



National Aeronautics and  
Space Administration

**MEASUREMENT  
SYSTEM  
IDENTIFICATION**

MSFC-SPEC-2497  
REVISION E  
EFFECTIVE DATE: 09/06/06

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

**EM40**

**MULTIPROGRAM/PROJECT COMMON-USE  
DOCUMENT**

**REQUIREMENTS FOR HAND WIPE CLEANING**

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MSFC - Form 454 (Rev. October 1992)

<b>Multiprogram/Project Common-Use Document</b>		
<b>EM40</b>		
<b>Title: Requirements for Hand Wipe Cleaning</b>	<b>Document No.: MSFC-SPEC-2497</b>	<b>Revision: E</b>
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### DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		5/3/95	
Revision	B	3/17/97	Revision B supersedes revision A and all changes in its entirety.
Revision	C	2/6/06	This document was changed to an editable form. This revision encompasses changes from SCN 1 through 9. Additional changes were submitted by the Shuttle Propulsion Office in MSFC ECR MP41-2198/CCBD SB3-01-5870.
Revision	D	3/24/06	Revision D supersedes revision C and all changes in its entirety. Changes were required corrections of formatting errors, typos and editing.
Revision	E	9/06/06	Revision E supersedes revision D and all changes in its entirety. Changes were submitted by the Shuttle Propulsion Office in MSFC ECR#: MP51-2201; editorial and formatting errors corrected throughout document.

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## 1.0 SCOPE

This specification establishes the requirements for use of environmentally compliant hand wipe cleaners on SRB & RSRM surfaces. When a critical process, as defined by NHB5300.4 (ID-2) per the respective Project Office utilizes any hand cleaning operations of this specification, the cleaning process shall be a part of the critical process.

## 2.0 APPLICABLE DOCUMENTS

### 2.1 Government Documents

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 requests for proposals shall apply.

#### SPECIFICATIONS

##### NASA

MSFC-SPEC-1918	Thermal Ablative Compound
MSFC-SPEC-2489	Organic Cleaner
MSFC-SPEC-2490	Organic with D-Limonene Cleaner
MSFC-SPEC-2491	Aqueous Cleaner
MSFC-SPEC-2945	Organic Cleaner
SE-S-0073	National Space Transportation System Specification, Fluid Procurement and Use Control

##### MILITARY

MIL-I-631	Insulation, Electrical, Synthetic –Resin Composition, Nonrigid
MIL-R-6855	Rubber, Synthetic
MIL-I-23053	Insulation Sleeving, Electrical, Heat Shrinkable
MIL-I-23594	Insulation Tape, Electrical; High Temperature, Polytetraflouroethylene Pressure Sensitive
MIL-T-81533	Trichloroethane 1, 1, 1, Inhibited, Vapor Degreasing
AMS-3819	Cloths, Cleaning for Aircraft Primary and Secondary Structural Surfaces

##### FEDERAL

TT-I-735	Isopropyl Alcohol, Grade A
O-A-51	Acetone

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

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## 2.2 Non Government Documents

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposals shall apply.

### STANDARDS

#### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1193     Standard Specification for Reagent Water  
 ASTM D4126     Standard Specification for Vapor Degreasing Grade and Solvent Grade 1, 1, 1  
                           – Trichloroethane

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

## 3.0 REQUIREMENTS

### 3.1 Equipment and Materials

Materials, processes, procedures, and equipment used for storing, handling and applying the cleaners shall not introduce contamination to the substrates being cleaned.

#### 3.1.1 Shelf Life

Shelf life requirements for materials, if applicable, shall be verified prior to use.

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### 3.1.2 In-Process Material

If the integrity of in-process material is at any time suspect (e.g. liquid-phase separation, not free flowing, cloudy, foreign material or precipitate present), the material in question shall be either recertified or discarded.

### 3.1.3 Preproduction Contamination Control

Work areas shall be protected from applicable contamination sources, such as overhead operations, precipitation, or moisture. Tools shall be visibly clean prior to start of operations. Eating, drinking, and use of tobacco products in the work area shall not be permitted. Personnel directly involved with exposed sensitive surfaces of components are required to have satisfactorily completed control training or Foreign Object Damage/Debris (FOD) training.

