



Designation: **C996 – 15 C996 – 20**

Standard Specification for Uranium Hexafluoride Enriched to Less Than 5 % ²³⁵U¹

This standard is issued under the fixed designation C996; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers nuclear grade uranium hexafluoride (UF₆) that either has been processed through an enrichment plant, plant or has been produced by the blending of Highly Enriched Uranium with other uranium to obtain uranium of any ²³⁵U concentration below 5 % and that is intended for fuel fabrication. The objectives of this specification are twofold: (1) ~~T₀~~ define the impurity and uranium isotope limits for Enriched Commercial Grade UF₆ so that, with respect to fuel design and manufacture, it is essentially equivalent to enriched uranium made from natural UF₆ and (2) ~~T₀~~ define limits for Enriched Reprocessed UF₆ to be expected if Reprocessed UF₆ is to be enriched without dilution with Commercial Natural UF₆. For such UF₆, special provisions, not defined herein, may be needed to ensure fuel performance and to protect the work force, process equipment, and the environment.

1.2 This specification is intended to provide the nuclear industry with a standard for enriched UF₆ that is to be used in the production of sinterable UO₂ powder for fuel fabrication. In addition to this specification, the parties concerned may agree to other appropriate conditions.

1.3 The scope of this specification does not comprehensively cover all provisions for preventing criticality accidents or requirements for health and safety or for shipping. Observance of this specification does not relieve the user of the obligation to conform to all applicable international, federal, state, and local regulations for processing, shipping, or in any other way using UF₆ (see, for example, TID-7016, DP-532, and DOE O474.1).

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only after SI units are provided for information only and are not considered standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

C761 Test Methods for Chemical, Mass Spectrometric, Spectrochemical, Nuclear, and Radiochemical Analysis of Uranium Hexafluoride

C787 Specification for Uranium Hexafluoride for Enrichment

C859 Terminology Relating to Nuclear Materials

C1052 Practice for Bulk Sampling of Liquid Uranium Hexafluoride

~~**E1703**~~ **C1883** Practice for Sampling of Gaseous Enriched Uranium Hexafluoride for Enrichment

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.2 ANSI/ASME Standards:³

ASME NQA-1 Quality Assurance Requirements for Nuclear Facility Applications

ANSI N14.1 Nuclear Materials—Uranium Hexafluoride—Packaging for Transport

¹ This specification is under the jurisdiction of ASTM Committee C26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.02 on Fuel and Fertile Material Specifications.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036-10036, <http://www.ansi.org>.

2.3 U.S. Government Documents.⁴

~~Inspection, Weighing, and Sampling of Uranium Hexafluoride Cylinders, Procedure for Handling and Analysis of Uranium Hexafluoride, Vol. 1, ORO-671-1 DOE Report ORO-671-1, Inspection, Weighing, and Sampling of Uranium Hexafluoride Cylinders, Procedure for Handling and Analysis of Uranium Hexafluoride, Vol 1, latest revision Nuclear Safety Guide, U.S. NRC Report TID-7016, TID-7016 Rev. 2, 1978 Nuclear Safety Guide, Rev. 2 Clarke, H. K., Handbook of Nuclear Safety, DOE Report DP-532 Handbook of Nuclear Safety Code of Federal Regulations, Title 10, 10 CFR 50 Code of Federal Regulations, Title 10, Part 50, (Appendix B)~~

2.4 Other Document:

~~The UF₆ Manual: Good Handling Practices for Uranium Hexafluoride, The UF₆ Manual: Good Handling Practices for Uranium Hexafluoride United States Enrichment Corporation Report USEC-651, Report, latest revision⁵~~

3. Terminology

3.1 Definitions:

3.1.1 Terms shall be defined in accordance with Terminology **C859**, except for the terms listed below.

3.2 Definitions of Terms Specific to This Standard:

~~3.1.1 Terms shall be defined in accordance with Terminology **C859** except for the following:~~

3.2.1 ~~Commercial Natural UF₆, n—~~UF₆ from natural unirradiated uranium (containing 0.711 ± 0.004 g ²³⁵U per 100-g U).~~100 gU).~~

3.2.1.1 Discussion—

It is recognized that some contamination with reprocessed uranium may occur during routine processing. This is acceptable provided that the UF₆ meets the requirements for Commercial Natural UF₆ as specified in Specification **C787**.

3.2.2 ~~Reprocessed-Derived Enriched UF₆, n—~~any UF₆ made from uranium that has been exposed in a neutron irradiation facility and subsequently chemically separated from the fission products and transuranic isotopes so generated.~~obtained from the blending of Highly Enriched Uranium with any other uranium.~~

~~3.1.4 Highly Enriched Uranium—~~any form of uranium having a ²³⁵U content of 20 % or greater.

3.2.3 ~~Enriched Commercial Grade UF₆, n—~~UF₆ enriched from Commercial Natural UF₆ or Derived Enriched UF₆ that meets the specification limits for Enriched Commercial Grade UF₆.

3.2.4 ~~Enriched Reprocessed UF₆, n—~~UF₆ enriched from Reprocessed UF₆, any mixture of Reprocessed UF₆ and Commercial Natural UF₆ or Derived Enriched UF₆, exceeding the applicable limits of Sections 4 and 5 for Enriched Commercial Grade UF₆. The wide range of irradiation levels, cooling times, reprocessing, conversion, and enrichment processes, and fuel cycle choices for combination with unirradiated UF₆, together with the varying acceptance limits of different fuel fabrication facilities, make it not practical to specify the exact radionuclide composition of Enriched Reprocessed UF₆.

~~3.2.5 Highly Enriched Uranium, n—~~any form of uranium having a ²³⁵U content of 20 % or greater.

~~3.2.6 Derived-Enriched-Reprocessed UF₆, n—~~any UF₆ obtained from the blending of Highly Enriched Uranium with any other uranium.~~made from uranium that has been exposed in a neutron irradiation facility and subsequently chemically separated from the fission products and transuranic isotopes so generated.~~

3.3 For enriched UF₆ transactions, “buyer” usually represents the electric power utility company or the fuel fabricator, and “seller” usually represents the isotopic enrichment facility.

4. Safety, Health Physics, and Criticality Requirements

4.1 The UF₆ concentration shall not be less than 99.5 g UF₆ per 100 g of sample in order to limit the potential hydrogen content for nuclear criticality safety.

4.2 The total absolute vapor pressure shall not exceed the ~~values given below:~~following values:

⁴ Available from U.S.—U. S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401:Accountability Office (GAO), 441 G St., NW, Washington, DC 20548, <http://www.gao.gov>.

⁵ Available from ~~United States Enrichment Corporation, 6903~~Centrus Energy Corporation, 6901 Rockledge Drive, Bethesda, MD 20817.