

MIL-D-83411A(USAF)
1 August 1973
SUPERSEDING
MIL-D-83411 (USAF)
26 February 1973

MILITARY SPECIFICATION
DEICER/ANTI-ICER FLUID (FOR RUNWAYS AND TAXIWAYS)

1. SCOPE

1.1 Scope. This specification covers the requirements for a corrosion inhibited, biodegradeable, liquid chemical deicer/anti-icer material. Environmental control is required as specified in 6.2.

1.2 Classification. The chemical deicer/anti-icer material shall be of one type and one grade (3.3).

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.

SPECIFICATIONS

Federal

QQ-P-416	Plating, Cadmium (Electro-deposited)
PPP-D-729	Drum, Metal, 55 Gallon (For Shipment of Noncorrosive Materials)
PPP-P-704	Pail, Shipping Steel (1 through 12 gallon)

Military

MIL-P-25690	Plastic, Sheets and Parts, Modified Acrylic Base, Monolithic, Crack Propagation Resistant
MIL-P-83310	Plastic Sheet, Polycarbonate, Transparent

STANDARDS

Federal

FED-STD-313	Symbols for Packages and Containers for Hazardous Industrial Chemicals and Materials
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FSC 6850

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STANDARDS (continued)

Military

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes

MIL-STD-1210 Fog and Ice Preventive Compounds

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS STANDARDS (ASTM)

C 672 Tentative Method of Test for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
D 92 Flash and Fire Points by Cleveland Open Cup, Test for
D 270 Petroleum and Petroleum Products, Sampling
D 1122 Specific Gravity of Engine Antifreezes by the Hydrometer
D 1177 Freezing Point of Aqueous Engine Antifreeze Solution, Test for
E 70 pH of Aqueous Solutions with the Glass Electrode Test for

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

UNIFORM CLASSIFICATION COMMITTEE AGENT

Uniform Freight Classification

(Applications for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 Riverside Plaza, Chicago, Illinois 60606.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC. AGENT

National Motor Freight Classification

(Applications for copies should be addressed to the American Trucking Associations, Tariff Order Section, 16 C P Street, N.W., Washington, D. C. 20036.)

(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.)

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3. REQUIREMENTS

3.1 Qualification. The liquid chemical deicer/anti-icer material furnished under this specification shall be a product which has been tested and qualified for listing on the applicable qualified products list (QPL) at the time set for opening bids (see 4.3 and 6.3).

* 3.2 Material. The material shall be a fluid with major constituents of glycols, urea and formamide with suitable corrosion inhibitors. The material shall conform to the requirements of this specification. (See 6.2)

* 3.2.1 Insolubles. The fluid material shall be substantially free from insoluble matter, and shall not contain more than 0.5 ml undissolved solids when examined in accordance with 4.6.1.

3.3 Composition. The deicing/anti-icing fluid furnished under this specification shall be formulated of high-grade materials with suitable corrosion inhibitors, and shall contain no components harmful to aircraft, concrete, or asphalt.

3.4 Toxic products and formulations. The toxic characteristics of the material shall be properly identified and defined to enable establishment of adequate safeguards and procedures to prevent adverse effects on the health of personnel applying the material. The manufacturer shall furnish formulation, toxicological and biological data to enable the evaluation of the deicer/anti-icer material for safety of personnel and to enable usage in conformance to applicable anti-pollution regulations in the area of intended use. Questions relative to the suitability of the product for intended U. S. Air Force use and utilization procedures will be referred to the appropriate local authority. In the absence of such local authority, questions will be referred to the Headquarters, AFLC/SGP, Wright-Patterson Air Force Base, Ohio 45433.

3.5 Physical properties. The physical properties of the deicer/anti-icer material shall conform to the requirements and tests as specified in table I.

3.6 Biodegradability. The deicer/anti-icer material shall be a minimum of 90 percent biodegradable. When requested by the procuring agency the bidder shall furnish the following information with his proposal as pertaining to the product.

- a. A statement of the ecological behavior of the product.
- b. The products total oxygen demand(TOD) 5-day, expressed in pounds-oxygen to pounds-product.

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- c. Percent degraded in five days.
- d. Presence by percent of the sulfur, halogens, phosphate, nitrate, heavy metals, (lead and chromates, cadmium, mercury).

