MAINTENANCE OF UF_6 TRANSPORT CYLINDERS IN COGEMA PIERRELATTE

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INTRODUCTION :

Uranium hexafluoride (UF_6) cylinders are used world-wide to transport natural UF_6 or reprocessed UF_6.

To ensure full security of these transports, this type of package is periodically maintained in AMC, the Cylinder Maintenance Facility at COGEMA/Pierrelatte.

The main purpose of the AMC, commissioned in the early 80's, is the maintenance and regulatory hydraulic testing of 30" and 48" cylinders, essentially the 30Bs and 48Ys.

During the past 10 years, more than 13,000 cylinders of these types have been washed and hydraulically re-tested in this facility on behalf of utilities, fuel manufacturers, enrichers and transporters, both French and foreign.

Besides the packages having contained UF_6 from natural uranium, this unit is specially equipped to process cylinders of UF_6 from reprocessing, thereby contributing to the mastery of the reprocessed uranium recycling process by the COGEMA Group.

All the work is done in accordance with written instructions in procedures and operating instructions. These documents permit the facility to be operated in compliance with the safety regulations. They list the operations to be performed on the cylinders, are under Quality Assurance and guarantee conformity of the operations with the ANSI N-14-1 regulations and USEC651 recommendations.

This document reviews the various maintenance steps of a cylinder : incoming package inspections, washing – shot blasting / painting –five-year hydraulic testing – drying – wall thickness control – valve tightness tests – as well as inspection procedures.

INCOMING PACKAGE INSPECTION :

Inspections of the incoming cylinders are made routinely. This preliminary inspection consists in making sure the cylinder complies with regulations. Checks are made on the identification and physical condition of the cylinder as well as on the conformity of its accessories with the ANSI standard. Radiological controls provide a good knowledge of the cylinder upon arrival.

The data collected during these operations enable any repair work to be planned.

At that time, weighing allows the amount of material that may still be contained in the cylinder to be estimated and a check of the internal pressure versus the data recommended by the USEC651 standard ensures the safety of the cylinder.

These operations are carried out before entering the facility. A temporary short-time storage may be required, depending on the shop load.

Hammering designed to dislodge the deposits on the bottom may also be done on the 48Ys.

INTERNAL WASHING, DIMENSIONAL AND RADIOLOGICAL CHECKS :

Once the cylinders enter the shop, internal washing is practically automatic. Three pressurized water washing lines enable coverage of all cases, including materials from natural or reprocessed uranium with an isotopic assay in U235 which may be higher or lower than 1%. These lines are located in cells covered by Nuclear Facilities Regulations.

An inspection then enables the cleanness of the cylinders to be demonstrated and may, at times, lead to a new wash, along with a phosphoric acid treatment.

An authorized certification agency can certify the quality of the washing on a cylinder.

