PLASTEC REPORT 25

COMPATIBILITY OF PLASTICS WITH LIQUID PROPELLANTS, FUELS AND OXIDIZERS

JANUARY 1966

PLASTEC

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DOVER, NEW JERSEY

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by

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JANUARY 1966

Plastics Technical Evaluation Center

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ABSTRACT

Much has been published on the subject of the compatibility of plastics with liquid propellants, fuels and oxidizers, but invariable from the standpoint of the propellant or fuel. This report is a rearrangement of the published compatibility data from the standpoint of the plastic material. It is in the form of a tabulation, with primary arrangement by plastic (or elastomeric) material; and thereunder, by fuel. All arrangements are alphabetical, in the form given in the original reference; that is, either by generic or trade designation. The compatibility evaluation is in terms of the original document, briefly culled to show behavior of the material at a given temperature and for a given time. Elastomers are included (although they are not a stated concern of PLASTEC); but oils, lubricants and greases are omitted, even though based on polymers. The information has been drawn from 43 references, which are annotated so that the information extracted from them shall have additional significance.

CONTENTS

Mention of a particular commercial product neither constitutes an endorsement by the Plastics Technical Evaluation Center, nor a voucher for the accuracy of a manufacturer's claim unless specifically noted.

SECTION 1. INTRODUCTION

This work had its inception some four years ago, when inquiry was made of the Center for information on the behavior of particular plastics when in contact with liquid propellants. Preparation of a response required search among existing documents, all of which were organized from the standpoint of the propellant or fuel in relation to materials in general. To arrive at even a simple answer, the effort entailed was far out of proportion and the end result could not be expressed in other than general and tentative terms.

With repeated inquiries of this nature, it was decided to convert all available liquid propellant compatibility data to the plastics standpoint; in other words, to convert what the propellant is compatible with to what the plastic is compatible with. In the conversion, in-between compatibility and incompatibility have been included. Thus, this document is an exhaustive effort to tell everything that anyone has published (unclassified) about the particular plastics as they behave in the presence of liquid propellants and related fuels.

Although not within the purlieu of the Center, elastomers were included in the search. However, polymer-based oils, lubricants and greases were passed over, even though the temptation to include them was great. The Center is virtually confined to solid plastic materials studies, or nonsolid materials (resins) on their way to becoming solid plastics.

It is recognized that the perfect report on this subject would contain two parts: from the standpoint of the plastic, and from the standpoint of the fuel. The size of the former (plastic) compilation is so great that it virtually precludes the addition of the latter (fuel) arrangement. This latter would be more of a convenience than a necessity, since the "fuel" arrangement is always available in the published literature, even though scattered.

This search has been confined to unclassified publications, in line with a general policy of the Center - to give its output the possibility of the widest dissemination. This is particularly justifiable in this case, since the classified work is largely confined to fuels under development. It is felt, however, that this rehashing of "old" data may be of particular help to the worker on classified projects.

No report on compatibility is complete without a precautionary note on the use of such data. Compatibility evaluations are only valid for the material studied. Only when a material is tied-down by a manufacturer's identification number, or by a precise and unwavering chemical formulation, can a value approach validity. However, this compilation has definite value for the explorer (as against the user) in that the side-by-side presentation of the findings of a number of investigators has an undeniable impact. For example, the finding on "*******" in contact with 50/50 Fuel blend may be: Class D, decomposed; Grade 3, blistered; Class D, Shore A decrease 25 units; Class C, tensile loss 73.8%, et cetera. On the other hand, "******" may have produced

these evaluations: Class A, no visible change; Grade 1, slight swelling but recovered; Class 2, fuel discolored; et cetera. It can be seen that the bits of information are quite valid, when combined; and that the reader will know what his chances are.

SECTION 2. ORGANIZATION

The body of this report is a tabulation of the found data under four headings: "Material" (either plastic or elastomer); "Fuel" (propellant, fuel or oxidizer with which the contact was made); "Behavior" (briefly, the kind of reaction which took place at a stated temperature for a certain length of time); and "Reference" (from which the information came).

A great deal of the information found used trade designations for identification of the plastic or elastomeric materials. These have been carried over into this report. In cases in which the trade designation was not further identified by the author of the report or could not be satisfactorily identified at the Center, the item was discarded as of questionable value to anyone. For completeness of reference, the generic name is included - for example: Polyethylene - See also "********", "*******", and "********".

The materials are alphabetized within the tabulation, by the given name (either trade or generic, as applicable). Within this frame, the fuels are further alphabetized so that for "********" there will be presented its behavior with Aerozine 50, ammonia, 50/50 fuel blend, hydrazine, IRFNA, nitrogen tetroxide, oxygen, pentaborane, RFNA, and UDMH (and other fuels, propellants, or oxidizers appropriately alphabetized among these). This secondary organization will help the reader in locating what plastic or elastomer is compatible with a certain fuel, to the extent that it will make it easier for him to scan the "Fuel" column.

The references are those reports from which the data came. These are presented in quite complete form at the end of this report. They are annotated to include the available identification of the materials studied, and the presentation of any special basis for evaluation ("Class" or "Grade" used for certain reactions). A "Comment" section giving the general viewpoint of the work reported is included.

This work has been a long-time side effort of the Center. Consequently, the compilation represents (in some cases) original reports and revisions or later versions (Refs 4 and 4B; Refs 2 and 39). When these appeared, the new facts were evaluated and added to the body of data without removal of the older items. Thus, in the "Behavior" cited in this

work, exposures for short term (from original report) and long term (from revised report) will both be given. In the total picture, all bits of information are of value.

The reader will note, in the particular references, that the "Grade" or "Class" evaluations are always in the same directions. That is, the lowest grade or class denotes compatibility ("A" or "1") and the increase in grade or class denotes lessened potential for compatibility ("C" or "3"). This makes scanning of the tabulation easier. However, for exactly what the author meant by the particular grade or class, the reader must turn to the reference.

Support information is presented in the appendixes. Appendix A lists and identifies the trade designations appearing in this report. Appendix B summarizes the liquid propellants, fuels and oxidizers encountered in the search, which are variously mentioned in conjunction with their contact behavior with plastics and elastomers.

MATERIAL	FUEL	BEHAVIOR	REF
A			
Aclar 191	Nitrogen tetroxide (<.2% moist)	Class 1, to 67 F	39
Acrylic	Hydrocarbon fuel	Unsatisfactory	3
Acrylic fibers - See "Orlon"			
Acrylic nitrocellulose, coating	50-50 Fuel blend	Class D, dissolved	4B
Acrylic nitrocellulose, paint	" " "	Class D (60 F, 30 d.)	4
Acrylic nitrocellulose, coating	Nitrogen tetroxide	Class D, stripped immediately	4B
Acrylic nitrocellulose, paint	" " "	Class D, 60 F, 30 d.	4
Acrylic nitrocellulose, seals	" " "	Grade 3	5-7
Acrylic nitrocellulose	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Acrylic resin w/aromatic hydrocarbons	Oxygen, liquid	Impact; 2/3 @ 10 KgM	32
Acrylic resin - See also "Lucite"			
Acrylic rubber - See "Acrylon"			
Acrylon felt	Oxygen	Grade 2	5-2
Acrylon rubber BA-12 and EA-5	Hydrogen peroxide, 90%	Class 4 at 150 F	39
" " " " "	RFNA	Poor resistance; failed after 1 hr. at 80 F.	27
Acrylon rubber BA-12	Hydrogen peroxide (conc)	Class 4 - Unacceptable	8
Acrylonitrile-butadiene-styrene - See "Cycolac"			
Acrylonitrile-butadiene 1000x132	Oxygen, liquid	Insensitive, impact (70 ft-lb, 1/20)	37
Acrylonitrile rubber	RFNA	Class 4 at 75 F	39
Adiprene B1156 and B1157	50/50 Fuel blend	Class 4, at 100 F	39
" " " " "	UDMH	Class 4, poor	8
Adiprene C	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Adiprene "L", sprayable	Oxygen, liquid	Impact, very sensitive (9/10)	18
Alathon	UDMH (liquid)	Class 1, 80 F	2
Alkyd coatings - See also "Glyptal"			
Alkyd No. 4, paint	50-50 Fuel blend	Class D, (60 F, 30 d.)	4
Alkyd No. 4, coating	" " "	Class D, stripped off	4B
Alkyd No. 4, coating	Nitrogen tetroxide	Class D, stripped immediately	4B
Alkyd No. 4, seals	" " "	Grade 3	5-7
Alkyd No. 4, paint	" " "	Class D (60 F, 30 d.)	4
Alkyd No. 4	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Alkyd enamel	Perchloryl fluoride, gaseous, dry	Class 4 at 390 F	2, 39
Alkyd resins	" " "	Class 4 at 390 F	2, 39
Alkyd resins - See also "Plaskon"			
Allyl chloride	Pentaborane	Grade 3, shock sensitive	5-6
Allyl resins	RFNA	Class 4 at 75 F	39
Aniline formaldehyde	"	Class 4 at 75 F	39
Araldite 502 (epoxy)	U-DETA	Unsatisfactory	12
Araldite/Thiokol	U-DETA	Unsatisfactory	12
Armalon	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Armalon sheet	Oxygen	Grade 1 5	5-2
Armalon coated fabric	Mixed amines	No apparent effect (7 d. @ RT)	38
Armalon - FEP dispersion coated glass	Oxygen, liquid	Impact (0/20 @ 10 KgM)	32
Armalon TFE Felt	50/50 Fuel blend	Class C (90 d. @ 55-60 F; 2% H_2); fuel discolored brown	40
" " "	Fluorine (gaseous)	Wt. loss; ignited during exposure to F_2	20
" " "	50/50 Hydrazine/UDMH	Class 3, incompatible	8
" " "	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Armalon 7700; 7700B	Aerozine 50	Satisfactory	21
Armalon 7700 impregnated with Teflon fibers	50/50 Fuel blend	Class C (60 F, 90 d.)	4
Armalon 7700B impregnated with Teflon fibers	" " "	Class A (60 F, 90 d.)	4
Armalon 7700 and 7700B impregnated with Teflon fibers	" " "	Class C, fuel discolored	4B
Armalon 7700 impregnated with Teflon fibers	Hydrazine family	Grade 3	5-5
Armalon 7700B impregnated with Teflon fibers	" " "	Grade 1	5-5
rmalon 7700	50/50 Hydrazine/UDMH	Class 2, limited service	8
malon 7700B	" " " "	Class 1, general service	8
lon 7700	50/50 Fuel blend	Class C (90 d. @ 55-60 F; 2% H_2); fuel discolored brown	40

MATERIAL	FUEL	BEHAVIOR	REF
A			
Armalon 7700B	50/50 Fuel blend	Class A (90 d. @ 55-60 F; 2% H_2O)	40
Armalon 7700 and 7700B with Teflon fibers	" " "	Class 3, to 60 F	39
Armalon 7700; 7700B	Nitrogen tetroxide	Satisfactory	21
" " " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F Class 2, to 60 F	39
Armalon 7700B	Nitrogen tetroxide, liquid	Class A, (90 d. @ 55-60 F)	40
Armalon 7700 and 7700B impregnated with Teflon	Nitrogen tetroxide	Class A (60 F, 90 d.)	4
Armalon 7700 impregnated with Teflon fibers	" " "	Class B, Shore A decrease 4 units, sample slightly yellow (90 d.)	4B
Armalon 7700B impregnated with Teflon fibers	" " "	Class B, Shore A increase 5 units, 1.5% shrinkage (180 d.)	4B
Armalon 7700 & 7700B impregnated with Teflon fibers	" " "	Grade 1	5-7
Armalon PDX 7700	FLOX-40 (40% F_2-60%O_2) gaseous	Class 4 at RT	39
Armalon PDX 7700 (B)	Oxygen, liquid	Suitable	8
Asbestos, braided, impregnated with Teflon	Hydrazine	Satisfactory	1, 3
Asbestos impregnated with Teflon (pump packing)	Hydrazine family	Grade 2	5-5
Asbestos impregnated with Teflon	Liquid hydrogen	Satisfactory	1, 3, 11
Asbestos impregnated with Teflon	Hydrogen liquid and cold gas	Grade 1	5-11
" " " " "	Hydrogen, ambient gas	Grade 1	5-11
B			
Bakelite	Hi-Cal 3	Class 2, no change at 120 F	2, 39
"	Hydrogen, liquid	Compatible for long term applications	8, 40
"	" " "	Class 1 or 2	2
"	Hydrogen, liquid and cold gas	Grade 1	5-11
	Hydrogen, ambient gas	Grade 1*	5-11
	*Not based on test results		
Bakelite DPDB-6169	Nitrogen tetroxide (liquid)	Compatible, possibilities for use as o-ring seal	25
Bakelite	N-Propyl nitrate	Satisfactory	1+3
Boltron 6200 (gray)	Hydrogen peroxide, 90%	Class 2 at 150 F, limited	8, 39
Buna rubber	Halogen fluoride family	Grade 3	5-8
Buna rubber	Boron hydride family	Grade 3	5-6
Buna A	Liquid oxygen	Impact; (2/3 @ 10 KgM)	32
Buna N	Aerozine 50	Unsatisfactory	21
"	Anhydrous ammonia	1.9% swell (7 d. @ RT)	33
"	" " " "	1.4% swell (7 d. @ 160 F)	33
"	Ethylene oxide	Ambient temp, intermittent use	3
"	50-50 Fuel blend	Class D, sample blistered (30 d.)	4B
"	" " "	Class D, crystals on specimen (1 d.)	4B
"	" " "	Class 3 (60 F, 30 d.)	4
"	" " "	70% loss in ultimate tensile (4 mo.)	16
Buna N, Parker N413-7	50/50 Hydrazine/UDMH	Class 2, limited service	8
Buna N	Hydrazine	Incompatibility	23
"	"	Class 2, 80 F	2
"	Hydrazine family	Grade 3	5-5
"	Hydrazine, liquid	Class 2 at 80 F Class 3 at 120 F	39
"	Hydrocarbon fuels	Satisfactory	1, 3
"	Hydrogen, liquid and cold gas	Grade 3 (not based on test results)	5-11
"	Hydrogen, ambient gas	Grade 1	5-11
"	Hydrogen peroxide, 90%	Class 4 at 150 F, unacceptable	3, 8, 39
"	JP/X	21% swell, 53% swell (21 d. @ RT)	33
"	"	47% swell (60 min. @ 350 F)	33
"	"	7% swell (60 min. @ 400 F)	33