### 3.1.4 Materials

<u>NAME</u>	<u>IDENTIFICATION</u>
Organic Cleaner	MSFC-SPEC-2489
Organic with D-Limonene Cleaner	MSFC-SPEC-2490
Aqueous Cleaner	MSFC-SPEC-2491
Organic Cleaner	MSFC-SPEC-2945
1, 1, 1 – Trichloroethane	MIL-T-81533
Cleaning, Low-Lint Cloths	AMS 3819, Texwipe 318 or equivalent
1, 1, 1 – Trichloroethane	ASTM D4126
Isopropyl Alcohol (IPA)	TT-I-735
Water	SE-S-0073, Grade A or ASTM D 1193, Type IV
Acetone	O-A-51

### 3.2 Toxic Products and Safety

The Vendor shall furnish a Material Safety Data Sheet (MSDS) to the procuring activity. The user of this specification shall be responsible for implementing the necessary safety procedures/precautions.

### 3.3 Personnel Certification

All processing shall be performed by personnel that are skill certified for the processes governed by this specification.

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### 3.4 Cleaner Selection

Usage of environmentally compliant cleaners is based primarily on the surface being cleaned. Cleaning shall be performed per paragraph 3.5 for the contaminants listed in Table I and the surfaces listed in Table II.

#### 3.4.1 Metal

Metal surfaces shall be cleaned using MSFC-SPEC-2489 cleaner and shall meet the applicable cleanliness criteria specified in section 4.1. If the contaminant is identifiable and cannot be removed by the Table II specified cleaner, use a cleaner specified in Table I.

#### 3.4.2 Primed and Topcoated Surfaces

Primed and topcoated surfaces shall be cleaned using MSFC-SPEC-2489 cleaner and shall meet the applicable cleanliness criteria specified in section 4.1. If the contaminant is identifiable and cannot be removed by the Table II specified cleaner, use a cleaner specified in Table I.

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Table I. Contaminants and Cleaners for Metal and Painted Surfaces

Contaminants	Cleaner(s)	Dry Time
Machinist Ink	O-A-51 (SRB Only) or MSFC-SPEC-2945 (SRB Only)	15 minutes 30 minutes
Part Marking Ink <sup>1</sup>	O-A-51 (SRB Only) or MSFC-SPEC-2945 (SRB Only)	15 minutes 30 minutes
Clear Overcoat <sup>2</sup>	O-A-51 or MSFC-SPEC-2945 (Only)	15 minutes 30 minutes
Tape Residue <sup>3</sup>	MSFC-SPEC-2490 (RSRM & SRB), O-A-51 (SRB Only), or MSFC-SPEC-2945 (SRB Only)	15 minutes 15 minutes 30 minutes
Grease Pencil, Paper Identification Label, DC-1200 Primer	MSFC-SPEC-2490 (RSRM & SRB)	15 minutes
Residual Uncured PR-1422 <sup>3,4</sup>	MSFC-SPEC-2490 (RSRM & SRB), O-A-51 (SRB Only), or MSFC-SPEC-2945 (SRB Only)	15 minutes 15 minutes 30 minutes
Primer/Topcoat Oversprays	MSFC-SPEC-2489, MSFC-SPEC-2490, O-A-51 MSFC-SPEC-2945 (All SRB Only)	15 minutes 30 minutes

<sup>1</sup> (SRB Only) For bare metal surfaces, O-A-51, TT-I-735 or MSFC-SPEC-2491 may also be used to remove the contaminants. Allow 15 minutes dry time minimum, before performing additional processing.

<sup>2</sup> (SRB Only) For bare metal surfaces, O-A-51 or MSFC-SPEC-2945 may also be used to remove the contaminant. Allow 15 minutes dry time for O-A-51 and 30 minutes dry time for MSFC-SPEC-2945 minimum, before performing additional processing.

<sup>3</sup> Suitable hand tools shall be used, if required.

<sup>4</sup> O-A-51 and MSFC-SPEC-2945 shall not be used on Urethabond or Hypalon topcoats.

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Table II. Surface and Corresponding Cleaner

