

**MATERIAL SELECTION LIST FOR PLASTIC FILMS, FOAMS,
AND ADHESIVE TAPES**

APPROVED: _____

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1. INTRODUCTION

This Kennedy Technical Instruction (KTI) was developed to provide users with test results on materials that were tested for flammability in accordance with NASA-STD-6001, Test 1; electrostatic discharge characteristics in accordance with KSC/MMA-1985-79, Standard Test Method for Evaluating Triboelectric Charge Generation and Decay, and hypergolic ignition/breakthrough characteristics in accordance with NASA-STD-6001, Supplemental Test A.2.7 (formerly KSC/MTB-175-88). The test results are summarized in Section 5.

As a new addition to Rev. H, alternate standard test methods may be used for flammability testing. Materials that have been tested by alternate flammability test methods, in addition to meeting the acceptance criteria for electrostatic discharge and hypergol ignition/breakthrough, will be listed in a new category, designated as Group 1, Subgroup A. It is the responsibility of the user to ensure that the flammability test results, for the specific test performed, are acceptable for the intended end use of the material tested.

Cleanroom operational requirements were not taken into consideration; therefore, if such an application is anticipated, the user should ensure the material meets the facility cleanroom requirements.

These listings do not take into account the effects of unknown formulation and/or process changes that could be performed by a manufacturer, which could result in a material performing differently than these test results would indicate. It is the responsibility of the user to ensure that the material to be used is representative of the materials as tested.

Materials that are known to be obsolete or could not be verified were deleted from this version of the list. Some obsolete materials that may still be stockpiled remain on the list. These cases are indicated by comments in the notes column of the table.

2. PLASTIC FILMS, FOAMS AND ADHESIVE TAPES

The plastic films, foams and adhesive tapes listed in the table were submitted for testing and subsequently grouped in several categories based on their ability to meet the acceptance criteria for flammability resistance, electrostatic discharge, and hypergolic ignition and breakthrough resistance. The test methods used in these evaluations include the following:

- a) Flammability. NASA-STD-6001, Test 1, Upward Flame Propagation or alternate as described in 2.1.2
- b) Electrostatic Discharge. KSC/MMA-1985-79, Standard Test Method for Evaluating Triboelectric Charge and Decay
- c) Hypergolic Ignition/Breakthrough. NASA-STD-6001, Supplemental Test A.7, Reactivity and Penetration of Materials due to Incidental Exposure to Hydrazine, Monomethylhydrazine, Unsymmetrical Dimethylhydrazine, Aerozine 50, Nitrogen Tetroxide, and Ammonia (formerly KSC/MTB-175-88, Procedure for Casual Exposure of Materials to Hypergolic Fluids, Exothermic Reaction Method and Penetration Method)

2.1 CATEGORIES

Prior to specifying a plastic film, foam or adhesive tape for procurement, the user should take into account the manufacturing tolerances regarding thickness. Flammability and hypergolic ignition/breakthrough results are applicable for the particular film thickness tested, as well as films of the same material with greater thickness. Thinner samples of previously tested materials should be submitted for additional flammability and hypergolic testing. Electrostatic discharge testing is not dependent upon thickness. Some color variations affect test results, and these were identified where applicable.

- 2.1.1 GROUP I: These materials met all the acceptance criteria for flammability resistance, electrostatic discharge for an environment that has a relative humidity of not less than 30%, and hypergolic ignition and breakthrough resistance.
- 2.1.2 GROUP I, SUBGROUP A: These materials were tested for flammability in accordance with a test procedure other than NASA-STD-6001 Test 1. The specified test procedure, listed in the notes column of the test results table in Section 3, should be reviewed in order to verify that the test is sufficiently conservative for the intended use conditions. These materials met the acceptance criteria for electrostatic discharge for an environment that has a relative humidity of not less than 30%. These materials also met hypergolic ignition and breakthrough resistance.
- 2.1.3 GROUP II, SUBGROUP A: These materials met the acceptance criteria for flammability resistance and electrostatic discharge for an environment that has a relative humidity (RH) of not less than 30%. They may or may not be suitable for hypergolic exposure.
- 2.1.4 GROUP II, SUBGROUP B: These materials met the acceptance criteria for flammability resistance and electrostatic discharge for an environment that has a relative humidity of not less than 45%. They may or may not be suitable for hypergolic exposure.
- 2.1.5 GROUP II, SUBGROUP C: These materials met the acceptance criteria for flammability resistance but not for electrostatic discharge. They may or may not be suitable for hypergolic exposure.

