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FEDERAL SPECIFICATION

SULFUR HEXAFLUORIDE, TECHNICAL GRADE

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE

1.1 This specification covers technical grade sulfur hexafluoride.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

Federal Specifications:

PR-C-901 - Cylinders, Compressed Gas: With Valve or Plug and Cap: ICC 3AA.

Federal Standards:

FED. STD. No. 123 - Marking for Domestic Shipment (Civilian Agencies).

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

FSC 6830

(Single copies of this specification and other Federal Specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, Washington.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

MIL-V-2 - Valve, Cylinder, Gas (For Compressed or Liquified Gases), General Specification for.
MIL-T-704- Treatment and Painting of Materiel.

Military Standards:

MIL-STD-101 - Color Code for Pipelines and for Compressed-Gas Cylinders.
MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attribute
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-147 - Palletized and Containerized Unit Loads, 40" X 48" Pallets, Skids, Runners, or Pallet-Type Base.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

Laws and Regulations:

Department of Transportation (DOT):

49CFR171-190 - Code of Federal Regulations.

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM) Standards:

D 2029 - Water Vapor Content of Electrical Insulating Gases by Measurement of Dew Point Temperature.
D 2200 - Standard Pictorial Surface Preparation Standards for Painting Steel Surfaces - Pictorial Surface Preparation Standard B-Sa-1.
D 2284 - Acidity of Sulfur Hexafluoride.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

National Bureau of Standards:

Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Material. The sulfur hexafluoride shall conform to table I.

TABLE I. Properties of sulfur hexafluoride

Physical property		Requirements
Dew point, max. °F.		- 50° F.
Air as nitrogen, max.	weight percent liquid	0.05 (500 p.p.m.)
Carbon tetrafluoride, max.	weight percent liquid	0.05 (500 p.p.m.)
Acidity as hydrofluoric acid, max.	weight percent	0.00003 (0.3 p.p.m.)
Assy., min.	weight percent	99.8

3.2 Containers and valves. Unless otherwise specified herein, the sulfur hexafluoride shall be contained in Government-furnished cylinders in accordance with 49CFR171-190 and equipped with valves with outlet connection No. 591 in accordance with Handbook H28. When specified (see 6.2), cylinders shall be furnished by the supplier and shall be in accordance with RR-C-901 and shall be equipped with valves in accordance with MIL-V-2. When specified (see 6.2), the sulfur hexafluoride shall be contained in supplier-owned, DOT approved containers.

3.3 Container maintenance. Government- and supplier-furnished containers that require maintenance shall be processed by the supplier for serviceability to meet the requirements of this specification and DOT Code 49 CFR 171-190 (see 6.3).

3.3.1 Container inspection and cleaning. Prior to filling with sulfur hexafluoride, each container shall be inspected. The container interior shall be clean and free of contaminants which could alter the properties of sulfur hexafluoride. Internal cleaning of the container shall be in accordance with ASTM D2200, Pictorial Surface Preparation Standard B-Sa-1.

3.3.2 Treatment and painting. Government-furnished containers for sulfur hexafluoride requiring repainting shall be cleaned, treated, and painted in accordance with MIL-T-704. Each cylinder shall be color coded and marked in accordance with MIL-STD-101.

3.3.3 Valves. Unless otherwise specified (see 6.2), replacement valves for defective valves in Government-furnished containers shall be supplier-furnished and shall be in accordance with MIL-V-2.

3.4 Capacity. Unless otherwise specified (see 6.2), containers shall be filled to the rated capacity. The weight of sulfur hexafluoride supplied shall be the difference between the filled weight and the unfilled tare weight of the container.

3.5 Leakage. Containers and valves shall not leak after being filled.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Classification of inspection. Inspection shall be classified as follows:

(a) Quality conformance inspection (see 4.3).
(b) Inspection of preparation for delivery (see 4.5).

4.3 Quality conformance inspection.

4.3.1 Inspection lot. All containers of sulfur hexafluoride filled in a 12-hour period from the same source volume shall be considered one lot.

4.3.2 Sampling. Unless otherwise specified herein, sampling for tests shall be from filled containers and shall be in accordance with MIL-STD-105, inspection level II.

4.3.3 Examination. All containers of sulfur hexafluoride shall be examined as specified in 4.4.1. One or more defects shall be cause for rejection.

4.3.4 Tests.

4.3.4.1 Individual. Each sulfur hexafluoride container shall be tested as specified in 4.4.2.5. Failure of the test shall be cause for rejection.

4.3.4.2 Samples. Samples selected in accordance with 4.3.2 shall be tested as specified in 4.4.2.1 through 4.4.2.4. AQL shall be 1.5 percent defective.

4.4 Inspection procedure.

4.4.1 Examination. The sulfur hexafluoride containers shall be examined for the following defects:

101. Container and valve not as specified.
102. Container maintenance not as specified.
103. Internal cleanliness not as specified.
104. Painting, color coding and marking not as specified.
105. Capacity not as specified.

