



Standard

UF6 Cylinder Identification

01

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02

Introduction

This guide is intended to provide a standardized format and application method for a global identifier for the uranium hexafluoride (UF6) cylinders most commonly used across the nuclear industry. Industry uses standardized steel cylinders (for example, Model 30B, as well as Model 48X, 48Y, and 48G cylinders) for storing UF6 and transporting it among the many nuclear fuel cycle facilities (e.g. uranium conversion, uranium enrichment, fuel fabrication, and deconversion). Given the desire to ensure that all nuclear materials are safe and secure, stakeholders of the UF6 industry have met to identify best practices and to explore opportunities to further improve the accounting for and control of cylinders containing UF6. This document describes a preferred global identifier for industry use.

While current international transportation standards require cylinders to display a metal nameplate with identification information such as owner, serial number, and certifications, the engraved information can often be difficult to read and there is not an industry standard for the format of the assigned serial number. Therefore, many cylinder owners currently add supplemental cylinder identifiers (e.g. labels and markings) for use at their respective facilities to improve the performance of on-site operations.

The wide variety of identification formats and supplemental labels used across industry has limited the ability of the international inspectorates, such as the International Atomic Energy Agency (IAEA) and the Atomic Energy Community (Euratom), to be able to automate their verification activities. Industry has also identified additional operational benefits of applying a standardized, machine-readable, global identifier to each cylinder.

A WNTI working group was established to identify an industry-wide identification format that provides for uniquely identifying cylinders and to investigate methods for making the global identifier machine-readable and independently verifiable. The participants of this working group are provided in Appendix A. The recommendations of this guide are focused primarily on the larger diameter cylinders (i.e., 30- or 48- inch diameter) containing nuclear materials subject to IAEA safeguards and used for transporting UF6 between facilities and countries.

03

Regulatory Considerations

Uranium hexafluoride is shipped and stored in standardized cylinders for processing by the conversion, enrichment, fuel fabrication, and de-conversion facilities operating in the front end of the nuclear fuel cycle. These facilities report their inventory and transfers of UF6 to national authorities and, when required, to international agencies such as IAEA and Euratom. This section describes the identification-related regulations associated with cylinder fabrication and the reporting of nuclear material to national, regional, and international organizations.

3.1 Current Standards for Cylinder Fabrication

Cylinder specification and use are regulated by the agencies that have authority over the transportation of radioactive materials. Cylinders used for commercial transport are fabricated from carbon steel in accordance with standards established by the International Organization for Standardization (ISO)¹ and the American National Standard Institute (ANSI)² to withstand the service conditions in the industry. These standards provide criteria for packaging used for transporting UF6 and define the requirements for in-service inspections, cleanliness, and maintenance for packaging in service.

The nameplates of cylinders that have been fabricated in accordance with the standards are stamped with the official code U symbol and are registered with a national board. The nameplates also contain additional

identification information provided by the purchaser (e.g., owner and serial number), the national board, and associated with the certification testing performed by the cylinder fabricator. This information is stamped or engraved on a nameplate that is welded to the valve end of the cylinder.

3.2 Regulations for Certification of Cylinders

All cylinders are periodically inspected and tested throughout their service life which typically extends beyond 40 years. Cylinders cannot be filled with UF6 unless they have been certified within the previous 5 years. The certification may involve hydro-testing and leak testing, as well as valve and plug inspection.

The cylinder identification is used for tracking and reporting the cylinder during the recertification process. The serial numbers are not changed during the certification process. Should the cleaning and certification process which may involve sandblasting and painting change the tare weight, the new tare weight is engraved on the nameplate.

3.3 Material Accountability

Companies comply with national and regional regulations regarding the storage, handling, and shipping of cylinders containing UF6. The cylinder identification or supplemental cylinder identifiers are used for recording and tracking the location of cylinders on-site and for transportation documentation.

For accountability purposes, a separate number - a batch number - is assigned to the nuclear material contained within the cylinder - the UF6. A cylinder owner may apply an additional label to the cylinder containing the batch number.

¹ ISO 7195, Nuclear Energy - Packagings for the transport of uranium hexafluoride (UF6), 2020-11

² American National Standard Institute (ANSI) N14.1, "Uranium Hexafluoride - Packagings for Transport," 2019

Site accountability systems track material on shipment and receipt, and during processing and storage at the facility.

Different companies may assign different batch numbers for the same material (e.g., a receiver may assign a different batch number than the one assigned by the shipper to the same cylinder of material). Reports to national and regional safeguards systems will include the batch identification but will likely not contain the cylinder identification.

National regulations will require that the cylinders in storage be periodically inventoried, and the material verified. Typically, the cylinders are located using the cylinder identification, and the accountability information is reported using the batch numbers assigned to the UF6. All inventory changes (shipments and receipts) are reported to the national authorities at a specified frequency.

3.4 International Safeguards for UF6

States with comprehensive safeguards agreements with the IAEA report on-site inventories of UF6 contained within cylinders as well as inventory changes (shipments and receipts) to the site. The IAEA periodically sends inspectors to the sites to independently verify the material inventories that are present and to verify the content of cylinders that have been received or prepared for shipment.

During on-site inspections, the inspectors need to be able to quickly locate and identify all the cylinders provided on the physical inventory listing and in the inventory change reports. They must be able to match the cylinder identification and supplemental cylinder identifiers physically attached to the cylinders with the submitted batch information.

While some companies have automated their inventory practices by applying supplemental, machine-readable identifiers (e.g., barcodes), the inspectorates cannot readily use these because the identifiers vary between cylinder owners and are not permanently attached to the cylinders. Thus, their verification activities remain a manual process that is labor intensive and time consuming. The challenges in reading the cylinder identification can lead to reading and transcription errors that require additional time to resolve.

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Identification Practices

The cylinder fabrication standards require a nameplate that includes information for cylinder identification.