3. ALTERNATE FLAMMABILITY TEST METHOD SUMMARY FOR GROUP 1, SUBGROUP A

Flame character	NASA-STD-6001B Test 1	FAA FAR 25.855
Flame source	Preformed igniter	Methane
Flame height (mm)	65	38
Flame duration (sec)	25	12 or 60
Heat output (J)	3000	Not listed
Peak temperature (°C)	1100	Minimum 843 °C

4. TEST RESULTS FOR FLAMMABILITY, ELECTROSTATIC DISCHARGE AND
INCIDENTAL EXPOSURE TO HYPERGOLS (TABLE)

ABBREVIATIONS USED IN TABLE:

CRCA: Component Refurbishment and Chemical Analysis (URS hypergol compatibility testing laboratory)

CTFE: Chlorotetrafluoroethylene

F: FAIL

FEP: Fluorinated Ethylene Propylene

MMH: Monomethylhydrazine

N₂H₄: Hydrazine

N₂O₄: Nitrogen Tetroxide

N/A: Not Applicable/Not Available

NBR: Nitrile-Butadiene Rubber

NT: Not Tested

P: Pass

PVC: Polyvinyl Chloride

PVF: Polyvinyl Fluoride

TRADE NAME	GENERIC NAME	BATCH/LOT	THICKNESS (in)	MM H	N ₂ H ₄	N ₂ O ₄	KSC REPORT	NOTES	LAST LISTED OWNER/ MANUFACTURER
PLASTIC FILMS, GROUP I									
Eslon G406AS	Anti-static PVC	981118	0.012	P	P	P	KSC-MSL-2000-0009		Sekisui America
Eslon DC	Anti-static PVC	70424	0.010	P	P	P	KSC-MSL-2010-0284		Sekisui America
Herculite 20, Yellow	PVC/nylon	N/A	0.012	P	P	P	KSC-MSL-2007-0080		Herculite
Herculite 80, White	PVC/polyester	16960, 16891	0.025	P	P	P	KSC-MSL-1999-0927		Herculite
Herculite 80, Yellow	PVC/polyester	N/A	0.023	P	P	P	KSC-MSL-2001-0238		Herculite
Lectrolite Duotone, green/black	PVC (green)/polyester scrim/PVC/conductive acrylic coating (black)	18035	0.012	P	P	P	KSC-MSL-2000-0540		Herculite
Lectrolite Duotone, green/black	PVC (green)/polyester scrim/PVC/conductive acrylic coating (black)	N/A	0.001	P	P	P	KSC-MSL-2006-0597		Herculite
LF8900C	Polyethylene	N/A	0.005	P	P	P	KSC-MSL-2000-0678	The distributor LF&P was listed as owner in previous revisions of KTI-5212, but EMI is the original and current manufacturer. NVR issues due to expired raw materials in 2016 are resolved for new purchases from EMI, but may still apply to existing stockpiles of material purchased from LF&P. The formulation and manufacturing process have not changed, and there is no change to flammability, ESD or hypergol compatibility status.	Engineered Materials, Inc. (EMI)
LF8900C	Polyethylene	N/A	0.005	P	P	P	KSC-MSL-2004-0185		Engineered Materials, Inc. (EMI)
LF8900C	Polyethylene	N/A	0.004	P	P	P	KSC-MSL-2005-0047		Engineered Materials, Inc. (EMI)
LF8900C	Polyethylene	N/A	0.005	P	P	P	KSC-MSL-2011-0131		Engineered Materials, Inc. (EMI)
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	N/A	0.011	P	P	P	KSC-MSL-2000-0050	Orcofilm AN-108 was discontinued and replaced by Lamart AN-108S. See Group I, Subgroup A.	Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	6696	0.008	P	P	P	KSC-MSL-2004-0203		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	6293	0.009	P	P	P	KSC-MSL-2005-0053		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	6869	0.007	P	P	P	KSC-MSL-2005-0248		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017

