ADR.

6.4.22.2 Each Type B(U) and Type C package design shall require unilateral approval, except that:

- (a) A package design for fissile material, which is also subject to 6.4.22.4, 6.4.23.7, and 5.1.5.2.1 shall require multilateral approval; and
- (b) A Type B(U) package design for low dispersible radioactive material shall require multilateral approval.

6.4.22.3 Each Type B(M) package design, including those for fissile material which are also subject to the requirements of 6.4.22.4, 6.4.23.7, and 5.1.5.2.1 and those for low dispersible radioactive material, shall require multilateral approval.

6.4.22.4 Each package design for fissile material which is not excepted by any of the paragraphs 2.2.7.2.3.5 (a) to (f), 6.4.11.2 and 6.4.11.3 shall require multilateral approval.

6.4.22.5 The design for special form radioactive material shall require unilateral approval. The design for low dispersible radioactive material shall require multilateral approval (see also 6.4.23.8).

6.4.22.6 The design for a fissile material excepted from "FISSILE" classification in accordance with 2.2.7.2.3.5 (f) shall require multilateral approval.

6.4.22.7 Alternative activity limits for an exempt consignment of instruments or articles in accordance with 2.2.7.2.2.2 (b) shall require multilateral approval.

6.4.22.8 Any design that requires unilateral approval originating in a country Contracting Party to ADR shall be approved by the competent authority of this country; if the country where the package design has been designed is not a Contracting Party to ADR, carriage is possible on condition that:

- (a) A certificate has been supplied by this country, proving that the package design satisfies the technical requirements of ADR, and that this certificate is validated by a competent authority of an ADR Contracting Party;
- (b) If no certificate and no existing package design approval by a country Contracting Party to ADR has been supplied, the package design is approved by the competent authority of an ADR Contracting Party.

6.4.22.9 For designs approved under the transitional measures see 1.6.6.

6.4.23 Applications and approvals for radioactive material carriage

6.4.23.1 *(Reserved)*

6.4.23.2 Applications for approval of shipment

6.4.23.2.1 An application for approval of shipment shall include:

- (a) The period of time, related to the shipment, for which the approval is sought;
- (b) The actual radioactive contents, the expected modes of carriage, the type of vehicle, and the probable or proposed route; and
- (c) The details of how the precautions and administrative or operational controls, referred to in the certificate of approval for the package design, if applicable, issued under 5.1.5.2.1 (a) (v), (vi) or (vii), are to be put into effect.

6.4.23.2.2 An application for approval of SCO-III shipments shall include:

- (a) A statement of the respects in which, and of the reasons why, the consignment is considered SCO-III;
- (b) Justification for choosing SCO-III by demonstrating that:
 - (i) No suitable packaging currently exists;
 - (ii) Designing and/or constructing a packaging or segmenting the object is not practically, technically or economically feasible;
 - (iii) No other viable alternative exists;

- (c) A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;
- (d) A detailed statement of the design of the SCO-III, including complete engineering drawings and schedules of materials and methods of manufacture;
- (e) All information necessary to satisfy the competent authority that the requirements of 4.1.9.2.4 (e) and the requirements of 7.5.11, CV33 (2), if applicable, are satisfied;
- (f) A transport plan;
- (g) A specification of the applicable management system as required in 1.7.3.

6.4.23.3 An application for approval of shipments under special arrangement shall include all the information necessary to satisfy the competent authority that the overall level of safety in carriage is at least equivalent to that which would be provided if all the applicable requirements of ADR had been met.

The application shall also include:

- (a) A statement of the respects in which, and of the reasons why, the shipment cannot be made in full accordance with the applicable requirements of ADR; and
- (b) A statement of any special precautions or special administrative or operational controls which are to be employed during carriage to compensate for the failure to meet the applicable requirements of ADR.