The cylinder identification is a string of alpha-numeric characters provided by the purchaser – typically a UF6 conversion plant, enrichment plant, or fuel fabricator. Once stamped or engraved, the identification number typically remains unchanged over the entire service life of the cylinder which can extend 40 years or longer. Occasionally, an identification number may be changed if a cylinder is sold, and the new owner desires a new number with a different format.

The identification information applied to the nameplates is often difficult to read due to the small size of the lettering and the lack of contrast between the engraved letters and the metal background. While the combination of markings (names, dates, certifications) make the entire nameplate unique, there is nothing that prevents multiple cylinders from having the same serial number.

The identification formats can vary widely across industry as each cylinder owner will establish its own specific format. Even within an organization, the format may change over time as cylinder owners change their names, revise their format, or change their practices. Some cylinder owners have reported that they are managing four or more ‘standard’ formats for their cylinders. Even if each cylinder owner establishes its own standardized format for identification of new UF6 cylinders, its entire cylinder fleet might contain multiple formats due to the presence of legacy cylinders.

Because the cylinder identification can be difficult to read, even from short distances away, many cylinder owner currently add a supplemental cylinder identifier for use at their respective facilities to improve the performance of onsite operations. The supplemental cylinder identifiers are applied with a variety of techniques, including marking, stenciling, adhesive labels, paint markings, and stickers. These identifiers may use the serial number stamped on the nameplate, or they can contain a different number created by the cylinder owner. Some of these identifiers may contain a feature that provides for the identification to be read by automated methods (e.g., bar code, RFID, etc.). A listing of identification formats used by industry and examples of supplemental identifiers are provided in Appendix B.

Since this WNTI Standard for UF6 cylinder identification was initially issued in 2017 several cylinder owners have begun transitioning to the recommended global identifier.

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Operational Practices

Cylinders are exposed to a variety of operational and environmental conditions over their service life. These conditions affect the location and utilization of the cylinder identification. The facility operational practices determine where and when IDs are read.

Facilities that regularly use model 30B and 48Y cylinders include conversion, enrichment, fuel fabrication and depleted UF6 (DUF6) conversion facilities. Since these facilities are typically not at the same location, the process for handling, processing, tracking, and reporting on the nuclear material contained in these cylinders can be rather complex. Today, there are approximately 20,000 cylinders in active circulation and greater than 100,000 cylinders in long-term storage. Figure 2 highlights the typical life cycle cycle of both model 30B and 48Y cylinders.

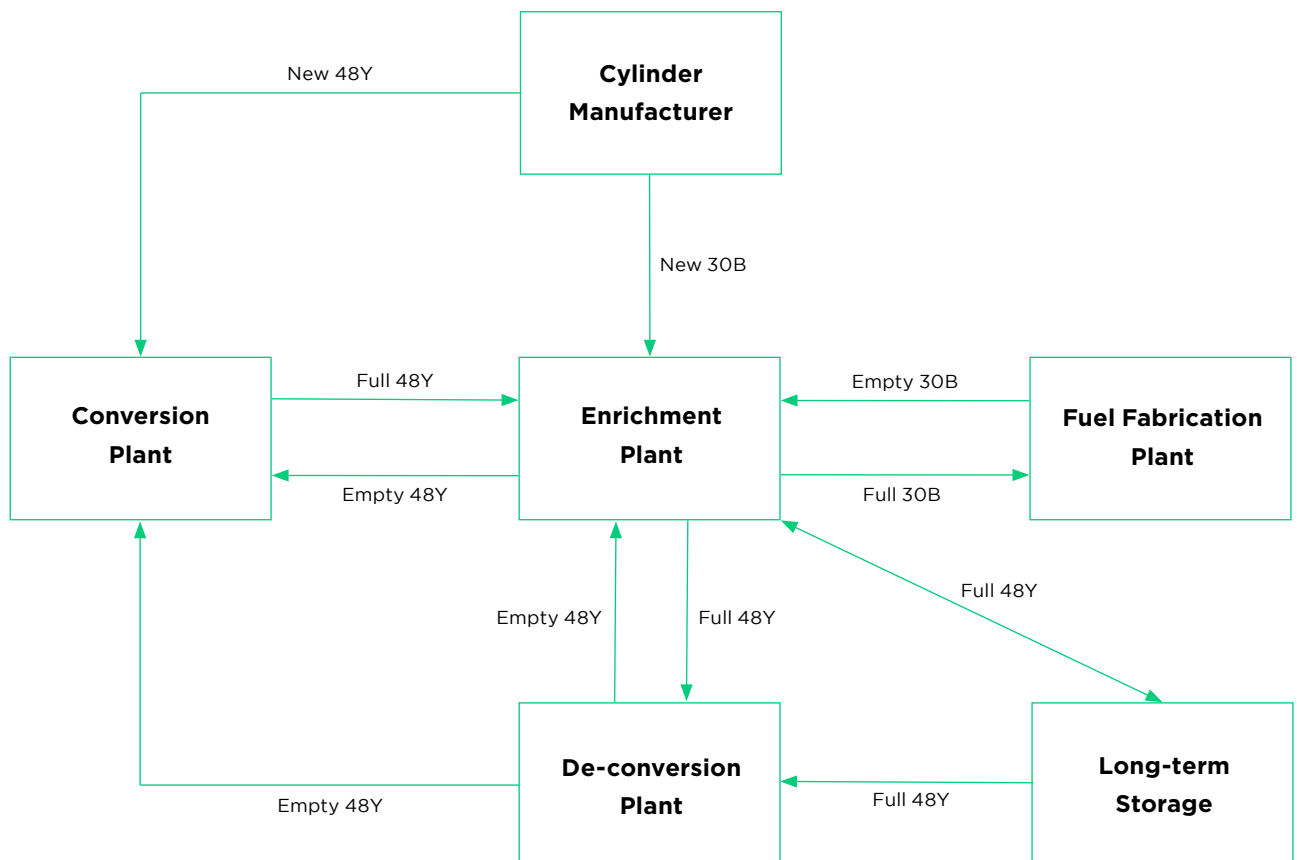


Figure 2. Typical life cycle pathways of model 30B and 48Y UF6 cylinders.