MATERIAL	FUEL	BEHAVIOR	REF
B			
Buna N	Nitrogen tetroxide	Class D, dissolved, 60 F	4, 4B
"	" " " "	Grade 3	5-7
"	" " " "	Incompatible	8, 21, 30
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
"	Oxygen, liquid	Incompatible	8
"	" "	Impact, sensitive (3/6)	18
"	" "	Insensitive, impact (0/10),40 ft-lb	33
"	" "	Slightly sensitive, impact (2/10), 40 ft-lb	33
"	" "	Sensitive, impact (4/10), 40 ft-lb	33
"	" "	Sensitive, impact (4/10), 50 ft-lb	33
"	" "	Very sensitive (10/10) - 50 ft-lb	33
Buna N, base sealant (HT-1)	Oxygen, liquid	Impact, very sensitive	18
Buna N	U-DETA (MAF-4)	Unsatisfactory	8
"	UDMH (vapor)	Class 4, 75 F	2
"	UDMH (liquid)	Class 4, 32 F	2
Buna N - B. F. Goodrich, Hycar 2202, 1043 std. #1, 1001	UDMH	Class 2, good	8
Buna N - B. F. Goodrich, Hycar G 41	"	Class 4, poor	8
Buna N - Melrath Gasket and Supply, Chemigum N6 12 and SL	"	Class 4, poor	8
Buna S	UDMH (liquid)	Class 4, 75 F	2
Buna S	Hydrogen peroxide	Class 4	3
Butyl, brominated - See "Hycar 2202"			
Butadiene-acrylonitrile - See also "Hycar 1000x88; 1000x132; 1001; 1011; 1014' 1041"			
Butadiene-styrene rubber - See "GRS"			
Butyl, Enjay, 268, Enjay 551	Aerozine 50	Unsatisfactory	21
Butyl, 805-70 and 1357	" "	10% swell, poor compression set; bleeds into fuel; blistered after 60 d. at 75 F	10
Butyl elastomer, 823-70	Aerozine 50 (dynamic or static extended service)	10% swell	10, 10A
Butyl elastomer, 9257 and 9357	Aerozine 50 (dynamic or static extended service)	Poor compression, set, 10% swell	10, 10A
Butyl elastomer, B480-7	" " " "	Poor compression set, 10% swell	10, 10A
Butyl, Parker B496-7	Aerozine 50	Compatible for long term applications (test temp 160 F)	40
Butyl, Hadbar XB800-71	" "	Compatible for long term applications (test temp 160 F)	40
Butyl rubber	Ammonia (dry)	Class 2, 75 F;	2
		Class 4, Hot	2
" "	Ammonia, gaseous	Class 2, to 75 F	39
		Class 4 at Hot	
" "	Ammonia, anhydrous, dry, ambient temp	Class 2, limited	8
" "	Ammonia, anhydrous: Liquid	Grade 2	5-12
	Gas (< 250 F)	Grade 2	5-12
" "	Ammonia, anhydrous	1% swell (7 d. @ RT)	33
	" " " "	1% swell (7 d. @ 160 F)	33
" "	Aniline	Satisfactory	3
" "	Boron hydride family	Grade 3	5-6
" "	Ethylene oxide	20.2% swell (7 d. @ 160 F)	33
" "	50/50 Fuel blend	Retains 85% of ultimate tensile	16
Butyl, Enjay 035	" " "	Class 1, to 80 F	39
		Class 2, to 75 F	
		Class 4 at 80 F	
Butyl, Enjay 218	" " "	Class 2, to 140 F	39
		Class 4 at 160 F	
Butyl, Enjay 268	" " "	Class 4 at 60 F	39
" " "	" " "	Class A (30 d. @ 50-60 F)	4B
" " "	" " "	Class C, 60 F, 30 d.	4
" " "	" " "	Class C, fuel discolored (90 d. @ 50-60 F)	4B
" " "	" " "	Class D, fuel discolored; Shore A decrease 12 units (180 d. @ 50-60 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
B			
Butyl, Enjay 551	50/50 Fuel blend	Class B, Shore A decrease 6 units (30 d. @ 55-60 F)	4B
" " "	" " "	Class C, fuel discolored yellow with white precipitate (90 d. @ 55-60 F)	4B
" " "	" " "	Class C (60 F, 30 d.)	4
" " "	" " "	Class 3, to 60 F	39
Butyl, Enjay, CR 617	" " "	Class 2, to 85 F	39
Butyl, Goshen 1357	50-50 Fuel blend	Class B, Shore A decrease 10 units (5 d. @ 70-80 F)	4B
" " "	" " "	Class C, Shore A decrease 9 units, fuel dark amber (100 d. @ 70-80F)	4B
" " "	" " "	Class D (80 F, 68 d.)	4
" " "	" " "	Class C, heavy precipitate extracted tensile loss 28.5% (2 d. @ 160 F)	4B
" " "	" " "	Class C (160 F 30 d.)	4
Butyl, Hadbar XB800-71	" " "	Class A, tensile loss 6.8% (30 d. @ 160 F)	4B
Butyl, Linear 7806-70	" " "	Class D, salts formed, Shore D decrease 13 units (7 d. @ 70-80 F)	4B
" " " "	" " "	Class D, precipitate extracted, cracked (30 d. @ 160 F)	4, 4B
Butyl, Parco 805-70	" " "	Class B (1 d. @ 70-80 F)	4B
" " " "	" " "	Class B, fuel dark amber (16 d. @ 70-80 F)	4B
" " " "	" " "	Class D (68 d. @ 70-80 F) softened, fuel discolored amber	40
" " " "	" " "	Class D (80 F, 68 d.)	4
" " " "	50/50 Fuel blend	Class C, precipitate extracted, tensile loss 28.8%, hardness not measured (2 d. @ 160 F)	4B
Butyl, Parco 823-70	" " "	Class B, Shore A decrease 8 units (1 d. @ 70-80 F)	4B
" " " "	" " "	Class C, precipitate extracted (27 d. @ 70-80 F)	4B
" " " "	" " "	Class B (142 d. @ 70-80 F) softened	40
" " " "	" " "	Class B (80 F, 142 d.)	4
Butyl, Parker 318-70	" " "	Class C, heavy precipitate extracted, tensile loss 29.7% (1 d. @ 160 F)	4B
" " " "	" " "	Class C (160 F, 30 d.)	4
Butyl, Parker B480-7	" " "	Class A (2 d. @ 70-80 F)	4B
" " " "	" " "	Class C, Shore A decrease 10 units, precipitate extracted (30 d. @ 70-80 F)	4B
" " " "	" " "	Class D, Shore A decrease 17 units (365 d. @ 70-80 F)	4B
" " " "	" " "	Class D (60 F, 162 d.)	4
" " " "	" " "	Class D, tacky and flowed (7 d. @ 160 F)	4B
Butyl, Parker B 496-7	" " "	Class C, white crystals (90 d. @ 55-60 F)	4B
		Class A, tensile loss 11.4% (30 d. @ 160 F)	4, 4B
Butyl, Parker XB 800-71	" " "	Class A (160 F, 30 d.)	4
Butyl Precision 214-907-9	" " "	Class D, violent reaction (1 d. @ 160 F)	4, 4B
" " " " "	" " "	Class D, slight reaction (7 d. @ 70-80 F)	4, 4B
Butyl, Precision 9257, 9357	" " "	Class B (50 d. @ 70-80 F) softened	4, 4B
Butyl, Precision 9357	" " "	Class D, Shore A decrease 11 units	4B
Butyl, Precision 9257	50-50 Fuel blend	Class D, Shore A decrease 12 units	4B
Butyl, Precision 940 x 559	" " "	Class A (151 d. @ 70-80 F)	4B
" " " " "	" " "	Class D, blistered (7 d. @ 160 F)	4B
Butyl, Formula 120 (resin cured) (Thiokol-RM Div)	" " "	Class C, precipitate formed (5 d. A 160 F)	4B
Butyl, Formula 121 (resin cured) (Thiokol-RM Div)	" " "	Class C, precipitate formed (5 d. @ 160 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
B			
Butyl, Stillman SR 613-75	50-50 Fuel blend	Class B, Shore A decrease 10 units (90 d. @ 55-60 F)	4B
" " " " "	" " "	Class B, softened (540 d. @ 70-80 F)	4, 4B
" " " " "	" " "	Class C, heavy precipitate extracted, tensile loss 16% (30 d. @ 160 F)	4, 4B
Butyl, Cohrlastic 500	50/50 Hydrazine/UDMH	Class 1, general service	8
Butyl, EC 847 (adhesive)	" " " "	Class 3, incompatible	8
Butyl, Enjay 551; Enjay No. 218 (cured with W/SP 1055)	" " " "	Class 1, general service	8
Butyl, Enjay 62790	" " " "	Class 1, general service	8
Butyl, Fairprene 5159	" " " "	Class 3, incompatible	8
Butyl, Firestone D-432	" " " "	Class 1, general service	8
Butyl, Goshen 1357	" " " "	Class 3, incompatible	8
Butyl, Linear 7247-70 and 7446-70	" " " "	Class 2, limited service	8
Butyl, Linear 8441-50	" " " "	Class 1, general service	8
Butyl, Parco 805-70	" " " "	Class 3, incompatible	8
Butyl, Parco 823-70	" " " "	Class 1, general service	8
Butyl, Parco TC 823-70; Parco 838-80; Parco TC 419-16; Parco TC 419-17; Parco TC 419-8	" " " "	Class 2, limited service	8
Butyl, Precision 9257 and 9357	" " " "	Class 2, limited service	8
Butyl, Parker B480-7	" " " "	Class 2, limited service	8
Butyl, Stillman 613-75	" " " "	Class 2, limited service	8
Butyl rubber	Halogen fluoride family	Grade 3	5-8
" "	Hydrazine family	Grade 2	5-5
" "	Hydrazine-type fuels	Fair	25
Butyl rubber (specific formulation)	" " " "	Compatible	26
Butyl elastomer, Parco 838-80	Hydrazine /MMH/water fuel blend (4:1:1)	Satisfactory after 3 weeks	14
Butyl rubber, Compound 805-70	Hydrazine, liquid	Class 1, to 140 F	39
Butyl rubber	Hydrogen: Liquid and cold gas	Grade 3	5-11
	Ambient gas	Grade 1	5-11
Butyl A-3405 and SR-384	Hydrogen peroxide, 90%	Class 4 @ 150 F	39
Butyl rubber	JP-4 Fuel	Deleteriously affected at RT	27
Butyl 218	JP-X Fuel	Excessive swell (7 d. @ RT)	34
Butyl rubber	Mixed amines	No apparent effect (7 d. @ RT)	38
" "	" "	Stiffened (7 d. @ RT)	38
Butyl coated cotton airplane cloth (white)	" "	No apparent effect (7 d. @ RT)	38
Butyl coated cotton airplane cloth (black)	" "	No apparent effect (7 d. @ RT)	38
Butyl rubber - Vistanex	" "	No apparent effect (7 d. @ RT)	38
Butyl rubber	Nitrogen tetroxide	Incompatible; life of 1 to 2 days at 160 F	41
" "	" " "	30% volume increase; rapid and large drop in ultimate tensile	16
" "	" " "	Grade 3	5-7
" "	" " "	Not chemically compatible	8
Butyl rubber (very low saturation)	Nitrogen tetroxide	Retains properties to fair degree (4 wks. immersion) while maintaining low volume swell.	25
Butyl, Enjay	" " "	Class D, severe	14A
Butyl, Enjay 268; 551	" " "	Class D (65 F - 30 d.)	4
" " " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 65 F	39
Butyl, Enjay 268	Nitrogen tetroxide, liquid	Class D, (55-60 F) dissolved	40
" " "	Nitrogen tetroxide	Class D, dissolving (1 d. @ 65 F)	4B
" " "	" " "	Unsatisfactory	21
Butyl, (Enjay 551)	" " "	Class D, 40% volume swell	4B
" " "	" " "	Unsatisfactory	21
Butyl, Formula 120 (resin cured) (Thiokol, RM Div)	" " "	Class D, 55% volume swell in 2 hr (63-67 F)	4B
Butyl, Formula 121 (resin cured) (Thiokol, RM Div)	" " "	Class D, 64% volume swell in 2 hr (63 -67 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
B			
Butyl, Formula 120 and 121 (Thiokol, RM Div)	Nitrogen tetroxide (<.2% moist)	Class 4 at 67 F	39
Butyl, 3M-11092-3A	Nitrogen tetroxide	Class D, Shore D decrease 14 units (1 d. @ 70-80 F)	4B
Butyl, Parco TC-419-19A	" " "	Class D, Shore D decrease 28 units (1 d. @ 70-80 F)	4B
Butyl, Parco 805-70	" " "	Class D, blistered in 4 hr (70-80 F)	4B
" " " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Butyl, Parco 846-80	Nitrogen tetroxide	Class D, 35% volume swell (1 d. @ 65 F)	4B
" " " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 65 F	39
Butyl, Parker 77-545	" " "	Class 4 at 60 F	39
Butyl, Parker V494-7	" " "	Class 4 at 67 F	39
Butyl, Parker B496-7	Nitrogen tetroxide	Class D, dissolving in 1 hr (70-80 F)	4B
" " " "	" " "	Compatible for short term usage	28
Butyl, Parker B496-7; XB-1235-10	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Butyl, Parker 805-70	Nitrogen tetroxide	Class D (65 F, 7 d.)	4
" " " "	Nitrogen tetroxide, liquid	Class D (7 d. @ 55-65 F) became tacky	40
Butyl, Parker XB-1235-10	Nitrogen tetroxide	Class D, 63% volume swell, Shore A decrease 50 units (7 d. @ 70-80 F)	4B
Butyl, Parker XV-1235-2 and XV-1235-5	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Butyl, Parker KB-1235-10	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Butyl, Precision 1330 x 20	Nitrogen tetroxide	Class D, became tacky (7 d. @ 70)	4B
" " " " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 70 F	39
Butyl, Stillman SR 613-75	Nitrogen tetroxide	Class D, sample flowed in 3 hr (65 F)	4B
Butyl rubber, protective coating	Oxidizers (general)	Undergoes slight attack, but substrate is protected	16
Butyl rubber	Oxygen, liquid	Incompatible	8
" "	" " "	Impact, violent detonation	18
Butyl Fairprene	" " "	Impact; (4/6 @ 10 KgM)	32
Butyl rubber	Pentaborane	Incompatible	8, 22
Butyl rubber (with carbon)	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Butyl, brominated	N-propyl nitrate	Sample dispersed (7 d. @ 160 F)	34
Butyl, chlorobutyl, MD 551	" " "	Sample dispersed (7 d. @ 160 F)	34
Butyl, Enjay 035	" " "	Fell apart (7 d. @ RT)	34
Butyl, Enjay 218	" " "	Shore A, loss - 11 to 46; 45% swell, to excessive (7 d. @ RT)	34
" " "	" " "	Fell apart (7 d. @ RT)	34
Butyl, Enjay 325	" " "	Shore A, loss - 22; 28% swell (1 d. @ 160 F)	34
Butyl, Enjay 325	Propyl nitrate	Shore A, loss - 4 to 58; 45% to 76% swell (7 d. @ 160 F)	34
Butyl, Enjay 218 (and w/fillers)	RFNA	Severely attacked at room temperature	27
Butyl, Fairprene	U-DETA (MAF-4)	Satisfactory	8
Butyl rubber	UDMH (Liquid or vapor)	Class 3, 75 F, Class 4, 130 F	8
Butyl rubbers (certain)	UDMH	Satisfactory	3
Butyl (resin cured)	"	16% swell (21 d. @ RT)	33
" " "	"	16% swell (14 d. @ 160 F)	33
Butyl, Chicago Rawhide-Sivrene 9623 and 9617	"	Class 2, good	8
Butyl, Chicago Rawhide-Sivrene 9694 and 20316	"	Class 3, fair	8
Butyl, Chlorobutyl, MD 551	"	Shore A, from gain - 1 to loss - 11; 14% to 16% swell (7 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
B			
Butyl, chlorobutyl, MD 551	UDMH	Shore A, loss - 23; 24% swell (7 d. @ 160 F)	34
Butyl, Conn Hard Rubber 3601	"	Class 2, good	8
Butyl, Enjay 218	"	Shore A, loss of 1 to 24 (7 d. @ @ RT)	34
" " "	"	Shore A, loss of 8 to 24 (14 d. @ RT)	34
" " "	"	Shore A, loss of 8 to 24 (21 d. @ RT)	34
" " "	"	Shore A, loss of 7 and 10 (42 d. @ RT)	34
" " "	"	Shore A, loss of 6 and 7 (84 d. @ RT)	34
" " "	"	Shore A, loss of 12 to 30 (7 d. @ 160 F)	34
" " "	"	Shore A, loss of 12 to 19 (14 d. @ 160 F)	34
" " "	"	Shore A, loss of 1 and 14 (21 d. @ 160 F)	34
" " "	"	Shore A, loss of 35 (26 d. @ 160 F)	34
" " "	"	Shore A, loss of 10 and 15 (42 d. @ 160 F)	34
" " "	"	Shore A, loss of 15 and 16 (3 mo @ 160 F)	34
" " "	"	Shore A, loss of 6 and 15 (6 mo @ 160 F)	34
Butyl, Enjay 218	"	10% to 23% swell (7 d. @ RT)	34
" " "	"	12% to 17% swell (14 d. @ RT)	34
" " "	"	10% to 18% swell (21 d. @ RT)	34
" " "	"	9% and 11% swell (42 d. @ RT)	34
" " "	"	8% and 10% swell (84 d. @ RT)	34
" " "	"	16% to 23% swell (7 d. @ 160)	34
" " "	"	16% to 23% swell (14 d. @ 160 F)	34
" " "	"	18% swell (21 d. @ 160 F)	34
" " "	"	22% swell (26 d. @ 160 F)	34
" " "	"	11% and 16% swell (42 d. @ 160 F)	34
" " "	"	14% swell (3 mo @ 160 F)	34
" " "	"	14% and 19% swell (6 mo @ 160 F)	34
" " "	"	Shore A, loss - 16 to 25; 18% to 25% swell (60 min @ 350 F)	34
" " "	"	Shore A, loss - 21 to 34 25% to 50% swell (60 min @ 400 F)	34
Butyl, Enjay 035	"	11% and 12% swell (7 d. @ RT)	34
" " "	"	Shore A, loss of 6 and 8 (7 d. @ RT)	34
" " "	"	Shore A, loss of 3 to 29 (7 d. @ RT)	34
" " "	"	13% to 40% swell (7 d. @ RT)	34
Butyl, Firestone Rubber, D404 (Tellurac/sulfur cure)	"	Class 3, fair	8
Butyl, Firestone Rubber D430, D431, D432	"	Class 2, good	8
Butyl, Firestone rubber D408; Polyisobutylene (Tellurac/sulfur cure)	"	Class 3, fair	8
Butyl, Parker Appliance, 37-014 and 37-024	"	Class 2, good	8
Butyl, 905-70 and 905-90		Class 2, good	8
Butyl, Precision Rubber, 907-90 and 925-70	"	Class 2, good	8
Butyl, Precision	"	Shore A, loss of 32 (7 d. @ RT)	34
" "	"	21% swell (7 d. @ RT)	34
Butyl, Stillman Rubber, SR 613-75	"	Class 2, good	8
Butyl, Stoner Rubber, BR-55	"	Class 2, good	8
Butyl, Synthetic Rubber Products, 50223	"	Class 2, good	8