6.4.23.4 An application for approval of Type B(U) or Type C package design shall include:

- (a) A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;
- (b) A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture;
- (c) A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements;
- (d) The proposed operating and maintenance instructions for the use of the packaging;
- (e) If the package is designed to have a maximum normal operating pressure in excess of 100 kPa gauge, a specification of the materials of manufacture of the containment system, the samples to be taken, and the tests to be made;
- (f) If the package is to be used for shipment after storage, a justification of considerations to ageing mechanisms in the safety analysis and within the proposed operating and maintenance instructions;
- (g) Where the proposed radioactive contents are irradiated nuclear fuel, a statement and a justification of any assumption in the safety analysis relating to the characteristics of the fuel and a description of any pre-shipment measurement as required by 6.4.11.5 (b);
- (h) Any special stowage provisions necessary to ensure the safe dissipation of heat from the package considering the various modes of carriage to be used and type of vehicle or container;
- (i) A reproducible illustration, not larger than 21 cm by 30 cm, showing the make-up of the package;
- (j) A specification of the applicable management system as required in 1.7.3; and
- (k) For packages which are to be used for shipment after storage, a gap analysis programme describing a systematic procedure for a periodic evaluation of changes of applicable regulations, changes in technical knowledge and changes of the state of the package design during storage.

6.4.23.5 An application for approval of a Type B(M) package design shall include, in addition to the general information required in 6.4.23.4 for Type B(U) packages:

- (a) A list of the requirements specified in 6.4.7.5, 6.4.8.4 to 6.4.8.6 and 6.4.8.9 to 6.4.8.15 with which the package does not conform;
- (b) Any proposed supplementary operational controls to be applied during carriage not regularly provided for in this Annex, but which are necessary to ensure the safety of the package or to compensate for the deficiencies listed in (a) above;
- (c) A statement relative to any restrictions on the mode of carriage and to any special loading, carriage, unloading or handling procedures; and
- (d) A statement of the range of ambient conditions (temperature, solar radiation) which are expected to be encountered during carriage and which have been taken into account in the design.

6.4.23.6 The application for approval of designs for packages containing 0.1 kg or more of uranium hexafluoride shall include all information necessary to satisfy the competent authority that the design meets the applicable requirements of 6.4.6.1, and a description of the applicable management system as required in 1.7.3.

6.4.23.7 An application for a fissile package approval shall include all information necessary to satisfy the competent authority that the design meets the applicable requirements of 6.4.11.1, and a specification of the applicable management system as required by 1.7.3.

6.4.23.8 An application for approval of design for special form radioactive material and design for low dispersible radioactive material shall include:

- (a) A detailed description of the radioactive material or, if a capsule, the contents; particular reference shall be made to both physical and chemical states;
- (b) A detailed statement of the design of any capsule to be used;
- (c) A statement of the tests which have been done and their results, or evidence based on calculations to show that the radioactive material is capable of meeting the performance standards, or other evidence that the special form radioactive material or low dispersible radioactive material meets the applicable requirements of ADR;
- (d) A specification of the applicable management system as required in 1.7.3; and
- (e) Any proposed pre-shipment actions for use in the consignment of special form radioactive material or low dispersible radioactive material.

6.4.23.9 An application for approval of design for fissile material excepted from "FISSILE" classification in accordance with Table 2.2.7.2.1.1, under 2.2.7.2.3.5 (f) shall include:

- (a) A detailed description of the material; particular reference shall be made to both physical and chemical states;
- (b) A statement of the tests that have been carried out and their results, or evidence based on calculation methods to show that the material is capable of meeting the requirements specified in 2.2.7.2.3.6;
- (c) A specification of the applicable management system as required in 1.7.3;
- (d) A statement of specific actions to be taken prior to shipment.