5.1 Cylinder Identification Activities

The operational need exists to be able to correctly identify cylinders as they are stored on site, moved, and processed on-site, and transported between facilities. While the existing UF6 cylinder numbering system has proven to be adequate for the logistics operations within the supply chain of UF6, the following improvements may be achievable if a global identifier for UF6 cylinders is implemented:

- all enterprise management systems within the supply chain using the same UF6 cylinder identifier
- all transport documentation within the supply chain using of the same UF6 cylinder identifier
- improved communication within the supply chain between consignor, consignee, transport agent, carriers, port authorities, customs, etc.
- improved tracking of UF6 cylinders within the supply chain
- more efficient operation for the verification of UF6 cylinders

The capability to correctly identify cylinders during their processing and storage at fuel cycle facilities is extremely important for:

- providing traceability for filling customer orders
- managing cylinder inventories and such cylinder transactions as sales or loans of cylinders to another operator or customer
- supporting databases that contain cylinder information and conditions to ensure that only compliant cylinders are placed in use
- facilitating compliance with national nuclear material control and international nuclear material safeguards requirements

To identify the cylinders, individual facility operators may use the serial number engraved on the nameplate or use their supplemental cylinder identifier.

5.1.1. Cylinder Identification Activities

For most of the time that a cylinder is on an operating site, it is placed in a storage area awaiting a processing or transfer/sampling activity. These storage areas can be inside a building or located outside in the weather. Cylinders can be stacked two or three high and close together in rafts. The nameplates located at the ends of the cylinders can be difficult to access, and it can be especially difficult to read the serial numbers engraved on the nameplates. A cylinder containing depleted materials may be placed in long-term storage and remain unmoved for longer periods of time (e.g., > 40 years).

Operators periodically physically verify each cylinder in storage for safety, security, and safeguards purposes. Reading and recording the cylinder identification is a fundamental part of these inspections. Operators that apply a supplemental cylinder identifier that provides for automatic reading (e.g., a barcode) can conduct these inventorying activities much quicker than those using completely manual inventorying processes. The operator will maintain a database to correlate the cylinder identification on the nameplate and any supplemental cylinder identifiers.

5.1.2. On-site Cylinder Handling and Processing Operations

Cylinders are transported between on-site areas via cranes, straddle buggies, forklifts, and other cylinder handling devices. Processing activities include feeding, filling, blending, and sampling. For these processing steps, the cylinders may be placed inside heating chests, autoclaves, or cooling boxes. Some facilities also have on-site cleaning areas to clean (remove residual materials remaining in the cylinders after emptying) prior to filling received cylinders or shipping the emptied cylinders.

The cylinder identification or supplemental cylinder identifier is used to locate the correct cylinder for movement. Facility operators that apply an identifier with a bar code can use equipment that can automatically read the cylinder identifier to verify that it is the correct cylinder prior to movement. The application and utilization of readable identifiers provides the capability to automatically track all cylinders on the site. There are applications in use today where crane systems are using automatic bar code readers to identify cylinders prior to lifting and moving them.

There are also times during the processing of cylinders when the cylinder identification is not visible. This includes those periods when the cylinder is within an autoclave, heating box or cooling box for processing.

5.1.3. Transport between Facilities

In most cases, the cylinder identification used on the paperwork that accompanies and reports on the cylinders being transported is the cylinder serial number engraved on the nameplate. There are times, however, when the shipper may choose to use the supplemental cylinder identifier applied to the cylinder instead of the serial number on the nameplate.

There are also times during the transporting and processing of cylinders when the cylinder identification is not visible. This includes those periods when thermal protection or a protective shipping package is placed on the cylinder for shipment.

The material accountability reports will list the batch number assigned to the material contained within the cylinder. Given that this batch number is not visible on the cylinder, the shipper and receiver use the cylinder identification to verify they are shipping and receiving the proper container. Since the shipper and receiver might well use different batch numbers to refer to the same consignment of nuclear material, shipper and receiver use of the same cylinder identification would

provide a common number that can be used to help match shipments and receipts.

The use of barcodes provides the capability to utilize scanners to provide more timely and accurate reading of the cylinder identification. In addition to being able to correlate the bar code to the information contained on the cylinder's nameplate, the operator has the capability to track all ANSI/ISO requirements within a dedicated database that captures this cylinder information.

Some companies continue to manually read and transcribe the serial number from the nameplate when recording cylinder information. Using this process can result in:

- errors in reading the numbers, especially on older nameplates
- transposition errors in manually reading and then recording the cylinder numbers in the databases
- excessive time required to perform manual ID reading and recording tasks

5.2. Cylinder Identification Environmental Conditions between Facilities

The cylinders and their identifiers are exposed to some challenging conditions. Cylinders processed in heating boxes can be exposed to dry air temperatures up to +235°F (113°C), while cylinders processed in steam-heated autoclaves are exposed to these temperatures in a steam environment. These temperatures exist where cylinders are heated for processing at feed stations, blending stations and sampling stations. Cylinders processed in cold boxes at product and tails withdrawal stations and blending stations can be exposed to temperatures as low as -40°F (-40°C). As a result, a cylinder identifier must survive extremes of both heat and cold that are encountered in facility operations.

Additionally, the outside storage of cylinders exposes the identifier to weather elements such as snow, rain, ice, etc. Cylinder identifiers may be exposed to acids and strong cleaning agents during cylinder repair and cleaning. The existing cylinder nameplates are designed and located on the cylinder to endure normal cylinder handling and storage practices, but the serial numbers and other information on the nameplate can degrade over time.

5.3. Compatibility with Existing Enterprise Reporting Systems

Whether manually reading and recording the cylinder serial number engraved on the nameplate or reading the supplemental cylinder identifiers (manually or automatically), companies align the cylinder identification with other important information in the facility databases.

This information may include, but is not limited to:

- gross weight of the cylinder and its contents from accountability scales or process scales
- the isotopic enrichment of the uranium contained in the cylinder from destructive analysis, nondestructive assay measurements, or process measurements
- history of cylinder certification information such as last hydro-test date
- other pertinent information such as recertification date, tare weights, cylinder owner, cylinder inspection reports, etc.