3.7 Specific gravity. The specific gravity of specimens offered for Government acceptance shall not vary by more than .005 from the specific gravity value listed on the Qualified Products List for each suppliers currently qualified product. Testing shall be as specified in 4.6.5.

Table I. Physical properties.

PROPERTY	REQUIREMENT	TEST PARAGRAPH
Corrosivity	Not to exceed limits of table II.	4.6.2
Stress corrosion	Shall not cause stress corrosion of 4340 steel.	4.6.3
* Eutectic point	To be reported for the as-received concentration. Shall not be higher than -10°F (23°C).	4.6.4
* Specific gravity	To be reported for the as-received concentration.	4.6.5
* pH	Minimum 6.5, maximum 10.0	4.6.6
Flash point	215°F minimum	4.6.7
Rinsibility	Completely rinsible in tap water.	4.6.8
* Compatibility	Pavement compatibility	4.6.9
Crazing	Shall not cause crazing of polycarbonate or acrylic base plastic.	4.6.10
Shelf life	Free of layering or precipitates.	4.8

3.8 Workmanship. The deicer/anti-icer material furnished under this specification shall be manufactured by such processes as to produce a homogeneous and uniform product substantially free from suspended material.

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Table II. Corrosivity.

METALS	Duration (hours)	Weight Change (milligrams)
Low Alloy Steel, Bare	120	-4
Magnesium, Dow No. 7 Coated	120	-3
Aluminum 2024, T-3 Bare	120	± 0.3
Aluminum 7075, T-6 Bare	120	± 0.3
Cadmium Plated Steel	120	± 0.3
Titanium 6Al-4V	120	± 0.3

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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspection are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of tests. The inspection and testing of the deicer/anti-icer material shall be classified as follows:

- a. Qualification tests (see 4.3).
- b. Quality conformance tests (see 4.4).

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4.3 Qualification test. Qualification testing shall consist of all inspections and tests specified herein.

4.3.1 Qualification test samples. Test samples shall consist of and be furnished in one gallon containers. Two identified one gallon samples shall be submitted for qualification testing.

4.3.2 Samples shall be identified with securely attached durable tags marked with the following information, and forwarded to the responsible activity for testing, as designated in the letter of authorization from the activity responsible for qualification (see 6.3).

- a. Samples for qualification tests.
- b. DEICER/ANTI-ICER FLUID (For runways and taxiways).
- c. Specific gravity
- d. Manufacturer's Code Number
- e. Manufacturer's Name
- f. Submitted by (name) (date) for qualification test in accordance with the requirements of MIL-D-83411A(USAF) under authorization (reference authorizing letter).

* 4.3.3 Test report. Prior to shipment of test samples, the manufacturer shall furnish a certified statement specifically identifying each ingredient in the fluid by a recognizable chemical or proprietary name, source and percentage by weight. The manufacturer shall furnish two copies of the report showing results of all qualifications test, specified herein.

* 4.4 Quality conformance tests. The quality conformance tests shall consist of the following:

- a. Specific gravity
- b. pH (see table I)
- c. Suspended matter (see 3.2.1)
- d. A certified statement from the producer that the product offered is essentially the same in all respects as the product sample originally qualified.

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4.4.1 Sampling for lot acceptance.

4.4.1.1 Lot. All materials manufactured as one batch, and offered for delivery at one time shall be considered as a lot for purpose of acceptance inspection and test.

4.4.1.2 Sampling for tests. A sample of finished deicer/anti-icer fluid shall be selected at random in accordance with ASTM D270, and subjected to all the applicable tests of this specification as specified in 4.4. If the sample fails any of the tests the lot represented by the sample shall be rejected.

4.4.1.3 Sampling for inspection of filled containers. A random sample of filled containers shall be selected in accordance with MIL-STD-105. The inspection level shall be 1 and the acceptable quality level (AQL) shall be 2.5 percent defective. Containers shall be examined to verify compliance with all stipulations of this specification regarding fill, closure, packing, marking and other requirements not involving tests. Each sample filled container shall also be weighed to determine the amount of contents.

4.4.2 Inspection of empty containers. Prior to filling, each empty container shall be visually inspected for cleanliness and suitability.

4.5 Toxicological data. The supplier shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use.

4.6 Test methods.

* 4.6.1 Solids determination. One hundred ml of the concentrated deicer/anti-icer material shall be placed in a clear graduated glass tube after thoroughly agitating the bulk container. The deicer/anti-icer in the test tube should be visually examined by holding the tube between the observer and a light source. There shall be no more than 0.5 ml sediment when the tube containing the deicer/anti-icer is allowed to stand for 24 hours.