6.4.23.10 An application for approval of alternative activity limits for an exempt consignment of instruments or articles shall include:

- (a) An identification and detailed description of the instrument or article, its intended uses and the radionuclide(s) incorporated;
- (b) The maximum activity of the radionuclide(s) in the instrument or article;
- (c) Maximum external dose rates arising from the instrument or article;
- (d) The chemical and physical forms of the radionuclide(s) contained in the instrument or article;

- (e) Details of the construction and design of the instrument or article, particularly as related to the containment and shielding of the radionuclide in routine, normal and accident conditions of carriage;
- (f) The applicable management system, including the quality testing and verification procedures to be applied to radioactive sources, components and finished products to ensure that the maximum specified activity of radioactive material or the maximum dose rates specified for the instrument or article are not exceeded, and that the instruments or articles are constructed according to the design specifications;
- (g) The maximum number of instruments or articles expected to be shipped per consignment and annually;
- (h) Dose assessments in accordance with the principles and methodologies set out in the *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014), including individual doses to transport workers and members of the public and, if appropriate, collective doses arising from routine, normal and accident conditions of carriage, based on representative carriage scenarios the consignments are subject to.

6.4.23.11 Each certificate of approval issued by a competent authority shall be assigned an identification mark. The identification mark shall be of the following generalized type:

VRI/Number/Type Code

- (a) Except as provided in 6.4.23.12 (b), VRI represents the distinguishing sign used on vehicles in international road traffic¹;
- (b) The number shall be assigned by the competent authority, and shall be unique and specific with regard to the particular design or shipment or alternative activity limit for exempt consignment. The identification mark of the approval of shipment shall be clearly related to the identification mark of the approval of design;
- (c) The following type codes shall be used in the order listed to indicate the types of certificate of approval issued:

AF	Type A package design for fissile material
B(U)	Type B(U) package design [B(U) F if for fissile material]
B(M)	Type B(M) package design [B(M) F if for fissile material]
C	Type C package design (CF if for fissile material)
IF	Industrial package design for fissile material
S	Special form radioactive material
LD	Low dispersible radioactive material
FE	Fissile material complying with the requirements of 2.2.7.2.3.6
T	Shipment
X	Special arrangement
AL	Alternative activity limits for an exempt consignment of instruments or articles

In the case of package designs for non-fissile or fissile excepted uranium hexafluoride, where none of the above codes apply, then the following type codes shall be used:

H(U)	Unilateral approval
H(M)	Multilateral approval.

6.4.23.12 These identification marks shall be applied as follows:

- (a) Each certificate and each package shall bear the appropriate identification mark, comprising the symbols prescribed in 6.4.23.11 (a), (b) and (c) above, except that, for packages, only the applicable design type codes shall appear following the second stroke, that is, the "T" or "X" shall not appear in the identification mark on the package. Where the approval of design and the

¹ *Distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, e.g. in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.*

approval of shipment are combined, the applicable type codes do not need to be repeated. For example:

A/132/B(M)F: A Type B(M) package design approved for fissile material, requiring multilateral approval, for which the competent authority of Austria has assigned the design number 132 (to be marked on both the package and on the certificate of approval for the package design);

A/132/B(M)FT: The approval of shipment issued for a package bearing the identification mark elaborated above (to be marked on the certificate only);

A/137/X: An approval of special arrangement issued by the competent authority of Austria, to which the number 137 has been assigned (to be marked on the certificate only);

A/139/IF: An industrial package design for fissile material approved by the competent authority of Austria, to which package design number 139 has been assigned (to be marked on both the package and on the certificate of approval for the package design); and

A/145/H(U): A package design for fissile excepted uranium hexafluoride approved by the competent authority of Austria, to which package design number 145 has been assigned (to be marked on both the package and on the certificate of approval for the package design);

(b) Where multilateral approval is effected by validation in accordance with 6.4.23.20, only the identification mark issued by the country of origin of the design or shipment shall be used. Where multilateral approval is effected by issue of certificates by successive countries, each certificate shall bear the appropriate identification mark and the package whose design was so approved shall bear all appropriate identification marks. For example:

A/132/B(M)F
CH/28/B(M)F

would be the identification mark of a package which was originally approved by Austria and was subsequently approved, by separate certificate, by Switzerland. Additional identification marks would be tabulated in a similar manner on the package;