Companies maintain databases to allow them to coordinate the information contained on the supplemental cylinder identifier and the official identification information on the nameplate utilized for tracking the cylinder.

The three types of numbers typically seen on the nameplates are:

- the manufacturer's serial number
- the owner's serial number, and
- the national board registration number

In addition to the utilization of the nameplate information for regulatory reporting, the operators of the facility may utilize the information in their:

- nuclear material control and accountancy (NMC&A) system
- production planning/order management system
- cylinder management and compliant-cylinder monitoring system

Operators maintain enterprise reporting and management information systems that fulfil these functions and utilize cylinder information. An industry standard format for cylinder identification should be compatible with these existing enterprise management systems or require minimal modification of these systems.

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Preferred Global Identifier

The global identifier is a stainless-steel plate consisting of the following:

1. A 10-character, alpha-numeric identification number consisting of 4 capital letters followed by 6 numbers:

a. A 3-capital letter “prefix” assigned by the cylinder owner,

b. A fourth capital letter reserved for use by the cylinder owner, and

c. A 6-digit number assigned by the cylinder owner (not to be duplicated within the cylinder owner organization).

2. A dot matrix (2D) barcode of the assigned 10-character identification number.

No special characters (e.g., -, #, _) or spaces will be used. Figure 3 is an example design for the global identifier; design specifications are provided in Appendix C.

For existing cylinders, a global identifier adhesive tag can be used as an alternative to the welding the stainless-steel plate.



Figure 3. Example global identifier containing 10-character global identification number with 2D barcode

6.1. Attachment Method

The global identifier should be part of the nameplate for new manufactured cylinders or attached to the valve end of the cylinder near the nameplate. The preferred location is centered below the nameplate. It should be welded to enable IAEA authentication. Welding the global identifier to the face of the cylinder must be done in accordance with ANSI and ISO standard and in accordance with qualified inspector. It should be noted that some countries may require an R-stamp, when welding the global identifier to an existing cylinder, please verify with the jurisdictional/inspection authority prior to welding on the head of the cylinder.

For existing cylinders, a global identifier adhesive tag can be used as an alternative to the welding the stainless-steel plate. The preferred location for the adhesive tag remains centered below the nameplate.

Appendix C provides additional illustrations of attachment locations. A review of the ANSI and ISO standards has concluded that expanding the nameplate or welding a global identifier to the cylinder is acceptable if the welding is done in accordance with the standards. For newly fabricated cylinders, the global identifier should be applied prior to initial cylinder certification. Should it not be possible to weld the global identifier onto the face of the cylinder, an alternative location would be on the inside of the skirt, with a label affixed below the nameplate on the valve end of the cylinder.

6.2. Functional and Performance Requirements

The global identifier meets the following functional and performance requirements:

- an identification number that is large enough to be visually read from a reasonable distance (e.g., 1-3 meters)
- machine readable
- capability to withstand all the environment conditions associated with cylinder transport and processing
- capability to endure for the entire cylinder service life
- reasonable application and maintenance costs.

An additional feature that enables the international inspectorates (e.g., IAEA, Euratom, etc.) to fully take advantage of the global identifier for international safeguards purposes is the welding of the global identifier to the cylinder to enable the IAEA to verify its authenticity.

- a numbering/lettering scheme that is not duplicated across industry

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Information Management

Cylinder owners will be responsible for the assigning and managing the 10-character global identification numbers assigned to the cylinders.

- Each cylinder owner will select a 3-letter prefix for its use³ to prevent two or more owners from using the same prefix, cylinder owners will reserve their prefix(s) with WNTI⁴. A list of reserved prefixes is provided in Appendix D. Alternatively, should an owner desire not to designate a specific 3-letter prefix, they can use the prefix “WNT”
- The fourth character is a capital letter provided for use by the owner. For cylinder owners that decide to use the “WNT” prefix, WNTI will assign the 4th capital letter (A-Z) for the owner to use on all its cylinders with the “WNT” prefix.
- The cylinder owner will assign the remaining 6 numbers and will manage the assigned numbers to ensure that the same 6-digit sequence is not duplicated.

This 10-character format is compatible with the Bureau International des Containers et du Transport Intermodal (BIC) format, should an individual cylinder owner be registered with BIC.

7.1 Assigning Cylinder Identification to New Cylinders

The organization purchasing a new cylinder will be responsible for assigning the 10-character global

identification and having it attached to the cylinder. The global identification (text and 2D barcode) can either be added to the bottom of the nameplate or attached as a global identifier as described in section 5.1.

For newly fabricated cylinders, it is desirable that the 10-character global identification number also be used as the serial number marked on the nameplate so that these numbers agree.

7.2. Assigning Cylinder Identification to Existing Cylinders

For existing cylinders, the cylinder owner will be responsible for assigning a 10-character identification number and affixing the global identifier adhesive tag to the cylinder head below the existing nameplate. The global identifier adhesive tag will contain the assigned 10-character identification number, a 2D barcode of the identification number and the owner.

In addition, a cylinder owner may find it beneficial to add supplemental information to the global identifier adhesive tag, such as the manufacturer serial number and the date the tag is affixed. As well, duplicate global identifier adhesive tags may be affixed to other locations of the cylinder to support a cylinder owner's on-site cylinder handling operations.

Initially there will likely be discrepancies between the 10-character identification numbers on the global identifier adhesive tags and the serial numbers engraved on existing nameplates, but over time the number of these cylinders will be reduced as existing cylinders reach the end of their service lives.

³ A cylinder owner may select more than one prefix for its use

⁴ A cylinder owner does not have to be a member of WNTI to reserve a 3-letter prefix.

The intent is that the global identification number assigned to an individual cylinder will remain unchanged. However, in the case of an ownership change the new cylinder owner may assign a new identification number and affix a new global identifier adhesive tag to the cylinder. The date of ownership change should be indicated on the adhesive tag. The cylinder owner information marked on the nameplate should be revised to reflect the new owner.