MATERIAL	FUEL	BEHAVIOR	REF
B			
Butyl, Thiokol Chemical, C 42986-1 and C 55935	UDMH	Class 2, good	8
Butyl rubber, phenolic, cured: Parker XB 1235-10	Aerozine 50	Unsatisfactory	21
" " " " " " "	Nitrogen tetroxide	Unsatisfactory	21
Butyl phenolic elastomer	" " "	Short term static service	10
Butyl-phenolic elastomer B496-7RV, 11092-3A	Nitrogen tetroxide (Dynamic or static short term service)	Predicted 7-day service	10A
Butyl-phenolic elastomer TC 419-19A	" " " "	Surface oxidation after 11-Day immersion	10A
Butyl-polyethylene Blends (Hi D.)	RFNA	Withstood 500 hr room temperature	27
C			
Capran 391 (Polyamide film)	Nitrogen tetroxide (<.2% moist)	Class 4 at 67 F	39
Carbon with plastic binders	Chlorine trifluoride	Incompatible	24
" " " " "	Halogen fluoride family	Grade 3	5-8
Carboxylnitroso terpolymer	Nitrogen tetroxide	Resistant (90 d. @ 165 F)	43
Cellulose	Perchloryl fluoride, dry	Class 4, 80 F	2
"	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
Cellulose 90 and 150	U-DETA	Unsatisfactory	12
Cellulose acetate - See also "Mystic tape"			
Cellulose acetate	Hydrazine, anhydrous	Incompatible (Class C)	8
" " "	Hydrazine, liquid	Class 4 at 75 F	39
" " "	Hydrazine hydrate	Incompatible, Class C	8
" " "	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
" " "	Perchloryl fluoride, dry	Class 4, 80 F	2
" " "	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
" " "	Propellant 113	Slight loss in weight	13
Cellulose acetate butyrate, Kodapak II	Nitrogen tetroxide	Class D, disintegrated (1 d. @ 70-80 F)	4B
Cellulose acetate butyrate - See also "Kodapak II"			
Cellulose acetate butyrate	Oxygen, liquid	Impact; 2/10, 9/20 @ 10 KgM	32
Cellulose compounds	RFNA	Class 4 at 75 F	39
Cellulose nitrate	Propellant 113	Slight loss in weight	13
Chemigum No. 12	50/50 Fuel blend	Class 4 at 100 F	39
Chemigum SL (urethane elastomer)	" " "	Class 4 at 75 F	39
Chemelic MT-411 (Teflon Fiberglas)	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Chlorinated polyether - See also "Penton"			
Chlorinated polyether	Nitrogen tetroxide	Slight chemical attack after 24 hours	10A
" " " "	" " "	May be impact-sensitive	10
Chlorinated polyether	Oxygen, liquid	Insensitive, impact (70 ft-lb, 0/20; 0/5)	37
Chlorinated rubber	RFNA	Class 3 to 75 F	39
Chlorofluorocarbon	Liquid oxygen	Impact; 0/20, 0/20, 0/20 @ 10 KgM	32
Chloroprene	Aerozine 50	Unsatisfactory	21
Chloroprene, Goshen 1168	50/50 Hydrazine/UDMH	Class 2, limited service	8
Chloroprene, Linear 7354-70	" " " "	Class 2, limited service	8
Chloroprene, Parco 347-90;318-70	" " " "	Class 2, limited service	8
Chloroprene	Nitrogen tetroxide	Unsatisfactory	21
" "	" " "	Class D, severe	14A
" "	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Coblastic 500 (Silicone)	Aerozine 50	Unsatisfactory	21
" " " " "	50-50 Fuel blend	Class D, Shore A increase 11 units (30 d. @ 55-60 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
C			
Cohrlastic 500 (Silicone)	50-50 Fuel blend	Class D (60 F, 90 d.)	4
" " " " "	Hydrazine family	Grade 3	5-5
" " " " "	Nitrogen tetroxide	Unsatisfactory	21
" " " " "	" " "	Grade 3	5-7
" " " " "	" " "	Class D, dissolved (30 d. @ 55-60 F)	4, 4B
" " " " "	Nitrogen tetroxide (< .2% moist)	Class 4 at 60 F	39
Co-Polymer P-200G, paint (Epoxy)	50/50 Fuel blend	Class D, 160 F	4
Co-Polymer P-200G, coating (Epoxy)	" " "	Class D, coating washed off within 3 min (160 F)	4B
Co-Polymer P-200G (Epoxy)	Nitrogen tetroxide	Grade 3	5-7
Co-Polymer P-200G, paint (Epoxy)	" " "	Class D, 75 F	4
Co-Polymer P-200G, coating (Epoxy)	" " "	Class D, dissolved in 2 min (75 F)	4B
Copper-braided Teflon	Fluoramine family: Gas	Grade 1	5-9
	Liquid	Grade 1	5-9
" " " "	Nitrogen trifluoride	Satisfactory in gaseous service	8
" " " "	Oxygen difluoride: Liquid	Grade 2	5-13
	Gas	Grade 2	5-13
Cordo plastic coating (E-1 resin + H-26 activator)	Hydrogen peroxide, 90%	Class 4 at room temperature	39
Cyanopropyl silicone	Nitrogen tetroxide	Incompatible	26
Cycolac (natural color) (acrylonitrite-butadiene-styrene)	Hydrogen peroxide, 90%	Class 4 at 150 F	39
D			
Dacron	50-50 Fuel blend	Broke up in 24 hrs	15
"	Hydrazine	Broke up in 24 hrs	15
"	Hydrogen, liquid	Satisfactory	1, 3
"	Hydrogen; Liq & cold gas	Grade 3*	5-11
	Ambient gas	Grade 1	5-11
	*Not based on test results		
Dacron cloth: Dac-2100; Dac-2101; Dac-2102	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Dacron	IRFNA	Disintegrated immediately	15
"	MON	Disintegrated immediately	15
"	Nitrogen tetroxide	Disintegrated immediately	15
Dacron felt	Oxygen	Grade 2	5-2
Dacron	Perchloryl fluoride, dry	Class 4, 80 F	2
"	Perchloryl fluoride, gaseous	Class 4 at 390 F	39
Dapon 35	Hydrazine, liquid	Class 4 at 140 F	39
Dapon 35, glass filled, and unfilled	50/50 Fuel blend	Class 2, to 75 F	39
" " " " " " "	UDMH	Class 2, good	8
Delrin	Aerozine 50	Unsatisfactory	21
"	50/50 Fuel blend	Class 4 at 60 F	39
"	" " "	Class D (60 F, 90 d.)	4
"	" " "	Class B, shrinks 7% (30 d. @ 55-60 F)	4B
"	" " "	Class D, shrinks 29%; Shore D decrease 19 units (90 d. @ 55-60 F)	4B
"	Hydrazine family	Grade 3	5-5
"	Nitrogen tetroxide	Unsatisfactory	21
"	" " "	Grade 3	5-7
"	" " "	Class D, severe	14A
"	" " "	Class D, reaction in 1 hr.	4B
"	" " "	Class D (55 F, 30 d.)	4
"	Nitrogen tetroxide (< .2% moist)	Class 4 at 60 F	39
Diallyl phthalate	Hydrazine, anhydrous	Incompatible, Class C	8
" " "	Hydrazine hydrate	Incompatible, Class C	8
" " "	Hydrazine hydrazine nitrate/water	Incompatible, Class C	8
" " "	RFNA	Class 4 at 75 F	39