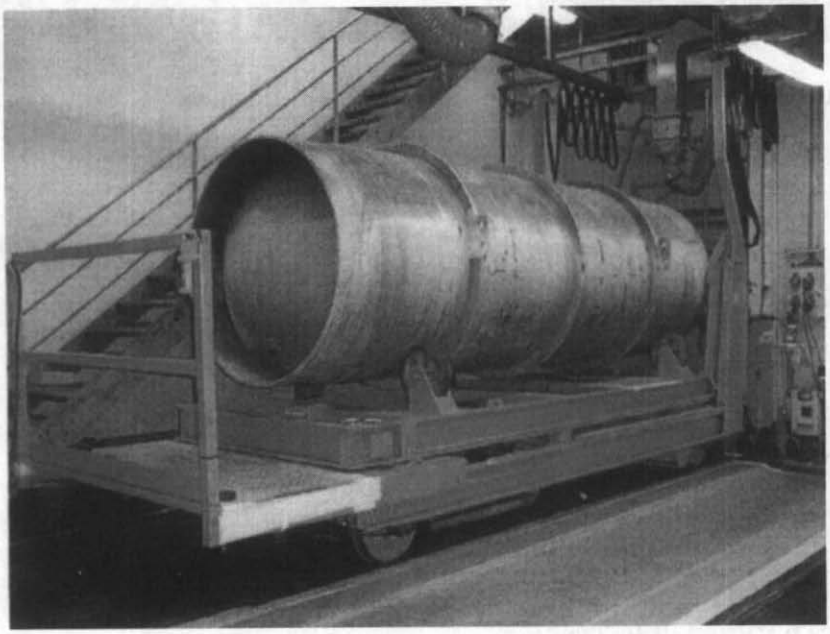


FIGURE 1 : Automated internal washing, effluent recovery and cleanness check.

Mechanical inspection of the cylinder includes disassembly, inspection and replacement of components, and then reassembly of the parts of the package.

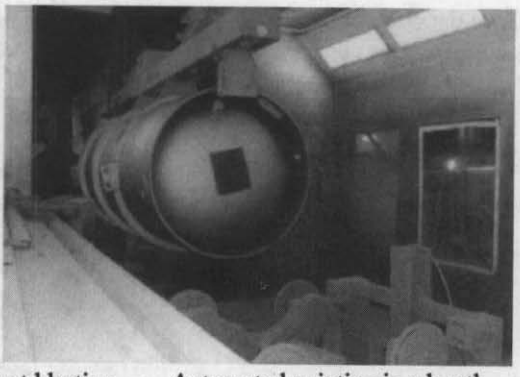
The threads of valves and plugs are cleaned and then inspected with gauges specified by the ANSI standard. Openings are then sealed with plugs.

An external radiological and an internal contamination test are included in these operations.

SHOT BLASTING AND PAINTING :

Shot blasting is done in an automated booth the confinement of which is ensured by reduced pressure. Steel shot is projected onto the cylinder.

An automatic painting booth allows one primer coat and two coats of paint to be applied. The paint has been chosen for its advantageous characteristics of being both primer and paint.



FIGURES 2 and 3 : External cleaning by shot blasting. Automated painting in a booth

A thickness check on the dry paint is then made using ultrasonics.

An area is reserved just outside the booth for finishing operations, namely labeling and affixing marks on the cylinders according to the owner's requirements.

WALL THICKNESS AND WELD CONTROLS :

Prior to the hydraulic test performed under a pressure of 28 bars, dimensional conformity is checked by ultrasonics in compliance with ANSI standards.

In particular, the welds are checked under the supervision of an approved agency such as Bureau Véritas.

FIVE-YEAR HYDRAULIC TEST :

This test required a heavy equipment for the facility. Specific tilting benches for the 48Ys and 30Bs had to be designed.

After being filled with water, the cylinder is submitted to a pressure of 28.10^5 Pa for 30 minutes. The pressure loss between the beginning and the end of the test must be less than

1.10^4 Pa. The package is then marked with a stamp ensuring the presence of an authorized supervision agency for recertification of the cylinder.