(c) The revision of a certificate shall be indicated by a parenthetical expression following the identification mark on the certificate. For example, A/132/B(M)F (Rev.2) would indicate revision 2 of the Austrian certificate of approval for the package design; or A/132/B(M)F (Rev.0) would indicate the original issuance of the Austrian certificate of approval for the package design. For original issuances, the parenthetical entry is optional and other words such as "original issuance" may also be used in place of "Rev.0". Certificate revision numbers may only be issued by the country issuing the original certificate of approval;

(d) Additional symbols (as may be necessitated by national regulations) may be added in brackets to the end of the identification mark; for example, A/132/B(M)F (SP503);

(e) It is not necessary to alter the identification mark on the packaging each time that a revision to the design certificate is made. Such re-marking shall be required only in those cases where the revision to the package design certificate involves a change in the letter type codes for the package design following the second stroke.

6.4.23.13 Each certificate of approval issued by a competent authority for special form radioactive material or low dispersible radioactive material shall include the following information:

(a) Type of certificate;

(b) The competent authority identification mark;

(c) The issue date and an expiry date;

- (d) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the special form radioactive material or low dispersible radioactive material is approved;
- (e) The identification of the special form radioactive material or low dispersible radioactive material;
- (f) A description of the special form radioactive material or low dispersible radioactive material;
- (g) Design specifications for the special form radioactive material or low dispersible radioactive material which may include references to drawings;
- (h) A specification of the radioactive contents which includes the activities involved and which may include the physical and chemical form;
- (i) A specification of the applicable management system as required in 1.7.3;
- (j) Reference to information provided by the applicant relating to specific actions to be taken prior to shipment;
- (k) If deemed appropriate by the competent authority, reference to the identity of the applicant;
- (l) Signature and identification of the certifying official.

6.4.23.14 Each certificate of approval issued by a competent authority for material excepted from classification as "FISSILE" shall include the following information:

- (a) Type of certificate;
- (b) The competent authority identification mark;
- (c) The issue date and an expiry date;
- (d) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the exception is approved;
- (e) A description of the excepted material;
- (f) Limiting specifications for the excepted material;
- (g) A specification of the applicable management system as required in 1.7.3;
- (h) Reference to information provided by the applicant relating to specific actions to be taken prior to shipment;
- (i) If deemed appropriate by the competent authority, reference to the identity of the applicant;
- (j) Signature and identification of the certifying official;
- (k) Reference to documentation that demonstrates compliance with 2.2.7.2.3.6.

6.4.23.15 Each certificate of approval issued by a competent authority for a special arrangement shall include the following information:

- (a) Type of certificate;
- (b) The competent authority identification mark;
- (c) The issue date and an expiry date;
- (d) Mode(s) of carriage;
- (e) Any restrictions on the modes of carriage, type of vehicle, container, and any necessary routeing instructions;

- (f) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the special arrangement is approved;
- (g) The following statement:

