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Space Administration

**MEASUREMENT
SYSTEM
INCH-POUND**

MSFC-SPEC-3709
BASELINE
EFFECTIVE DATE: 10-JAN-2017

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

EM22

MSFC TECHNICAL STANDARD

**SPECIFICATION FOR
SOLVENT, CLEANING,
TRANS-1-CHLORO-3,3,3,-
TRIFLUOROPROPENE,
SOLSTICE[®] PF**

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MSFC TECHNICAL STANDARD EM22	
Title: Solvent, Cleaning, Trans-1-Chloro-3,3,3,-Trifluoropropene, Solstice® PF	
Document No: MSFC-SPEC-3709	Baseline
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1.0 SCOPE

1.1 Scope

This specification establishes the requirements for Honeywell Solstice® Performance Fluid (PF) solvent, trans-1-chloro-3,3,3-trifluoropropene. This material is intended for use for cleaning and cleanliness verification for spaceflight hardware and related ground support equipment and test systems.

1.2 Classification

The grade is specified based on the allowable level of nonvolatile residue (NVR) contamination in the solvent as follows:

Grade A – High Purity (HP), low NVR level for precision cleaning and NVR verification sampling.

Grade B – Standard Purity, commercial standard NVR level for general use. May be packaged and distributed by KYZEN under product name Metalnox® 6920.

2.0 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

The following documents of the revision listed (or latest revision if no revision is listed) form a part of this document to the extent specified herein.

ASTM D2109	Standard Test Methods for Nonvolatile Matter in Halogenated Organic Solvents and Their Admixtures
ASTM D2988	Standard Test Methods for Water-Soluble Halide Ion in Halogenated Organic Solvents and Their Admixtures
ASTM D2989	Standard Test Method for Acidity-Alkalinity of Halogenated Organic Solvents and Their Admixtures
ASTM D3401	Standard Test Method for Water in Halogenated Organic Solvents and Their Admixtures
ASTM D6806	Standard Practice for Analysis of Halogenated Organic Solvents and Their Admixtures by Gas Chromatography
ISO/IEC 17025:2005	General Requirements for the Competence of Testing and Calibration of Laboratories

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- ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes
- ISO 9001 Quality Management Systems - Requirements
- MIL-PRF-27401 Propellant Pressurizing Agent, Nitrogen

3.0 REQUIREMENTS

3.1 Chemical and Physical Properties

The solvent shall be composed of > 99.0 % (by weight) trans-1-chloro-3,3,3, trifluoropropene (Chemical Abstract Service [CAS] Registry Number 102687-65-00, alternate designation 1233zd(E)), conforming to the requirements of Table I when tested as specified in section 4.

TABLE I. Requirements and test methods

Chemical or Physical Property		Requirement (Note 1)	Test Method (Paragraph)
Chemical Purity		99.0 % (w/w) min.	4.4.1
Nonvolatile Residue	Grade A – for precision cleaning and NVR verification sampling	2 ppm (w/w) max. (Note 2)	4.4.2
	Grade B – for general use	10 ppm (w/w) max.	
Acidity (as hydrochloric acid)		1 ppm (w/w) max.	4.4.3
Moisture		100 ppm (w/w) max.	4.4.4
Free chloride ion		1 ppm (w/w) max.	4.4.5
Note 1 – Requirements apply to new or recycled solvent			
Note 2 – May be achieved by distillation following procurement as Grade B.			

3.2 Additives

The solvent shall contain no inhibitor or stabilizer additives.

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3.3 Shelf Life

Shelf life is reported by the manufacturer to be 15 years from date of fill when stored as labeled. The solvent shall be tested prior to use on flight hardware or flight interface hardware.

3.4 Visual Appearance

When examined visually, the solvent shall be a homogeneous, clear, colorless (water-white) liquid that is free of particulate matter.

4.0 VERIFICATION

4.1 Acceptance Tests

Material acceptance tests shall include all the tests required in this specification.

4.2 Certification

A certified test report from the supplier shall accompany each lot of material comprising a shipment stating that the material meets all the requirements of this specification. This report shall include the actual test data (e.g., sample analysis report and actual laboratory results) for all requirements of this specification.

4.3 Inspection and Testing

4.3.1 Responsibility for Inspection and Testing

The supplier is responsible for the performance of all inspections and testing specified herein. Suppliers may, with the approval of the procuring authority, use their own facilities or those of a commercial laboratory. The procuring authority reserves the right to perform any of the inspections and testing set forth in this specification, where such are deemed necessary to ensure compliance with specification requirements. Alternate test methods of equivalent accuracy and precision may be approved by the procuring authority.

4.3.2 Material Inspection

4.3.2.1 Inspection Lot

Containers filled in a 24-hour period from the same source and with the same type of solvent and container size shall be considered an inspection lot.

4.3.2.2 Sampling

4.3.2.2.1 Sampling and Testing before Fill.

Before filling of each lot of cylinders, a sample of sufficient size to perform the required tests shall be randomly selected from each lot of solvent. This sample may be performed at the original manufacturing facility. The sample shall be tested in accordance with Table I.

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4.3.2.2.2 Sampling and Testing after Fill

After filling each lot of cylinders, the lot of filled cylinders shall be sampled in accordance with ASQC Z1.4, General Inspection Level II, Acceptable Quality Level 1%.

The samples shall be tested and verified in accordance with Section 3.0 for visual appearance, moisture, and nonvolatile residue.

4.3.2.3 Examination

Samples selected in accordance with 4.3.2.2 shall be examined and tested for conformance to the requirements listed in Section 3.0 and Table I. A result other than that specified shall constitute failure of the test.

4.4 Test Methods

4.4.1 Chemical Purity

The solvent shall be tested for chemical purity by gas chromatography in accordance with ASTM D6806.