Material Family	Surface	Cleaner	Dry Times**
Metal	Aluminum (AL)-Bare Aluminum-Anodized Aluminum-Alodined Inconel-Bare Alloy Steel-Bare & Cadmium Plated Stainless Steel-Bare Titanium-Bare Lead	MSFC-SPEC-2489	15 minutes
Primed and/or Topcoated Surface	Deft or Crown Metro Topcoat-Aluminum, Stainless Steel Deft or Crown Metro Primer-Aluminum, Stainless Steel Topcoat-Rust-Oleum Primer-Rust-Oleum Urethabond Topcoat Hypalon Topcoat Acrymax Topcoat Chemlok Zinc-Rich Primer Carboline Zinc-Rich Primer Briner 565 Zinc-Rich Primer Carbonzinc 7WB Hentzen Primer Hentzen Topcoat	MSFC-SPEC-2489	15 minutes
Thermal Protection System (TPS)	BTA MSFC-SPEC-1918 (K5NA) or RT455	MSFC-SPEC-2489	30 minutes
	Cork	TT-I-735	
Rubber Material	EPDM	MSFC-SPEC-2489	15 minutes
	Silicone	MSFC-SPEC-2491	
	NBR	ASTM D4126 or MIL-T-81533	30 minutes
	Aft Inhibitor Liner	Water per 3.1.4	
Plastic	Plastic Sealant Cap	MSFC-SPEC-2489	15 minutes
Composite Materials	EA-934 NA	MSFC-SPEC-2489	15 minutes
	Carbon or Glass Phenolic		60 minutes
	Propellant	ASTM D4126, MIL-T-81533 or MSFC-SPEC-2490	60 minutes
Sealant	RTV-133 PR-1422 3-6077 RTV	MSFC-SPEC-2489	15 minutes
Cable and Cable Assemblies	Cable (Teflon, Ether Base Polyurethane, Kapton, Polyolefin, MIL-R-6855, MIL-I-631, MIL-I-23053)	MSFC-SPEC-2489*	15 minutes
Nylon	Mounting Base	MSFC-SPEC-2489	15 minutes
Teflon Tape	MIL-I-23594	MSFC-SPEC-2489	15 minutes
Thermal Tape	Silicone Rubber	MSFC-SPEC-2491	15 minutes

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Viton	O-Ring V-2 Filler Packing with Retainer S&A Gaskets	TT-I-735 <hr/> None	15 minutes
Miscellaneous	Solid Film Lube Thermal Curtains Fused Silica Glass Fused Silica Glass with MgF <sub>2</sub> Coating	TT-I-735	15 minutes

All cleaners may have incidental contact on all surfaces, provided the required dry times specified in paragraph 3.5 are met before additional processing with the following exceptions:

- a. If incidental contact occurs between MSFC-SPEC-2491 or water and alloy steel surfaces, reclean the affected surface per paragraph 3.5.1.
- b. If incidental contact with bare MSA-2 or Cork surfaces occurs, a one – hour dry time, minimum, is required before additional processing can be performed. If incidental contact occurs with bare MCC-1 surfaces, a two hour dry time is required before additional processing can be performed.
- c. If incidental contact of closed cable connectors with an unapproved cleaner occurs, dry the affected surface with a low-lint cloth and reclean per paragraph 3.5.1 with the approved cleaner. Incidental contact of an open connector with an unapproved cleaner is not permitted.

\*SRB cables may also be cleaned with TT-I-735.

\*\*There is no required dry time between hand wipe cleaning operation and abrading operation.

As a minimum, the dry time requirement is to be met between final hand wipe cleaning of substrate and application of subsequent material.

### 3.4.3 TPS Materials

Thermal Protection System (TPS) materials shall be cleaned using the specified cleaner in Table II. Cleaned TPS surfaces shall meet the applicable cleanliness criteria specified in Section 4.1.

#### 3.4.3.1 BTA

Booster Trowellable Ablator shall be cleaned using MSFC-SPEC-2489 cleaner.

#### 3.4.3.2 K5NA or RT455 (MSFC-SPEC-1918)

K5NA or RT455 shall be cleaned using MSFC-SPEC-2489 cleaner.

#### 3.4.3.3 MSA-2 and MCC-1

Bare MSA-2 and MCC-1 are not cleaned with liquid cleaners. If incidental contact with any cleaner occurs with bare MSA-2 a one hour dry time, minimum is required before additional processing can be performed. If incidental contact occurs with MCC-1, a two hour dry time, minimum, is required before additional processing can be performed.

#### 3.4.3.4 Cork

Cork shall be cleaned using TT-I-735.

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### 3.4.4 Foams

Foams (PR-855 and Insta Foam) are not cleaned with liquid cleaners. Foams shall be cleaned by mechanically removing the contaminated foam and shall meet the applicable cleanliness criteria specified in Section 4.1.

### 3.4.5 Composite Materials

Composite materials shall be cleaned using MSFC-SPEC-2489, except propellant shall be cleaned using ASTM-D4126, MIL-T-81533 or MSFC-SPEC-2490, cleaner and shall meet the applicable cleanliness criteria specified in Section 4.1.

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### **3.4.6 Sealant**

Sealants shall be cleaned using MSFC-SPEC-2489 cleaner and shall meet the applicable cleanliness criteria specified in Section 4.1.

