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Nuclear Industry Standard

of the People's Republic of China

EJ/T 307-2014

Replacing EJ/T 307-1996

Requirements on application of uranium hexafluoride cylinder

六氟化铀容器使用要求

Issued on: November 17, 2014 **Implemented on: February 1, 2015**

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Foreword

This Standard replaces EJ/T 307-1996 Requirements on application of uranium hexafluoride cylinder.

Compared with EJ/T 307-1996, this Standard has the main changes as follows:

a) ADD the requirements that the stainless steel containers need to be conducted with cold-hot test when operating at -196°C;

b) ADD the methods of pressure test and gas leakage test;

c) ADD the requirements of paint identifications for serial-number 300L, 740L, 1,000L and 3m^3 containers;

d) ADD the item that the allowable loading amount of containers shall not be greater than 3.0kg when the loading abundance of 1L containers is less than 5%;

e) CHANGE the pressure test cycle of 60L containers from 3a to 5a. CHANGE the pressure test cycle of 1L containers whose loading abundance is less than 5% from 1a to 5a;

f) ADD the requirements of critical control during the hydrolysis;

g) ADD the relevant requirements for scrapping containers;

h) USE the contents referenced from EJ/T 190 to replace the contents of Item c in Article 6.1.3.3 of the previous Standard;

i) ADD the operating provisions of liquid filling;

j) DELETE Table 4 in the original Standard.

This Standard was proposed by China National Nuclear Corporation (CNNC).

This Standard shall be under the jurisdiction of the Institute for Standardization of Nuclear Industry.

Drafting organization of this Standard: CNNC Lanzhou Uranium Enrichment Co., Ltd.

Main drafters of this Standard: Zhou Junjie, Wu Tingfang, Xin Zhiyi, Li Jiangang, Zhang Minhua, Wei Xiangpeng, and Jing Mingxuan.

This Standard was first released in 1987, and was first revised in 1996.

Requirements on application of uranium hexafluoride cylinder

1 Scope

This Standard specifies the management and application methods of UF_6 containers.

This Standard applies to the application of 1L, 60L, 300L, 740L, 1,000L and 3m^3 UF_6 containers, and shall be considered as a reference for the application of other UF_6 containers.

2 Normative references

The provisions in the following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest versions apply to this Standard.

GB 150 Steel pressure containers

GB/T 3864-1996 Industrial nitrogen

GB 11806 Regulations for the safe transport of radioactive material

GB 15146.3 Nuclear criticality safety for fissile materials outside reactors – Part 3: Requirements for nuclear criticality safety in the storage of fissile materials

EJ/T 190-1994 Technical conditions for steel containers

EJ/T 303 1L UF_6 containers

EJ/T 304 60L UF_6 containers

EJ/T 305 300L UF_6 containers

EJ/T 306 1,000L UF_6 containers

EJ/T 350 740L UF_6 containers

buckles. The engagement length of the threads between the bolts of embedded valve bodies and the valve bodies shall not be less than 1.5 times of the bolt diameter. The bolts and nuts shall have Φ2mm lead sealing holes.

3.2.9 The tin-plated valves shall be screwed in for 7-12 buckles, while the container plugs shall be screwed in for 5-8 buckles. The screwing torque shall be within the range of 280-560N•m. The valves and plugs shall have Φ2mm lead sealing holes.

4 Tests conducted to new containers

4.1 Cold-hot test

4.1.1 The stainless steel containers need to be conducted with cold-hot test when operating at -196°C. When each batch of containers includes more than 10pcs, SAMPLE the containers accounting for 10% to 20% of the batch quantity for cold-hot test. If one of the containers is unqualified, INCREASE the sampling quantity to 40% of the batch quantity. If the non-conformance products still exist, CONDUCT the cold-hot test to the entire batch of containers. When the batch quantity is equal to or less than 10pcs, CONDUCT the cold-hot test to each container.

4.1.2 The method of conducting the cold-hot test to the containers is as follows:

a) During the test, EVACUATE the container until the pressure is lower than 133Pa. After 30min, CHECK whether the pressure meets the requirements of the vacuum test.

b) PUT the container in the dedicated Dewar bottle. POUR in liquid nitrogen, so as to cool down the container. The liquid level of liquid nitrogen shall always submerge the welds of container neck. FREEZE the container for 1h. Naturally THAW to room temperature. HEAT the container to the maximum allowable temperature according to the provisions of design drawings. MAINTAIN heating for 1h. Naturally COOL down to room temperature.

c) The vacuum test for containers shall meet the requirements of Article 4.4.1.