MATERIAL	FUEL	BEHAVIOR	REF
D			
Diallyl phthalate	UDMH (liquid)	Class 4, 75 F	2
Disogrin	" "	Class 4, < 140 F	2
Dow Corning elastomer	Fluorine: Liquid	Grade 3	5-10
	Gas	Grade 3	5-10
" " " " "	Fluorine gas	Class 4, all temps.	2, 39
Duroid 5600 (fiber-reinforced Teflon)	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Duroid 5600	Oxygen	Spontaneous ignition temp - 470 C at 7500 psi; 468 C at 2000 psi	42
Duroid 5650	"	Spontaneous ignition temp - 444 C at 7500 psi; 461 C at 2000 psi	42
Duroid 5870	"	Spontaneous ignition temp - 463 C at 7500 psi; 452 C at 2000 psi	42
Duroid 5813	"	Spontaneous ignition temp - 463 C at 7500 psi; 463 C at 2000 psi	42
Dynamar (experimental polymer)	Nitrogen tetroxide	Incompatible	26
Dynel felt	Oxygen	Grade 2	5-2
E			
EPR, Ethylene propylene rubber, Formula 132	50-50 Fuel blend	Class A, volume swell, not measured (30 d. 160 F)	4B
EPR, Ethylene propylene rubber	Nitrogen tetrafluoride	Promising compatibility	26
EPR, Ethylene propylene rubber, Resistazine 74	Nitrogen tetroxide	Class C, discolored N_2O_4; softened (5 d. @ 65 F)	4B
EPR, Ethylene propylene rubber, Formula 132	" " "	Class A (3 d. @ 60 F)	4B
" " " " " " "	" " "	Class B, Shore A decrease 8 units (5 d. @ 60 F)	4B
" " " " " " "	" " "	Class D, Shore A decrease 16 units (7 d. @ 60 F)	4B
" " " " " " "	" " "	Class B, Shore A decrease 9 units (1 d. @ 68-72 F)	4B
" " " " " " "	" " "	Class D, degraded (5 d. @ 68-72 F)	4B
" " " " " " "	" " "	Class D, fell apart on handling (30 d. @ 63-67 F)	4B
EPR, Ethylene propylene rubber, X10	Nitrogen tetroxide	Class D, soft and gummy (4 d. @ 65 F)	4B
EPR, Ethylene propylene rubber, E-612-2	" " "	Class D, dissolved (4 d. @ 65 F)	4B
EPR, Ethylene propylene rubber, E-632-1	" " "	Class D, soft and gummy (7 d. @ 65 F)	4B
EPR, Ethylene propylene rubber, X-7000-1 thru 7 and 9 thru 11	" " "	Class D, dissolved (18 d. @ 63-67 F)	4B
EPR, Ethylene propylene rubber Formulas 116 and 117	" " "	Class D (80 F, 7 d.)	4
EPR Ethylene-propylene rubber	Perchloryl fluoride	Promising compatibility	26
Epocast	Oxygen	Grade 3	5-2
Epocast 202	Oxygen, liquid	Impact sensitive (3/10)	18
Epocast, potting resin 12	" " "	Impact sensitive (5/18)	18
Epoxidized olefin - See also "Oxiron"			
Epoxy - See also "Araldite", "CoPolymer P-200G", "Rezkiad"			
Epoxy cane resins - See also "Epon", "Epoxylite"			
Epoxy compounds - See also "Hysol"			
Epoxy EC847, EC1595, EC1598	Aerozine	Unsatisfactory	21
Epoxy: EC-1469, EC-1470, EC-1595, EC-1598, Epon VI W/A, Epon VIII W/A	Aerozine 50	No visible change in 24 hr immersion at 75 ±5 F.	10
Epoxy (adhesives & coatings) EC-1470, EC-1596, EC-1630, EC-1469	" "	No visible change (24 hr @ 75 F)	10A
Epoxy cement and filler	" "	No visible change (24 hr @ 75 F)	10A
Epoxy Epon 4-104, Epon 5-109-1, Epon 8-31, Epon 929, Epon VIII, W A	" "	No visible change (24 hr @ 75 F)	10A

MATERIAL	FUEL	BEHAVIOR	REF
E			
Epoxy: Epon 828, Epon VI, Epon VIII, Epon 422, Epon 901, Epon 1031, Epon EX1469	Aerozine 50	Unsatisfactory	21
Epoxy, modified, Epon 422, Epon YP-100	" "	No visible change (24 hr @ 75 F)	10A
Epoxy, modified, Epon 1031 W/BF_3-400	" "	No visible change (24 hr @ 75 F) other than slight softening	10A
Epoxy, novolac type, Epon 1031/BF_3	" "	Softened in 24 hr, 75 +5 F	10, 10A
Epoxy novolac (Dow)	" "	No change in appearance Wt change -+0.42% (7 d, @ 70 F)	36
Epoxy novolac Bisphenol A (Dow)	" "	No change in appearance, Wt change -+0.42% (7 d, @ 70 F)	36
Epoxy novolac, Bisphenol A (Shell)	" "	Rough surface (2 d, @ 70 F)	36
Epoxy novolac (Shell)	" "	Rough surface (2 d, @ 70 F)	36
Epoxy novolac, Bisphenol A (Dow)	" "	Appearance good (2 d, @ 70 F)	36
Epoxy novolac (Dow)	" "	Appearance good (2 d, @ 70 F)	36
" " " "	" "	Dissolved (7 d, @ 70 F)	36
Epoxy novolac resin system	" "	Good, no crazing (30 d, @ 60 F)	36A
		Fair, severe crazing (30 d, @ 100 F)	36A
Epoxy novolac/glass composite	" "	Fair, slight swelling (1 mo, @ 60 F)	36B
		Fair, slight delamination (1 mo, @ 100 F)	36B
Epoxy novolac	" "	Flexure, 97.0% ret (7 d, @ 60 F)	36C
" " "	" "	Flexure, 94.5% ret (30 d, @ 60 F)	36C
" " "	" "	Flexure, 83.5% ret (90 d, @ 60 F)	36C
" " "	" "	Flexure, 93.2% ret (7 d, @ 100 F)	36C
" " "	" "	Flexure, 34.9% ret (30 d, @ 100 F)	36C
" " "	" "	Flexure, 47.6% ret (90 d, @ 100 F)	36C
" " "	" "	Hardness, -5 change (7 d, @ 60 F)	36C
" " "	" "	Hardness, -8 change (30 d, @ 60 F)	36C
" " "	" "	Hardness, -5 change (90 d, @ 60 F)	36C
" " "	" "	Hardness, -5 change (7 d, @ 100 F)	36C
" " "	" "	Hardness, -10 change (30 d, @ 100 F)	36C
" " "	" "	Hardness, -16 change (90 d, @ 100 F)	36C
Epoxy, novolac/glass filament	" "	Shear, 69.2% ret (7 d, @ 60 F)	36C
" " " " " "	" "	Shear, 45.7% ret (30 d, @ 60 F)	36C
" " " " " "	" "	Shear, 34.6% ret (90 d, @ 60 F)	36C
" " " " " "	" "	Shear, 58.2% ret (7 d, @ 100 F)	36C
" " " " " "	" "	Shear, 31.7% ret (30 d, @ 100 F)	36C
" " " " " "	" "	Shear, 31.5% ret (90 d, @ 100 F)	36C
" " " " " "	" "	Flexure (long), 88.5% ret (7 d, @ 60 F)	36C
" " " " " "	" "	Flexure (long), 86.6% ret (30 d, @ 60 F)	36C
" " " " " "	" "	Flexure (long), 49.0% ret (90 d, @ 60 F)	36C
" " " " " "	" "	Flexure (long), 32.5% ret (7 d, @ 100 F)	36C
" " " " " "	" "	Flexure (long), 43.8% ret (30 d, @ 100 F)	36C
" " " " " "	" "	Flexure (long), 36.2% ret (90 d, @ 100 F)	36C
Epoxy Laminate	" "	Unsatisfactory	21
Epoxy, Epon, Haveg 41	Ammonia, gaseous	Class 1, to 212 F	39
Epoxy cements	Boron hydride family	Grade 3	5-6
Epoxy-filled carbon (Karbate #15 & #25)	Chlorine trifluoride, liquid	Class 4 at 75 F	39
Epoxy No. 1 Coatings	50/50 Fuel blend	Class D, dissolved (30 d, @ 55-60 F)	4B
Epoxy No. 5, modified	" " "	Class D, edges swollen (30 d, @ 55-60 F)	4B
Epoxy No. 7	" " "	Class L, stripped off (30 d, @ 55-60 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
E			
Epoxy No. 9	50/50 Fuel blend	Class D, dissolved (30 d. @ 55-60 F)	4B
Epoxy paints No. 1, Modified No. 5, No. 7, No. 9, 6809	" " "	Class D (60 F, 30 d.)	4
Epoxy, Epon VI	" " "	Class D (55-60 F)	4B
Epoxy, Epon VI,	" " "	Class 4 at 60 F	39
Epoxy, Epon 422, 4-3 (Adhesive)	" " "	Class D, blistered and decomposed	4B
Epoxy Epon 828	50/50 Fuel blend	Class D, decomposing (1 d. @ 55-60 F)	4B
" " "	" " "	Class 4 at 60 F	39
" "	" " "	Class D, 60 F, 30 d.	4
Epoxy Epon 1031 (with PMDA)	" " "	Class D, disintegrating in 1 hr (70-80 F)	4B
" " " " " "	" " "	Class 4 at 80 F	39
Epoxy, EC 1469	" " "	Class 4 at 60 F	39
" " "	" " "	Class D (55-60 F)	4B
Epoxy No. 6809	" " "	Class D, peeled off (30 d. @ 55-60 F)	4B
Epoxy laminate	" " "	Class D, 30 d. @ 55-60 F; delaminated	40
Epoxy-glass laminate	" " "	Class 4 at 60 F	39
Epoxy-glass laminate (composition unknown)	" " "	Class D (60 F, 180 d.)	4
" " " " " "	" " "	Class C, partly delaminated (90 d. @ 55-60 F)	4B
		Class D, delaminated, 80% volume swell (180 d. @ 55-60 F)	4B
Epoxy, Epon 828 (plastic)	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Epoxy glass laminate	" " " "	Class 3, incompatible	8
Epoxy resin	Hi-Cal 3	Class 2, NC @ 120 F	2, 39
Epoxy, Epon	Hydrazine, liquid	Class 3, to 75 F	39
Epoxy, Epon	Hydrazine, anhydrous	Limited service, Class B	8
Epoxy, Epon 828, sealant	Hydrazine family	Grade 3	5-5
Epoxy, Epon VI, sealant	" " "	Grade 1	5-5
Epoxy, Epon	Hydrazine Hydrate	Limited service, Class B	8
Epoxy, Epon	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8-5
Epoxy, EC847, EC1595, EC1596	Nitrogen tetroxide	Unsatisfactory	21
Epoxy, No. 1, paint	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-60 F) dissolved	40
Epoxy: No. 1; No. 5; No. 7; No. 9; 6809	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Epoxy No. 1, No. 7, No. 9, 6809	Nitrogen tetroxide	Class D, stripped immediately (55-60 F)	4B
Epoxy, modified, No. 5	" " "	Class D, stripped immediately (55-60 F)	4B
Epoxy, modified, No. 5	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Epoxy, paint No. 1, Modified No. 5, No. 7, No. 9, 6809	Nitrogen tetroxide	Class D (60 F, 30 d.)	4
Epoxy: Epon 828, Epon VI, Epon VIII, Epon 422, Epon 901, Epon 1031, Epon EX1467	" " "	Unsatisfactory	21
Epoxy, Seals: No. 1, Modified No. 5, No. 7, No. 9, 6809	" " "	Grade 3	5-7
Epoxy X-Epon 4-184; Epoxy X-Epon 5-100-1	" " "	Softens and dulls but recovers well after spillage or 1 hr. vapor exposure	10A
Epoxy, Epon 422, Adhesive	" " "	Class D, lost adhesion (1 d. @ 70-80 F)	4B
Epoxy, Epon 422	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Epoxy, Epon 828, potting compound	Nitrogen tetroxide	Class D, dissolved (55-60 F)	4B
Epoxy, Epon 828	" " "	Class D, decomposed in 1 hr (70-80 F)	4B
Epoxy, Epon 828, seals	" " "	Grade 3	5-7
Epoxy, Epon 828	" " "	Class D (60 F, 30 d.)	4

