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-(I)-6001A, Test 1; electrostatic discharge characteristics in accordance with KSC/MMA-1985-79; and hypergolic ignition/breakthrough characteristics in accordance with NASA-STD-(I)-6001A, Supplemental Test A.7 (formerly KSC/MTB-175-88).

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. Batch/lot testing is required for all PFAs.

The following legend applies:

Trade Name:	Material trade name and/or part number
F:	Fail
MMH:	Monomethylhydrazine
N_2H_4:	Hydrazine
N_2O_4:	Nitrogen Tetroxide
N/A:	Not Applicable/Not Available
NT:	Not Tested
P:	Pass
Test No.:	KSC Test Report Number
Thk:	Thickness

2. PLASTIC FILMS LISTINGS

These plastic films listings are composed of various plastic films that 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-(I)-6001A, Test 1, Upward Flame Propagation

b) Electrostatic Discharge. KSC/MMA-1985-79, Standard Test Method for Evaluating Triboelectric Charge and Decay

c) Hypergolic Ignition/Breakthrough. NASA-STD-(I)-6001A, 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 PLASTICS FILMS CATEGORIES AND TEST RESULTS.

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

2.1.1 GROUP I. These plastic films 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. See Table 1.

Table 1. Plastic Films Listings, Group I

Trade Name	Manufacturer	Batch/Lot No.	Thk(in)	Test No.
Saf-T-Vu M1083	Frommelt Safety Products	GW1448	0.010	00-0434
Eslon G-406AS	Sekisui America Corp.	981118	0.012	00-0009
Herculite 80, White	Herculite Products	16960, 16891	0.025	99-0927
Herculite 80, Yellow	Herculite Products	N/A	0.023	01-0238
Herculite 20, Yellow	Herculite Products	N/A	0.012	07-0080
Orcofilm AN-108	Orcon Corp.	N/A	0.011	00-0050
Orcofilm AN-108	Orcon Corp.	6696	0.008	04-0203
Orcofilm AN-108	Orcon Corp.	6293	0.009	05-0053
Orcofilm AN-108	Orcon Corp.	6869	0.007	05-0248
Lectrolite Duotone, Green/Black	Herculite Products	18035	0.012	00-0540
Lectrolite Duotone	Herculite Products	N/A	0.01	06-0597
LF8900-C Film	LF&P Inc.	N/A	0.005	00-0678
LF8900-C Film	LF&P, Inc.	N/A	0.005	04-0185
LF8900-C Film	LF&P, Inc.	N/A	0.004	05-0047

2.1.2 GROUP II, Subgroup A. These plastic films 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. See Table 2.

Table 2. Plastic Films Listings, Group II, Subgroup A

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
LF8900-A	LF&P Inc.	N/A	0.004	NT	NT	NT	00-0166
NMD-FR, 190NPA1-NN	National Metallizing	9100137AA21	0.0015	P	F	P	01-0188
NMD-FR, 100NPA1-N	National Metallizing	N/A	0.001	P	P	F	02-0086
Llumalloy 50% HSC, 100GA	CP Films, Inc.	N/A	0.001	P	P	F	01-0480
Llumaloy, 1 mil	CPF Films	N/A	0.001	NT	NT	NT	06-0103
Llumaloy, 2 mil	CPF Films	N/A	0.002	P	P	F	06-0482
160XC, 1.5 mil, Black Kapton Film	Dupont Films	09491RHB	0.002	NT	F	NT	04-0127
G405124, 2 mil, Aluminized Kapton Film	Sheldahl, Inc.	I-T502775-3	0.002	NT	F	NT	04-0127
Herculite 80M Plasticized Fabric	Herculite Products, Inc	27286	0.02	NT	NT	NT	04-0345
Herculite 80M Plasticized Fabric	Herculite Products, Inc	26757	0.02	NT	NT	NT	04-0345
Herculite 80M Plasticized Fabric	Herculite Products, Inc.	28634	0.02	NT	NT	NT	04-0690
Sheldahl Film 165916-001	Sheldahl, Inc.	N/A	0.0065	P	P	F	04-0557
Sheldahl Film 165814-001	Sheldahl, Inc.	N/A	0.007	P	P	F	04-0557
Lectrolite Duotone Black/Green	Herculite Products, Inc.	31607	0.01	P	F	P	05-0274
PHE Fabric	Fairprene	N/A	0.02	P	P	P	05-0118
PHE Fabric, cryogenically treated	Fairprene	N/A	0.002	P	P	P	04-0668
KNF Film	KNF	N/A	0.004	P	P	P	06-0084
Wrightlon AS 6000 Film	Airtech International	N/A	0.001	P	P	F	06-0427
Orcon AN-35 Film	Orcon Corp.	6418	0.009	P	F	P	05-0060
Orcofilm AN-108	Orcon Corp.	76419	0.007	NT	NT	NT	06-0490
Orcofilm AN-108	Orcon Corp.	76419	0.007	NT	NT	NT	07-0343
Orcofilm AN-108	Orcon Corp.	76128	0.009	NT	NT	NT	07-0343
Vac-Pak Heat Stabilized Nylon 6 Film	Richmond Aircraft Products, Inc.	4406201	0.002	NT	NT	NT	05-0238