4.6.2 Corrosivity. The corrosivity test of the material shall be conducted on 2024 T-3 bare aluminum, bare low alloy steel, 7075 T-6 bare aluminum, titanium 6Al-4V, magnesium (Dow 7, conversion coated) and type I, Class 2 cadmium plated steel conforming to QQ-P-416.

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4.6.2.1 Panels. Panels of the metal shall be 1 inch by 2 inches in size and .030 inches nominal thickness. The panels shall be degreased and markings removed by the use of suitable solvents and a mild abrasive except for the magnesium panel which should be cleaned by solvent washing only. Panels shall each be weighed to the fourth decimal place. Each panel shall be placed in an individual 100 ml beaker or glass jar of similar size and proportions. A mixture of 25 percent by volume of deicer/anti-icer and 75 percent by volume of distilled water should be put into each container to immerse the lower half of the panel. The container should be covered with a plastic membrane secured by a rubber band. The exposure period shall be 120 hours after which the panels shall be visually examined for corrosion in the immersed area, interface and vapor zone. The panels shall then be rinsed in water, dried and weighed. Any weight change shall be recorded.

4.6.3 Stress corrosion. The stress corrosion test shall be conducted on not less than three notch bar test specimens of 4340 bare steel and heat treated to Rockwell C 52/53 (see 4.6.3.1). The test specimens shall be uni-axially loaded to 75 percent of the ultimate notch bar strength, while subjected to alternate immersion in a solution of 25 percent by volume of deicer in distilled water. The immersion period shall be 10 minutes of each hour. The duration of the test shall be 200 cycles (200 hours). The fracture of one or more specimens during the exposure period shall be cause for rejection of the material. The notch bar specimens shall be of the dimensions given in figure 1.

4.6.3.1 Heat treat procedure for notch bar stress corrosion specimen of 4340 steel. The heat treat procedure shall be of the following steps.

- a. Normalize at $1625^{\circ}\text{F} \pm 25^{\circ}\text{F}$ for 1-hour in a controlled atmosphere.
- b. Air Cool.
- c. Stress relieve 2-hours at 1250°F .
- d. Rough machine blank.
- e. Austenitize at $1525^{\circ}\text{F} \pm 25^{\circ}\text{F}$ for 1-hour in salt bath or controlled atmosphere.
- f. Oil quench until warm to the hand.
- g. Double temper four hours in air at 475°F for a hardness of Rockwell 52/53 after tempering.
- h. Finish to dimensions of drawing as shown in figure 1.