MATERIAL	FUEL	BEHAVIOR	REF
E			
Epoxy, Epon 828	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Epoxy, Epon: VI; VII; 422; 901; 1031; Ex1469	" " "	Class 4 at 75 F	39
Epoxy, Epon 1031 (with PMDA)	Nitrogen tetroxide	Class D, surface attack (1 d. @ 70-80 F)	4B
Epoxy Epon 1031 (with PMDA)	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Epoxy, novolac type	Nitrogen tetroxide	Slight discoloration during splash test	10
Epoxy, novolac type, 1031/BF_3	" " "	Rapid color change (24 hr) during immersion	10
Epoxy novolac (Dow)	" " "	Severely pitted (7 d. @ 70 F) Wt change - +5.70	36
Epoxy novolac (Dow)	" " "	Slight surface attack (2 d. @ 70 F)	36
" " " "	" " "	Severely pitted (7 d. @ 70 F)	36
Epoxy novolac; Bisphenol A (Dow)	" " "	Dissolved (7 d. @ 70 F)	36
Epoxy novolac; Bisphenol A (Shell)	" " "	Severely degraded (2 d. @ 70 F)	36
Epoxy novolac; Bisphenol A (Dow)	" " "	Degraded (2 d. @ 70 F)	36
Epoxy novolac (Shell)	" " "	Completely degraded (2 d. @ 70 F)	36
Epoxy novolac resin system	" " "	Poor, severe crazing (30 d. @ 60 F)	36A
		Poor, severe errosion (30 d. @ 100 F)	36A
Epoxy, novolac type, Epon 1031 W/BF_4 (adhesive)	" " "	Slight discoloration during splash test, No Change in 24 hr.	10A
Epoxy, novolac type, Epon 1031 W/BF_4	" " "	Rapid color change; no visible change in 24 hrs immersion	10A
Epoxy novolac	" " "	Flexure, 73.4% ret (7 d. @ 60 F)	36C
" "	" " "	Flexure, 21.7% ret (30 d. @ 60 F)	36C
" "	" " "	Flexure, 14.2% ret (90 d. @ 60 F)	36C
" "	" " "	Flexure, 18.2% ret (7 d. @ 100 F)	36C
" "	" " "	Flexure, 18.7% ret (30 d. @ 100 F)	36C
" "	" " "	(Severe corrosion) (90 d. @ 100 F)	36C
" "	" " "	Hardness, +7 change (7 d. @ 60 F)	36C
" "	" " "	Hardness, +1 change (30 d. @ 60 F)	36C
" "	" " "	Hardness, -16 change (90 d. @ 60 F)	36C
" "	" " "	Hardness, 0 change (7 d. @ 100 F)	36C
" "	" " "	Hardness, +5 change (30 d. @ 100 F)	36C
Epoxy, novolac/glass filament	" " "	Shear, 65.0% ret (7 d. @ 60 F)	36C
" " " " "	" " "	Flexure (long), 16.6% ret (7 d. @ 60 F)	36C
" " " " "	" " "	Delamination (7 d. @ 100 F)	36C
Epoxy laminate	" "	Unsatisfactory	21
	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-60 F) delaminated	40
Epoxy-glass laminate (composition unknown)	Nitrogen tetroxide	Class D (60 F, 30 d.)	4, 4B
Epoxy laminate	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Epoxy	Oxygen, liquid	Impact; 2/25, 3/3, 3/6, 2/2, 2/20 @ 10 KgM	32
"	" "	Violently impact sensitive	32
Epoxy resin	" "	Moderate impact detonation	18
Epoxy, Epon 6 adhesive	" "	Impact sensitive (6/10)	18
Epoxy, Epon 8 adhesive	" "	Very impact sensitive (2/2)	18
Epoxy, Epon VIII, curing agent A	" "	Very impact sensitive (10/10)	18
Epoxy, Epon 92	" "	Very impact sensitive (10/10)	18
Epoxy, Epon, sealant #718	" "	Very rigid; shattered under impact	17
Epoxy, Epon 828 (CL) set resin	" "	Impact sensitive (5/10), (2/2)	18
Epoxy, Epon 828/fiberglass laminate w/ Epon VI	" "	Very hard (Epon VI); shattered under impact (Epon V)	17

MATERIAL	FUEL	BEHAVIOR	REF
E			
Epoxy, Epon 828/fiberglass laminate w/718 sealant	Oxygen, liquid	Sealant very rigid; shattered under impact	17
Epoxy system J4899	" "	Impact insensitive (0/20)	18
Epoxy adhesive	" "	Impact; 7/10 @ 10 KgM	32
Epoxy, adhesive	" "	Incompatible	8
Epoxy-bound steel	" "	Impact; 5/5 @ 10 KgM	32
Epoxy cement	" "	Impact; 2/2, 5/20, 2/3 @ 10 KgM	32
Epoxy laminate, glass fiber	" "	Moderate impact detonation	18
" " " " "	" "	Impact sensitive (7/10)	18
Epoxy-glass	" "	Impact; 2/3, 19/20, 20/20, 2/2, 2/2 @ 10 KgM	32
Epoxy, Epon/mylar sealant	" "	Impact sensitive (3/10)	18
Epoxy-Phenolic	" "	Impact; 20/20 @ 10 KgM	32
Epoxy-polyamide adhesive	" "	Impact; 3/3 @ 10 KgM	32
Epoxy, Epon 828/polyamide 115	" "	Very hard & brittle	17
Epoxy (filled) and polyamide (filled) adhesive	" "	Impact; 16/24 @ 10 KgM	32
Epoxy and polysulfide	" "	Impact; 10/20 @ 10 KgM	32
Epoxy potting compound	" "	Impact; 1/1, 1/1 @ 10 KgM	32
Epoxy resin w/inert filler	" "	Moderate impact detonation	18
Epoxy, Scotchcast #5	" "	Impact sensitive (5/10)	18
Epoxy resins	Perchloryl fluoride, dry	Class 2, 390 F	2, 39
" "	RFNA	Class 4 at 75 F	39
Epoxy, Epon YB-100, coating	"	Class 4 at 75 F	39
Epoxy, Epon 400 XR61, coating	"	Class 1, to 75 F	39
Epoxy, modified, coating	"	Class 4 at 75 F	39
Epoxy, Epon 470 and Epon 471	WFNA	Class 4, all temps, unacceptable	2, 8, 39
Epoxy, aluminized (protective coating)	Oxidizers (general)	Satisfactory for non-flat surfaces such as fayings (edges only exposed)	16
Epoxylite 5302	Oxygen, liquid	Very sensitive (2/3)	18
Ethyl acetate	Pentaborane	Grade 3 (Shock sensitive)	5-6
Ethyl cellulose	Hydrazine, anhydrous	Limited service, Class B	8
" "	Hydrazine, liquid	Class 3, at 75 F	39
" "	Hydrazine family	Grade 2	5-5
" "	Hydrazine hydrate	Limited service, Class B	8
" "	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
" "	Perchloryl fluoride, dry	Class 4, 80 F	2, 39
Ethylene propylene rubber - See also "Resistazine", "EPR"			
Exon 400 XR61 (Chlorotrifluoroethylene)	RFNA	Withstood 168 hrs @ 80 F, 1 hr @ 160 F	27
Exon 400 XR61	JP-4 Fuel	Exceptional resistance to RT immersion. Lost 41% of tensile after 72 hrs @ 80 F. Partially dissolved at 160 F	27
F			
Fairprene 5159	Aerozine 50	Unsatisfactory	21
Fairprene 5159, potting compound	50/50 Fuel blend	Class D (60 F, 30 d.)	4
" " " " "	" " "	Class D, swollen; became brittle (30 d. @ 55-60 F)	4, 4B
Fairprene 5051, neoprene on duck	Hi-Cal 3	Class 4, stiffened at 77 F	2, 39
Fairprene 5039, neoprene on nylon	Hi-Cal 3	Class 4, became brittle at 77 F	2, 39
Fairprene 5159	Hydrazine family	Grade 3	5-5
Fairprene PS57-167 (Viton A, 116 glass)	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Fairprene PS57-168 (Viton A, Dacron)	" " " "	Class 2 at 150 F	39
Fairprene (Viton A); 5806; 5807; 5809	" " " "	Class 2 at 150 F	39
Fairprene 5159,potting compound	Nitrogen tetroxide	Class D (60 F, 30 d.)	4
" " " " "	" " "	Class D, 400% volume swell (14 d. @ 55-60 F)	4B
" " " " "	" " "	Unsatisfactory	21
Fairprene 5159	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39

MATERIAL	FUEL	BEHAVIOR	REF
F			
Fairprene seals	Nitrogen tetroxide	Grade 3	5-7
Fairprene, butyl	U-DETA	Satisfactory	12
Fairprene, Viton 84-001	"	Unsatisfactory	12
Fiberglas	Aniline	Satisfactory	3
Flexitallic filled with asbestos	Hydrogen, liquid and cold gas	Grade 1	5-11
" " " " "	Hydrogen, ambient gas	Grade 1	5-11
Flexitallic filled with Teflon	Hydrogen, liquid and cold gas	Grade 1	5-11
" " " " "	Hydrogen, ambient gas	Grade 1	5-11
Flexitallic (Teflon & metal)	Nitrogen tetroxide	Grade 1	5-7
Flexitallic gaskets	U-DETA	Satisfactory	12
Flexitallic gaskets (Canadian asbestos filled, or Teflon filled)	U-DETA (MEF-4)	Satisfactory	8
Fluorel	Aerozine 50	Unsatisfactory	21
"	Chlorine trifluoride	Ignited on contact	19
Fluorel gum	" " " "	Softened, 5 d. @ RT, still rubbery	26
Fluorel	50/50 Fuel blend	Class D, broken up less than 30 days (55-60 F)	4B
"	" " "	Class D, blistered in 1 hr (70-80 F)	4B
		Class D (60 F, 30 d.)	
"	" " "	Class D (60 F, 30 d.)	18
		Class 4 at 60 F	39
Fluorel 2141	Hydrogen peroxide (conc)	Class 2-limited (not > 120 F)	8
Fluorel elastomer KX-2141	MON (Mixed oxides of nitrogen)	Slight increase in weight, 5% increase in volume; decrease in hardness (13%)	14
Fluorel	Nitrogen tetroxide	Unsatisfactory	21
"	" " "	Class D, > 300% volume swell, fell apart (30 d. @ 55-60 F)	4B
"	Nitrogen tetroxide (< .2% moist)	Class 4 at 60 F	39
"	Oxygen, liquid	Impact; 0/20 @ 10 KgM	32
Fluorinated ethylene-propylene - See "Teflon FEP"			
Fluorinated ethylene propylene	Oxygen, liquid	Impact; 0/20 @ 10 KgM	32
Fluorinated hydrocarbon	Amine systems	Acceptable, but subject to compression set (with replacement required)	16
" " " " "	Nitrogen tetroxide	Acceptable, but subject to compression set (with replacement required)	16
Fluorline 100 coating	RFNA	Class 1, to 75 F	39
Fluorline 100	WFNA, liquid	Class 1, to 75 F	39
" "	WFNA	Class 3, 75 F (intermittent spillage)	2
" "	"	Class 3, only fair corrosion resistance, 75 F limit	8
Fluorobestos	Aerozine 50	Satisfactory	21
Fluorobestos filled with asbestos	" "	Compatible for long term applications (test temp 55-60 F)	40
Fluorobestos filled with asbestos	50/50 Fuel blend	Class 1, to 60 F	39
Fluorobestos filled with asbestos	" " "	Class A, 2% H_2O, "A" rating based on visual observation (90 d. @ 55-60 F)	4, 4B
Fluorobestos	50/50 Hydrazine/UDMH	Class 2, limited service	8
" "	Hydrazine family	Grade 1	5-5
" "	Nitrogen tetroxide	Satisfactory	21
" "	Nitrogen tetroxide (< .2% moist)	Class 1, to 60 F	39
Fluorobestos filled with asbestos	Nitrogen tetroxide	Class B (60 F, 30 d.)	4
" " " " "	" " "	Class A (180 d. @ 55-60 F)	4B
" " " " "	" " "	Grade 2	5-7
" " " " "	" " "	Compatible for long term applications, test temp 55-60 F	40
Fluorobestos A, B	Oxygen, liquid	Suitable	8
Fluorocarbon - See also "Fluoroflex", "Fluorosint"			

