

# USERS GUIDE SF<sub>6</sub>



## INVENTEC SPECIALIZES IN PACKAGING AND DISTRIBUTION OF SF<sub>6</sub> GAS AND REGENERATION OF POLLUTED GAS.

Pyrostop 6 - trademark of SF<sub>6</sub> for sulfur hexafluoride sold by INVENTEC – is a neutral, non toxic, non-flammable gas, whose dielectric properties are particularly interesting.

It is used in several areas, notably in the electricity sector (high and very high voltage) and in particle accelerators. It is also used in magnesium foundries where it is used to prevent the ignition of molten metal on contact with air.

The impact of SF<sub>6</sub> on the greenhouse effect is very important. It has been included in the group of greenhouse gases listed in the Kyoto Protocol in December 1997. Thus, it is particularly important to control its use and to minimize releases to the atmosphere. Regeneration is possible and INVENTEC has developed an Ecoprogram avoiding its destruction in many cases.



*Inventec - Saint Priest*

## I USE SF<sub>6</sub> IN MY INSTALLATION. ARE THERE DIFFERENT PURITIES FOR THIS GAS?

Yes. SF<sub>6</sub> is a gas that is most often used in the electrical industry.

In this field, products must meet IEC standards. (1)

There are 2 standards to qualify SF<sub>6</sub>:

1. IEC 60376, which indicates that SF<sub>6</sub> is brand new and meets certain specifications in terms of purity and impurities on the liquid phase.
2. The IEC 60480 standard for the SF<sub>6</sub> issued from regeneration. It indicates the minimum specifications on the liquid phase.

INVENTEC offers both qualities: PYROSTOP 6 (SF<sub>6</sub>) and PYROSTOP 6T (technical grade).

For information, you will find below the dew point of SF<sub>6</sub>:

Dew point SF<sub>6</sub>

Dew point in ° C	Humidity ppm weight	Dew point in ° C	Humidity ppm weight	Dew point in ° C	Humidity ppm weight	Dew point in ° C	Humidity ppm weight
-49 °C	5.4 ppm	-46 °C	7.8 ppm	-43 °C	11.0 ppm	-40 °C	16.0 ppm
-48 °C	6.1 ppm	-45 °C	8.7 ppm	-42 °C	12.0 ppm	-39 °C	17.0 ppm
-47 °C	6.9 ppm	-44 °C	10.0 ppm	-41 °C	14.0 ppm	-38 °C	20.0 ppm

Pyrostop 6T is made from polluted SF<sub>6</sub> which has faced faulty sparks or been degraded. The used SF<sub>6</sub> is purified in our factory. INVENTEC has developed equipment which allows the reprocess the gas to meet the specifications we warranty. The gas analysis at several stages is done by our laboratory.

(1) International Electro-technical Committee.

## HOW CAN YOU ENSURE THE QUALITY OF YOUR PRODUCT?

We receive brand new SF<sub>6</sub> in bulk from various producers. Upon the arrival of gas in our factory, our laboratory analyses the gas in order to be sure that it complies to the IEC 60376 standard.



*Photo: laboratory analysis of SF<sub>6</sub>.*

The product can not be accepted if it does not meet the specifications. The entire process of analysis is included in our of insurance quality manual ISO 2001 version 2000. After analysis it is named Pyrostop 6 – INVENTEC trade mark. .

Before filling, the packages are checked. The cylinders are fitted with non return valves to prevent them from being filled without in our knowledge with contaminated products. The cylinders which don't have this device are vacuumed.

Regarding the quality of "technical" SF<sub>6</sub>, the product is analysed at the exit of the treatment cycle, and eventually reprocessed, until he meets the guaranteed specifications.

## I WANT TO MAKE SURE THE QUALITY OF SF<sub>6</sub> THAT IS IN MY INSTALLATION. HOW?

INVENTEC has a laboratory where the SF<sub>6</sub> is analyzed in gas or liquid phase. We propose the rental of sample bottles so you can make a sampling of SF<sub>6</sub> in your installation and send it to us. When the analysis has been completed, we will communicate our results focused on product purity, as well as water content, non condensable gases and some other impurities (HF, CF<sub>4</sub> ...).

## AND IF THE PRODUCT INSIDE MY INSTALLATION NO LONGER MEETS THE MINIMUM SPECIFICATIONS THAT I HAVE SET MYSELF, WHAT SHOULD I DO?

No problem. INVENTEC has developed equipment for the reprocessing of SF<sub>6</sub>. As part of our Ecoprogram, we propose a range of packages for the reclaim of used SF<sub>6</sub>, 20 kg, 40 kg or 460 kg capacity.