4.2 Pressure (hydraulic/air pressure) test

4.2.1 The requirements for pressure gages and the safety precautions of the pressure test are as follows:

a) USE two pressure gages that are proven to be qualified along with the

same measuring range for conducting the pressure test;

b) The precision of pressure gages shall not be lower than Level 1.5. CONDUCT verification within half a year. The appropriate measuring range shall be 1.5 to 3 times of the test pressure. The dial diameter shall be greater than 100mm;

c) The safety precautions of the pressure test shall be implemented according to TSG R0004-2009.

4.2.2 CONDUCT hydrostatic test or air pressure test according to the requirements of design drawings.

4.2.2.1 The method of hydrostatic test is as follows:

a) The hydrostatic test of containers shall be conducted according to the Article 8.5.2 of EJ/T 190-1994.

b) After the hydrostatic test, DRAIN the water in the container. USE dried and degreased compressed air for drying. DRY the container in the drying oven where the temperature is controlled at 100°C ± 5°C for 24h.

4.2.2.2 The air pressure test of containers shall be conducted according to the Article 8.5.3 of EJ/T 190-1994. If using nitrogen, the nitrogen shall meet the requirements of GB/T 3864-1996.

4.3 Gas leakage test

4.3.1 For 740L and 3m^3 containers, after the assembly is qualified, CONDUCT gas leakage test according to the requirements of drawings.

4.3.2 The requirements and methods of the gas leakage test of containers shall be implemented according to the Article 8.5.4 of EJ/T 190-1994.

4.4 Vacuum test

4.4.1 CONDUCT vacuum test to the containers after the assembly. After the container assembly is qualified, EVACUATE the containers in time. The leakage rate shall meet the requirements of drawings or the provisions in Table 5 of EJ/T 190-1994. The time for the inner surfaces of containers to contact with the atmosphere shall not be longer than 24h.

4.4.2 After the vacuum containers are qualified, USE dry nitrogen to seal up the containers whose shelf life is more than 6 months for safekeeping. The sealing pressure shall be within the range of 0.05MPa to 0.1MPa (gage pressure). The quality of nitrogen shall conform to the indicators of first-grade products

6.3.3 For 740L and 3m^3 containers, PUNCH lead sealing holes on the square valve rods and the valve covers of the JF 22 valves. CONDUCT lead sealing to the above valves. CONDUCT lead sealing when the valves with protective covers leave the factory.

6.3.4 CONDUCT lead sealing to the container plugs.

6.3.5 Specially ASSIGN someone to manage the lead sealing pliers. The labels of lead sealing heads shall be traceable.

6.4 Container filing

6.4.1 The container property organizations shall establish the container ledger, and shall place the manufacturing documents and materials on file.

6.4.2 The container property organizations shall keep the “container turnover records”, so as to circulate together with the containers.

6.4.3 In the process of container turnover, NOTE down the acceptance, pressure test, cleaning, assembly, passivation, loading abundance, weighing, and other conditions of the containers in detail in the “container turnover records”.

6.4.4 The container property organizations shall note down all the significant events occurred in the process of container turnover and application on the container ledger.

7 Storage, transportation and handover of the vessels containing materials

7.1 Storage and transportation

7.1.1 The storage and transportation of containers shall meet the requirements specified in the GB 11806 and the Chapter 8 of EJ 1056-2005.

7.1.2 Solidly FIX the transported containers on the transport vehicles. It is strictly forbidden to slip and crash the containers during the transportation. The special vehicles shall be driven at the limit-speed during the transportation. Generally, the speed shall not be faster than 20km/h.

7.1.3 The storage of UF_6 containers shall meet the requirements specified in the GB 15146.3.

7.2 Handover

7.2.1 Container handover in the factory

During the container is turnovered and handovered in the factory, it is necessary to present the “container turnover records” and the “equipment interchange receipt for container delivery/storage”.

7.2.2 Handover of container delivery

7.2.2.1 For the cleaned and qualified containers after being tested as well as the containers allowing to be reused after the materials have been emptied, the handover personnel shall verify the serial numbers and the internal quality of containers according to the “container turnover records” and the “equipment interchange receipt for containers”.

7.2.2.2 The product vessels containing materials and the sample containers shall have product quality certificates and “container turnover records”. CHECK the serial numbers and the internal quality of containers.

7.2.2.3 The containers and valves shall be tight without any leakage within the stipulated pressure testing period. The container valves shall be closed tight. The valve cavities shall be clean without any materials or foreign matters.

7.2.2.4 The outside surfaces of handover containers shall be clean. The painting shall be in perfect condition without coming off or any rusty spots. None of the parts shall be missing. The clearance between the connecting flanges shall be even. The bolts and nuts shall be tightened. The lead sealing shall be conducted according to the requirements of Article 6.3.

