

Test Instruction

Periodic inspections of the 30B-X cylinder

0045-PA-2021-001-Rev0

Prepared	Checked	Released
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1 Scope, Objective and Responsibilities

These instructions describe the type and scope of the in-service inspections and tests of the 30B-X cylinder as required by [ANSI N14.1] or [ISO 7195], as well as the required additional tests for the internal CCS of the 30B-X cylinder. The in-service inspections and tests consist of:

- Routine operational inspections of the 30B-X cylinder when received and prior to sampling, withdrawal, filling, or shipping to ensure that it remains in a safe, usable condition.
- Five-year periodic inspections and tests for recertification of the 30B-X cylinder.

The user of the 30B-X cylinder is responsible for carrying out the in-service inspections and tests.

2 Applicable Documents and Regulations

Handling instructions [0045-HA-2021-001]	Use and handling of the DN30-X package
Specification [0045-SPZ-2021-001]	Specification of the 30B-X cylinder

- [ANSI N14.1] Uranium Hexafluoride – Packaging for Transport
- [ANSI N14.5] Radioactive Materials – Leakage Tests on Packages for Shipment
- [ASNT SNT-TC-1A] Personnel Qualification and Certification in Nondestructive Testing
- [ISO 7195] Nuclear Energy – Packagings for the transport of uranium hexafluoride (UF₆)
- [DIN EN ISO 9712] Non-destructive testing – Qualification and certification of NDT personnel

The standards, regulations and rules mentioned in this document must be applied in their currently valid revision.

3 Description of the 30B-X cylinder

The main components of the 30B-X cylinder are:

- The cylinder shell with an ellipsoidal head on each end
- The valve and plug half couplings
- The cylinder valve and plug
- The interior criticality control system (CCS) consisting of criticality control rods (CCRs) containing neutron absorbing material in the form of boron carbide (B₄C), three lattice holders, and longitudinal stiffeners that keep the CCRs in position. Two CCR restraints each consisting of a backing bar and a rotation preventing device that maintain the positioning of the CCS within the 30B-X cylinder cavity.

4 Qualification of Personnel

The personnel responsible for the in-service inspections and tests of the 30B-X cylinder must be familiar with this test instruction.

The responsible person for supervising the in-service inspections and tests of the 30B-X cylinder must be appointed by the management of the user and has to be independent from operations.

In compliance with [ANSI N14.1], all nondestructive examination (NDE) personnel shall be certified in accordance with [ASNT SNT-TC-1A] or [DIN EN ISO 9712], or other equivalent standards, and inspections shall be carried out using Code¹-compliant procedures.

5 Health Physics Clearance

Health physics clearance has to be available before the in-service inspections and tests of the 30B-X cylinder begin.

6 In-Service Inspections and Tests

6.1 Routine Operational Inspections

Routine operational inspections of 30B-X cylinders shall be performed as specified in [ANSI N14.1], section 5.4.1 and at least as described in [USEC 651] (or in equivalent plant specific instructions). In addition to [ANSI N14.1], section 5.4.1 the following applies to the 30B-X cylinder:

- Conditions of the 30B-X cylinder that might indicate excessive damage of the CCS, such as severe outer damages of the cylinder shell or skirts, should be referred to a qualified inspector. Reuse of such cylinders is only allowed after internal inspection of such cylinders and proof that the CCS is undamaged.

Details on the routine operational inspections of 30B-X cylinders are also provided in handling instruction [0045-HA-2021-001].

6.2 Periodic Inspections and Tests

Five-year periodic inspections and tests of 30B-X cylinders shall be performed as specified in [ANSI N14.1], section 5.4.2.2 and at least as described in [USEC 651] (or in equivalent plant specific instructions). In addition to [ANSI N14.1], section 5.4.2.2 the following applies to the 30B-X cylinder:

- An internal and external examination of the 30B-X cylinder has to be performed by a qualified inspector, including a visual inspection of the internal CCS as far as accessible.
- Deviating from [ANSI N14.1], Table 3, a 30B-X cylinder shall no longer be used in UF₆ service when the shell thickness has decreased below 11 mm.

¹ **Code** or “the Code” Section VIII, Division 1 of the ASME *Boiler and Pressure Vessel Code*.

7 Equipment for Inspections

The equipment used for dimensional checks and weight checks has to be calibrated. The calibration certificates have to be valid. For the tare weight re-establishment of the 30B-X cylinder that is required at each five-year periodic inspection described in section 6.2, a suitable weighing device designed for at least 1700 kg [3750 lb] has to be used. In addition, the uncertainty of the weighing device has to be less than $\pm 0.1 \%$.