Packaging dedicated to contain SF<sub>6</sub> which is out of specifications must have an appropriate labelling. These packages must be transported by a carrier that has the amenities of transporting SF<sub>6</sub>. SF<sub>6</sub> is then returned to our factory where it is analyzed, and then retreated when impurities allow it

## WHAT IS THE PROCEDURE TO SEND THE PRODUCT WHICH IS OUT OF SPECIFICATIONS? CAN I PUT IT DIRECTLY INTO YOUR CYLINDERS AND RETURNED TO YOU?

No. Used SF<sub>6</sub> may contain impurities that are not compatible with brass (material of valves for brand new SF<sub>6</sub> that we deliver).

We offer packages dedicated to the recovery of gas with adapted accessories. As far as legislation is concerned, these cylinders have to be retested every 5 years (instead of 10 years for cylinders of brand new or recycled SF<sub>6</sub>).

For recovery of used SF<sub>6</sub>, we recommend the use of transfer equipment allowing you to recover the used gas safely for your workers and the environment.

## THAT BECOMES MY SF<sub>6</sub>?

When SF<sub>6</sub> arrives to our plant, we analyze it and decide, based on the impurities that we have found, if your SF<sub>6</sub> can be regenerated or not.

Our testing laboratory has equipment to verify the purity of SF<sub>6</sub> (by chromatography on the gas or liquid phase), water content, non condensable gases, acidity and other impurities such as S<sub>2</sub>F<sub>10</sub>.

We proceed with its treatment so as to bring the specifications of the IEC 60480 ed.2 standard.

INVENTEC has the appropriate prefecture permissions necessary to perform the activity of trading or brokering used gases dated 11.07.2001 issued by the Prefecture of the Rhone. We are also in close collaboration with DREAL Lyon for this type of activity.

Finally, our site is classified SEVESO II. Our staff is trained in handling dangerous goods.

## **IS SF<sub>6</sub> A DANGEROUS GAS? ARE THERE ANY PRECAUTIONS TO BE OBSERVED FOR TRANSPORTATION?**

Brand new or recycled SF<sub>6</sub> is a neutral non-flammable gas, non-explosive and non toxic. It is not considered a hazardous substance according to the criteria of the European Community. However, in case of skin contact, this product may cause burns or frostbite.

In terms of transportation, SF<sub>6</sub> is considered a dangerous product and its packaging must be labelled to identify the regulatory risk (code labelling 2.2).

The UN Code of new SF<sub>6</sub> and of "technical" SF<sub>6</sub> is 1080.

It is ranked:

- Class 2 for rail or road transport.
- Class 2.2 for transport by ship or by plane.

The UN Code of polluted SF<sub>6</sub> sent back our site for regeneration is 3308.

It is ranked:

- Class 2 for rail and road transport

this gas is considered as toxic (code 2.3) and corrosive (code 8).

SF<sub>6</sub> can travel by passenger or cargo aircraft under certain conditions. Contact us if necessary.

## CAN SF<sub>6</sub> BE USED IN ANY GAS CYLINDER?

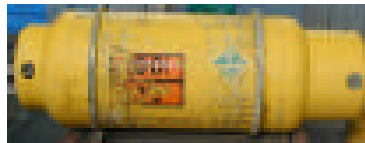
No.

Each gas has its own characteristics in terms of pressure, corrosivity, compatibility with materials, ... Moreover, the packaging must have the approval of official agencies (Mines Department for the packaging of this gas in France or European Pi approval ) and must be reclassified on a regular basis (every 10 years for non-polluted SF<sub>6</sub>).

The vapour pressure of SF<sub>6</sub> is such that this gas must be put in cylinders with a test pressure of 70 bar minimum. INVENTEC offers a range of packaging from 7 to 600 l of which you will find the specifications below:



*Drums 600 l*



*Drums 448 l*



*Cylinders*

SF <sub>6</sub> PACKAGINGS						
Water capacity in l C=cylinders D=drums	C 7 l	C 10.5 l	C 23 l	C 41.5 l	D 448 l	D 600 l
Tara	9 kg	11 kg	23kg	37 kg	380 kg	400 kg
Maxi SF <sub>6</sub> load	6 kg	10 kg	23 kg	42 kg	465 kg	600 kg
Unit gross weight	15 kg	21 kg	46 kg	79 kg	845 kg	1000 kg
Diameter	240 mm	240 mm	230 mm	240 mm	710 mm	650 mm
Height (C) or Length (D)	390 mm	465 mm	830 mm	1210 mm	1950 mm	2225 mm

Finally, a filling rate has to be respected for the filling in order to avoid overfilling of the packages during their filling. This ratio is 1.04 kg / l for packaging tested to 70 bars.