2.1.3 GROUP II, Subgroup B. These plastic films 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. See Table 3.

Table 3. Plastic Films Listings, Group II, Subgroup B

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
IPPLON KM 1300	Airtech International Inc.	N/A	0.0005	NT	NT	NT	99-0249

2.1.4 GROUP II, Subgroup C. These plastic films met the acceptance criteria for flammability resistance but not for electrostatic discharge. They may or may not be suitable for hypergolic exposure. See Table 4.

Table 4. Plastic Films Listings, Group II, Subgroup C

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
LF8900	LF&P Inc.	N/A	0.0035	P	P	P	00-0011
Cryovac Shrink Wrap	Cryovac	N/A	0.0005	NT	NT	NT	05-0151
KNC Noise Abatememnt Curtain	Kinetics Noise Control, Inc.	N/A	0.7	NT	NT	NT	04-0560
Antistatic Nylon Bag	KNF	148384-1	0.002	P	P	F	07-0013
Herculite 20 White Laminated Fabric	Herculite	N/A	0.014	P	P	P	07-0080
TEMP-R-GLAS 10 mil Fabric	TEMP-R-GLAS	N/A	0.01	NT	NT	NT	04-0020
TEMP-R-GLAS 6 mil fabric	TEMP-R-GLAS	N/A	0.006	NT	NT	NT	04-0020
ORANGE NOMEX IIIA, 4.5 OZ., FREESTYLE 450	Dupont	N/A	0.018	P	P	P	05-0037
ORANGE NOMEX IIIA, 6.0 OZ., FREESTYLE 600	Dupont	N/A	0.02	P	P	P	05-0038
Lectrolite Duotone	Herculite Products, Inc.	N/A	0.01	NT	NT	NT	04-0098
95-245 EPOXY & MEGASEAL NSU	PPG	N/A	0.008	NT	NT	NT	04-0031
Firetex and Pitt-Tech Coating	PPG	N/A	0.015	NT	NT	NT	04-0344
SCM 3404 Coating	GE	N/A	0.01	NT	NT	NT	04-0343
SE6035 Silicone Rubber Sheet	GE Silicones	N/A	0.13	NT	NT	NT	04-0602
60382D Neoprene Rubber Sheet, Yellow	Mosites Rubber Co.	N/A	0.12	NT	NT	NT	04-0602

3. FOAMS LISTINGS

These foams listings are composed of various foams (rubber, silicone, or composite construction) that 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 resistance. The test methods used in these evaluations include the following:

a) Flammability. NASA-STD-(I)-6001A, Test 1, Upward Flame Propagation

b) Electrostatic Discharge. KSC/MMA-1985-79, Standard Test Method for Evaluating Triboelectric Charge and Decay

c) Hypergolic Ignition/Breakthrough. NASA-STD-(I)-6001A, 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)

3.1 FOAMS CATEGORIES AND TEST RESULTS.

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

3.1.1 Group I. These foams met all of the acceptance criteria for flammability resistance, electrostatic discharge for an environment that has a relative humidity of not less than 30%, and hypergolic ignition resistance. See Table 5.

Table 5. Foams Listings, Group I

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	TestNo.
Kaimannflex ST, Black	Kaimann	N/A	0.78	99-0495
Econo Stat AFS175, Charcoal Gray	Sno White Floor Mat Systems	N/A	0.38	99-0601
285 LDC, Black	Z-MAR Technology	N/A	0.37	99-0916
285 HDC, Black	Z-MAR Technology	N/A	1.00	99-0916
Insul-Sheet 1800 Foam Rubber P/N 6RSX048070	Nomaco, Inc	N/A	0.5	04-0205
Z-MA01	Z-Mar	N/A	0.5	06-0524

3.1.2 Group II, Subgroup A. These foams met the acceptance criteria for flammability resistance and electrostatic discharge for an environment that has a relative humidity of not less than 30%. They may or may not be suitable for hypergolic exposure. See Table 6.

Table 6. Foams Listings, Group II, Subgroup A

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
Pyrell 4.0, Dark Grey	Stephenson & Lawyer	N/A	1.00	P	F	P	99-0747
CR Safguard Medium, Blue	Chestnut Ridge Foam	N/A	1.00	P	F	P	99-0541
Pyrell #4 Foam	Foamex International	N/A	0.5	NT	NT	NT	04-0102

3.1.3 Group II, Subgroup B. These foams 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. See Table 7.

Table 7. Foams Listings, Group II, Subgroup B

Trade Name	Manufacturer	Batch/Lot No.	Thk(in)	MMH	N_2H_4	N_20_4	TestNo.
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3.1.4 Group II, Subgroup C. These foams met the acceptance criteria for flammability resistance but not for electrostatic discharge. They may or may not be suitable for hypergolic exposure. See Table 8.