4.4.2 Nonvolatile Residue

The solvent shall be tested for nonvolatile residue in accordance with ASTM D2109 or an equivalent test method, using a minimum sample volume of 100 milliliter (mL).

4.4.3 Acidity

The solvent shall be tested for acidity in accordance with ASTM D 2989 or an equivalent test method.

4.4.4 Moisture Content

The solvent shall be tested for moisture content in accordance with ASTM D3401 or an equivalent test method.

4.4.5 Free Chloride Ion

The solvent shall be tested for free chloride ion by ion chromatography in accordance with ASTM D2988 or an equivalent test method.

4.4.6 Visual Appearance

A sample of the solvent shall be examined in a clear glass container to verify that it is homogeneous, clear, colorless (water-white) and free of particulate matter. This may be the same sample used for the tests shown in Table I.

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4.5 Inspection of Packaging

The packaging of the container of solvent shall be examined to ensure there is no leakage, corrosion, or visible contaminants that could degrade the solvent or cause it to be inadvertently released from its container.

5.0 PREPARATION FOR DELIVERY

5.1 Packaging

5.1.1. Cylinders

The solvent shall be furnished in cylinders conforming to 49 CFR 173 in accordance with the manufacturer's commercial practice and this specification.

5.1.2. Tamper Evident Seals

Packaging shall have tamper evident integrity control seals installed on all inlets/outlets after filling.

5.1.3. Re-Use of Cylinders

Cylinders that may be returned to the supplier for re-cleaning and re-use are preferred. The supplier shall be responsible for the certification and maintenance of these cylinders.

5.2 Marking

Each container of solvent shall include the proper warning labels for personnel safety in accordance with 29 CFR 1910.

Each container shall also be legibly and permanently labeled with the following information:

MATERIAL: Solvent, cleaning
SPECIFICATION: MSFC-SPEC-3709
MANUFACTURER'S NAME AND PRODUCT IDENTIFICATION:
DATE OF FILL:
EXPIRATION DATE:
LOT NUMBER:
GROSS WEIGHT:
NET WEIGHT:
PURCHASE ORDER NUMBER:

5.3 Container Inspection and Cleaning.

Containers shall be inspected and cleaned as required such that the solvent will meet the requirements listed in Table I.

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5.4 Filling of Cylinders

5.4.1 Filling

Unless otherwise specified, cylinders (50 lb or larger) shall be filled to within – 0 % / + 10 % of the net weight of solvent shown on the cylinder label.

5.4.2 Net Weight of Solvent

The net weight of the solvent supplied shall be the difference between the filled (gross) and the unfilled (tare) weight of the container.

5.4.3 Calibration of Scale

The scale shall have an accredited calibration for commerce in accordance with ISO/IEC 17025:2005.

5.5 Use of Propellants

Propellant, if required for purging or pressurization, shall be clean, dry nitrogen of sufficient purity to maintain the solvent purity requirements of Table I, MIL-PRF-27401 Grade B or equivalent, minimum. HFO-1234ze (trans-1,3,3,3-Tetrafluoroprop-1-ene) may be used as a propellant when mixed with Solstice PF (or Solstice PF-HP) at a 20% propellant ratio by weight during initial fill into original container. Use of other propellants is prohibited.

5.6 Leakage

Containers and valves shall not leak after being filled and sealed.

5.7 Safety Data Sheet.

The Safety Data Sheet (SDS) shall be provided by the supplier with each delivery of solvent and permanently retained by the user.

6.0 NOTES

6.1 Intended Use

The solvent described in this specification is intended for use as a precision cleaning fluid and cleanliness verification fluid for spaceflight hardware and related ground support equipment, their interfaces, and any other systems in which it may be used to clean. Solvent should be filtered for particulate at the point of use as required for the specific end use.

6.1.1. Grade A solvent

Grade A solvent (Honeywell Solstice® PF-HP) is intended for precision cleaning of hardware that is sensitive to NVR contamination or as a sampling solvent for verification of hardware NVR cleanliness. Highly sensitive applications may require further distillation to achieve an

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NVR background level below 1 ppm. Solvent may be procured as Grade B and purified by distillation to meet the requirements of Grade A.

6.1.2 Grade B solvent

Grade B solvent (Honeywell Solstice® PF or KYZEN Metalnox® 6920) is intended for general cleaning of hardware that is less sensitive to NVR contamination.

6.2 Recovery and Re-use of Solvent

The solvent may be recovered, recycled, and re-used if it meets the purity requirements of this specification.

6.3 Standard Package Sizes

Standard package sizes available from the supplier are shown in Table II. Other package sizes may be available by special order.

TABLE II. Standard package sizes

Grade	Cylinder Size by Solvent Weight		
	1000 lb (Returnable)	200 lb (Returnable)	50 lb (Disposable)
A – High Purity	Available	Available	Not Currently Available
B – Standard Purity	Available	Available	Available

6.4 Procurement Data

Procurement documents should specify the following:

- a. Title, number, revision, and date of this specification.
- b. Grade
- c. Method of shipment.
- d. Quantity of solvent by weight and cylinder size.
- e. When a different sampling plan is required (see 4.3.2.2).
- f. Packaging requirements (see section 5.)
- g. Delivery of a Certificate of Compliance to the requirements of Table I.
- h. Compliance with ISO 9001.

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APPENDIX A: Acronyms and Abbreviations

CAS	Chemical Abstract Service
HP	high purity
lb	pound
max.	maximum
min.	minimum
NVR	nonvolatile residue
PF	Performance Fluid
PF-HP	Performance Fluid – High Purity
ppm	parts per million
SDS	Safety Data Sheet
w/w	weight/weight

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