"This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be carried.";
- (h) References to certificates for alternative radioactive contents, other competent authority validation, or additional technical data or information, as deemed appropriate by the competent authority;
- (i) Description of the packaging by a reference to the drawings or a specification of the design. If deemed appropriate by the competent authority, a reproducible illustration, not larger than 21 cm by 30 cm, showing the make-up of the package shall also be provided, accompanied by a brief description of the packaging, including materials of manufacture, gross mass, general outside dimensions and appearance;
- (j) A specification of the authorized radioactive contents, including any restrictions on the radioactive contents which might not be obvious from the nature of the packaging. This shall include the physical and chemical forms, the activities involved (including those of the various isotopes, if appropriate), mass in grams (for fissile material or for each fissile nuclide when appropriate), and whether special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.2.7.2.3.5 (f) if applicable;
- (k) Additionally, for packages containing fissile material:
 - (i) a detailed description of the authorized radioactive contents;
 - (ii) the value of the criticality safety index;
 - (iii) reference to the documentation that demonstrates the criticality safety of the package;
 - (iv) any special features, on the basis of which the absence of water from certain void spaces has been assumed in the criticality assessment;
 - (v) any allowance (based on 6.4.11.5 (b)) for a change in neutron multiplication assumed in the criticality assessment as a result of actual irradiation experience; and
 - (vi) the ambient temperature range for which the special arrangement has been approved;
- (l) A detailed listing of any supplementary operational controls required for preparation, loading, carriage, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat;
- (m) If deemed appropriate by the competent authority, reasons for the special arrangement;
- (n) Description of the compensatory measures to be applied as a result of the shipment being under special arrangement;
- (o) Reference to information provided by the applicant relating to the use of the packaging or specific actions to be taken prior to the shipment;
- (p) A statement regarding the ambient conditions assumed for purposes of design if these are not in accordance with those specified in 6.4.8.5, 6.4.8.6, and 6.4.8.15, as applicable;
- (q) Any emergency arrangements deemed necessary by the competent authority;
- (r) A specification of the applicable management system as required in 1.7.3;
- (s) If deemed appropriate by the competent authority, reference to the identity of the applicant and to the identity of the carrier;
- (t) Signature and identification of the certifying official.

6.4.23.16 Each certificate of approval for a shipment issued by a competent authority shall include the following information:

- (a) Type of certificate;
- (b) The competent authority identification mark(s);
- (c) The issue date and an expiry date;
- (d) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the shipment is approved;
- (e) Any restrictions on the modes of carriage, type of vehicle, container, and any necessary routeing instructions;
- (f) The following statement:

"This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be carried.";
- (g) A detailed listing of any supplementary operational controls required for preparation, loading, carriage, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat or maintenance of criticality safety;
- (h) Reference to information provided by the applicant relating to specific actions to be taken prior to shipment;
- (i) Reference to the applicable certificate(s) of approval of design;
- (j) A specification of the actual radioactive contents, including any restrictions on the radioactive contents which might not be obvious from the nature of the packaging. This shall include the physical and chemical forms, the total activities involved (including those of the various isotopes, if appropriate), mass in grams (for fissile material or for each fissile nuclide when appropriate), and whether special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.2.7.2.3.5 (f) if applicable;;
- (k) Any emergency arrangements deemed necessary by the competent authority;
- (l) A specification of the applicable management system as required in 1.7.3;
- (m) If deemed appropriate by the competent authority, reference to the identity of the applicant;
- (n) Signature and identification of the certifying official.

6.4.23.17 Each certificate of approval of the design of a package issued by a competent authority shall include the following information:

- (a) Type of certificate;
- (b) The competent authority identification mark;
- (c) The issue date and an expiry date;
- (d) Any restriction on the modes of carriage, if appropriate;
- (e) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the design is approved;
- (f) The following statement:

"This certificate does not relieve the consignor from compliance with any requirement of the government of any country through or into which the package will be carried.";