MATERIAL	FUEL	BEHAVIOR	REF
F			
Fluorocarbon, modified - See also "Rulon"			
Fluorocarbon resins - See also "Teflon", "Kel-F"			
Fluorocarbon Plaskon	Diisopropenyl acetylene (DIPA)	Good resistance, (7 d. @ 160 F)	29
" " " "	Dimethyl hydrazine	Severe attack (7 d. @ 160 F) not recommended for use	29
" " " "	Fluorine, liquid	Severe attack (7 d. @ 160 F) not recommended for use	29
" " " "	Hydrazine	Severe attack (7 d. @ 160 F), not recommended for use	29
Fluorocarbon, Teflon, Kel-F	Hydrocarbon fuels	Satisfactory	3
Fluorocarbon, Plaskon	Hydrogen peroxide (90%)	Excellent resistance (7 d. at 160 F)	29
" " " "	JP-4, flight grade	Excellent resistance (7 d. at 160 F)	29
" " " "	JP-X	Good resistance (7 d. @ 160 F)	29
" " " "	Oxygen, liquid	Excellent resistance (7 d. at 160 F)	29
	" " "	Impact; 0/20 @ 10 KgM	32
Fluorocarbon Telecon			
Fluorocarbon Plaskon	Propyl nitrate	Excellent resistance (7 d. at 160 F)	29
" " " "	RFNA	Excellent resistance (7 d. at 160 F)	29
" " " "	UDMH	Severe attack (7 d. @ 160 F) not recommended	29
Fluorocarbon ether (FC75)	Oxygen, liquid	Impact insensitive (0/20)	18
Fluorocarbon rubbers: duPont, Viton A-9653; Viton A-44-11 A-35; Viton A-247M; (3M) Kel-F 3700; Kel-F 5500; (3M) Fluororubber 1F4; Fluorel A	UDMH	Class 4, poor	8
Fluoro compounds - See also "Lankote"			
Fluoroflex T, seals	Boron hydride family	Grade 1	5-6
Fluoroflex T-TP1001	Hydrogen peroxide, 90%	Class 1 at 150 F	8, 39
Fluoroflex T-TP1000 (black)	" " " "	Class 2 at 150 F	39
Fluoroflex T (Teflon)	Oxygen difluoride	Class 3, -109 F	39
" " " "	Pentaborane	Approved for use	3A
" " " "	" "	Compatible for long-term applications	8, 22, 40
Fluoroflex T (carbon filled) "Thick"	Perchloryl fluoride - tetrafluorohydrazine	+2.85* (Gaseous, 1 d.)	20
"Thick"	" " " "	+8.0 Slight gain no apparent change (Gaseous, 21 d.)	20
"Thin"	" " " "	+0.56 (Gaseous, 1 d.)	20
	*Change in wt/unit area,	mg/sq in.	
Fluoroflex T (Teflon)	Perchloryl fluoride (50)/tetrafluorohydrazine, gaseous	Class 3, to -109	39
Fluorogold and fluorocrabon CG-12	Oxygen	Grade 1	5-2
Fluorogreen	Aerozine 50	Satisfactory	21
" "	" "	Compatible for long term applications (test temp 55-60 F)	40
Fluorogreen	50/50 Fuel blend	Class 1, to 60 F	39
" "	" " "	Class A (180 d. @ 55-60)	4B
" "	Nitrogen tetroxide	Satisfactory	21
" "	Nitrogen tetroxide (<.2% moist)	Class 1, to 60 F	39
Fluorogreen gaskets (glass-impregnated Teflon)	Nitrogen tetroxide	Most compatible of materials used	28
" " " " "	" " "	Compatible for long term applications, test temp 55-60 F	40
Fluorogreen filled with ceramic	" " "	Class A, 60 F, 30 d.	4
" " " " "	" " "	Class A (180 d. @ 55-60 F)	4B
" " " " "	" " "	Grade 1	5-7
Fluorogreen E-600 and E-609	Oxygen	Grade 1	5-2

MATERIAL	FUEL	BEHAVIOR	REF
F			
Fluorohalocarbon - See also "Halon"			
Fluorohalocarbon	Oxygen, liquid	Impact; 0/20, 0/40, 0/20, 2/3 @ 10 KgM	32
Fluoro resin; Lankote	" " "	Impact sensitive (3/6)	18
Fluoro rubber - See also "Fluorel"			
Fluoro rubber, IF4	Hi-Cal 3	Class 2, NC @ 120 F	2, 39
Fluoro rubber, IF 4	50/50 Fuel blend	Class 4 at 60 F	39
Fluoro rubber: Viton A	" " "	Class D (30 d. @ 55-60 F) decomposed	40
" " " " "	" " "	Class D (60 F 30 d.)	18
" " " " "	" " "	Class D, broke up (10 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, dissolved (1 d. @ 70-80 F)	4B
Fluoro rubber; Viton B	" " "	Class D (30 d. @ 55-60 F) dissolved	40
" " " " "	" " "	Class D (60 F, 30 d.)	18
" " " " "	" " "	Class D, dissolved (30 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, dissolved (1 d. @ 70-80 F)	4B
Fluoro rubber: Kel-F elastomer	" " "	Class D, dissolved	40
" " " " "	" " "	Class D (60 F, 30 d.)	18
Fluoro rubber: Kel-F 5500	" " "	Class D, dissolved in minutes (55-60 F)	4B
Fluoro rubber, Stillman	" " "	Class 4 at 60 F	39
" " " " "	" " "	Class D, broke up (30 d. @ 55-60 F)	4B
Fluoro rubber, Precision 18007, 18057	" " "	Class D, dissolved (1 d. @ 160 F)	4B
Fluoro Rubber, EX 821-A70	" " "	Class D, blistered in 4 hr (70-80 F)	4B
Fluro rubber	Nitrogen tetroxide	Class D - severe	14A
Fluoro rubber, Formulas 75-79, 84, 85, and 94-99	" " "	D, Fluoro rubbers with added fillers did not reduce volume swell below 199%, poor to good strength retention (7 d. @ 70-80 F)	4, 4B
Fluoro rubber: Viton A & B	" " "	Grade 3	5-7
Fluoro rubber: Viton A	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-60 F) dissolved	40
" " " " "	Nitrogen tetroxide	Class D (60 F, 30 d.)	4
" " " " "	" " "	Class D, 90% volume swell in 0.5 hr (60 F)	4B
" " " " "	" " "	Class D, fell apart (30 d @ 55-60 F)	4B
" " " " "	" " "	Class D, 200% volume swell (70-80 F)	4B
Fluoro rubber: Viton B	" " "	Class D, extremely swollen (30 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, 100% volume swell in 1 hr, shrinkage in 24 hr (70-80 F)	4B
Fluoro rubber: Viton B, EX 821-A70	" " "	170% volume swell, very soft (30 d. @ 55-60 F)	4B
" " " " " " "	" " "	Blistered (1 d. @ 70-80 F)	4B
Fluoro rubber: Viton B, Stillman EX 774m-1	" " "	Class D (67 F, 30 d.)	4
Fluoro rubber: Kel-F 3700, 5500	Nitrogen tetroxide, liquid	Class D, 55-60 F; excessive volume swell in 45 min.	40
Fluoro rubber: Kel-F 3700, 5500	" " "	Class D, 65 F	4
Fluoro rubber: Kel-F 3700	" " "	Class D - 300% volume swell in 45 min (55-65 F)	4B
Fluoro rubber: Kel-F-5500	" " "	Class D, 900% volume swell (14 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, dissolved in 2 hr (70-80 F)	4B
Fluoro rubber: Omni X-FBF-4	" " "	Class D, 300% volume swell in 3 hr (70 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
F			
Fluoro rubber: Parker V494-7	Nitrogen tetroxide	Class D (67 F, 30 d.)	4
" " " " "	" " "	234% volume swell in 2 hours	4B
Fluoro rubber: Parker 77-545	" " "	Class D, 100% volume swell in 4 hrs.	4B
Fluoro rubber: Parker 1235	Nitrogen tetroxide, liquid	Class D (7 d. @ 70-80 F) excessive volume swell and softening	40
Fluoro rubber: Parker XV-1235-2	Nitrogen tetroxide	Class D, 500% volume swell, Shore A decrease 60 units (7 d. @ 70-80 F)	4, 4B
Fluoro rubber: Parker XV-1235-5	" " "	Class D, 43% volume swell, Shore A decrease 60 units (7 d. @ 70-80 F)	4, 4B
Fluoro rubber: Parker TFNM-TFE*	" " " "	Class D (80 F, 7 d.)	4
	*Trifluoronitrosomethane tetrafluoroethylene		
Fluoro rubber: Stillman, TH 1057	Nitrogen tetroxide	Class D (65 F, 31 d.)	4
" " " " " " "	" " "	Class D, 205% volume swell (31 d. @ 55-65 F)	4B
" " " " " " "	" " "	Class D, 50% volume swell in 1 hr, shrinkage in 24 hrs. (70-80 F)	4B
Fluoro rubber; Stillman Ex 774M-1	" " "	Class D, 181% volume swell	4B
Fluoro rubber: TFNM-TFE	" " "	Class D, 174% volume swell, poor elastomeric properties, different oven cures reduce swell to 48% but retain poor elastomeric properties (7 d. @ 70-80 F)	4B
Fluoro rubber	Oxygen, liquid	Impact, very sensitive (3/3)	18
Fluoro rubber w/Dacron base	" " "	Impact, very sensitive (3/3)	18
Fluoro rubber	UDMH (liquid)	Class 4, 75 F	2
Fluorosilicone rubber - See also "Viton A"			
Fluorosilicone rubber (seals)	Boron hydride family	Group 1	5-6
Fluorosilicone	Chlorine trifluoride	Class C, reacts violently	8
" " "	" " " "	Low order detonation	19
Fluorosilicone rubber, LS 53	Aerozine 50	Unsatisfactory	21
Fluorosilicone rubber, LS 53*	DIPA	11% swell (7 d. @ RT)	33
		12% swell (7 d. @ 160 F)	33
	*Affected propellant stability excessively		
Fluorosilicone rubbers: LS 53	50/50 Fuel blend	Class D, 30 d. @ 55-60 F; decomposed	4, 4B, 40
" " " " "	" " "	Class D, blistered (1 d. @ 70-80 F)	4B
Fluorosilicone rubbers: Hadbar 58789-23GT	" " "	Class D, Shore A decrease 25 units (1 d. @ 70-80 F)	4B
" " " " " "	" " "	Class C, 30 d. @ 160 F; precipitate extracted; tensile loss 73.8%	4, 40
Fluorosilicone rubber: LS 53	HiCal-3	Class 2, 120 F (Slightly less resistent)	2, 39
Fluorosilicone rubber: LS 53	Hydrazine family	Group 3	5-5
Fluorosilicone rubber: Hadbar 58789-23 FT; 58789-23 GT; 58789-23 HT 40; 58789-23 HT 80	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Fluorosilicone, LS-53	Hydrogen peroxide, 90%	Class 2 at 150 F limited	8, 39
Fluorosilicone elastomers	Nitrogen tetroxide	Short term static service	10
Fluorosilicone rubber	" " "	Limited service	30
" " " "	" " "	Group 3	5-7
" " " "	" " "	380% increase in volume: rapid & large drop in ultimate tensile	16
Fluorosilicone rubber, LS 53	" " "	Unsatisfactory	21
" " " " "	Nitrogen tetroxide, liquid	Class D, 30 d. @ 63-67 F; excessive volume swell	4, 40
" " " " "	Nitrogen tetroxide	Class D, >500% volume swell (5 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, 50% volume swell in 1 hr, shrinkage in 24 hr (70-80 F)	4B
Fluorosilicone rubber, LS 63	" " "	Class D, crumbled (1 d. @ 70-80 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
F			
Fluorosilicone rubber, Hadbar series 58789-23	Nitrogen tetroxide	Class D, >185% volume swell (7 d. @ 70-80 F)	4, 4B
Fluorosilicone rubber, Hadbar series 58789-23GT	" " "	Class D, swollen and blistered (1 d. @ 63-67 F)	4, 4B
Fluorosilicone rubber, LS 53, LS 63	" " "	Class D (67 F, 30 d.)	4
Fluorosilicone rubber, Formulas 55-67 and 80-83	" " "	Class D (80 F, 7 d.)	4
Fluorosilicone rubbers	" " "	Class C/D, slight to severe	14A
Fluorosilicone rubber, LS 53	" " "	Shore A, loss - 17; 40% swell (7 d. @ RT)	34
" " " " "	" " "	40% swell (1 d. @ RT)	33
Fluorosilicone	Oxygen, liquid	Impact; 0/20, 2/20, 0/20, 0/20 @ 10 KgM	32
Fluorosilicone rubber	" " "	Impact: 0-2/20 @ 10 KgM	32
" " " "	Pentaborane	Compatible, approved for use	3A, 8, 22, 40
" " " "	" "	Class 1 to 75 F	39
Fluorosilicone rubber (iron oxide filler)	Perchloryl fluoride, dry	Class 2, 390 F	2
" " " "	Perchloryl fluoride, gaseous	Class 2, to 390 F	39
Fluorosint T-30 (Polymer corp)	Oxygen, liquid	Suitable	9
Fluorothane	Bromine trifluoride, liquid	Class 3, to 200 F	39
Foam, Dow Corning R-7002	Pentaborane	Incompatible	8
Foam, Dow Corning R-7003	" "	Incompatible	8
Foam, Nopco F-10	" "	Incompatible	8
Foam, Nopco B-49	" "	Incompatible	8
Foam rubber	Perchloryl floride	Unsatisfactory	3
" "	" " "	Class 4, 390 F	2
Fluran B-4100	Hydrogen peroxide, 90%	Class 3 @ 150 F, very limited	8, 39
Furans	Ammonia, gaseous	Class 2, to Hot	39
"	Ammonia, liquid	Class 2, to Hot	
"	Ammonia, anhydrous	Grade 1	5-12
"	liquid, gas (< 250° F)	Grade 1	5-12
"	Ammonia, anhydrous, moist, ambient temp.	Class 2 limited	8
"	Ammonia, anhydrous, dry, ambient temp.	Class 2 limited	8
"	Ammonia, dry	Class 2, hot	2
"	Ammonia, moist	Class 2, hot	2
Furan resins	RFNA	Class 4 at 75 F	39
" "	WFNA	Class 4, all temps	2, 8, 39
Furan resin, asbestos reinforced, Haveg 60	UDMH	Class 3, fair	8
Furane resin	Hydrazine family	Grade 2	5-5
" "	Hydrazine, anhydrous	Limited service, Class B	8
" "	Hydrazine hydrate	Limited service, Class B	8
" "	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
G			
GRS (Butadiene-styrene rubber)	Ammonia, anhydrous, dry, ambient temp.	Class 2, limited	8
GRS	Ammonia, anhydrous: liquid	Grade 2	5-12
	Gas (- 250° F)	Grade 2	5-12
GRS	Ammonia (dry)	Class 2, 75 F; Class 4, hot	2, 39
GRS	Fluorine: Liquid	Grade 3	5-10
	Gas	Grade 3	5-10
GRS	Fluorine gas	Class 4, all temps	2, 39
GRS	Perchloryl fluoride, dry	Class 2, 390 F	2, 39
GRS Gum Rubber	Perchloryl fluoride	Satisfactory	3
Garlock 900	Aerozine 50	Satisfactory	21
Garlock 22	" "	Unsatisfactory	21