4.4.2 Tests.

4.4.2.1 Dew point. The samples of sulfur hexafluoride shall be tested for dew point in accordance with ASTM D 2029, or by absorption by P_2O_5. A dew point higher than minus 50° F. shall constitute failure of this test.

4.4.2.2 Acidity (hydrolizable fluorides). The samples of sulfur hexafluoride shall be tested for acidity in accordance with ASTM D 2284. Acidity as HF exceeding a weight percent liquid greater than 0.00003 (0.3 p.p.m.) shall constitute failure of this test.

4.4.2.3 Carbon tetrafluoride and air as nitrogen. The samples of sulfur hexafluoride shall be tested for carbon tetrafluoride and air as nitrogen by chromatographic separation utilizing the following operating conditions:

Carrier gas	- Helium, 40 ml per minute.
Column	- Silica gel, 30-50 mesh.
Column size	- 6 ft x 1/4 inch normal.
Column temperature	- 25° C.
Program rate	- None (isothermal).
Block temperature	- 25° C.
Sample volume	- 5 ml approximately.
Attenuation	- Lowest which keeps peaks on scale.

The chromotograph shall be a Perkins Elmer Model No. 154 or equivalent with a 1 mv recorder. A closed system sampling manifold shall be used to accommodate standard cylinders of pure reagents of carbon tetrafluoride, nitrogen and sulfur hexafluoride; a mercury vacuum gage manometer, a Heisse gage 0-300 p.s.i., and a vacuum pump; an empty cylinder for standard mixture and an equalizing valve. The true weight percent of CF_4 and of nitrogen in the 5 ml sample shall be calculated using the ratio of the weight percents in the sample and the standard in direct proportion to the ratio of the normalized area of the peaks.

$$\text{True weight percent of } CF_4 \text{ or } N_2 \text{ in sample} = \frac{CX}{S} \quad \text{where:}$$

C = True weight percent CF_4 or N_2 in the standard.
X = Normalized average peak area of CF_4 or N_2 in the sample.
S = Normalized average peak area of CF_4 or N_2 in the standard.

The use of an infrared spectrophotometer for determination of CF_4 is also acceptable. A weight percent of either carbon tetrafluoride or of air as nitrogen greater than 0.05 (500 p.p.m.), shall constitute failure of this test.

4.4.2.4 Assay. Assay shall be by difference, after impurity content has been determined. An assay of less than 99.8 percent shall constitute failure of this test.

4.4.2.5 Leakage. All cylinders after filling shall be tested for leakage by applying a soap solution to all portions of the valve and the junction of the valve and cylinder. Care shall be taken to ensure that the solution utilized does not contaminate the valve outlet. A halide detector torch or other halogen-compound detection apparatus may also be utilized. Any leakage of gas shall constitute failure of this test.

4.5 Inspection of preparation for delivery. The packing, palletization (when specified) and marking shall be examined to determined if any is missing, incorrect or incomplete, as applicable. One or more defects shall be cause for rejection.

5. PREPARATION FOR DELIVERY

5.1 Packing. Shipment of containers of sulfur hexafluoride shall conform to DOT Code 49CFR171-190.

5.1.1 Palletization. When specified (see 6.2), cylinders shall be palletized in accordance with MIL-STD-147.

5.2 Marking. The containers shall be marked in accordance with DOT Code 49CFR171-190.

5.2.1 Civil agencies. In addition to the marking specified in 5.2, the containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military agencies. In addition to the marking specified in 5.2, the containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The sulfur hexafluoride covered by this specification is intended for use as a dielectric fluid or gas in electric or electronic equipment.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

(a) Title, number, and date of this specification.
(b) When supplier-furnished cylinders are required (see 3.2).
(c) When sulfur hexafluoride will be contained in supplier-owned containers (see 3.2).
(d) When Government-furnished replacement valves are required (see 3.3.3).
(e) When containers will be filled to less than rated capacity (see 3.4).
(f) When palletization of cylinders is required (see 5.1.1).

6.3 Maintenance of Government-furnished containers. Purchasers should specify the extent to which Government-furnished containers that require maintenance should be processed by the gas supplier.

6.3.1 The gas supplier should furnish at no additional cost all services which are required at each and every filling of a container to comply with applicable regulations and normal standard practice. Such services would include, but not be limited to, all inspection, testing, evacuation, and handling services required for the gas supplied.

6.3.2 A schedule of allowable fees should be specified by the purchaser for the gas supplier's performance of services such as the replacement of valves, valve parts, and cylinder caps, hydrostatic testing, cleaning, painting, color coding, marking, and handling of unserviceable containers as required. All materials and components for these services may be furnished by the gas supplier.

6.4 Basis of purchase. Sulfur hexafluoride should be purchased by weight in DOT 3AA approved cylinders in the liquid phase at 310 p.s.i., 70° F.

MILITARY INTEREST:

Custodians:

Army - ME
Air Force - 68

Review activity:

Army - MD

User activity:

Army - EL

Other interest:

DSA - GS

Preparing activity:

Army - ME

CIVIL AGENCIES INTEREST:

COM-NBS
VA-DMS
GSA-FSS
HEW

Orders for this publication are to be placed with General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein. Price 10 cents each.