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Implementation

Following acceptance of this WNTI standard, it is anticipated that within a year each cylinder owner will develop a transition plan to begin converting to the use of the global cylinder identification format and to begin applying the global identifiers to the cylinders that they own.

The transition plan will provide for:

1) New cylinders - beginning to assign the 10-character global identification number:

- Using this number as the serial number engraved on the nameplate
- Adding the larger-sized number and a 2D barcode to the valve end of the cylinder by either: enlarging the nameplate to add the information at the bottom or welding a separate global identifier below the nameplate.

2) Existing cylinders in circulation - assigning a 10-character identification number to the cylinder in as timely a manner as possible, and affix an adhesive tag with the global identifier to the valve end cylinder below the nameplate during the next cylinder certification (within the next 5 years) or at the next opportunity.

3) Existing cylinders in long-term storage (e.g., tails cylinders) - assigning a 10-character identification number to the cylinder at the cylinder owner's discretion. The newly assigned identification number could be attach to the valve end of the cylinder by using a label until such time that the global identifier can be permanently attached.

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References

ISO 7195, Nuclear Energy – Packagings for the transport of uranium hexafluoride (UF₆) - 2020

ANSI 14.1, Nuclear Materials – uranium hexafluoride packagings for transport - 2019

ISO 6246 – Freight Containers – Coding, Identification and marking, 1995-12-01

Appendix A

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 Honeywell
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 AREVA TN
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 AREVA NC
 TAM International
 Global Nuclear Fuel
 Daher NT
 AREVA NC
 Nuclear Fuel Transport
 Centrus Energy
 WNTI
 TENEX
 Urenco
 JNFL
 Electricité de France (EDF)
 Daher NT
 TENEX
 WNTI
 WNTI
 Electricité de France (EDF)
 Columbia Hi Tech
 WNTI
 Energy Resources
 Urenco Ltd
 JNFL
 Columbia Hi Tech
 CIMC
 AREVA NC
 Worthington Industries
 ORNL
 ORNL
 contractor to BNL
 NFL

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Appendix B

Identification Practices

The cylinder fabrication standards described in Chapter 2 require a nameplate (Figure B-1) that includes a serial number (also referred to as a factory number). The serial numbers are provided to the cylinder fabricator by the purchaser, typically an enrichment plant or a UF6 conversion plant or fuel fabricator.

The table below presents excerpts of current nameplate-related identification requirements for cylinders.



Figure B-1. Representative nameplate.

Table B-1: Identification requirements within the ANSI & ISO fabrication standards.

MARKINGS	ANSI 14.1		ISO 7195	
	30B	48X, Y, OR G	30B	48X, Y, OR G
MIN CHARACTER SIZE	5/32 INCH	1 INCH	7MM	25MM
CODE U STAMP	Yes		Yes	
NATIONAL BOARD NUMBER	Yes		Yes	
OWNER'S NAME OR SYMBOL	Yes		Yes	
OWNER'S SERIAL NUMBER	Yes		Yes	
MANUFACTURER ID	Yes		Yes	
DATE OF MANUFACTURING	Yes		Yes	

The identification information applied to the nameplates is often difficult to read due to the small size of the letters and numbers and the lack of contrast between the engraved letters and the metal background. The fabrication standards do not provide a standard format for the serial numbers and do not provide a means to prevent different companies from using the same numbers. While the combination of markings (names, dates, certifications) makes the entire nameplate unique, there is nothing that prevents many cylinders from having the same serial number.

Identification Formats

The cylinder identification is a combination of letters and numbers provided by the purchaser to the cylinder fabricator to be engraved on the nameplate. Once stamped or engraved, the identification number typically remains unchanged over the entire lifetime of the cylinders which can extend 40 years or longer. Occasionally, an identification number may be changed if a cylinder is sold and the new owner desires a new number with a different format.

- 1122 nnnn	- HON nnnn
- 1127 nnnn	- JMnnn
- Aaa nnn	- SAE nnnn
- AC nnnn	- ST nnnnn
- CAM nnnn	- SKB nnnn
- CE nnnn	- TC-nnnn
- COG nnnnn	- TY-nnnn
- EURO nnnnn	- UREUnnnnn
- GEWnnn	

The multiplicity of formats used for identifying new and legacy cylinders can pose a challenge to accurate, timely and cost-efficient reading and recording of the numbers. For example, in the past many identification numbers used spaces (), periods (.), or dashes (-) in the format. In addition, often it can be difficult to

These identification formats can vary widely across industry as each cylinder owner will establish its own specific format. Even within an organization, the format may change over time as cylinder owners change their names, revise their format, or change their practices. Some cylinder owners have reported that they are managing four or more “standard” formats for their cylinders. Even if each cylinder owner establishes its own standardized format for identification of new UF6 cylinders, its entire cylinder fleet might contain multiple formats due to the presence of legacy cylinders.

The members of the WNTI working group on UF6 cylinder identification have reported the following formats being used on cylinders in active circulation or in long-term storage yards (Note: this list is not intended to be a complete list of all formats used.)

“a” represents a letter
“n” represents a number

distinguish between similar numbers and letters such as “0” and “O”, “5” and “S”, “1” and “l”, etc. As discussed below, some operators have resorted to using supplemental labels for facilitating identifying cylinders at their facilities.

Supplemental Cylinder Identifiers

Because the cylinder identification can be difficult to read, even from short distances away, many companies currently add a supplemental cylinder identifier for use at their respective facilities to improve the performance of on-site operations. The supplemental cylinder identifiers are applied with a variety of techniques, including marking, stenciling, adhesive

labels, paint markings, and stickers. These identifiers may use the serial number stamped on the nameplate or they can contain a different number created by the cylinder owner. Some of these identifiers may contain a feature that provides for the identification to be read by automated methods (e.g., bar code, RFID, etc.). Figures B-2 and B-3 show industry-applied stencils and barcode stickers.



Figure B-2. Cylinder owner applied stencil.

