
**Nuclear energy — Packaging of uranium
hexafluoride (UF₆) for transport**

*Énergie nucléaire — Emballage de l'hexafluorure d'uranium (UF₆) en
vue de son transport*



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7195 was prepared by Technical Committee ISO/TC 85, *Nuclear energy*, Subcommittee SC 5, *Nuclear fuel technology*.

This second edition cancels and replaces the first edition (ISO 7195:1993), which has been technically revised.

Introduction

The packaging of uranium hexafluoride (UF_6) for transport is an essential operation in the nuclear industry. The United States Standard ANSI N14.1 (first issued in 1971) has been used internationally as an accepted procedure for packaging UF_6 , and the standard cylinders and protective packages included in ANSI N14.1 have been used widely as accepted designs for international transport of UF_6 . However, in some cases minor adaptations of the American standard were required to meet local conditions in a particular country. For example, equivalent materials may have been used instead of the materials specified. Moreover, the certification of cylinders as pressure vessels can have required equivalent authorization procedures appropriate in the countries concerned, rather than the US certification procedure specified.

This International Standard has been developed from and is based on ANSI N14.1, but with incorporation of, and allowance for, other equivalent technical solutions and national authorization and certification procedures. IAEA recommendations relevant to UF_6 have also been taken into consideration. ISO 7195 was first issued in 1993 and the revision process started in 1998.

This International Standard specifies the internationally accepted guidelines and procedures for packaging of UF_6 for transport. It does not relieve the consignor from compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the material is transported.

This International Standard is consistent with, but does not replace, the recommendations of the International Atomic Energy Agency contained in IAEA Safety Standards Series No. TS-R-1:1996 (as revised 2003). Quoting from the Introduction to these Regulations,

“The objective of these Regulations is to protect persons, property and the environment from the effects of radiation during the transport of radioactive material. Protection is achieved by requiring containment of the radioactive contents, control of external radiation levels, prevention of criticality and prevention of damage caused by heat. These requirements are satisfied firstly by applying a graded approach to contents limits for packages and conveyances and to performance standards applied to package designs depending upon the hazard of the radioactive contents. Secondly, they are satisfied by imposing requirements on the design and operation of packages and on the maintenance of packages, including a consideration of the nature of the radioactive contents. Finally, they are satisfied by requiring administrative controls including, where appropriate, approval by competent authorities.”

In addition, due to the chemical risks associated with UF_6 , there are special requirements for packages containing this material.

It should be noted that the IAEA Regulations form the essential basis of regulations for international transport (Agreement for the safe transport of dangerous goods by rail, RID; European agreement for the safe transport of dangerous goods by road, ADR; International maritime dangerous code, IMDG; and Technical instructions for the safe transport of dangerous goods by air issued by the International Civil Aviation Organization, ICAO) that accordingly form the basis for national regulations. There are nevertheless minor differences in practice in the various countries. However, these minor differences are not considered significant in relation to this International Standard and do not affect the guidelines stated. Individual countries may issue national standards for packaging of UF_6 for transport, for which this International Standard can form the basis. This International Standard does not take precedence over applicable governmental regulations.

This International Standard presents information on UF_6 cylinders, valves, protective packages and shipping. However, it should be emphasized that this information has been derived from widespread practical applications and is therefore the result of international experience. As this experience grows, improved designs of cylinders and valves may come forward. Improvements shall be subject to approval by competent authorities. Authorized improvements may be considered for incorporation in this International Standard on the occasion of future revisions. Annex A of this International Standard is provided for information.

Throughout this International Standard and in conformity with standard ISO practice, SI metric units are used in preference to imperial units (which are given in parenthesis for information). However, if the original type identification of a cylinder is based on its size, the imperial units are maintained (e.g. 48" cylinder, 48Y, 30B, etc.). If a common, commercially available component uses features that are defined in an appropriate non-SI metric-based Standard document, only the relevant base units are quoted.

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Nuclear energy — Packaging of uranium hexafluoride (UF₆) for transport

1 Scope

This International Standard specifies requirements for packaging of uranium hexafluoride (UF₆) for transport.

It applies to

- packages designed to contain uranium hexafluoride in quantities of 0,1 kg or more,
- design, manufacture, inspection and testing of new cylinders and protective packagings,
- maintenance, repair, inspection and testing of cylinders and protective packagings,
- in-service inspection and testing requirements for cylinders and protective packagings.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 263, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0.06 to 6 in*

ISO 898-1:1999, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs*

ISO 9453, *Soft solder alloys — Chemical compositions and forms*

ISO 12807, *Safe transport of radioactive materials — Leakage testing on packages*

IAEA Safety Standards Series No. TS-R-1, *Regulations for the Safe Transport of Radioactive Materials, 1996 Edition (as revised 2003)*

ANSI/ASME B1.1:2003, *Unified Inch Screw Threads, UN and UNR Thread Form*

ANSI/ASME B1.20.1:1983 (R2001), *Pipe Threads, General Purpose, inch*

ANSI/ASME B16.11:2001, *Forged Steel Fittings, Socket-Welding and Threaded*

ANSI/AWS A5.8/A5.8M:2004, *Specification for Filler Metals for Brazing and Braze Welding*

ANSI/AWS A5.14/A5.14M:1997, *Specification for Nickel and Nickel Alloy Bare Wire Electrodes and Rods*

ANSI/A5.18:1993, *Specification for Nickel and Nickel Alloy Bare Wire Electrodes and Rods*

ANSI/CGA V-1:2003, *Compressed Gas Cylinder Valve Outlet and Inlet Connections*

EN 10025:1990, *Hot rolled products of non-alloy structural steels — Technical delivery conditions*

EN 10025:1990/A1:1993, Amendment 1

EN 10028-3:2003 *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10088-2:1995, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*

ASTM A20/A20M-B:2004a, *Standard Specification for General Requirements for Steel Plates for Pressure Vessels*

ASTM A36/A36M:2004, *Standard Specification for Carbon Structural Steel*

ASTM A53/A53M:2004a, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

ASTM A105/A105M:2003, *Standard Specification for Carbon Steel Forgings for Piping Applications*

ASTM A106/A106M:2004b, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

ASTM A108:2003, *Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished*

ASTM A131/A131M:2004ae1, *Standard Specification for Structural Steel for Ships*

ASTM A240/A240M:2004, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

ASTM A285/A285M:2003, *Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength*

ASTM A516/A516M:2004, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

ASTM A575/A575M:1996 (2002), *Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades*

ASTM B16/B16M:2000, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*

ASTM B32:2004, *Standard Specification for Solder Metal*

ASTM B127:1998, *Standard Specification for Nickel-Copper Alloy Plate, Sheet, and Strip*

ASTM B150:1998, *Standard Specification for Aluminum Bronze Rod, Bar, and Shapes*

ASTM B160:1999, *Standard Specification for Nickel Rod and Bar*

ASTM B161:2003, *Standard Specification for Nickel Seamless Pipe and Tube*

ASTM B162:1999, *Standard Specification for Nickel Plate, Sheet, and Strip*

ASTM B164:2003, *Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire*

ASTM B165:1993 (2003)e1, *Standard Specification for Nickel-Copper Alloy Seamless Pipe and Tube*

ASTM B366:2004, *Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings*