

## Bromine pentafluoride



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### IDENTIFICATION

#### Bromine pentafluoride

**ZVG No:** 122801  
**CAS No:** 7789-30-2  
**EC No:** 232-157-8

### CHARACTERISATION

#### SUBSTANCE GROUP CODE

133100 Fluorine compounds, inorganic  
133300 Bromine compounds, inorganic

#### STATE OF AGGREGATION

The substance is liquid.

#### PROPERTIES

colourless  
pungent odour

#### CHEMICAL CHARACTERISATION

Highly reactive oxidizing liquid.

The substance itself does not burn, but reacts so violently with inflammable substances that it can partly ignite them without any other sources of combustion and fuel any existing fire substantially.

Decomposes in water.

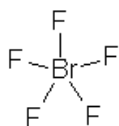
Sensitive to moisture.

Highly volatile.

Acute or chronic health hazards result from the substance.  
(see: chapter REGULATIONS).

[Substance information in Wikipedia](#)

### FORMULA

BrF<sub>5</sub>**Molar mass:** 174,9 g/mol**Conversion factor** (gaseous phase) at 1013 mbar and 20 °C:1 ml/m<sup>3</sup> = 7,27 mg/m<sup>3</sup>

## PHYSICAL AND CHEMICAL PROPERTIES

[Melting point](#) | [Boiling point](#) | [Density](#) | [Vapour pressure](#) | [Solubility](#) | [Hazardous reactions](#)

### MELTING POINT

Melting point: -60,5 °C

Reference: [00108](#)

### BOILING POINT

Boiling Point: 40,76 °C

Reference: [00108](#)

### DENSITY

DENSITY

Value: 2,466 g/cm<sup>3</sup>

Temperature: 25 °C

Reference: [00108](#)

RELATIVE VAPOUR DENSITY

Ratio of the density to dry air at the same temperature and pressure

Value: 6,04

Reference: [00108](#)

RELATIVE DENSITY OF THE VAPOUR-AIR-MIXTURE

Ratio of the density to dry air at 20 °C and standard pressure

Value: 3,05

Reference: [99999](#)

### VAPOUR PRESSURE

Vapour pressure: 413 hPa

Temperature: 20 °C

Reference: [00108](#)

Vapour pressure: 670 hPa

Temperature: 30 °C

Reference: [00108](#)

Vapour pressure: 1450 hPa

Temperature: 50 °C

Reference: [00108](#)

## SOLUBILITY IN WATER

decomposition

Reference: [00302](#)

## HAZARDOUS REACTIONS

### Hazardous chemical reactions

Risk of explosion in contact with:

water  
aluminium powder (rare)  
ammonium chloride  
chlorine (heat)  
chloromethane  
dichlorine heptoxide  
hydrogen sulfide  
hydrogenous compounds (rare)

The substance can react dangerously with:

ammonia  
iodine  
phosphorus  
antimony  
arsenic  
arsenic pentoxide  
barium  
benzene  
boron (powder)  
acetic acid  
ethanol  
potassium iodide  
metal oxides  
metal powder  
methane  
organic materials  
phosphorus pentoxide  
concentrated nitric acid  
sulfur  
sulfur dioxide  
concentrated sulfuric acid  
selenium (powder)  
hydrogen

## OCCUPATIONAL HEALTH AND FIRST AID

[Occupational health check](#)

### OCCUPATIONAL HEALTH CHECK

**Prophylaxis offer:** Occupational medical prevention has to be offered when, conducting activities with this substance, an exposure cannot be excluded.

**Obligatory prophylaxis:** The employer shall arrange occupational medical prophylaxis if, exerting activities with this substance, skin contact cannot be excluded.

**Deadlines:** Employees may exert activities with this substance only after participation in obligatory prophylaxis. Prophylaxis offer has to be made prior to taking up work. Deadlines for the inducement or proposal of regularly recurrent occupational medical prevention are to gather from the Occupational Health Rule (Arbeitsmedizinische Regel) "[AMR Nummer 2.1](#)".

## SAFE HANDLING

[Handling](#) | [Storage](#) | [Fire and explosion protection](#) | [Organisational measures](#) | [Personal protection](#) | [Disposal considerations](#) | [Accidental release measures](#) | [Fire fighting measures](#)

### TECHNICAL MEASURES - HANDLING

#### Workplace

Provision of very good ventilation in the working area.

Vapour/air mixtures are heavier than air. Adequate ventilation at the floor area must be ensured as well.

Washing facility at the workplace required.

Eye bath required. These locations must be signposted clearly.

When handling excessive amounts of the substance an emergency shower is required.

#### Equipment

Use only closed apparatus.

If dangerous pressure can arise from contact with heat, suitable safety measures and equipment should be provided.

If release of the substance cannot be prevented, then it should be suctioned off at the point of exit.

Don't conduct exhaust air together with combustible vapours.

Label containers and pipelines clearly.

Suitable materials:

Polyethylene PE

Rubber

Steel or stainless steel containers when coated with polyethylene.

Plastics have to be proven for their resistibility.

Unsuitable materials:

Glass

Metal

Wood

#### Advice on safer handling

Take care to keep workplace clean and dry.

The substance must not be present at workplaces in quantities above that required for work to be progressed.

Do not leave container open.

Use leak-proof equipment with exhaust for refilling or transfer.

Provide leak control and facilities for rinsing with air or inert gas.

Avoid splashing.

Fill only into labelled container.

Never refill excess materials back to the container.

Avoid any contact when handling the substance.

Do not transport together with incompatible substances.

Use an appropriate exterior vessel when transporting in fragile containers.

#### Cleaning and maintenance

Use protective equipment while cleaning if necessary.

Do not clean damp.

Only conduct maintenance and other work on or in the vessel or closed spaces after obtaining written permission.

### TECHNICAL MEASURES - STORAGE

### **Storage**

Keep in locked storage or only make accessible to specialists or their authorised assistants.

Do not use any food containers - risk of mistake.

Containers have to be labelled clearly and permanently.

Store in the original container as much as possible.

Preferably use unbreakable containers rather than glass containers.

Place fragile vessels in break-proof outer vessels.

Maximum content 90%.

Keep container tightly closed.

Store in a cool place.

Store in a dry place.

Keep container in a well-ventilated place.

Store in a fire resistant place.

No wood shelving.

Protect from exposure to sunlight.

Protect from overheating/heating up.

Protect from moisture.

### **Conditions of collocated storage**

Storage class 5.1 A (Strongly oxidizing substances)

Strongly oxidizing substances must be stored separately. Collocated storage with oxidizing substances of storage class 5.1B and also with noncombustible substances of storage classes 12 and 13 is permitted.

## **TECHNICAL MEASURES - FIRE AND EXPLOSION PROTECTION**

### **Technical, constructive measures**

Substance has an oxidizing effect.

Fire fighting equipment must be available.

Inspect the electrical fittings regularly against the higher risk of corrosion.

### **Precaution on handling**

Keep away from open flames.

Observe the smoking prohibition!

Absolutely no welding in the working area.

Only work with vessels and lines after these have been thoroughly rinsed and inerting.

Work done with fire or open flame should only be carried out with written permission if the risk of fire or explosion cannot be completely eliminated.

Keep away from combustible materials.

Filter the solutions only with glass wool, glass chips, or ceramic filters. Do not use any filtration materials made of paper which risks ignition after drying. Do not leave any cleaning rags lying in the open.

## **ORGANISATIONAL MEASURES**

Instruction on the hazards and the protective measures using instruction manual ([TRGS 555](#)) are required with signature if just more than one minor hazard was detected.

Instruction must be provided before employment and then at a minimum of once per annum thereafter.

An escape and rescue plan must be prepared when the location, scale, and use of the work-site so demand.

Observe the restrictions on juvenile employment as defined in the "Jugendarbeitsschutzgesetz".

Observe the restrictions on activities of pregnant women according to the the „Mutterschutzgesetz“ (German Maternity Protection Act)

Only employees are permitted to enter the work areas. Signposting to this effect must be displayed.

## PERSONAL PROTECTION

### Body protection

Depending on the risk, wear a sufficiently long apron and boots or a suitable chemical protection suit.

Wear flameproof protective clothing.

### Respiratory protection

In an emergency (e.g.: unintentional release of the substance) respiratory protection must be worn. Consider the maximum period for wear.

Respiratory protection: Gas filter B, colour code grey.

Use insulating device for concentrations above the usage limits for filter devices, for oxygen concentrations below 17% volume, or in circumstances which are unclear.

### Eye protection

Sufficient eye protection must be worn.

Wear chemical safety goggles.

If the face is at risk a protective shield must also be worn.

If vapours or aerosols that may injure the eyes arise, then safety of the eyes can best be guaranteed by wearing a full mask.

### Hand protection

Use protective gloves. The glove material must be sufficiently impermeable and resistant to the substance. Check the tightness before wear. Gloves should be well cleaned before being removed, then stored in a well ventilated location. Pay attention to skin care.

Skin protection cremes do not protect sufficiently against the substance.

Textile or leather gloves are completely unsuitable.

Currently there is no information available regarding suitable glove materials.

Ask the manufacturer for suitable materials.

### Occupational hygiene

Foods, beverages and other articles of consumption must not be consumed at the work areas.

Suitable areas are to be designated for these purposes.

Avoid contact with skin. In case of contact wash skin.

Avoid contact with eyes. In case of contact rinse the affected eye(s).

Avoid inhalation of vapour or mist.

Avoid contact with clothing. Contaminated clothes must be exchanged and cleaned carefully.

Before a break it might be necessary to change clothes.

Provide washrooms with showers and if possible rooms with separate storage for street clothing and work clothing.

The skin must be washed with soap and water before breaks and at the end of work. Apply fatty skin-care products after washing.

## DISPOSAL CONSIDERATIONS

Hazardous waste according to Waste Catalogue Ordinance (AVV).

If there is no way of recycling it must be disposed of in compliance with the respective national and local regulations.

Collection of small amounts of substance:

Collect in container for toxic, inorganic residues and heavy metal salts and their solutions.

Collection vessels must be clearly labelled with a systematic description of their contents. Store the vessels in a well-ventilated location. Entrust them to the appropriate authorities for disposal.

## ACCIDENTAL RELEASE MEASURES

Evacuate area. Warn affected surroundings.

The hazardous area may only be entered once suitable protective measures are implemented. Only then can the hazardous situation be removed (see chapter Personal Protection).

Absorb any spilt liquid with an absorbent (e.g. diatomite, vermiculite, sand) and dispose of according to regulations.

Attention! Substance reacts with water. Avoid contact with water.

Afterwards ventilate area and wash spill site.

Endangerment of watert:

The effects on water sources have not yet been classified. Yet escape into ground, lakes, or streams should be avoided under all circumstances. Inform responsible authorities in case of escape.

## FIRE FIGHTING MEASURES

### Instructions

Substance is non-combustible, but has an oxidizing effect.

In case of ambient fire:

If possible, take container out of dangerous zone.

Heating causes a rise in pressure, risk of bursting and explosion.

Shut off sources of ignition.

### Special protective equipment

In the case of inclusion in an ambient fire hazardous substances can be released.

Hydrogen fluoride

Bromine

Wear self-contained breathing apparatus and special tightly sealed suit.

## REGULATIONS

[GHS Classification/Labelling](#) | [Workplace labelling](#) | [Transport Regulations](#) | [SevesoIII](#) | [Restriction of use](#) | [Technical rules](#) | [Regulations of accident insurers](#) | [Occupational health check](#)

## EUROPEAN GHS CLASSIFICATION AND LABELLING

### Classification

Oxidising liquids, Category 1; H271

Acute toxicity, Category 3, oral; H301

Acute toxicity, Category 3, dermal; H311

Acute toxicity, Category 2, inhalation; H330

Skin corrosion, Category 1B; H314



**Signal Word** "Danger"

### Hazard Statement - H-phrases

H271: May cause fire or explosion; strong oxidiser.

H301: Toxic if swallowed.

H311: Toxic in contact with skin.

H330: Fatal if inhaled.

H314: Causes severe skin burns and eye damage.

### Precautionary Statement - P-phrases

P210: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P280: Wear protective gloves/protective clothing/eye protection/face protection.

P301+P310+P330: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth.

P303+P361+P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water or shower.

P304+P340+P310: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.

P305+P351+P338+P310: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

Manufacturer's specification  
by ABCR  
The P-phrases were adjusted.

Reference: [02000](#)

Checked: 2022

### GHS-CLASSIFICATION OF MIXTURES

The classification of mixtures containing this substance results from Annex 1 of Regulation (EC) 1272/2008.

Reference: [99999](#)

### WORKPLACE LABELLING ACCORDING TO GERMAN ASR A1.3

#### Prohibition label



No open flame; fire, open ignition sources and smoking prohibited



No admittance for unauthorized persons



No eating and drinking

#### Warning label



Caution - toxic material



Caution - corrosive material





Caution - oxidizing material

### Precept label



Use safety goggles



Wear safety gloves

### TRANSPORT REGULATIONS

UN Number: 1745  
Shipping name: Bromine pentafluoride  
Hazard Identification Number: 568  
Class: 5.1 (Oxidizing Agents)  
Packing Group: I (high danger)  
Danger Label: 5.1/6.1/8



Classification code: OTC

Tunnel restrictions:

Transports in tanks: passage forbidden through tunnels of category B, C, D and E.  
Other transports: passage forbidden through tunnels of category E.

Reference: [07902](#)

### DIRECTIVE 2012/18/EU (Seveso III)

**The substance is subject to the hazard categories of the Hazardous Incident Ordinance:**

- |    |  |
|----|--|
| H2 | Acute toxic, Category 2 (all exposure routes) or Category 3 (inhalation exposure route) or Category 3 (oral route if neither acute inhalation toxicity classification nor acute dermal toxicity classification can be derived) |
| P8 | Oxidising liquids or solids, Category 1, 2 or 3  |

### Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: H2

Acute toxic

Qualifying quantity for the application of

Lower-tier requirements: 50 t

Upper-tier requirements: 200 t

### Quantity thresholds for determination of operation scopes:

Annex I Part 1 Section: P8

Oxidising liquids or solids

Qualifying quantity for the application of

Lower-tier requirements: 50 t

Upper-tier requirements: 200 t

## RESTRICTIONS OF USE / BANS OF USE

### REACH Regulation (EC) No 1907/2006 Annex XVII

Annex XVII, Point 3

1. The putting into circulation and the utilisation of the substance is not allowed in decorative objects, games and joke articles.

2. Substances labelled with H304 which can be utilised as fuels in decorative lamps and are put in circulation in amounts of 15 l or less must not contain a dye and/or a perfume.

Further information on prohibitions can be taken from the regulation.

Annex XVII to Regulation (EC) No 1907/2006, [consolidated version](#) (BAUA) (only in German)

### Consumer Goods Ordinance

Attachment 1 to § 3, Point 5

The substance must not be utilised for the production or treatment of joke articles.

## TECHNICAL RULES FOR HAZARDOUS SUBSTANCES

### [TRGS 201](#)

Einstufung und Kennzeichnung bei Tätigkeiten mit Gefahrstoffen; Ausgabe Februar 2017, zuletzt geändert und ergänzt April 2018

### [TRGS 400](#)

Gefährdungsbeurteilung für Tätigkeiten mit Gefahrstoffen; Ausgabe Juli 2017

### [TRGS 555](#)

Betriebsanweisung und Information der Beschäftigten; Ausgabe Februar 2017

### [TRGS 600](#)

Substitution; Ausgabe Juli 2020

### [TRGS 401](#)

Gefährdung durch Hautkontakt, Ermittlung - Beurteilung - Maßnahmen; Ausgabe Juni 2008; zuletzt berichtigt März 2011

### [TRGS 500](#)

Schutzmaßnahmen; Ausgabe September 2019

### [TRGS 509](#)

Lagern von flüssigen und festen Gefahrstoffen in ortsfesten Behältern sowie Füll- und Entleerstellen für ortsbewegliche Behälter; Ausgabe Juni 2022

### [TRGS 510](#)

Lagerung von Gefahrstoffen in ortsbeweglichen Behältern; Ausgabe Januar Dezember 2020

### [TRGS 800](#)

Brandschutzmaßnahmen; Ausgabe Dezember 2010

## REGULATIONS OF GERMAN ACCIDENT INSURERS

DGUV Guideline 350-001 (BGG 904): Guidelines for occupational medical examinations  
G 34 : Fluorine and its inorganic compounds

[DGUV Regel 112-190](#)

Benutzung von Atemschutzgeräten, Ausgabe November 2021  
(in German only)

## LINKS

[International Limit Values](#)

## REFERENCES

Quelle: 00001

IFA: Erfassungs- und Pflegehandbuch der GESTIS-Stoffdatenbank (nicht öffentlich)

Data acquisition and maintenance manual of the GESTIS substance database (non-public)

Quelle: 00108

Sorbe "Sicherheitstechnische Kenndaten chemischer Stoffe" ("Safety-related characteristics of chemical substances"), Online-Datenbank, ecomed Storck, Landsberg (ab 2022)

Quelle: 00302

G. Hommel "Handbuch der gefährlichen Güter" ("Handbook of Dangerous Goods"), CD-ROM  
"Hommel interaktiv" ab Version 10.0 Springer-Verlag, Heidelberg, 2011

Quelle: 02000

Internet-Quelle, nicht spezifiziert

Quelle: 05300

[TRGS 510](#) "Lagerung von Gefahrstoffen in ortsbeweglichen Behältern" Ausgabe Dezember 2020

Quelle: 06002

L. Roth, U. Weller

"Gefährliche Chemische Reaktionen" Loseblattsammlung mit Ergänzungslieferungen

"Dangerous chemical reactions" loose-leaf collection with supplement deliveries

ecomed-Verlag

Quelle: 07635

AUERDATA 98

Quelle: 07902

BAM: Datenbank [Gefahrgut-Schnellinfo](#)

Quelle: 99999

Angabe des Bearbeiters

Indication of the editor

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**This material data sheet was carefully compiled. However no liability can be assumed for the data content, whatever the legal cause may be.**

Bouteille BrF<sub>5</sub> (Pentafluorure de brome) à évacuer

Bouteilles BrF<sub>5</sub> produites au Wuhan Chemical Industry Research Institute (Chine).

Fiche de spécifications du produit fournie par le producteur :

## Bromine Pentafluoride

1. Product: Bromine Pentafluoride
2. Formula: BrF<sub>5</sub>
3. Molecular weight: 174.92
4. Properties: BrF<sub>5</sub> is a colourless liquid at room temperature and fumes strongly in the air. It has good thermostability (stable at ~~20°C~~<sup>460°</sup>) and high chemical reactivity. It can react with most metallic and nonmetallic elements. It burns in contact with organic substances. BrF<sub>5</sub> is strongly toxic and corrosive. It'll corrode glass, ceramics, etc. BrF<sub>5</sub> is a favourable fluorinating agent or oxidizer.  
 Boiling point: 40.76°C  
 Melting point: -60.5°C  
 Specific gravity: 2.57 (Liquid phase 0 °C)  
 Vapour pressure: 500mmHg (25°C)  
 Heat of vaporization: 7.31 Kcal/g-mole  
 Density (solid) : 3.09g/cm<sup>3</sup>
5. Specifications: BrF<sub>5</sub> content: >96%

## 6. Applications:

- (1) BrF<sub>5</sub> can be used for determination of oxygen content in metals.
- (2) It can be used as a fluorinating agent for preparation of organic fluorides.
- (3) It can be used in a chemical laser.
- (4) It can be used as an oxidizing agent for rocket fuels.
- (5) It can also be used in atomic power industry.

## 7. Package, Storage and Transportation:

The product is dangerous, so specific package and transportation is required. In general, metallic cylinders with a working pressure of 10-kg/cm<sup>2</sup> (made of stainless steel or Monel metal or nickel containing alloy) may be used. The container should be kept in a cool and dry place. In the transportation of the cylinders, any wooden case outside is forbidden.

## Manufacturer:

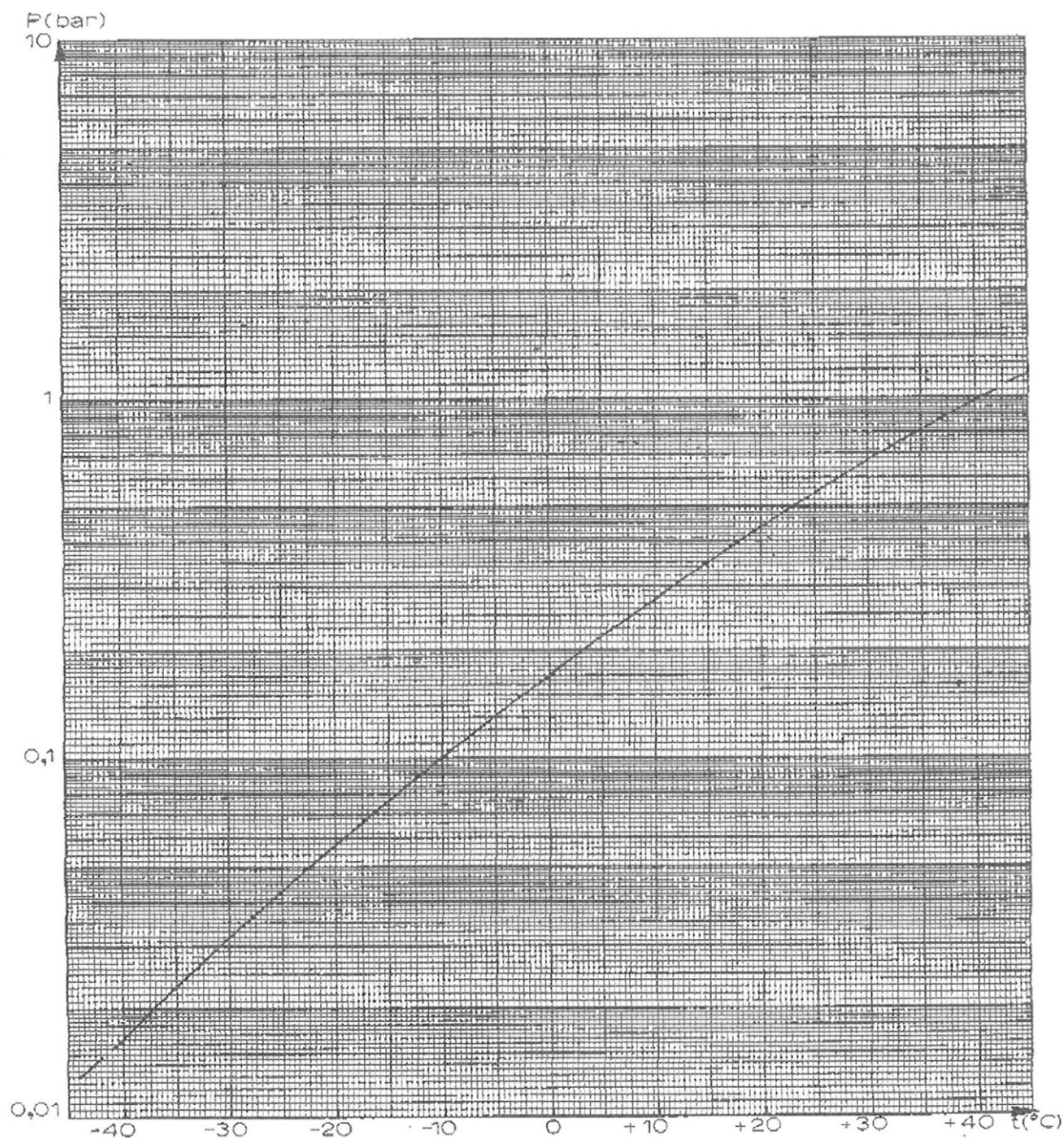
The Wuhan Chemical Industry Research Institute, China.



Produit liquide avec une pression de vapeur variable selon la température ; pression de vapeur d'environ 0,7 bar à 25°C (cf. courbe ci-dessous)

pression de vapeur saturante [1]

| vapor pressure [1]



Livré dans bouteilles en inox « haute qualité » remplies au maximum avec 1,5 kg de BrF<sub>5</sub>.  
Le produit est spécifié à une pureté de 96%, avec des impuretés, principalement de BrF<sub>3</sub>, mais également des traces de Br<sub>2</sub>, HF, et F<sub>2</sub>

Laboratoire LGL-TPE@UJM possède **3 bouteilles à évacuer** :

- N°1 - bouteille dont le BrF<sub>5</sub> a été totalement consommé (**possibles résidus**)
- N°2 - bouteille en cours d'utilisation installée sur ligne dans laquelle il reste environ **750 g de BrF<sub>5</sub>**
- N°3 - bouteille non entamée dans laquelle il doit y avoir une quantité comprise **entre 1 et 1,5 kg de BrF<sub>5</sub>**



Dimension des bouteilles dans lesquelles est conditionné le BrF5 :



Bouteille N° 3 : réserve pleine



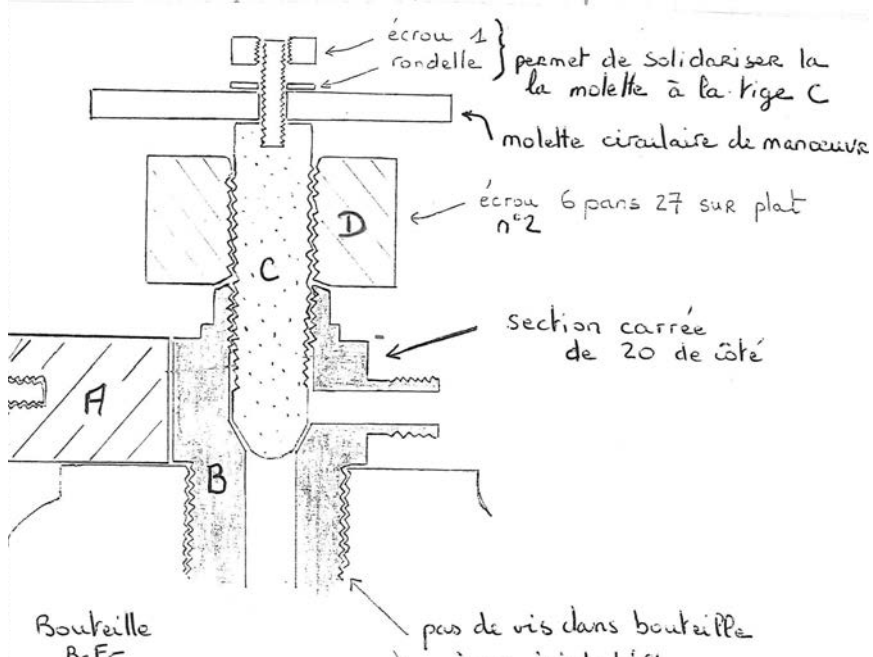
Hauteur cylindre : A = 22 cm

Hauteur vanne : B = 8,5 cm

Diamètre cylindre : 9 cm

Volume approximatif de chaque bouteille, calculé sur la base des dimensions extérieures du cylindre (H= 22 cm et diamètre = 9 cm) : 1400 cm<sup>3</sup>

**Croquis interprétatif de la vanne de la bouteille** ; c'est un plan déduit à partir de l'aspect extérieur de la vanne, il n'était pas fourni par le vendeur ; il a été établi pour réaliser les éléments de fixation de la bouteille sur notre installation de façon à s'assurer de ne pas entrainer le pas de vis B, mais uniquement la tige filetée C en manœuvrant la molette de la vanne.



Le pentafluorure de brome est un liquide incolore dans les conditions ordinaires (15°C, 760 mm Hg). C'est un composé toxique, très agressif, fumant à l'air (hydrolyse due à l'humidité atmosphérique).

## propriétés physiques

Formule chimique: BrF<sub>5</sub>

Masse molaire: 174,896 g.mole<sup>-1</sup>

point de fusion [1]

T = 211,85 K (-61,3°C) à 1 atm

point d'ébullition [1]

(1 atm)

Bromine pentafluoride is a colorless liquid in normal atmospheric conditions (15°C and 760 mm Hg). It is a toxic, highly corrosive compound which fumes in air (hydrolysis by atmospheric moisture).

## physical properties

Formula: BrF<sub>5</sub>

Molecular weight: 174,896 g.mole<sup>-1</sup>

melting point [1]

T = 211,85 K (-61,3°C) à 1 atm

boiling point [1]

(1 atm)

Température (K)	(°C)	Chaleur latente (kcal.kg <sup>-1</sup> )	Masse volumique liquide (kg.m <sup>-3</sup> )
Temperature		Latent heat	Liquid density
313,65	40,5	42,5	2411

masse volumique [1]

(1 bar)

density [1]

(1 bar)

Température (°C)	Liquide (kg.m <sup>-3</sup> )
Temperature	Liquid
0	2551
15	2499
50	2378

chaleur spécifique [2]

c<sub>p</sub> = 0,138 kcal.kg<sup>-1</sup>.K<sup>-1</sup> pour le gaz parfait à 25°C

heat capacity [2]

c<sub>p</sub> = 0,138 kcal.kg<sup>-1</sup>.K<sup>-1</sup> for the perfect gas at 25°C

viscosité [3]

(pression de l'ordre de 10<sup>-2</sup> à 10<sup>-1</sup> bar)

(multiplier ces valeurs par 10<sup>-5</sup> pour obtenir des poises)

viscosity [3]

(at about 10<sup>-2</sup> to 10<sup>-1</sup> bar)

(multiply these values by 10<sup>-5</sup> to obtain poises)

Température (°C)	Viscosité
Temperature	Viscosity
0	14,0 (*)
15	14,7 (*)
50	16,2
100	18,4

(\*) valeur extrapolée

(\*) extrapolated value

stabilité [1]

Le pentafluorure de brome est stable à la température ambiante et ne commence à se dissocier que vers 400°C (0,1% environ).

stability [1]

Bromine pentafluoride is fairly stable at room temperature and only begins to show significant dissociation around 400°C (about 0.1%).

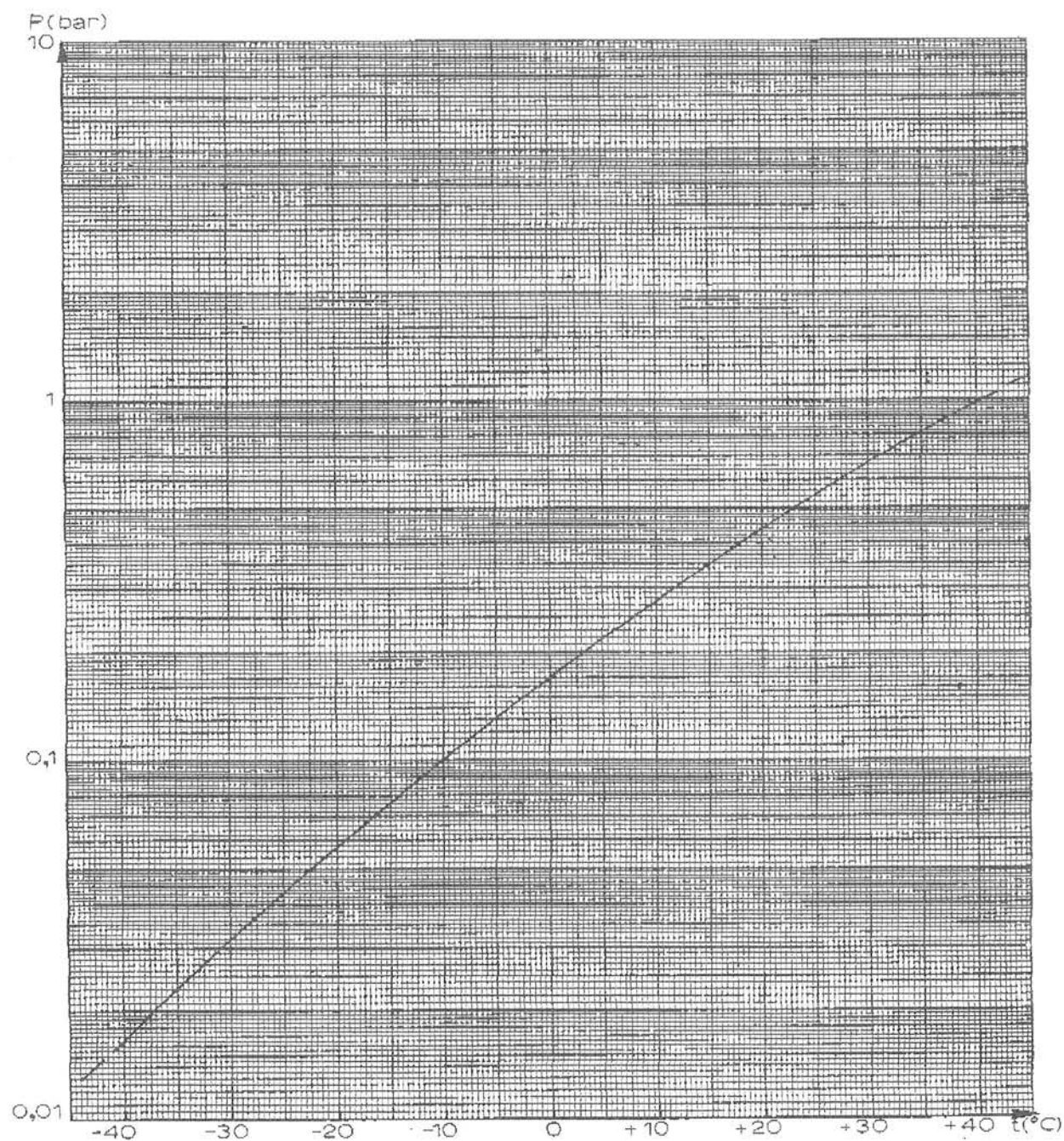


pentafluorure de brome  
 $\text{BrF}_5$

bromine pentafluoride  
 $\text{BrF}_5$

pression de vapeur saturante [1]

vapor pressure [1]





## inflammabilité

Le pentafluorure de brome est ininflammable dans l'air, mais c'est un agent oxydant très puissant.

## propriétés biologiques [4]

L'action nocive du pentafluorure de brome se caractérise par une irritation des muqueuses de l'appareil respiratoire.

La concentration maximale admissible recommandée pour le pentafluorure de brome dans les atmosphères des locaux industriels, permettant des expositions de 8 heures par jour pendant 5 jours par semaine, sans effet décelable pour la plupart des individus est:

0,1 ppm.vol

ou  
or

0,7 mg.m<sup>-3</sup>

## traitement des intoxications accidentelles

Eloigner les sujets atteints d'affections cutanées et respiratoires de la zone pouvant être contaminée.

En cas d'inhalation, éloigner le sujet de l'atmosphère polluée, en lui évitant tout effort musculaire. Le maintenir au chaud.

Mettre en oeuvre s'il y a lieu une assistance respiratoire.

Prévenir immédiatement le service médical spécialiste.

## précautions pour le stockage et la manipulation

ATTENTION: LE PENTAFLUORURE DE BROME EST UN GAZ PLUS LOURD QUE L'AIR, EXCESSIVEMENT TOXIQUE, TRÈS AGRESSIF.

NE JAMAIS UTILISER DE PENTAFLUORURE DE BROME SANS AVOIR CONSULTÉ LE CHAPITRE III.

Le pentafluorure de brome peut réagir violemment avec les matières organiques non saturées en fluor.

En conséquence, il est recommandé à l'opérateur de se protéger par:

- casquette en cuir chromé, munie d'une visière en matière plastique,
- gants en cuir chromé,
- tablier en cuir chromé, couvrant bien le manipulateur, avec manchettes, facilement dégrafable.

Une propreté et une préparation rigoureuse des circuits destinés à recevoir du pentafluorure de brome est indispensable. On peut citer à titre d'exemple la combustion vive d'une tuyauterie en cuivre, provoquée par une brasure mal décapée. Toute installation devant contenir du pentafluorure de brome doit subir impérativement:

- un décapage, à l'aide d'une solution d'acide nitrique à 10 ou 20%, des parties métalliques présentant des traces visibles d'oxydation, puis un rinçage à l'eau distillée.
- un dégraissage de l'ensemble de l'installation à l'aide de trichloréthylène.
- un séchage à l'aide d'acétone.
- un test d'étanchéité à l'aide d'un détecteur à hélium.
- un étuvage de l'installation (robinets de bouteilles, canalisation, vannes, etc. ...) aux environs de 120°C pendant au minimum 30 minutes.

## flammability

Bromine pentafluoride is nonflammable in air, but is a powerful oxidizing agent.

## biological properties [4]

The harmful effects of bromine pentafluoride are distinguished by irritation of the mucous membranes of the respiratory tract.

The following threshold limit value is recommended for bromine pentafluoride, as the concentration in air to which nearly all workers may be exposed during an 8-hour workday and 40-hour workweek, without adverse effects:

## first aid suggestions

Remove the victim affected by skin and respiratory ailments from the contaminated zone.

In case of inhalation, remove the victim from the contaminated area, sparing him any muscular effort. Keep him warm.

Employ artificial respiration if necessary.

Summon competent medical aid immediately.

## precautions in handling and storage

CAUTION: BROMINE PENTAFLUORIDE IS A HIGHLY TOXIC AND CORROSIVE GAS WHICH IS HEAVIER THAN AIR. NEVER USE IT WITHOUT REFERRING TO CHAPTER III.

Bromine pentafluoride is likely to react violently with organic compounds which are unsaturated in fluorine.

Consequently, the operator is advised to protect himself by the following means:

- chrome-leather helmet fitted with a plastic visor,
- chrome-leather gloves,
- chrome-leather apron providing full protection to the operator, fitted with oversleeves and easily removable.

Systems designed to contain bromine pentafluoride must be maintained absolutely clean and in perfect order. Accidents can occur, such as the burning of copper piping caused by poorly cleaned brazing. Any installation containing bromine pentafluoride must be subjected to:

- pickling in 10 to 20% nitric acid solution, of all metal components exhibiting visible traces of oxidation. This should be followed by rinsing with distilled water.
- decreasing of the entire installation by means of trichloroethylene.
- drying by the use of acetone.
- leak test carried out by means of a helium detector.
- stoving of the installation cylinder valves, piping, valves, etc.) at about 120°C for at least 30 minutes.
- vacuum pumping of the installation ( $P \leq 10^{-2}$  mm Hg) in preference to dry gas flushing.

un pompage sous vide de l'installation ( $P \leq 10^{-2}$  mm Hg) plutôt qu'un balayage de gaz sec.

Ces opérations doivent être menées simultanément, sinon l'eau et les substances gazeuses adsorbées sur les parois transformeraient le pentafluorure de brome en acide fluorhydrique, très agressif vis-à-vis des matériaux mis en oeuvre.

- l'installation étant sous vide, une passivation au fluor est réalisée de la manière suivante:
  - introduire lentement 0,1 bar de fluor.
  - renouveler cette injection toutes les 15 minutes jusqu'à ce que la pression de 0,3 bar soit atteinte.
  - compléter en fluor pour obtenir 1 bar.
  - laisser en contact 30 minutes.
  - augmenter la pression jusqu'à 10 bars.
  - maintenir l'installation pendant plusieurs heures à cette pression.