- (g) References to certificates for alternative radioactive contents, other competent authority validation, or additional technical data or information, as deemed appropriate by the competent authority;
- (h) A statement authorizing shipment where approval of shipment is required under 5.1.5.1.2, if deemed appropriate;
- (i) Identification of the packaging;
- (j) Description of the packaging by a reference to the drawings or specification of the design. If deemed appropriate by the competent authority, a reproducible illustration, not larger than 21 cm by 30 cm, showing the make-up of the package shall also be provided, accompanied by a brief description of the packaging, including materials of manufacture, gross mass, general outside dimensions and appearance;
- (k) Specification of the design by reference to the drawings;
- (l) A specification of the authorized radioactive content, including any restrictions on the radioactive contents which might not be obvious from the nature of the packaging. This shall include the physical and chemical forms, the activities involved (including those of the various isotopes, if appropriate), mass in grams (for fissile material the total mass of fissile nuclides or the mass for each fissile nuclide, when appropriate) and whether special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.2.7.2.3.5 (f), if applicable;
- (m) A description of the containment system;
- (n) For package designs containing fissile material which require multilateral approval of the package design in accordance with 6.4.22.4:
 - (i) a detailed description of the authorized radioactive contents;
 - (ii) a description of the confinement system;
 - (iii) the value of the criticality safety index;
 - (iv) reference to the documentation that demonstrates the criticality safety of the package;
 - (v) any special features, on the basis of which the absence of water from certain void spaces has been assumed in the criticality assessment;
 - (vi) any allowance (based on 6.4.11.5 (b)) for a change in neutron multiplication assumed in the criticality assessment as a result of actual irradiation experience; and
 - (vii) the ambient temperature range for which the package design has been approved;
- (o) For Type B(M) packages, a statement specifying those requirements of 6.4.7.5, 6.4.8.4, 6.4.8.5, 6.4.8.6 and 6.4.8.9 to 6.4.8.15 with which the package does not conform and any amplifying information which may be useful to other competent authorities;
- (p) For package designs subject to the transitional provisions in 1.6.6.2.1, a statement specifying those requirements of ADR applicable as from 1 January 2021 with which the package does not conform;
- (q) For packages containing more than 0.1 kg of uranium hexafluoride, a statement specifying those prescriptions of 6.4.6.4 which apply if any and any amplifying information which may be useful to other competent authorities;
- (r) A detailed listing of any supplementary operational controls required for preparation, loading, carriage, unloading and handling of the consignment, including any special stowage provisions for the safe dissipation of heat;
- (s) Reference to information provided by the applicant relating to the use of the packaging or specific actions to be taken prior to shipment;

- (t) A statement regarding the ambient conditions assumed for purposes of design if these are not in accordance with those specified in 6.4.8.5, 6.4.8.6 and 6.4.8.15, as applicable;
- (u) A specification of the applicable management system as required in 1.7.3;
- (v) Any emergency arrangements deemed necessary by the competent authority;
- (w) If deemed appropriate by the competent authority, reference to the identity of the applicant;
- (x) Signature and identification of the certifying official.

6.4.23.18 Each certificate issued by a competent authority for alternative activity limits for an exempt consignment of instruments or articles according to 5.1.5.2.1 (d) shall include the following information:

- (a) Type of certificate;
- (b) The competent authority identification mark;
- (c) The issue date and an expiry date;
- (d) List of applicable national and international regulations, including the edition of the *IAEA Regulations for the Safe Transport of Radioactive Material* under which the exemption is approved;
- (e) The identification of the instrument or article;
- (f) A description of the instrument or article;
- (g) Design specifications for the instrument or article;
- (h) A specification of the radionuclide(s), the approved alternative activity limit(s) for the exempt consignment(s) of the instrument(s) or article(s);
- (i) Reference to documentation that demonstrates compliance with 2.2.7.2.2 (b);
- (j) If deemed appropriate by the competent authority, reference to the identity of the applicant;
- (k) Signature and identification of the certifying official.

6.4.23.19 The competent authority shall be informed of the serial number of each packaging manufactured to a design approved by them under 1.6.6.2.1, 1.6.6.2.2, 6.4.22.2, 6.4.22.3 and 6.4.22.4.

6.4.23.20 Multilateral approval may be by validation of the original certificate issued by the competent authority of the country of origin of the design or shipment. Such validation may take the form of an endorsement on the original certificate or the issuance of a separate endorsement, annex, supplement, etc., by the competent authority of the country through or into which the shipment is made.

CHAPTER 6.5

REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF INTERMEDIATE BULK CONTAINERS (IBCs)

6.5.1 General requirements

6.5.1.1 Scope

The requirements of this Chapter apply to intermediate bulk containers (IBCs) the use of which is expressly authorized for the carriage of certain dangerous goods according to the packing instructions indicated in Column (8) of Table A in Chapter 3.2. Portable tanks and tank-containers which meet the requirements of Chapter 6.7 or 6.8 respectively are not considered to be IBCs. IBCs which meet the requirements of this Chapter are not considered to be containers for the purposes of ADR. The letters IBC only will be used in the rest of the text to refer to intermediate bulk containers.