7.2.2.5 All the serial numbers of the parts of 1L containers shall be consistent with those of the containers.

7.2.2.6 The limiting value of the dosage level on the container surfaces and the contamination control value of the surfaces of transport packages shall conform to the requirements specified in Article 8.5.2 and 8.5.3 of EJ 1056-2005. The container delivery organizations shall issue the certificate of surface dosage test.

8 Process operating rules

8.1 Before the process operation, CONDUCT the pressure test to the containers at room temperature. The absolute pressure in the containers shall not be greater than 0.02MPa.

8.2 The operating provisions of heating and evaporation are as follows:

9.2 Cleaning methods and steps

9.2.1 The method of hydrolysis is as follows:

a) When the mass of residual materials is lower than the limiting value specified in Table 2, ADD no more than 20L of water to the container. When the ^{235}U concentration is lower than 1.0% of the mass concentration, the above mentioned restriction is no longer applicable.

b) When the mass of residual materials is higher than the limiting value specified in Table 2, or needs critical control, ADD neutron absorber (such as boron solution). ADD 10g of boron in a liter of water, so as to prepare the boron solution.

9.2.2 The method of alkaline wash is as follows:

a) ADD the prepared sodium carbonate solution with the concentration of 5% (m/m) and the hydrogen peroxide with the concentration of more than 27.5% (m/m) to the container at the same time. The adding quantity respectively accounts for about 1/3 and 1/2 of the container volume. USE steam to heat the container. USE compressed air to stir and/or rotate the container until the discharged cleaning fluid becomes clear. TAKE sample to analyze the uranium content in the lye. The uranium content shall be equal to or lower than 5mg/L.

b) During the alkaline wash, USE the sodium carbonate solution with the concentration of 5% (m/m) and the hydrogen peroxide with the concentration of more than 27.5% (m/m) to soak the valves and parts for 1h. USE steam to heat the valves and parts. USE compressed air to stir and clean them. SHIFT them to another water tank. USE water to flush until the valves and parts become clean.

9.2.3 The method of water scrubbing is as follows: ADD water to the container. USE compressed air to stir or rotate the container until the discharged cleaning water becomes clear, and the PH value of water solution is equal to or less than 8.5.

9.2.4 The method of rust-removal is as follows:

a) For 60L, 300L, 740L, 1,000L and $3m^3$ containers, USE oxalic acid to remove rust. ADD the oxalic acid solution with the concentration of 4.5%-10% (m/m) to the container. The adding quantity accounts for 1/3 to 1/2 of the container volume. USE steam to heat the container up to 70°C to 80°C. USE compressed air to stir. SOAK for 24h. DISCHARGE the oxalic acid scrubbing solution. CONDUCT water scrubbing according to the

provisions of Article 9.2.3.

b) USE ethyl alcohol to scrub 1L containers for rust removal.

c) For 60L, 300L, 740L, 1,000L and 3m^3 containers, USE the oxalic acid solution with the concentration of 1%-2% (m/m) to soak the valves and parts. USE steam to heat the containers. USE compressed air to stir and scrub them. SHIFT them to another water tank. USE water to flush until the valves and parts become clean.

9.2.5 USE degreased hot compressed air to dry the containers as well as the valves and parts. BAKE them in a drying oven where the temperature is controlled at 100°C ± 5°C for 24h. CHECK the cleaning quality.

9.3 Inspection and requirements after cleaning

9.3.1 The inspection and requirements of 1L containers are as follows:

a) Only several corrosion spots can be allowed to exist on the neck. A large area of slight dark spots cannot be allowed to exist on other parts.

b) There shall be no radial scratches, bruises or pits on the cylinders and packing seals.

9.3.2 For 60L, 300L, 740L, 1,000L and 3m^3 containers, the inspection and requirements are as follows:

a) The depth of the bruises, pits or scratches on the outside surfaces shall not be more than 10% of the container wall thickness;

b) The corrosion area caused by rusting shall not be more than 10% of the total container area;

c) There shall be no traces of corrosion, green spots, sediments, moisture, scratches or white alkaline substances on the visual surfaces of valve elements, bellows and valve passages;

d) The inner container shall be clean and dry without any pollutants;

e) The radioactivity of the contaminations α and β on the outside surface shall not be greater than 0.17Bq/cm^2. USE the cotton balls soaked with ethyl alcohol to scrub the local small area of contamination. USE wet soda or the alkali wash water prepared according to the Article 9.2.2 to scrub the large area of contamination;

f) USE ultrasonic wave to measure the wall thickness of container shells

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