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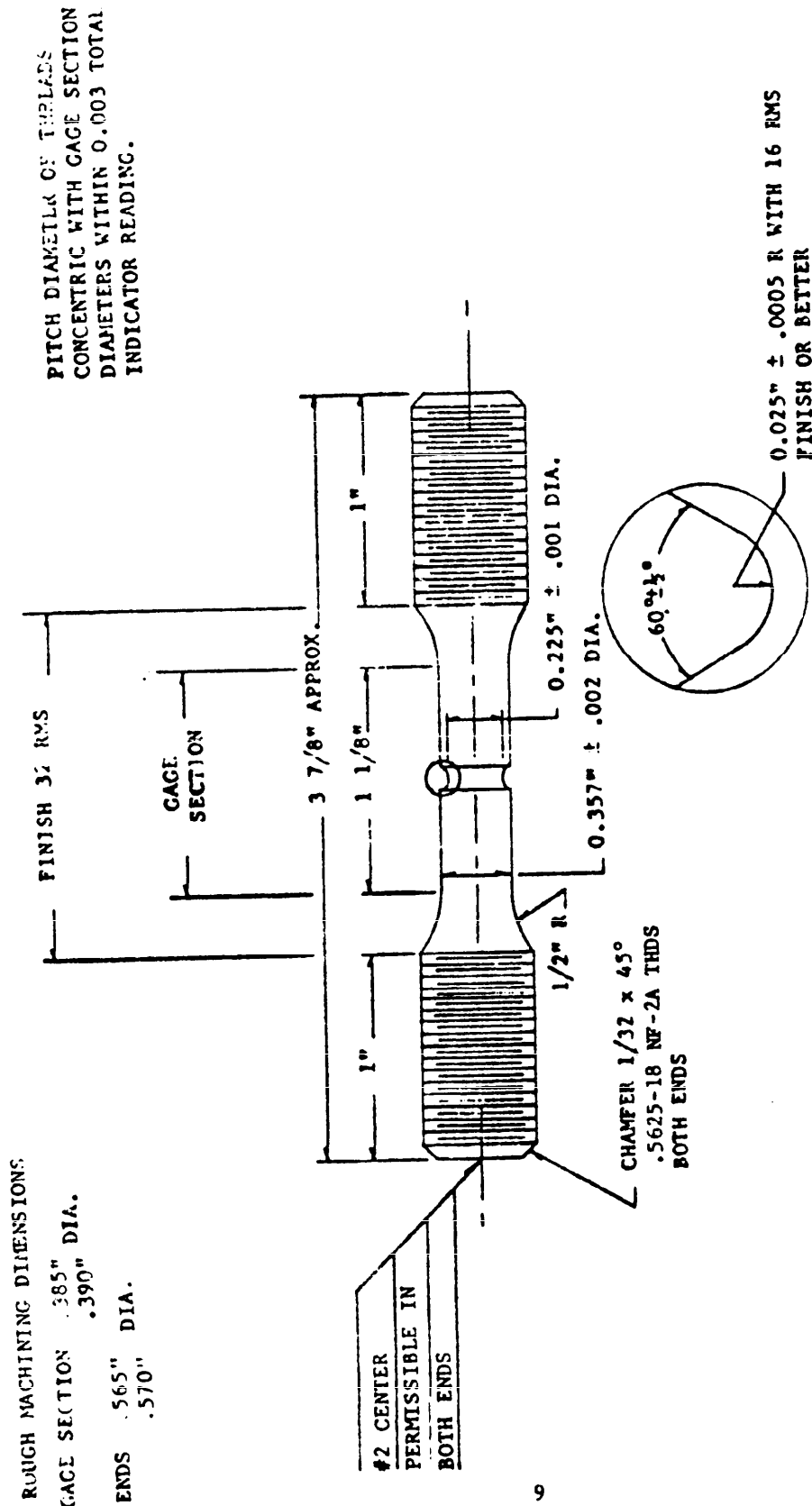


FIGURE 1.
NOTCHED STRESS CORROSION SPECIMEN

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- * 4.6.4 Eutectic (slush or freeze point). The slush point or freeze point shall be determined in accordance with ASTM D1177.
- * 4.6.5 Specific gravity. The specific gravity of the fluid shall be determined in accordance with ASTM D1122.
- * 4.6.6 pH content. The pH content of the material shall be determined in accordance with ASTM E70.
- * 4.6.7 Flash point. The flash point shall be determined in accordance with ASTM92, except that the fire point need not be determined.
- 4.6.8 Rinsibility. A 3-inch by 8-inch panel of clear glass shall be cleaned to a water break free surface, dried and coated with the deicer/anti-icer material by pouring the material over the panel while it is held in a horizontal position. The panel shall then be inclined at 45 degrees for 10 minutes after which it shall be placed in a horizontal position for 24 hours at room conditions. At the expiration of the exposure period the panel shall be rinsed in tap water for five minutes. There shall be no visible trace of the deicer/anti-icer material.
- 4.6.9 Pavement compatibility. The material compatibility with pavement shall be tested in accordance with ASTM C672. A 25 percent by volume solution of deicer/anti-icer chemical in tap water shall be substituted for calcium chloride (7.1 of ASTM C672). The condition of the surface shall have a rating of not more than 2 when rated in accordance with 8.1.4 of ASTM C672.
- 4.6.10 Crazing of plastics. Using not less than five specimens of plastic sheet, polycarbonate, transparent conforming to MIL-P-83310 and five specimens of plastic, sheets and parts, modified acrylic base, monolithic, crack propagation resistant conforming to MIL-P-25690, the test shall be conducted in accordance with MIL-P-83310 except that the deicer/anti-icer material shall replace the ethylene glycol.

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4.7 Biodegradability. Results of biodegradability studies conducted according to accepted procedures for biodegradability and bio-assays will be provided by the manufacturer to the procuring agency. The Air Force, Headquarters, AFLC/SGP, Wright-Patterson Air Force Base will provide consultation to the procuring agency in reviewing the results of biodegradability, bio-assay studies provided by the manufacturer.