TRADE NAME	GENERIC NAME	BATCH/LOT	THICKNESS (in)	MM H	N ₂ H ₄	N ₂ O ₄	KSC REPORT	NOTES	LAST LISTED OWNER/ MANUFACTURER
PLASTIC FILMS, GROUP I, continued									
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	77430	0.007	P	P	P	KSC-MSL-2009-0019 KSC-MSL-2009-0185	Orcofilm AN-108 was discontinued and replaced by Lamart AN-108S. See Group I, Subgroup A.	Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	77531	0.007	P	P	P	KSC-MSL-2009-0147		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	76419	0.007	P	P	P	KSC-MSL-2007-0343 KSC-MSL-2009-0227		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Orcofilm AN-108	Nylon-reinforced aluminized Tedlar (PVF)	77314	0.008	P	P	P	KSC-MSL-2009-0505		Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
Saf-T-Vu, Anti-static	Anti-static PVC	GW1448	0.010	P	P	P	KSC-MSL-2000-0434	Designated as M1083	Frommelt Safety
Saf-T-Vu, Anti-static	Anti-static PVC	A-0287GW2413	0.010	P	P	P	KSC-MSL-2010-0002		Frommelt Safety
Seiden F	Anti-static PVC	N/A	0.010	P	P	P	KSC-MSL-2009-0367		Achilles Corporation
PLASTIC FILMS, GROUP I, SUBGROUP A									
AN-108S	Nylon-reinforced aluminized Tedlar (PVF)	280199, 280200, 280201		P	P	P	NASA-4109	Flammability tested per FAA FAR 28.855. See Section 3.	Lamart Corporation
PLASTIC FILMS, GROUP II, SUBGROUP A									
Herculite 80M	PVC/polyester	27286	0.020	NT	NT	NT	KSC-MSL-2004-0345		Herculite
Herculite 80M	PVC/polyester	26757	0.020	NT	NT	NT	KSC-MSL-2004-0345		Herculite
Herculite 80M	PVC/polyester	28634	0.020	NT	NT	NT	KSC-MSL-2004-0690		Herculite
Kapton 160XC, black	Anti-static polyimide	09491RHB	0.002	NT	F	NT	KSC-MSL-2004-0127	160XC no longer a valid designation.	DuPont
Lectrolite Duotone, green/black	PVC (green)/polyester scrim/PVC/conductive acrylic coating (black)	31607	0.010	P	F	P	KSC-MSL-2005-0274		Herculite
Lectrolite Duotone, green/black	PVC (green)/polyester scrim/PVC/conductive acrylic coating (black)	13324-42576	0.010	NT	NT	NT	KSC-MSL-2009-0057		Herculite
Lectrolite Duotone, green/black	PVC (green)/polyester scrim/PVC/conductive acrylic coating (black)	13324-42577	0.100	NT	NT	NT	KSC-MSL-2009-0057		Herculite