During the in-service inspections and tests, the inspected area has to be sufficiently illuminated, either through daylight or through artificial light of at least 500 Lux (this is the equivalent illumination 1 m away from an 80 W fluorescent lamp). Disturbing light effects such as reflections have to be avoided.

For the visual inspection of the internal CCS of the 30B-X cylinder, video-endoscopy equipment has to be used that has been tested and maintained according to the manufacturer's specifications. The tester must be trained on the use of this device.

8 Inspection Performance, Evaluation, and Assessment of Results

8.1 Visual Inspections

The internal and external examination of the 30B-X cylinder by a qualified inspector is carried out on various components of the 30B-X cylinder:

- Inner and outer surface of the 30B-X cylinder as far as accessible
- Internal CCS including the CCRs as far as accessible

The visual inspection is carried out with respect to the following aspects:

- Presence or absence of parts
- Cleanliness
- Surface condition
- Irregularities, damages, and deformations
- Corrosion
- Integrity

The criteria and requirements for the degree of corrosion of the 30B-X cylinder are provided in Appendix 2. Furthermore, dimensional checks may be necessary if objections are raised from visual inspections.

8.2 Dimensional Checks

Dimensional checks are only necessary if objections are raised from visual inspections during routine operational inspections described in section 6.1 or periodic inspections described in section 6.2. Dimensional checks are carried out by means of adequate measuring devices. The criteria and requirements for dimensional checks of the 30B-X cylinder are provided in Appendix 1.

9 Non-conformances and Deviations

The repair of 30B-X cylinders has to be performed in accordance with [ANSI N14.1], section 5.5 and specification [0045-SPZ-2021-001].

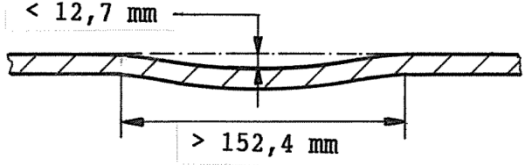
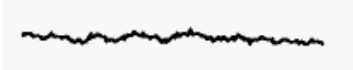
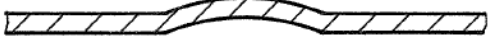

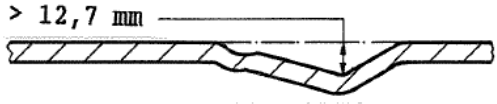
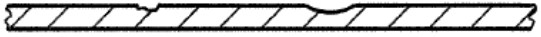
10 Documentation

The performance and results of the five-year inspections must be recorded in written protocols.


11 Literature

[0045-HA-2021-001]	Use and handling of the DN30-X package
[0045-SPZ-2021-001]	Specification of the 30B-X cylinder
[ASNT SNT-TC-1A]	Personnel Qualification and Certification in Nondestructive Testing
[ANSI N14.1]	Uranium Hexafluoride – Packaging for Transport
[ANSI N14.5]	Radioactive Materials – Leakage Tests on Packages for Shipment
[DIN EN ISO 9712]	Non-destructive testing – Qualification and certification of NDT personnel
[ISO 7195]	Nuclear Energy – Packagings for the transport of uranium hexafluoride (UF ₆)
[USEC 651]	The UF ₆ Manual – Good Handling Practices for Uranium Hexafluoride

Appendix 1 Acceptable and Unacceptable Damage to 30B-X Cylinders

	Check for:	Explanation
1	Pressure-envelope (shell or heads) curved dents	<p>Acceptable: any shallow/gentle curved dent in the cylinder shell that has a depth to diameter ratio of less than 1/12, providing the depth is less than 12.7 mm. Any cut, dent or gouge in the cylinder shell that is less than 2.54 mm in depth.</p> 
2	Cracks in the pressure envelope	<p>Unacceptable: visible cracks</p> 
3	Pressure-envelope bulges	<p>Unacceptable: visible bulges</p> 
4	Pressure-envelope dents	<p>Unacceptable: sharp dents</p> 
5	Pressure-envelope gouges, cuts or dents	<p>Unacceptable: any gouge, cut or dent with a depth greater than 12.7 mm or a depth to diameter ratio greater than 1/12, if the depth is between 2.54 mm and 12.7 mm.</p> 
6	Pressure-envelope gouges, cuts or dents	<p>Unacceptable: any gouge, cut or dent with a depth such that the wall thickness is less than 11 mm and a noticeable loss of metal.</p> 
7	Skirt torn from head with removal of metal from head	

Appendix 2 Criteria for Degree of Corrosion for the 30B-X Cylinder

	Condition	Classification	Further action
1		Acceptable	
2		Acceptable	
3		Acceptable	Measurement of wall thickness in the corroded areas and further investigation if required.
4		Acceptable	Measurement of wall thickness and further investigation if required.
5		Not acceptable	Refurbishing required.