Supplemental cylinder identifiers generally vary in style and format between cylinder owners such that an identifier applied by one cylinder owner cannot be used by other cylinder owners. As a cylinder travels between multiple facilities over its service life, it can accumulate a variety of different types



Figure B-3. Cylinder owner applied sticker containing a 1D barcode.

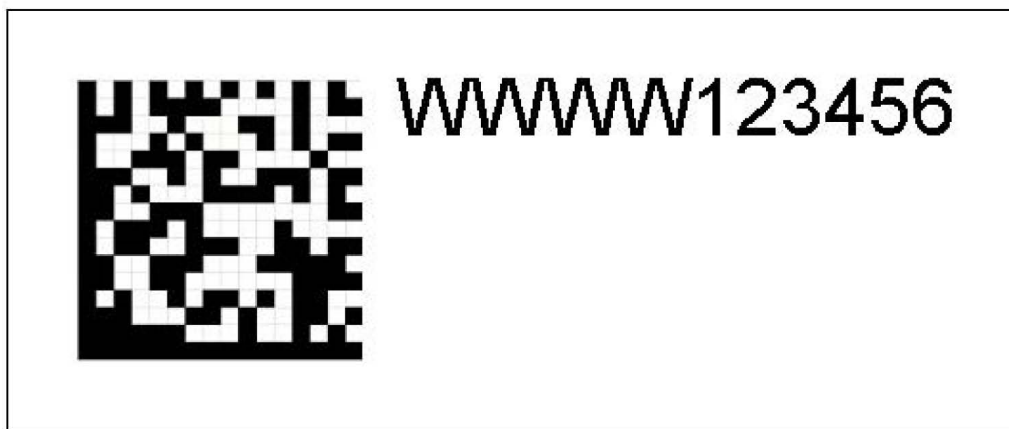
of marking and labels. While these supplemental identifiers are effective in supporting domestic reporting requirements, they often cannot be used for international reporting because they are not permanently applied.

Appendix C

Specifications for the Global Identifier

Global Identifier for New Cylinders

The global identifier shall contain a 10-character, alpha-numeric global identification number and a two-dimensional (2D) Data Matrix representation of the identification number.



Materials

The preferred global identifier is a stainless-steel plate:

- The plate should be constructed from 13-20 gage⁵ ASTM A240, UNS S30400 or S30403 sheet.⁶
- The plate dimensions should be at least 12.7 cm (5.0 inches) long and at least 5.3 cm (2.1 inches) tall.

Dimensions of global identification number

Data Matrix (2D) barcode:

- A 14 x 14 format should be used.
- The data matrix barcode should use 2.54 mm (0.1 inch) modules resulting in a 35.6 mm (1.4 inch) square data matrix barcode.
- A quiet zone of 1 module (2.54 mm) shall be used around the barcode.
- The top, side and bottom of the data matrix barcode quiet zone shall be at least 6.35 mm (0.25 inches) from the edges of the plate.

⁵ Similar to ANSI N14.1-2012 Figure 2 Notes on Page 42

⁶ Similar to ANSI N14.1-2012 Section 6.3.2-10

Alpha-numeric identification number:

- Arial font should be used.
- The characters shall be at least 7 mm (0.278 inches) tall (Arial size 28 font).
- The top of the characters shall be aligned with the top of the barcode. (8.9 mm from the top edge of the plate).
- The letters should be capitalized.

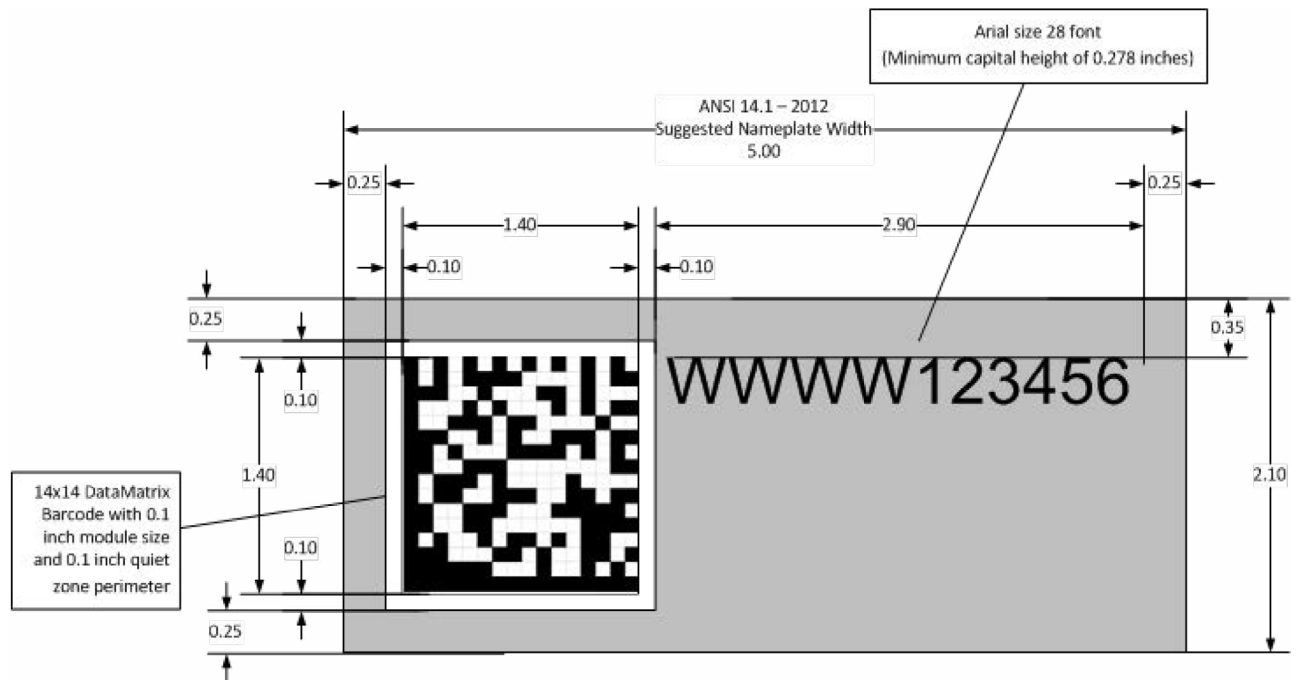


Figure 4 Dimension for Global Identifier for new cylinders

Application of global identification number:

- The plate surface shall be ball blasted and treated with a laser marking ink (e.g., CerMark LMM6000) prior to laser marking.
- The plate surface shall be treated before marking and after marking as recommended by the laser marking ink manufacture.
- The global identifier shall have the alphanumeric cylinder ID laser marked onto the surface.
- The global identifier shall have the 2D Data Matrix barcode laser marked onto the surface.

