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AEROSPACE MATERIAL SPECIFICATION

SAE AMS-H-81829

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Submitted for recognition as an American National Standard

Heat Transfer Fluid, Fluorochemical

NOTICE

This document has been taken directly from U.S. Military Specification MIL-H-81829, Amendment 1, and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE technical standards. The initial release of this document is intended to replace MIL-H-81829, Amendment 1. Any part numbers established by the original specification remain unchanged.

The original Military Specification was adopted as an SAE standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE Committee level, and (b) the use of the existing government specification or standard format.

Under Department of Defense policies and procedures, any qualification requirements and associated qualified products lists are mandatory for DOD contracts. Any requirement relating to qualified products lists (QPL's) has not been adopted by SAE and is not part of this technical report.

1. SCOPE:

1.1 This specification covers inert, fluorochemical, liquid heat transfer agents.

2. APPLICABLE DOCUMENTS:

The following publications, 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.

2.1 U.S. Government Publications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-105 Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-290 Packaging, Packing, and Marking of Petroleum Products

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2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 86	Boiling Range
ASTM D 97	Pour Point
ASTM D 445	Viscosity
ASTM D 877	Dielectric Strength
ASTM D 1298	Specific Gravity

3. REQUIREMENTS:

3.1 Material:

The heat transfer fluid shall be a clear, colorless, odorless, non-flammable, inert fluorochemical liquid.

3.2 Physical properties:

The physical properties of the heat transfer fluid shall conform to the requirements of Table I.

TABLE I
Physical Properties

Property	Limits	Test Paragraph
Boiling range 194 F°(90°C) to 225°F(107°C)	90 percent (minimum)	4.4.1
Viscosity		4.4.1
77°F(25°C)	0.50 centistokes (min.)	
-40°F(-40°C)	5.0 centistokes (max.)	
Pour point	Less than -80°F(-62°C)	4.4.1
Specific gravity 25°C/25°C	1.72 ± 0.08	4.4.1
Hydrolytic Stability	10 micrograms per milliliter fluoride (max.)	4.4.2

3.3 Electrical properties:

The electrical properties shall conform to the requirements of Table II:

TABLE II
Electrical Properties

Property	Limit	Test Paragraph
Dielectric Strength at 77°F (25°C)	34KV/0.1 inch (2.54 mm)	4.4.1
Electrical Resistance	2 X 10^5 megohms (min)	4.4.3

3.4 Workmanship:

The heat transfer fluid shall be uniform and free from dirt and other foreign material.

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 contract or order, the supplier may use his own or any other facilities suitable for the performance of 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 inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Sampling:

Sampling for quality conformance inspection and tests shall be performed in accordance with the provisions set forth in MIL-STD-105, except where otherwise indicated.

4.2.1 Sampling for examination of end item: A one quart sample shall be taken from each lot of transfer fluid for examination in accordance with 4.2.2.1.

4.2.1.1 Lot: A lot is defined as an indefinite number of unit containers offered for acceptance and filled with a homogenous mixture of material from one isolated container or filled with a homogeneous mixture of material manufactured by a single plant run (not exceeding 24 hours) through the same processing equipment, with no change in ingredient materials.

4.2.2 Quality conformance inspection:

4.2.2.1 Examination of end item: The end item shall be visually examined for defects in appearance and workmanship (see paragraphs 3.1 and 3.4). The lot size, for determining the sample size, shall be expressed in units of filled containers. The sample unit shall be one filled unit container. The inspection level shall be level I and Acceptable Quality Level (AQL) of 2.5 expressed in defects per hundred units.

4.2.2.2 Examination of filled containers for net contents: The sample unit for this examination shall be one filled unit container. The inspection level shall be S-2. The average net contents per container for all sample units examined shall be not less than quantity specified.

4.2.2.3 Examination of preparation for delivery: An examination shall be made to determine that the packaging, packing, and markings comply with the requirements of Section 5 of this specification. Table III indicates the major criteria. The sample unit for this examination shall be one shipping container fully packed, selected just prior to the closing operation. Shipping containers fully prepared for delivery shall be examined for closure defects. The inspection level for determining the sample size shall be S-2 and the acceptable quality level (AQL) shall be 2.5 expressed in defects per 100 units.

TABLE III Major Inspection Criteria

Examine	Defect
Packaging (as applicable)	Container not as specified. Container damaged, leaking, or otherwise defective. Closure not as specified.
Packaging (as applicable)	Not level specified, not in accordance with contract requirements. Arrangement of units per shipping container not as specified. Container not as specified, closures not accomplished by specified methods or materials. Any nonconforming component, component missing, damaged or otherwise defective affecting serviceability. Inadequate application of components, such as incomplete closures of case liners, container flaps, loose or inadequate strapping, bulged or distorted containers.
Count (as applicable)	Less than specified or indicated quantity of primary containers per shipping container.
Markings	Omitted, incorrect, illegible, incomplete or not in accordance with contract requirements. Precautionary markings missing or not as specified.

4.3 Testing of the end item:

The end item shall be tested in accordance with the tests specified in 4.4 for conformance to the specified requirements. The sample unit for test shall be one pint of material. The sample size shall be three pints taken after final filtration, while packaging from an agitated mixing tank. There shall be no failure to meet the specified requirements.

4.4 Test methods:

4.4.1 The tests listed in Table IV shall be conducted in accordance with the applicable ASTM Test Methods:

TABLE IV. Test Methods

Test	ASTM Method
Dielectric strength	D 877
Pour point	D 97
Specific Gravity	D 1298
Viscosity	D 445
Boiling Range	D 86

4.4.2 Hydrolytic Stability:

4.4.2.1 Reagents: Dissolve 0.5 gram of zirconium oxychloride ($ZrOCl_2 \cdot 8H_20$) in distilled water in a 100 ml volumetric flask, dilute to mark and mix well. Dissolve 0.1 gram of alizarin sodium monosulfate in 100 ml. distilled water and store in an amber colored bottle in a cool place. To 25 ml of the zirconium oxychloride solution add dropwise and with agitation, 25 ml of the alizarin monosulfate solution. If a turbidity persists allow the mixture to stand until it settles, usually overnight. Then add 100 ml. of distilled water and mix well. Store the diluted solution in an amber colored bottle in a cool place. Prepare a fresh diluted solution whenever needed, discarding the solution when it is more than 72 hours old.

4.4.2.2 Fluoride standard: Dissolve 0.2210 g of CP sodium fluoride in distilled water in a 100 ml volumetric flask, dilute to volume and mix well. This solution contains 0.1 percent or 1000 ppm of fluoride. When 5 ml of this solution is diluted to 100 ml. in a volumetric flask and mixed well the diluted solution contains 50 ppm fluoride.

4.4.2.3 Procedure:

4.4.2.3.1 Hydrolysis: Twenty five ml. of a 1 percent $NaHCO_3$ solution and 25 ml of the sample shall be placed in a 250 ml flask fitted with a reflux condenser. The refluxing shall last four hours using boiling chips and a heating mantle and minimum heat to maintain the refluxing. The liquid in the flask shall be cooled and the aqueous (upper) layer separated. The fluorochemical (bottom) layer shall be washed with three 10 ml portions of distilled water. Combine the aqueous layer and washings, and dilute to 120 ml with distilled water.