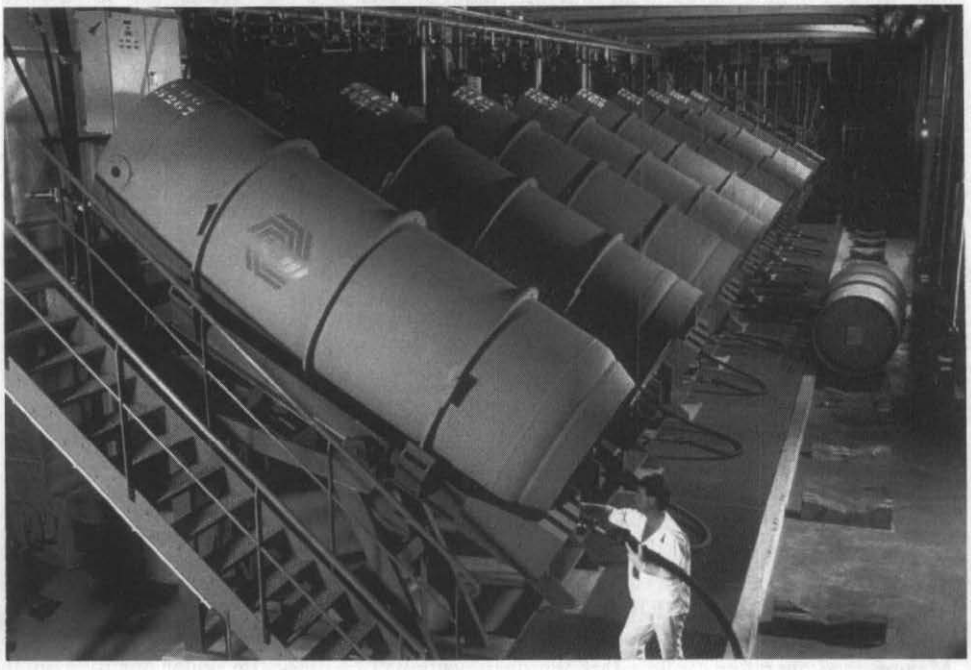


FIGURE 4 : Hydraulic test bench

INTERNAL DRYING :

After the cylinder has been emptied, it is dried for 12 hours. This consists in circulating dry air with controlled humidity. The humidity must remain below the dew point, i.e. – 35°C.

LEAK TIGHTNESS TEST :

Remounting the valves and plugs complies with the torque tightening and the number of apparent threads specified in the ANSI standard. Tightness of the threading requires standardized tinning.

Depending on the criteria required, the tightness test is a helium test or a simple soap bubble test under an internal pressure of 7.10^5 Pa. Leakage rate must be lower than 10^{-4} Pa/m^3/s.

CONTROL PRIOR TO DELIVERY :

Prior to delivery, the cylinder is put under vacuum $< 1.10^3$ Pa or under nitrogen $< 1.30.10^5$ Pa according to the requirements of the next client to use the cylinder.

A final weighing allows to check conformity of the dead weight indicated on the identification plate of the cylinder. In the event of a difference, the indicated dead weight may be updated in the presence of representatives of the competent authority.

Lastly, an overall control of the operations carried out declares conformity of the work done with the client's order.

DELIVERY OR TEMPORARY STORAGE :

The cylinder may be delivered after a temporary storage in a reserved area so that clients may optimize their planning for the use of their equipment.

METROLOGY :

The measuring instruments required for the operations on cylinders are calibrated by an external organization according to stringent procedures based on approved standards.

These measurements are made in a metrology facility.

MAINTENANCE CERTIFICATES :

Maintenance operations follow-through documents will be drawn up under quality assurance. A real time computer monitoring validates each operation before the next one can begin. The form describing the whole of the operations (type of work to be performed, applicable procedures and operating instructions) is then closed by the shop supervisor.

This supervisor validates and issues a regulatory maintenance certificate. A certificate delivered by the authorized supervision agency issues a certificate of conformity after the regulatory hydraulic test.

From the unique experience gained by this unit, a statistical report and a description of the defects detected on the cylinders having caused their rejection are drawn up.

CONCLUSION :

Thanks to a maximum capacity of 1800 cylinders/year, COGEMA provides its clients with a technical potential capable of rapidly meeting their requirements, even if occasional.

Cylinder maintenance is included in the catalog of « UF_6 Services » provided by COGEMA to the nuclear industry. Also included are : isotopic mixing and adjustments of UF_6, purification and homogenization of reprocessed UF6, laboratory analyses, rental, sales and dismantling of 30B – 48Ys, of sample bottles and of transport overpacks.

These operations, all carried out on the Pierrelatte site, enable COGEMA to offer a unequaled range of « UF_6 Services » to the fuel cycle industry.