Une autre technique consiste à éliminer le fluor entre chaque injection, tout en utilisant les mêmes pressions de remplissage que ci-dessus.

### recommandations importantes

En cas d'arrêt momentané ou prolongé d'une installation, il est recommandé de ne pas la maintenir sous pression de pentafluorure de brome. L'appareillage doit être stocké sous vide ou sous pression de gaz inerte (ex. helium).

Une installation ne doit jamais être remise à l'air. A chaque remise en service, il est préférable de repasser le montage.

### détection des fuites - analyse

Le pentafluorure de brome même à faible concentration présente une odeur irritante, et fume à l'air. En raison de sa toxicité, de son agressivité chimique et de son pouvoir oxydant puissant, il est conseillé de suivre les recommandations données dans le paragraphe "PRECAUTIONS POUR LE STOCKAGE ET LA MANIPULATION". Le pentafluorure de brome et ses mélanges gazeux peuvent être analysés par:

- dosage des ions en solutions
  - dosage volumétrique
  - colorimétrie
  - conductimétrie
- analyse de la phase gazeuse
  - spectrométrie Raman
  - absorption infra-rouge
  - chromatographie en phase gazeuse
  - microsublimation

### compatibilité avec les matériaux

La résistance des matériaux au pentafluorure de brome est variable. Jusqu'à 200°C, les principaux matériaux usuels peuvent être utilisés. Aux températures élevées, seuls l'Inconel ®, le Monel ® et le nickel doivent être utilisés (voir tableau ci-dessous). Le choix des matériaux dépend donc de la température et de la pureté exigée. Tous les travaux précis doivent être réalisés dans des appareillages métalliques: le Monel ® est conseillé dans ce cas.

*These operations must be carried out simultaneously, or the water and substances adsorbed on the walls will transform the bromine pentafluoride into hydrofluoric acid, which is extremely corrosive to the materials employed.*

- with the installation under vacuum, it should be passivated as follow:
  - slowly introduce fluorine at 0,1 bar.
  - repeat this operation every 15 minutes until the pressure reaches 0,3 bar.
  - add fluorine to raise the pressure to 1 bar.
  - leave in contact for 30 minutes.
  - increase the pressure to 10 bar.
  - keep the installation at this pressure for several hours.

*Another method consists of eliminating the fluorine between injections, while employing the same filling pressures as those mentioned above.*

### important recommendations

*In the case of temporary or prolonged shutdown of an installation, it is not advised to retain the installation under bromine pentafluoride pressure. The equipment should be stored under vacuum or inert gas pressure (e.g., helium). The installation should never be opened to the surrounding air.*

*When recommissioned, the installation should be repassivated.*

### leak detection and analysis

*Even in low concentrations, bromine pentafluoride has an irritating odor and fumes in air. Owing to its toxicity, chemical aggressivity and high oxidizing power, it is recommended the follow the suggestions given in the paragraph entitled "PRECAUTIONS IN HANDLING AND STORAGE".*

*Bromine pentafluoride and gaseous mixtures containing it may be analysed by the following methods:*

- determination of ions in solution
  - volumetric determination
  - colorimetry
  - conductimetry
- gas phase analysis
  - Raman spectrometry
  - infrared absorption
  - gas phase chromatography
  - microsublimation.

### materials of construction

*Materials exhibit varying resistance to bromine pentafluoride. At low and medium range temperatures, most commonly used materials may be employed. At high temperatures, only in Inconel ®, Monel ® and nickel may be used (see table below).*

*The choice of materials thus depends on the temperature and required purity. Accurate work must be carried out in metallic equipment: Monel ® is recommended in this case.*

## métaux et alliages

## metals and alloys

Matériau	Material	Compatibilité Compatibility
Fer	Iron	B: $t < 200^{\circ}\text{C}$
Acier doux	Mild steel	A: $t < 200^{\circ}\text{C}$
Aciers inoxydables	Stainless steels	A: $t < 200^{\circ}\text{C}$
Aluminium	Aluminum	A: $t < 400^{\circ}\text{C}$
Magnésium	Magnesium	A: $t < 200^{\circ}\text{C}$
Cuivre	Copper	A: $t < 200^{\circ}\text{C}$
Argent	Silver	A: $t < 200^{\circ}\text{C}$
Plomb	Lead	A: $t < 200^{\circ}\text{C}$
Etain	Tin	A: $t < 200^{\circ}\text{C}$
Zinc	Zinc	A: $t < 200^{\circ}\text{C}$
Inconel ®	Inconel ®	A: $t < 400^{\circ}\text{C}$
Monel ®	Monel ®	A: $t < 600^{\circ}\text{C}$
Nickel	Nickel	A: $t < 500^{\circ}\text{C}$

A: bonne résistance  
B: aucune résistance

A: good resistance  
B: no resistance

## plastiques et divers

## plastics and other materials

Matériau	Material	Compatibilité Compatibility
Néoprène ®	Neoprene ®	A
Téflon ®	Teflon ®	A
Kel-F ®	Kel-F ®	A
Caoutchoucs	Rubbers	B
Chlorure de polyvinyle	Polyvinyl chloride	B
Huiles et graisses	Oils and greases	B
Verres au molybdène	Molybdenum glass	B

A: bonne résistance  
B: aucune résistance

A: good resistance  
B: no resistance

## utilisations

Le pentafluorure de brome est essentiellement utilisé comme intermédiaire de synthèse des dérivés fluorés.

## uses

Bromine pentafluoride is mainly employed as a synthesis intermediate in the production of fluorinated derivatives.

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