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PLASTIC FILMS, GROUP II, SUBGROUP A, continued									
Llualloy	metalized polyester	N/A	0.001 and 0.002	NT	NT	NT	KSC-MSL-2006-0103 KSC-MSL-2006-0482	Material is no longer manufactured, but may be stockpiled.	CP Films
Sheldahl G405124	Aluminum coated polyimide	I-T502775-3	0.002	NT	F	NT	KSC-MSL-2004-0127	Part number G405124 replaced by 159946	Sheldahl
PLASTIC FILMS, GROUP II, SUBGROUP B									
Aeropackaging Anti-Static Orange Cleanroom Film	Nylon 6	N/A	0.002	P	P	F	KSC-MSL-2015-0144	Version tested was lay-flat tubing; Material failed penetration in N ₂ O ₄	Aeropackaging
PLASTIC FILMS, GROUP II, SUBGROUP C									
A4000	FEP	N/A	0.002	NT	NT	NT	KSC-MSL-2014-0198		Airtech
Aclar 22A	CTFE	N/A	0.0015	P	P	P	KSC-MSL-2009-0207		Honeywell
Herculite 20, White	PVC/nylon	N/A	0.014	P	P	P	KSC-MSL-2007-0080		
KNF Anti-static Nylon Bag	Anti-static nylon	148384-1	0.002	P	P	F	KSC-MSL-2007-0013		KNF Corporation
Melinex 1311	Anti-static polyester	N/A	0.004	P	P	P	KSC-MSL-2009-0031		DuPont Teijin Films
Nomex IIIA Freestyle 450	93% Nomex (aramid fiber) with 5% Kevlar (aramid fiber) and 2% antistatic fiber	N/A	0.018	P	P	P	KSC-MSL-2005-0037	Name changed to TenCate Freestyle 450	DuPont
Nomex IIIA Freestyle 600	93% Nomex (aramid fiber) with 5% Kevlar (aramid fiber) and 2% antistatic fiber	N/A	0.020	P	P	P	KSC-MSL-2005-0038	Name changed to TenCate Freestyle 600	DuPont
FOAMS, GROUP I									
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
FOAMS, GROUP II, SUBGROUP A									
Insul-Sheet	PVC/NBR	1 2	0.5625	F	P	P	KSC-MSL-2015-0167 KSC-MSL-2015-0168	Previously manufactured by Nomaco; stock still exists (may be designated as Insul-Sheet 1800); failed delta T in MMH, but passed penetration.	K-Flex
FOAMS, GROUP II, SUBGROUP B									
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

TRADE NAME	GENERIC NAME	BATCH/LOT	THICKNESS (in)	MM H	N ₂ H ₄	N ₂ O ₄	KSC REPORT	NOTES	LAST LISTED OWNER/ MANUFACTURER
FOAMS, GROUP II, SUBGROUP C									
Armasport MC	PVC/NBR	N/A	0.55	F	P	P	KSC-MSL-2007-0393		Armacell
Armasport MLO	PVC/NBR	N/A	0.23	P	P	P	KSC-MSL-2009-0379		Armacell
Insul-Sheet	PVC/NBR	B23	0.5625	F	P	P	KSC-MSL-2015-0166	Previously manufactured by Nomaco; stock still exists (may be designated as Insul-Sheet 1800); failed delta T in MMH, but passed penetration.	K-Flex
Pyrell 2.0, Light Grey	Polyester	35121	0.5, 1, 2	NT	NT	NT	KSC-MSL-2010-0069	0.25" thickness material of the same lot failed flammability.	Foamex Innovations
ADHESIVE TAPES, GROUP I									
363LC	Aluminum, glass fiber tape, silicone adhesive	4406201	0.006	P	P	P	KSC-MSL-2005-0112		3M
E&H #770-3FRD	Metalized Tedlar (PVF) insulation blanket splicing tape, acrylic adhesive	12434-Q2	0.007	P	P	P	KSC-MSL-2011-0169		E&H Laminating & Slitting Company
OT-157TN	Aluminized PVF tape, acrylic adhesive	42294	0.0038	P	P	P	KSC-MSL-2014-0146 (Flammability, ESD) CRCA 301494-301498 (Hypergol compatibility)	NASA-STD-6001 Test 1 standard sample size is 2.5" wide. Tape provided was 2.0" wide. Test is considered non-standard. N ₂ O ₄ exposure showed slight degradation, but no penetration.	Originally owned by Orcon Aerospace, sold to Lamart Corporation in 2017
UltraTape 2149	Polyester tape, conductive synthetic rubber adhesive	N/A	0.003	P	P	P	KSC-MSL-2010-0221		UltraTape
ADHESIVE TAPES, GROUP II, SUBGROUP A									
363LC	Aluminum, glass fiber tape, silicone adhesive	4522201	0.007	NT	NT	NT	KSC-MSL-2006-0143		3M
363LC	Aluminum, glass fiber tape, silicone adhesive	45299-01	0.007	NT	NT	NT	KSC-MSL-2006-0538		3M
363LC	Aluminum, glass fiber tape, silicone adhesive	46334-1	0.008	NT	NT	NT	KSC-MSL-2007-0106		3M
363LC	Aluminum, glass fiber tape, silicone adhesive	48066-01	0.005	NT	NT	NT	KSC-MSL-2009-0255		3M