4.8 Shelf life. The amount of 50cc of deicer/anti-icer fluid shall be placed in a graduated cylinder and stored at -20°F (-28.9°C) for 72 hours. At the end of the exposure period the material shall be visually examined for layering and precipitates and observations recorded. If layering or precipitation is noted the material may be agitated by shaking the cylinder manually for not more than 1 minute. Failure of the material to form a homogeneous solution shall be cause for rejection.

4.9 Rejection criteria. When any acceptance test sample fails to meet any of the test requirements of this specification or when the number of defective filled containers exceeds the acceptance number as specified in 4.3, the lot represented by the sample shall be rejected.

5. PREPARATION FOR DELIVERY

*5.1 Packaging. Packaging shall be as specified in 5.2. Gallon containers shall be used for packaging and packing for shipment.

*5.2 Packing. The anti-icing/deicing fluid shall be furnished in 5 gallon or 55 gallon containers as specified (see 6.4). Packing shall be level A, B, or C as specified (see 6.4).

5.2.1 Level A.

5.2.1.1 Five Gallon. Five gallon containers shall conform to type I, class 3, PPP-P-704.

5.2.1.2 Fifty-five Gallon. Fifty-five gallon drums shall conform to type I, PPP-D-729, tight head.

5.2.2 Level B.

5.2.2.1 Five Gallon. Five gallon containers shall conform to type I, class 3, PPP-P-704.

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5.2.2.2 Fifty-five Gallon. Fifty-five gallon drums shall conform to type II, PPP-D-729, tight head.

5.2.3 Level C. Anti-icing fluid shall be packed in containers to afford the degree of protection necessary to prevent deterioration or damage during direct shipping from the supply source to the first receiving activity for immediate use. Containers shall conform to Uniform Freight Classification Rules or National Freight Classification Rules, as applicable.

*5.3 Marking. In addition to any special marking required by the contract or order, each container shall be marked in accordance with the requirements of FED-STD-313 and shall include the precautionary marking as specified in 5.3.1 and 5.3.2.

* 5.3.1 Precautionary marking. Each container shall be marked with the following precautionary marking: (see 6.5)

DO NOT TAKE INTERNALLY.
AVOID CONTACT WITH EYES .
KEEP CONTAINER CLOSED WHEN NOT IN USE.

* 5.3.2 Special marking. The freezing point of the supplied material shall be marked on the container.

6. NOTES

6.1 Intended use. The deicing/anti-icing fluid covered by this specification is intended as an adjunct to the removal of ice from runways and taxiways, in combination with mechanical devices, and as an anti-icer when applied to taxiways or runways in anticipation of icing conditions.

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6.2 Environmental control. The major constituents of the deicer/anti-icer materials covered by this specification are glycols, urea and formamide. These materials in concentrations exceeding 1 to 2 percent in the waterway are acutely toxic to fish and crustacea. Chronic toxicity and oxygen depletion may result from recurrent discharges of even lesser concentrations. Where there is danger that runoff from areas treated with deicer/anti-icer will pollute adjacent streams or other bodies of water, the user should develop contingency plans to collect and properly treat these materials prior to discharge to a stream. For the U. S. Air Force, assistance in this regard is available through Headquarters AFLC/SGP in accordance with AFR19-1.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Air Force Materials Laboratory, ATTN: MXA, Wright-Patterson Air Force Base, Ohio 45433, and information pertaining to qualification of products may be obtained from that activity.

6.3.1 If the product is modified in any way subsequent to initial qualification, the modified form shall be subjected to and shall pass the same qualification inspections.

* 6.4 Ordering data. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Size of containers (see 5.2.1).
- c. Quantity.
- d. Level of packaging and packing required (see 5.1 and 5.2).

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6.5 Precautionary handling instructions. The deicing/anti-icing fluid furnished under this specification is mildly toxic and contact with skin and eyes should be avoided. Although the fluid has a minimum flash point requirement of 215 F, it should be used with care.

6.6 Unit of purchase. The fluid covered by this specification should be purchased by volume, the unit being one U. S. Gallon, 231 cubic inches at 25°C (77°F).

6.7 Changes in this specification. The margins of this specification are marked with an asterisk (*) to indicate where changes (additions, modification, corrections, deletions) from the previous issue have been made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:
Air Force - 11

Preparing activity:
Air Force - 11

Reviewer activity:
Air Force - 68

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