Global Identifier for Existing Cylinders

Materials

The preferred global identifier for existing cylinders:

- Acrylic label (Zebra Z-Endure 4000T)
- Polyester label (Zebra Z-Ultimate 3000T).

Dimensions of global identification number

The dimension are the same as provided above for the global identifier on new cylinders

Application of global identification number:

- The global identifier for existing cylinders shall have the alphanumeric cylinder ID marked onto the surface.
- The global identifier for existing cylinders shall have the 2D Data Matrix barcode marked onto the surface.
- The global identifier for existing cylinders shall have the name of the owner marked onto the surface.
- The date and MSN may be affixed onto the surface of the global identifier for existing cylinders. However, for ownership change the date shall be provided.

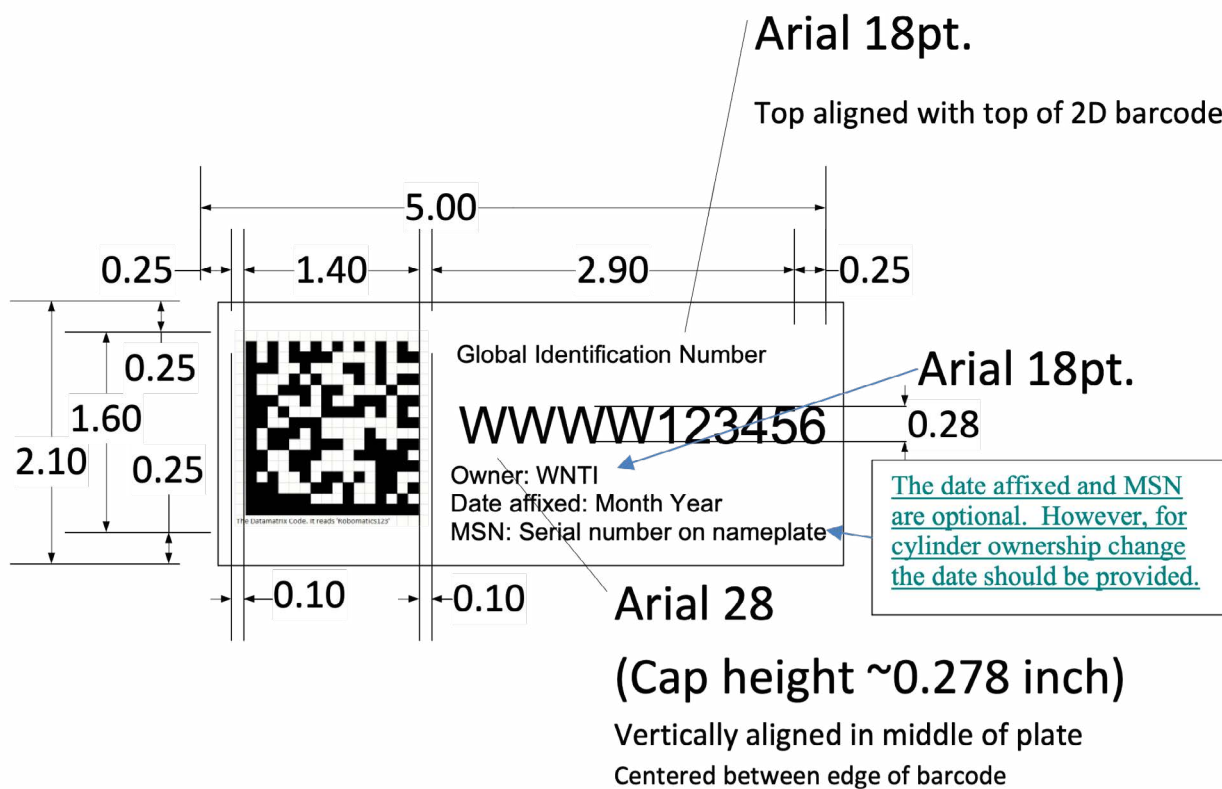


Figure 5 Global Identifier for Existing Cylinders

Placement of Global Identifier

The preferred location of the global identifier is centered below the nameplate on the valve end of the cylinder. The identifier will be applied with a continuous weld around all 4 sides or in the case of the adhesive tag it is affixed to the cylinder. The welding can be performed in phases to control heat applied to cylinder during application. Welding of the global identifier on the inside of the skirt as an alternate location to the valve end of the cylinder is allowed as described in section 5.1.

- Welding must follow the ANSI N14.1 and/or the ISO 7195 standards

- R stamp may be required to weld on the head of the cylinder. Please verify with the jurisdictional/ inspection authority prior to welding on the cylinder head.

For 30B cylinders, the top of the global identifier should be 7.62 cm (3 inches) from the center of the valve to not interfere with the valve cover and allow the global identifier to be read with the valve cover in place (Figure 5)

For 48Y cylinders, the top of the global identifier should be 14 cm (5.5 inches) from the center of the valve (Figure 6).