### **3.4.7 Cable Assemblies**

Cable assemblies shall be cleaned using MSFC-SPEC-2489 (SRB cables may also be cleaned with TT-I-735) and shall meet the applicable cleanliness criteria specified in Section 4.1. Cable connectors are not cleaned per this specification.

### **3.4.8 Thermal Tape**

Thermal tape shall be cleaned using MSFC-SPEC-2491 cleaner and shall meet the applicable cleanliness criteria specified in Section 4.1.

### **3.4.9 Nylon**

Nylon shall be cleaned using MSFC-SPEC-2489 cleaner and shall meet the applicable cleanliness criteria specified in Section 4.1.

### **3.4.10 Rubber**

EPDM shall be cleaned using MSFC-SPEC-2489. Silicone shall be cleaned using MSFC-SPEC-2491. NBR shall be cleaned using ASTM D4126 or MIL-T-81533 and the Aft Inhibitor Liner shall be cleaned using water per 3.1.4. After cleaning, all surfaces shall meet the applicable cleanliness criteria specified in Section 4.1.

### **3.4.11 Plastic**

Plastics shall be cleaned using MSFC-SPEC-2489 cleaner and shall meet the applicable cleanliness criteria specified in Section 4.1.

### **3.4.12 Teflon**

Teflon shall be cleaned using MSFC-SPEC-2489 and shall meet the applicable cleanliness criteria specified in Section 4.1.

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### 3.4.13 Viton

Viton (except S&A gaskets) shall be cleaned using TT-I-735 and shall meet the applicable cleanliness criteria specified in Section 4.1. S&A gaskets shall be cleaned with a dry, lint-free cloth only.

### 3.4.14 Miscellaneous

Solid film lube surfaces shall be cleaned using TT-I-735 and shall meet the applicable cleanliness criteria specified in Section 4.1. Thermal curtains (and their associated surfaces) shall be cleaned using TT-I-735 and shall meet the applicable cleanliness criteria in Section 4.1. Fused Silica Glass and Fused Silica Glass with MgF<sub>2</sub> coating shall be cleaned using TT-I-735 (Isopropyl Alcohol) and shall meet the applicable cleanliness criteria specified in Section 4.1.

## 3.5 CLEANING PROCEDURE

Cleaners shall be in accordance with Table II or Paragraph 3.4. Materials used shall be in accordance with Paragraph 3.1.4. Cleaning methods are specified below:

### 3.5.1 Method I – Organic Cleaning

Organic cleaner specifications are:

MSFC-SPEC-2489	
MSFC-SPEC-2490	
TT-I-735	
ASTM D4126	MIL-T-81533
MSFC-SPEC-2945	O-A-51

The cleaning process for these cleaners is as follows:

- a. Wipe surface with a clean, low-lint cloth(s) lightly dampened with the specified cleaner.
- b. Repeat step "a" until no contaminants are evident on cleaned surface.
- c. Wipe surface again with a clean, dry, low-lint cloth before the cleaner completely evaporates.
- d. Prior to sealant application, repeat dry wiping process, replacing cloth as necessary, until no cleaner is evident on the cleaned surface.
- e. As a minimum, follow the dry times in Table II after the final dry wipe before beginning subsequent processing for specified surfaces.

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f. Special contaminants may be cleaned using cleaners and dry times per Table I if cleaners in Table II did not cover the contaminant.

### 3.5.2 Method II – Aqueous Cleaning

Aqueous cleaning shall be performed with MSFC-SPEC-2491 cleaner as follows:

- a. Wipe surface with a clean, low-lint cloth(s) lightly dampened with the specified cleaner.
- b. Repeat step "a" until no contaminants are evident on the surface.
- c. Wipe surface with a clean, low-lint cloth dampened with water.
- d. Wipe surface with a clean, dry, low-lint cloth before the water completely evaporates from the substrate surface.
- e. Prior to sealant application, repeat dry wiping process, replacing cloth as necessary, until no water is evident on cloth.
- f. As a minimum, follow the dry times in Table II after the final dry wipe before beginning subsequent processing for specified surfaces.

### 3.6 Repair/Rework

For individual K5NA or RT455 and BTA repairs, each of the underlying substrates shall be treated as a part of the same system and shall be cleaned using MSFC-SPEC-2489 cleaner followed by a one hour dry time, minimum.

For individual cork repairs, each of the underlying substrates shall be treated as part of the same system and shall be cleaned using TT-I-735 followed by one hour dry time, minimum.

All repair surfaces (K5NA or RT455, BTA & cork) shall meet the cleanliness criteria specified in the applicable process specification requirement.