MATERIAL	FUEL	BEHAVIOR	REF
G			
Garlock silastic 250	Boron hydride family	Group 3	5-6
Garlock silicone rubber 9383	" " " "	Group 3	5-6
Garlock 22	50-50 Fuel blend	Class A (30 d. @ 55-60 F)	4B
" "	" " "	Class B, Shore A decrease 10 units (180 d. @ 55-60 F)	4B
" "	" " "	Class D, fuel discolored yellow, Shore A decrease 21 units (270 d. @ 55-60 F)	4B
" "	" " "	Class C (60 F, 90 d.)	4
" "	" " "	Class B, fuel slightly discolored (1 d. @ 70-80 F)	4B
Garlock 900; Garlock 22	" " "	Class 4 at 60 F	39
Garlock 900	" " "	Class D, fuel yellow, crystals on specimen, Shore D decrease 12 units (30 d. @ 55-60 F)	4B
" "	" " "	Class D (60 F, 90 d.)	4
" "	" " "	Class C, heavy precipitate extracted (1 d. @ 70-80 F)	4B
Garlock 22; Garlock 900	50/50 Hydrazine/UDMH	Class 1, general service	8
Garlock 900 (GRS binder)	HiCal-3	Class 3, 120 F, stiffened	2, 39
Garlock 7021 (GRS-high sulfur binder)	"	Class 3, 120 F, stiffened and roughened	2, 39
Garlock (7228 (neoprene bidder)	"	Class 4, blistered at 120 F, fibers loosened	2, 39
Garlock 7705 (GRS-blue asbestos)	"	Class 4, stiffened at 120 F	2, 39
Garlock 8748 (Buna-N binder)	"	Class 3, stiffened at 120 F	2, 39
Garlock 22	Hydrazine family	Grade 2	5-5
Garlock 735	Hydrazine	Satisfactory	1, 3
Garlock 900	Hydrazine family	Grade 3	5-5
Garlock gasket 900	Hydrazine, liquid	Class 3, to 200 F	39
Garlock packing	Hydrogen, liquid	Satisfactory	8
" " "	" " "	Compatible for long term applications	40
" " "	" " "	Class 1 or 2	2
" " "	Hydrogen: Liquid & cold gas	Grade 1	5-11
	Ambient gas	Grade 1	5-11
Garlock 5681 (Teflon-impregnated asbestos)	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Garlock 735	Monomethylhydrazine	Preferred (unspecified performance)	3A
Garlock 22	Nitrogen tetroxide	Unsatisfactory	21
" "	" " "	Class D, 60 F	4
" "	" " "	Class D, blistered badly (1 d. @ 65 F)	4B
Garlock 22; Garlock 900	Nitrogen tetroxide (<.2% moist)	Class 4 at 65 F	39
Garlock 900	Nitrogen tetroxide	Class D (60 F, 30 d.)	4
" "	" " "	Grade 3	5-7
" "	" " "	Class D, sample delaminated and swollen (1 d. @ 65 F)	4B
" "	" " "	Satisfactory	21
Garlock 2000	Oxygen	Grade 3	5-2
Garlock 900, gasket	Oxygen, liquid	Positive detonation, impact test	18
Garlock 901, gasket	" " "	No reaction, impact test	18
Garlock 230	Pentaborane	Approved for use	3A
Garlock silastic 250	" "	Incompatible	8, 22
Garlock silicone rubber 9383	" "	Incompatible	8, 22
Garlock 735	U-DETA (MAF-4)	Unsatisfactory	8
" "	U-DETA	Satisfactory	12
Garlock gasket 900	UDMH	Satisfactory	1, 3
Garlock 900, gasket	UDMH	Among best, but unspecified performance	3A
" " " "	UDMH, liquid	Class 3, 75 F	2
Garlock 900 (compressed asbestos with rubber)	UDMH	Class 2, good	8
Garlock red rubber	UDMH, liquid	Class 4, 75 F	2
Garlock 230, 233	WFNA, liquid	Class 4 at 75 F	39

MATERIAL	FUEL	BEHAVIOR	REF
G			
Genetron GC	IRFNA	Tensile loss, 1000 psi (7 d. @ RT)	34
" "	"	Tensile gain, 600 psi (14 d. @ RT)	34
" "	"	Tensile loss, 300 psi (21 d. @ RT)	34
" "	"	Tensile loss, 1800 psi (1 d. @ 160 F)	34
" "	"	Tensile loss, 800 psi (7 d. @ 160 F)	34
" "	Nitrogen tetroxide	Tensile loss, 1200 psi (1 d. @ RT)	34
" "	" " "	Tensile gain, 1400 psi (7 d. @ RT)	34
" "	" " "	Tensile loss, 1600 psi (14 d. @ RT)	34
" "	" " "	Tensile loss, 3100 psi (21 d. @RT)	34
" "	" " "	Tensile gain, 1600 psi (42 d. @ RT)	34
" "	" " "	Tensile loss, 900 psi (3 mo. @ RT)	34
" "	" " "	Shredded (7 d. @ 160 F)	34
" "	" " "	Class B, Shore C increased 8 units (90 d. @ 70-80 F)	4B
" "	" " "	Class D, shredded, 16% loss in strength (7 d. @ 160 F)	4B
" "	Nitrogen tetroxide (<.2% moist)	Class 2, to 80 F	39
Genetron GCX-3B	Nitrogen tetroxide	Grade 1	5-7
" " "	" " "	Class A, hardness not measured (30 d. @ 55-65 F)	4, 4B
" " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 65 F)	39
Genetron XE-2B	Nitrogen tetroxide	Class A, hardness not measured (30 d. @ 55-65 F)	4, 4B
" " "	" " "	Grade 1	5-7
" " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 65 F	39
Genetron Trithene A	Nitrogen tetroxide	Grade 3	5-7
Genetron HL	Oxygen difluoride (Liquid)	Grade 2*	5-13
	*Gain in weight indicating absorption		
	Oxygen difluoride (Gas)	Grade 2	5-13
Genetron VK	Oxygen difluoride (Liquid)	Grade 3	5-13
	Oxygen difluoride (Gas)	Grade 3	5-13
Genetron UK	Propellant 113	Increase wt. & thickness	13
Gen-Flex plastic tubing	Liquid oxygen	Impact; 2/4 @ 10 KgM	32
Geon latex 31X	Hydrogen peroxide, 90%	Class 4 at RT	39
Geon 118	" " " "	Class 4 at 150 F	39
Geon 404 (yellow)	" " " "	Class 3 at 150 F very limited	8, 39
Geon 8372	Hydrogen peroxide	Class 4	3
Glass fiber - See "Fiberglas"			
Glyptal	Boron hydride family	Grade 1	5-6
Glyptal, thread compound	Halogen fluoride (family)	Grade 3	5-18
Glyptal	Fluorine, Liquid	Grade 3	5-10
"	Fluorine, Gas	Grade 3	5-10
"	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Glyptal, clear	Oxygen, liquid	Positive detonation, impact	18
Glyptal, lacquer cement	" " "	Sensitive to impact (5/5)	18
Graphite with plastic binders	Chlorine trifluoride	Incompatible	24
" " " " "	Halogen fluoride family	Grade 3	5-8
H			
H-film	50/50 Fuel blend	Class 4 at 160 F	39
"	" " "	Class D, dissolved immediately	4B
"	Nitrogen tetroxide	Class D, Crumbled (7 d. @ 70-80 F)	4B
"	" " "	Incompatible	26
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
HT 424	Aerozine 50	Unsatisfactory	21
"	Nitrogen tetroxide	Unsatisfactory	21