TRADE NAME	GENERIC NAME	BATCH/LOT	THICKNESS (in)	MM H	N ₂ H ₄	N ₂ O ₄	KSC REPORT	NOTES	LAST LISTED OWNER/ MANUFACTURER
ADHESIVE TAPES, GROUP II, SUBGROUP A, continued									
OT-16A	Aluminized PVF tape, acrylic adhesive	6026 14552	0.006	NT	NT	NT	KSC-MSL-2004-0237 KSC-MSL-2006-0355	No longer available, but may be stockpiled. OT-157TN (Group I) is the replacement for OT-16A.	Orcon
OT-16A	Aluminized PVF tape, acrylic adhesive	10551 15300 16315	0.005	NT	NT	NT	KSC-MSL-2006-0355 KSC-MSL-2006-0539 KSC-MSL-2007-0132		Orcon
Saint-Gobain 2925-7	Glass-foil tape, silicone adhesive	4021126	0.008	NT	F	NT	KSC-MSL-2004-0127		Saint-Gobain
ADHESIVE TAPES, GROUP II, SUBGROUP B									
3M 42 Anti-Static Tape	Kapton (polyimide) tape with anti-static polymer adhesive	N/A	0.003	NT	NT	NT	KSC-MSL-2000-0371		3M
Cho-Foil CCJ-36-201-0100 and -0200	Aluminum foil, conductive adhesive	425	0.0035	NT	P	NT	KSC-MSL-2015-0051 (Flammability, ESD) CRCA 306466-306469 (N ₂ H ₄ compatibility)		Parker Chomerics
Sheldahl 146379	Second surface aluminum-coated FEP tape, 3M 966 (acrylic) adhesive	426879	0.005	NT	P	NT	KSC-MSL-2015-0051 (Flammability, ESD) CRCA 306551-306554 (N ₂ H ₄ compatibility)	Part number incorrectly listed in reports as 143679	Sheldahl
ADHESIVE TAPES, GROUP II, SUBGROUP C									
Paint Replacement Tape 5004	Fluoropolymer film, acrylic adhesive	N/A	0.070	NT	NT	NT	KSC-MSL-2004-0016		3M
3M966	Acrylic adhesive, kraft paper liner	14068	0.002	NT	P	NT	KSC-MSL-2015-0051 (Flammability, ESD) CRCA 306824, 306825 (N ₂ H ₄ compatibility)	N ₂ H ₄ exposure showed slight degradation of adhesive, no penetration.	3M
Permacel P224	Polyimide tape, acrylic adhesive	201310100035	0.003	NT	P	NT	KSC-MSL-2015-0051 (Flammability, ESD) CRCA 306619-306622 (N ₂ H ₄ compatibility)	N ₂ H ₄ exposure showed slight degradation of adhesive, no penetration.	Nitto Americas
Nitto Denko P213LW	Glass cloth tape, acrylic adhesive	L00373249	0.0073	NT	P	NT	KSC-MSL-2015-0051 (Flammability, ESD) CRCA 306539-306542 (N ₂ H ₄ compatibility)	N ₂ H ₄ exposure showed slight degradation of adhesive, no penetration.	Nitto Americas