## 4.0 QUALITY ASSURANCE PROVISIONS

### 4.1 Process Verification

Process verification shall be in accordance with the applicable subsequent process specifications or drawing requirements. If no requirements are specified, then surfaces shall be cleaned to a "visibly clean" criteria.

## 5.0 Notes

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## **5.1 DEFINITIONS**

5.1 **Incidental Contact.** Incidental contact occurs when a cleaner on a dampened, low-lint cloth comes in contact with a surface for which it has not been recommended for use. Incidental contact will not result in damage or contamination of the surface. All other conditions including the cleaning of a surface with the wrong cleaner are not acceptable unless otherwise specified within this document.

5.1.2 **Visibly Clean.** Visibly Clean surfaces shall be those that demonstrate an absence of all particulate and nonparticulate visible to the normal, unaided (except corrected vision) eye. Particulate is identified as a matter of observable length, width, and thickness. Nonparticulate is film matter without definite dimension. Observation distance shall be 1 to 4 feet.

## **5.2 Modifications or Changes**

Recommendations for modifications or changes to the requirements specified herein shall be submitted in writing to Office of Primary Responsibility Designee (OPRD) of this document at MSFC for consideration.

**NOTICE :** When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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*	MSFC-SPEC-2497	211 -	HANDWIPE WIPE CLEANING REQUIREMENTS FOR	000-00-0000	0000000	ZA	NONE
CHG NO.	CHG REV	CHG NOTICE	RESPONSIBLE ENGINEER	RESPONSIBLE ORGANIZATION	ACTION DATE	DESCRIPTION	
5	B	SCN005	MICHAEL COUSSONS	EE51	03/17/97	REVISION 'B' SUPERSEDES REVISION 'A' AND ALL CHANGES IN ITS ENTIRETY.	
6	B	SCN006	TERRIE RICE	EH43	04/29/99	REPLACE PAGES 1-4 AND 8-9.	
7	B	SCN007	DENNIS GRIFFIN	MP41	05/26/00	RELEASES CHANGES PAGES AUTHORIZED BY ECR MP41-2183, CCBD SB3-01-5314A.	
8	B	SCN008	JOYCE RUCKER	MP41	11/28/01	REVISE MANUFACTURER'S ADDRESS AND UPDATE LOW-LINT CLEANING CLOTHS (SB3-01-5454 AND SM3-01-5637)	
9	B	SCN009	MARY JO HARRIS	MP41	02/18/03	REPLACE PAGES 4,5,6, AND 9 (SB3-01-5547, SM3-01-5742)	
*	10	B	SCN000	EUGENA GOGGANS	EO03	02/22/07	DOCUMENT RELEASED THRU PDS. NO LONGER TRACKED IN ICMS.

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DWG SIZE	DRAWING NUMBER	DWG REV	EPL/DRL/DDS NUMBER	DWG REV	EPL DSH	EPL REV	EO DASH NUMBER	EO REV	PART NUMBER
			MSFC-HDBK-1453		202	-			
			MSFC-HDBK-1674		202	-			
			MSFC-HDBK-2221		203	-			
			MSFC-HDBK-505		202	-			
			MSFC-HDBK-670		202	-			
			MSFC-MNL-1951		209	-			
			MSFC-PROC-1301		202	-			
			MSFC-PROC-1721		202	-			
			MSFC-PROC-1831		202	-			
			MSFC-PROC-1832		202	-			
			MSFC-PROC-404		202	-			
			MSFC-PROC-547		202	-			
			MSFC-QPL-1918		204	-			
			MSFC-RQMT-1282		202	-			
			MSFC-SPEC-1198		202	-			
			MSFC-SPEC-1238		202	-			
			MSFC-SPEC-1443		202	-			
			MSFC-SPEC-164		202	-			
			MSFC-SPEC-1870		202	-			
			MSFC-SPEC-1918		203	-			
			MSFC-SPEC-1919		206	-			
			MSFC-SPEC-2083		202	-			
			MSFC-SPEC-2223		202	-			
			MSFC-SPEC-2489		206	-			
			MSFC-SPEC-2490		205	-			
			MSFC-SPEC-2491		203	-			
			MSFC-SPEC-2492		203	-			
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			MSFC-SPEC-445		202	-			
			MSFC-SPEC-504		202	-			
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			MSFC-SPEC-684		202	-			
			MSFC-SPEC-708		202	-			
			MSFC-SPEC-766		202	-			
			MSFC-STD-1249		202	-			
			MSFC-STD-1800		202	-			
			MSFC-STD-246		202	-			
			MSFC-STD-2594		203	-			