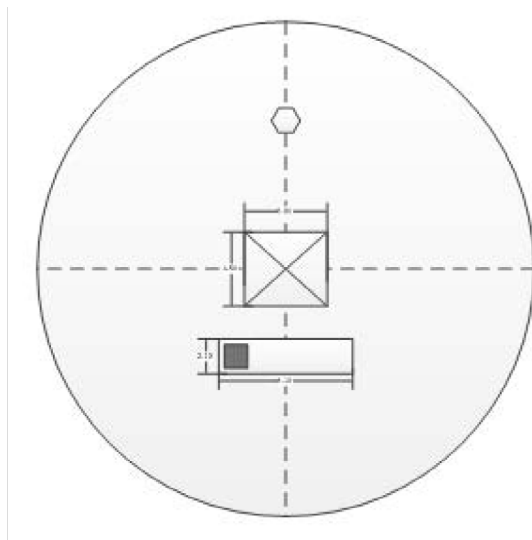


Figure 5. 30B with global identifier shown with valve cover

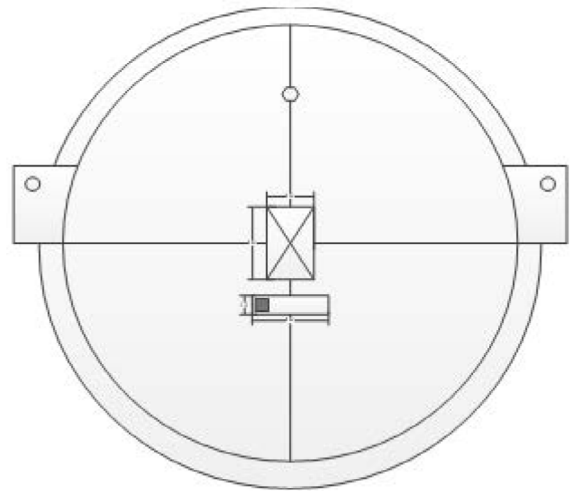


Figure 6. 48Y with global identifier

Alternate Specifications for the Global Identifier for New Cylinders

For new cylinders, an alternative placement option is to expand the size of the nameplate to add the global identification number and 2D barcode at the bottom.

A suggested layout for model 30B and 48Y cylinder nameplates is provided in Figure 7 and Figure 8, respectively.


NAT'L. BOARD No. <input type="text"/>	
ANSI N14.1-2009	
<input type="text"/>	<input type="text"/>
MAWP <input type="text"/> PSIG @ <input type="text"/> °F	
MDMT <input type="text"/> °F @ <input type="text"/> PSIG	
MIN. TRANSPORT TEMP. <input type="text"/> °F	
<input type="text"/>	
MODEL No. <input type="text"/>	SERIAL No. <input type="text"/>
WATER CAP. @ 60°F <input type="text"/> lb	MAX. NET WT. UF ₆ <input type="text"/> lb
MO/YR BUILT & RE-TARE DATES	
<input type="text"/>	<input type="text"/>
TARE & PERIODIC RE-TARE WTS (lb)	
<input type="text"/>	<input type="text"/>
Global Identification Number:	
WNTA123456	
	

Figure 7. Suggested layout for 30B cylinder nameplates


NAT'L. BOARD No. <input type="text"/>	
ANSI N14.1-2009	
<input type="text"/>	
MAWP <input type="text"/> PSIG @ <input type="text"/> °F	
MDMT <input type="text"/> °F @ <input type="text"/> PSIG	
MIN. TRANSPORT TEMP. <input type="text"/> °F	
<input type="text"/>	
MODEL No. <input type="text"/>	
<input type="text"/>	
WATER CAP. @ 60°F <input type="text"/> lb	
MAX. NET WT. UF ₆ <input type="text"/> lb	
MO/YR BUILT & RE-TARE DATES	
<input type="text"/>	<input type="text"/>
TARE & PERIODIC RE-TARE WTS (lb)	
<input type="text"/>	<input type="text"/>
Global Identification Number:	
WNTA123456	
	

Figure 8. Suggested layout for 48Y cylinder nameplates.

Appendix D

PREFIX	CYLINDER OWNER/ORGANIZATION
ACO	American Centrifuge Operating, LLC
CAM	Cameco
CXP	AREVA NC
DNT	Daher NT
DOE	U.S. Department of Energy
FAE	Electricite de France
GEW	Global Nuclear Fuel
HON	Honeywell/Converdyn
KAP	Kazatomprom
ORN	Orano
TAM	TAM
TNX	TENEX
URE	Urenco
USU	United States Enrichment Corporation
WEC	Westinghouse Columbia USA
WUK	Westinghouse UK
WSE	Westinghouse Sweden
WNT	Assigned by World Nuclear Transport Institute*

*For a cylinder owner that does not desire a designated 3-letter prefix, they can use the prefix "WNT" and request from WNTI a 4th letter designation (A – Z). The owner would then be responsible for assigning the remaining string of 6 digits not to be duplicated by the owner.

Appendix E

Definitions and Acronyms

Batch number: a number assigned for accountancy purposes to the nuclear material contained within the cylinder.

Cylinder: For this guideline, the term cylinder refers to a 30- or 48- inch diameter cylinder fabricated to the ISO 7195 and ANSI N14.1 standards for UF6 transport.

Cylinder identification (ID): a string of alpha-numerical characters assigned to identify an individual cylinder.

Cylinder identifier: a nameplate, label, or other attachment that contains the cylinder ID assigned to the cylinder.

Global identification number: standardized format for the ID used across industry, not duplicated.

Global identifier: a metal plate permanently attached to the cylinder containing a 10-character cylinder ID displayed in both textual and 2D barcode form.

Machine-readable: a capability of being read using an instrument (e.g., barcode scanner); an individual does not have to visually read the ID and transcribe it to another media.

Service life: a cylinder begins service upon its initial acceptance of any radioactive material. The service life ends when the cylinder is no longer suitable for transport or storage of UF6 per fabrication standard; typically, 40 years or longer.

Supplemental cylinder identifier: a supplemental marking or label applied to the cylinder by the cylinder owner for their use.

Tare weight: the as-built weight of the clean, empty cylinder, including only the valve(s) [with cap(s) and plug(s) (no valve covers or protectors)] corrected to an internal gas pressure of 5 psia.

Unique: contains a characteristic that cannot be duplicated.



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