Table 8. Foams Listings, Group II, Subgroup C

Trade Name	Manufacturer	Batch/Lot No.	Thk(in)	MMH	N_2H_4	N_20_4	TestNo.
Poron BF-1000, White	Rogers Corp.	N/A	1.00	NT	NT	NT	99-0495
Pyrell 2.0, Light Grey	Stephenson & Lawyer	N/A	1.00	NT	NT	NT	99-0747
Thermax Foam (bare; regular w/ GE 3402; HDP w/GE SCM 3402)	Dow	N/A	1.0; 1.1; 1.1	NT	NT	NT	04-0024
Formawall Panel, white, W/22/66	Centria Formawall	N/A	1.97	NT	NT	NT	04-0673
ArmaSport MC Foam Pad	Armacell	N/A	0.55	F	P	P	07-0393
Foam Pad P/N R16410	Saint Gobain	N/A	0.09	P	P	P	07-0358

4. ADHESIVE TAPES LISTINGS

The adhesive tapes listings are composed of various adhesive tapes (plastic, rubber, fabric, or composite construction) that 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 resistance. The test methods used in these evaluations include the following:

a) Flammability. NASA-STD-(I)-6001A, Test 1, Upward Flame Propagation

b) Electrostatic Discharge. KSC/MMA-1985-79, Standard Test Method for Evaluating Triboelectric Charge and Decay

c) Hypergolic Ignition/Breakthrough. NASA-STD-(I)-6001A, 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)

4.1 ADHESIVE TAPES CATEGORIES AND TEST RESULTS.

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

4.1.1 Group I. These adhesive tapes met all of the acceptance criteria for flammability resistance, electrostatic discharge for an environment that has a relative humidity of not less than 30%, and hypergolic ignition resistance. See Table 9.

Table 9. Adhesive Tapes Listings, Group I

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	TestNo.
Orcotape OT-16	Orcon Corporation	2828	0.005	99-0858
Orcotape OT-16A	Orcon Corporation	5463	0.003	03-0051
Scotch 363LC	3M	3931201	0.006	00-0182
363LC High Temperature Tape	3M	3634402801	0.008	04-0155
363LC High Temperature Tape	3M	3634403301	0.008	04-0155
363 LC Pressure Sensitive Tape	3M	4406201	0.006	05-0112

4.1.2 Group II, Subgroup A. These adhesive tapes met the acceptance criteria for flammability resistance and electrostatic discharge for an environment that has a relative humidity of not less than 30%. They may or may not be suitable for hypergolic exposure. See Table 10.

Table 10. Adhesive Tapes Listings, Group II, Subgroup A

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	TestNo.
2925-7 Glass-Foil Tape	Saint Gobain Performance Plastics	4021126	0.008	NT	F	NT	04-0127
Orcotape OT-16A	Orcon Corp.	6026	0.006	NT	NT	NT	04-0237
Orcotape OT-16A	Orcon Corp.	14552	0.006	NT	NT	NT	06-0355
Orcotape OT-16A	Orcon Corp.	10551	0.005	NT	NT	NT	06-0355
Orcotape OT-16A	Orcon Corp.	15300	0.005	NT	NT	NT	06-0539
Orcotape OT-16A	Orcon Corp.	16315	0.005	NT	NT	NT	07-0132
Scotch 363LC Adhesive Tape	3M	4522201	0.007	NT	NT	NT	06-0143
363LC Adhesive Tape	3M	45299-01	0.007	NT	NT	NT	06-0538
363LC Adhesive Tape	3M	46334-1	0.008	NT	NT	NT	07-0106

4.1.3 Group II, Subgroup B. These adhesive tapes 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. See Table 11.

Table 11. Adhesive Tapes Listings, Group II, Subgroup B

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
Solder Mask Tape 42	3M	N/A	0.003	NT	NT	NT	00-0371

4.1.4 Group II, Subgroup C. These adhesive tapes met the acceptance criteria for flammability resistance but not for electrostatic discharge. They may or may not be suitable for hypergolic exposure. See Table 12.

Table 12. Adhesive Tapes Listings, Group II, Subgroup C

Trade Name	Manufacturer	Batch/Lot No.	Thk (in)	MMH	N_2H_4	N_20_4	Test No.
Temp-R-Tape Kapton K102	Furon/CHR Industries	N/A	0.002	NT	NT	NT	99-0452
Scotch 364	3M	3245	0.009	P	F	P	00-0300
Tape, Product 953	Scarpa	N/A	0.003	NT	NT	NT	04-0457
Paint Replacement Tape #5004	3M	N/A	0.07	NT	NT	NT	04-0016