6.5.1.1.2 The requirements for IBCs in 6.5.3 are based on IBCs currently in use. In order to take into account progress in science and technology, there is no objection to the use of IBCs having specifications different from those in 6.5.3 and 6.5.5, provided that they are equally effective, acceptable to the competent authority and able to successfully fulfil the requirements described in 6.5.4 and 6.5.6. Methods of inspection and testing other than those described in ADR are acceptable, provided they are equivalent, and are recognized by the competent authority.

6.5.1.1.3 The construction, equipment, testing, marking and operation of IBCs shall be subject to acceptance by the competent authority of the country in which the IBCs are approved.

NOTE: Parties performing inspections and tests in other countries, after the IBC has been put into service, need not be accepted by the competent authority of the country in which the IBC has been approved, but the inspections and tests have to be performed according to the rules specified in the IBC's approval.

6.5.1.1.4 Manufacturers and subsequent distributors of IBCs shall provide information regarding procedures to be followed and a description of the types and dimensions of closures (including required gaskets) and any other components needed to ensure that IBCs as presented for carriage are capable of passing the applicable performance tests of this Chapter.

6.5.1.2 *(Reserved)*

6.5.1.3 *(Reserved)*

6.5.1.4 Designatory code system for IBCs

6.5.1.4.1 The code shall consist of two Arabic numerals as specified in (a), followed by a capital letter(s) specified in (b), followed, when specified in an individual section, by an Arabic numeral indicating the category of IBC.

(a)	Type	For solids, filled or discharged		For liquids
		by gravity	under pressure of more than 10 kPa (0.1 bar)	
	Rigid	11	21	31
	Flexible	13	-	-

(b) Materials

- A. Steel (all types and surface treatments)
- B. Aluminium
- C. Natural wood
- D. Plywood
- F. Reconstituted wood
- G. Fibreboard
- H. Plastics material
- L. Textile
- M. Paper, multiwall
- N. Metal (other than steel or aluminium).

6.5.1.4.2 For composite IBCs, two capital letters in Latin characters shall be used in sequence in the second position of the code. The first shall indicate the material of the inner receptacle of the IBC and the second that of the outer packaging of the IBC.

6.5.1.4.3 The following types and codes of IBC are assigned:

Material	Category	Code	Sub-section
Metal			
A. Steel	for solids, filled or discharged by gravity	11A	6.5.5.1
	for solids, filled or discharged under pressure	21A	
	for liquids	31A	
B. Aluminium	for solids, filled or discharged by gravity	11B	6.5.5.1
	for solids, filled or discharged under pressure	21B	
	for liquids	31B	
N. Other than steel or aluminium	for solids, filled or discharged by gravity	11N	6.5.5.1
	for solids, filled or discharged under pressure	21N	
	for liquids	31N	
Flexible			
H. Plastics	woven plastics without coating or liner	13H1	6.5.5.2
	woven plastics, coated	13H2	
	woven plastics with liner	13H3	
	woven plastics, coated and with liner	13H4	
	plastics film	13H5	
L. Textile	without coating or liner	13L1	6.5.5.2
	coated	13L2	
	with liner	13L3	
	coated and with liner	13L4	
M. Paper	multiwall	13M1	6.5.5.2
	multiwall, water-resistant	13M2	
H. Rigid plastics	for solids, filled or discharged by gravity, fitted with structural equipment	11H1	6.5.5.3
	for solids, filled or discharged by gravity, freestanding	11H2	
	for solids, filled or discharged under pressure, fitted with structural equipment	21H1	
	for solids, filled or discharged under pressure, freestanding	21H2	
	for liquids, fitted with structural equipment	31H1	
	for liquids, freestanding	31H2	