## **IS THE VALVE OUTLET FOR NEW SF<sub>6</sub> OR RECYCLED SF<sub>6</sub> STANDARD?**

The output characteristics of valves can vary from one country to another.

In France, we use the valves with the following output:

- For cylinders diameter 21.7 mm thread 1.814 on the right.
- For drums container diameter 26.1 mm thread: 1814 right.

The valves are made of brass. The major part of our packages is being equipped with check valves to prevent cylinder filling without our knowledge. SF<sub>6</sub> is normally used in the gas phase. Thus, the cylinders proposed by INVENTEC are not equipped with dip tubes. If your use requires a specific output of SF<sub>6</sub> in liquid phase, we can, on request equip the valves with dip tubes.

SF<sub>6</sub> cylinders can either be sold or allocated on a monthly rental basis.

In case you want a valve corresponding to another standard (English, American, German, Italian Standards) we will respond to your request via intermediate connectors.

The packages we provide you are in good testing conditions.

## **I HAVE SF<sub>6</sub> IN A PACKAGE THAT WAS RETESTED FOR OVER 10 YEARS. WHAT SHOULD I DO?**

The last date of retest should be reviewed by the filler. The INVENTEC staff checks these dates before filling. Regarding the use of gas, you can empty the bottle even when the test date is over. If the package is not in a good testing date, it can only be sent to the retesting centre. It is prohibited to fill containers if its latest testing date is expired. Before transferring new or used gas in a bottle, your technicians will ensure that the date of trial has not been exceeded.

## IS THERE ANY SPECIAL PRECAUTIONARY HANDLING OF SF<sub>6</sub>?

Of course, SF<sub>6</sub> is a liquefied gas which pressure varies with temperature. Handling must be done within certain safety rules. Operators must wear gloves, eye protection and be especially careful when handling hoses or equipment containing SF<sub>6</sub>.

Moreover, this gas has a very high greenhouse warming potential. We must therefore care against leakage of gas, especially during manipulation. To assist in these operations, we propose transfer equipment, easy to use, allowing you to perform the following services:

- decanting installation containing SF<sub>6</sub>,
- temporary storage of SF<sub>6</sub>
- filtration of contaminants at 0.1 microns,
- gas drying (dehydration)
- transfer of gas in the facility or to packaging recovery.

These devices are mounted on trolleys which include all accessories necessary to transfer or recover SF<sub>6</sub> (hoses fittings...). This is the range of GRU (Gas Recovery Unit), and GTU (GAS TRANSFER UNIT) to transfer the gas bottle to bottle and .GRV (GAZ RECOVERY AND high VACUUM)



*Pictures transfer groups SF<sub>6</sub>.*

For the filling of packages, we propose scales for weighing bottles or bars weighing to weigh containers.

**I HAVE EQUIPMENT WHICH IS AT END OF LIFE AND WHICH CONTAINS SF<sub>6</sub>. I AM NOT QUALIFIED TO CLEAR THESE DEVICES. CAN YOU INDICATE ME TO A SPECIALIST?**

Yes. Our engineering department is able to come on sites and to recover used SF<sub>6</sub>

**I HAVE BOTTLES OR CONTAINERS OF SF<sub>6</sub>. WHAT IS THE MAINTENANCE TO MAKE ON THESE PACKAGES?**

These packages are considered as pressure vessels. You we must be careful not to damage them. During transport, the valves shall be protected by caps. On the other hand, the cylinders which are filled with new or "technical" SF<sub>6</sub> should undergo regular retesting very 10 years in a general case (5 years for packaging intended to contain used SF<sub>6</sub>).

INVENTEC has a hydraulic retesting workshop in which we can proceed with the reclassification of your packaging. We have 3 to 4 sessions per month conducted under the supervision of an Inspector of Mines or APAVE. To achieve this, we need the manufacturing documents packages. In case you did not buy these cylinders or containers from INVENTEC PROMOSOL, you must provide these documents.

**I USE SF<sub>6</sub> BUT I WANT TO REVIEW ALL MY INSTALLATION OF GAS SUPPLY. CAN YOU HELP ME?**

Yes. Our engineering department is at your disposal to study your facility and offer the necessary changes to meet your needs while respecting the law.

My equipment goes abroad and I want to have gas on site. What do you suggest?

In addition to our European network in France, Switzerland, Germany, Spain, England, Benelux, Hungary, we have an export branch.

Our export services can put you in contact with their foreign distributors. We can finally take care of the export of SF<sub>6</sub> to your account. Our team knows fully export control regulations in force for the export of hazardous gases.

**FOR ALL OTHER QUESTIONS REGARDING SF<sub>6</sub>, PLEASE CONTACT US**

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