MATERIAL	FUEL	BEHAVIOR	REF
H			
Halogenated hydrocarbon - See also "ACLAR"			
Halogenated polybutadiene - See also "Hydropol"			
Halgene	Hydrogen peroxide, 90%	Class 2 at 150 F, limited	8, 39
Halon TFE Fluorocarbon	Diisopropenyl acetylene (DIPA)	Good	29
Halon	Fluorine, gaseous	Acceptable at moderate pressures and low flow rates	3A
Halon TFE Fluorocarbon	Hydrazine	Severe attack	29
" " " " "	JP/X	Good	29
" " " " "	Oxygen, liquid	Excellent	29
" " " " "	Propyl nitrate	Excellent	29
" " " " "	UDMH	Severe attack	29
Haveg 61	Hydrazine, liquid	Class 3, to 200 F	39
Haveg 41 (asbestos filled phenolic)	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Haveg 60 (phenolic)	" " " "	Class 4 at 150 F	39
Haveg 41 (phenolic resin)	UDMH, liquid	Class 4, 75 F	2
Haveg 60 (furan resin)	" "	Class 1, 75 F	2
Heresite Industrial	WFNA	Class 4, all temps, unacceptable	2, 8
Hexacholorobutadiene	Hydrogen peroxide (conc)	Class 3 V, limited	8
HiFax	IRFNA	Brittle (7 d. @ RT)	34
"	Nitrogen tetroxide	Tensile gain, 970 psi (1 d. @ RT)	34
"	" " "	Too brittle to test (7 d. @ RT)	34
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Hycar 2202	Aerozine 50	Unsatisfactory	21
Hycar	Boron hydride family	Grade 3	5-6
Hycar G41	50/50 Fuel blend	Class 4 at 100 F	39
Hycar 520-41-125-1; 1043 Std No. 1; 1001	" " "	Class 4 at 85 F	39
Hycar 2202	" " "	Class B, fuel gassing (1 d. @ 55-60 F)	4B
" "	" " "	Class C, fuel discolored, 14% volume swell (270 d. @ 55-60 F)	4B
" "	" " "	Class D, 43% volume swell (30 d. @ 55-60 F)	4B
" "	" " "	Class 3, to 60 F; Class 4 at 85 F	39
Hycar 1001-520-39-5-2	HiCal-3	Class 3, 120 F, slight stiffening	2, 39
Hycar 1001-520-39-5-4	"	Class 2, 120 F, NC	2, 39
Hycar 1001-520-37-83-5	"	Class 2, 120 F, NC	2, 39
Hycar 1001-520-39-5-1	"	Class 4, 120 F, stiffened	2, 39
Hycar 1001-520-39-5-3	"	Class 4, 120 F, stiffened	2, 39
Hycar 1001-520-39-5-5	"	Class 4, 120 F, blistered	2, 39
Hycar 1042-520-24-144-1	"	Class 4, 120 F, brittle, crazed	2, 39
Hycar 1000-520-37-83-1	"	Class 2, 120 F, NC	2, 39
Hycar 1000X88-520-39-20-3	"	Class 2, 120 F	2, 39
Hycar	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
Hycar 2202	50/50 Hydrazine/UDMH	Class 1, general service	8
Hycar	Hydrogen peroxide	Class 4	3
Hycar PA 478-1-1 (black)	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Hycar 1000X88	JP-X	Shore A loss - 16 to 20 (7 d. @ RT)	34
Hycar 1000X88	JP-X	45% to 59% swell (7 d. @ RT)	34
Hycar 1000X132	"	Shore A loss - 12 to 20 (7 d. @ RT)	34
" " "	"	40% to 49% swell (7 d. @ RT)	34
Hycar 1001	"	54% swell (7 d. @ RT)	34
" "	"	Shore A, loss - 6 (7 d. @ RT)	34
" "	"	13% to 42% swell (7 d. @ 160 F)	34
" "	"	5% to 50% swell (14 d. @ 160 F)	34
" "	"	53% swell (21 d. @ 160 F)	34
Hycar 1011	"	21% to 66% swell (7 d. @ RT)	34
" "	"	22% to 51% swell (14 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
H			
Hycar 1011	JP-X	21% swell (21 d. @ RT)	34
" "	"	9% swell (42 d. @ RT)	34
" "	"	8% to 22% swell (3 mo. @ RT)	34
" "	"	9% swell (6 mo. @ RT)	34
" "	"	Shore A, loss - 3 to 28 (7 d. @ RT)	34
" "	"	Shore A, loss - 13 to 27 (14 d. @ RT)	34
" "	"	Shore A, loss - 13 (21 d. @ RT)	34
" "	"	Shore A, loss - 3 (42 d. @ RT)	34
" "	"	Shore A, loss - 5 to 14 (3 mo. @ RT)	34
" "	"	Shore A, loss 4 to gain 2 (6 mo. @ RT)	34
" "	"	Shore A, loss - 7 to 15 (7 d. @ 160 F)	34
" "	"	Shore A, loss - 7 to 18 (14 d. @ 160 F)	34
" "	"	Shore A, loss - 8 (21 d. @ 160 F)	34
" "	"	Shore A, loss - 8; 47% swell (60 min @ 350 F)	34
" "	"	Shore A, loss - 5; 7% swell (60 min @ 400 F)	34
Hycar 1014	"	Shore A, loss - 7 (7 d. @ RT)	34
Hycar 1014	"	64% swell (7 d. @ RT)	34
Hycar 1041	"	Shore A, loss - 13 to 21 (7 d. @ RT)	34
" "	"	Shore A, loss - 25 (14 d. @ RT)	34
" "	"	Shore A, loss - 10 and 14 (7 d. @ 160 F)	34
" "	"	Shore A, loss - 8 (14 d. @ 160 F)	34
" "	"	20% to 40% swell (7 d. @ RT)	34
" "	"	38% to 40% swell (14 d. @ RT)	34
" "	"	5% to 22% swell (7 d. @ 160 F)	34
" "	"	7% swell (14 d. @ 160 F)	34
Hycar 1072	"	Shore A, loss - 23 (7 d. @ RT)	34
" "	"	Shore A, loss - 23 (14 d. @ RT)	34
" "	"	Shore A, loss - 13 (21 d. @ RT)	34
" "	"	Shore A, loss - 18 (14 d. @ 160 F)	34
" "	"	15% swell (7 d. @ RT)	34
" "	"	66% swell (14 d. @ RT)	34
" "	"	35% swell (21 d. @ RT)	34
" "	"	80% swell (14 d. @ 160 F)	34
Hycar 2202	Nitrogen tetroxide	Unsatisfactory	21
" "	" " "	Class D, dissolving (1 d. @ 65 F)	4, 42
	Nitrogen tetroxide (+.2% moist)	Class 4 at 65 F	39
Hycar; Hycar 2202, Coating	RFNA	Class 4 at 75 F	39
Hycar 2202	RFNA-7	Severe attack at RT	27
" "	UDMH	Shore A, loss - 18 (7 d. @ RT)	34
" "	"	39% swell (7 d. @ RT)	34
Hydrocarbon polymers; Formulas 39, 53 and 101	Nitrogen tetroxide	Grade 2	5-7
Hydropol	Chlorine trifluoride	Low order detonation	19
"	50 50 Fuel blend	Compatible	19
Hydropol V	" " "	Class 2, to 140 F. Class 4 at 160 F	39
Hydropol T	" " "	Class 2, to 145 F	39
Hydropol	Hydrazine	Compatible	19
"	"	4% swell (7 d. @ RT)	34
"	"	2% to 5% swell (21 d. @ RT)	34
"	"	3% shrink (5 mo. @ RT)	34
"	"	2% swell (7 d. @ 160 F)	34
"	"	6% swell (5 mo. @ 160 F)	34
"	"	Shore A, loss - 1 (7 d. @ RT)	34
"	"	Shore A, loss - 1 (14 d. @ RT)	34
"	"	Shore A, loss 1 to gain 3 (21 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
H			
Hydropol	Hydrazine	Shore A, gain - 4 (5 mo. @ RT)	34
"	"	Shore A, loss - 1 (7 d. @ 160 F)	34
"	"	Shore A, gain - 4 (5 mo. @ 160 F)	34
"	Hydrazine, liquid	Class 2, to 160 F	39
Hydropol V, TP	Nitrogen tetroxide, liquid	-19 to 48% swell in 1d; 19 to 33% swell in 7 d., crumbled when flexed; good appearance	19
Hydropol	Propyl nitrate	Shore A, no change to loss - 2; 2% shrink to 5% swell (6 mo. @ RT)	34
"	" " "	Shore A, loss - 17; 33% swell (7 d. @ 160 F)	34
"	" " "	Shore A, gain - 3; 22% swell (2? d. @ 160 F)	34
"	" " "	Shore A, loss - 18; 10% and 13% swell (3 mo. @ 160 F)	34
"	" " "	5% shrink; brittle (3 mo. @ 160 F)	34
"	" " "	13% swell; brittle (3 mo. @ 160 F)	34
"	" " "	Shore A, no change to loss - 2; 4% and 8% swell (6 mo. @ 160 F)	34
"	" " "	5% swell (6 mo. @ RT)	33
"	" " "	13% swell (3 mo. @ 160 F)	33
"	" " "	4% swell (6 mo. @ 160 F)	33
Hydropol OT (plastic)	U-DETA (MAF-4)	Satisfactory	8
Hydropol TP	U-DETA	Satisfactory	12
Hydropol	UDMH	Shore A, loss - 7; 22% swell (60 min. @ 350 F)	34
"	"	Shore A, loss - 12; 20% swell (60 min. @ 400 F)	34
"	"	20% swell (14 d. @ 160 F)	34
"	"	Shore A, loss - 7 (7 d. @ 160 F)	34
Hydropol T	"	Class 2, good	8
Hydropol V	UDMH (liquid)	Class 3, 160 F	2
Hydropol V (9567), (9568), (9569), (9570), (1128), (1130), (1132), (3246) (Phillips Petroleum)	UDMH	Class 2, good	8
Hypalon 20	Aerozine 50	Unsatisfactory	21
Hypalon	Ammonia anhydrous	1.5% swell (7 d. @ RT)	33
"	" " "	1% swell (7 d. @ 160 F)	33
Hypalon 20	50/50 Fuel blend	Class 4 at 80 F	39
" "	" " "	Class D, 60 F, 90 d.	4
" "	" " "	Class D, black particles in fuel (7 d. @ 70-80 F)	4B
Hypalon	50/50 Hydrazine/UDMH	Class 2, limited service	8
"	Hydrazine	Incompatible	23
Hypalon 20	Hydrazine family	Grade 3	5-7
Hypalon gasket	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Hypalon "O" ring (GRC 80-5)	" " " "	Class 3 at 150 F	8, 39
Hypalon S-2	" " " "	Class 4 at 150 F	8, 39
Hypalon V-54-B (gray); V-56-a (gray); V-163-4 (black)	" " " "	Class 4 at 150 F	39
Hypalon	Nitrogen tetroxide	Incompatible	8, 3
"	" " "	Class D, 60 F	4
"	" " "	Grade 3	5-7
Hypalon 20	" " "	Unsatisfactory	21
" "	" " "	Class D, 100% volume swell in 7 hours (65 F)	4B
" "	Nitrogen tetroxide (~.2% moist)	Class 4 at 65 F, at 75 F	39
" "	Oxygen, liquid	Very sensitive, impact (2-2)	18
Hypalon adhesive	" " "	Impact: 2-10 @ 10 KgM	32
Hypalon rubber	" " "	Impact: 2-3, 2-2 @ 10 KgM	32
Hypalon, carbon filled	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Hypalon	RFNA	Fair resistance to acid immersion. Considerable attack after 8 hrs immersion. Decomposed after 72 hrs.	27

MATERIAL	FUEL	BEHAVIOR	REF
H			
Hysol: 4-77C(clear); 4-77D (amber); 4-77E; 4-77F; 4-78A (white); 4-78B (brown) 4-78C (amber); 4-78D (amber); 6000B (amber)	Hydrogen peroxide, 90%	Class 4 at 150 F	39
I			
Inorganic plastics	RFNA	Class 4 at 75 F	39
Insuroc	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Irr thene 101	Hydrogen peroxide, 90%	Class 2 at 150 F, limited	8, 39
" "	IRFNA	Blistering 7 d. @ RT	34
Irrathene 102	"	Blistering 7 d. @ RT	34
Irrathene 101	Nitrogen tetroxide	Tensile loss - 460 psi 1 d. @ RT	34
" "	" " "	Tensile loss - 920 psi 7 d. @ RT	34
Irrathene 201	" " "	Tensile loss - 200 psi 1 d. @ RT	34
" "	" " "	Tensile loss - 500 psi 7 d. @ RT	34
" "	" " "	Tensile loss - 2500 psi 14 d. @ RT	34
Isobutylene copolymers, formulas 41-43, 45-52, 103-109 and 111	" " "	Class D (80 F, 7 d.)	4
Isobutylene copolymers, formulas 44, 87-99, 100. 102	" " "	Class D (80 F, 30 d.)	4
Isobutylene copolymers, formula 101	" " "	Class B (80 F, 30 d.)	4
Isoprene	" " "	Class D - Severe	14A
K			
Kel-E-1	Hydrazine, liquid	Class 4 at 140 F	39
Kel-E-5	" " "	Class 4 at 140 F	39
Kel-F	Aerozine 50	Unsatisfactory	21
Kel-F elastomer	" "	Unsatisfactory	21
Kel-F LOX grade	" "	Unsatisfactory	21
Kel-F	Alcohols (methyl, ethyl, isopropyl, furfuryl)	Approved for use	3
"	Ammonia, gaseous	Class 2, to Hot	2, 39
"	Ammonia, liquid	Class 2, to Hot	2, 39
"	Ammonia, anhydrous, liquid	Grade 1	5-12
"	Ammonia, anhydrous, gaseous (< 250 F)	Grade 1	5-12
"	Ammonia, anhydrous, dry, ambient temp.	Class 2, limited	8
"	Ammonia, anhydrous, moist, ambient temp.	Class 2, limited	8
"	Ammonia, anhydrous	Satisfactory	3
Kel-F 5500, elastomer, seals	Boron hydride family	Grade 1	5-6
Kel-F and glass yarn, seals	" " " "	Grade 1	5-6
Kel-F 500, unplasticized, seals	" " " "	Grade 1	5-6
Kel-F	Bromine trifluoride, liquid	Class 2, to 75 F	39
"	Chlorine trifluoride	Satisfactory	3
"	Chlorine trifluoride gas *May be sensitive to high flow rates	Class 2, RT* room temperature	2
Kel-F	Chlorine trifluoride	Compatible, under static conditions only; long term applications.	40
"	" " " "	Incompatible; absorbs CTF at ambient temperature	31
"	" " " "	Approved, except for flow conditions	3
"			

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kel-F	Chlorine trifluoride	Promising for contact (avoid compounding ingredients which may react)	25
"	" " " "	Limited service	24
"	Chlorine trifluoride, gaseous	Class 2, to 75 F	39
"	Chlorine trifluoride, liquid	Class 2, to 85 F	39
"	Chlorine trifluoride	Class A, general service	8
Kel-F elastomer	" " " "	Class C, incompatible; swells and softens	8
Kel-F 800	" " " "	Apparent compatibility	19
Kel-F 5500	" " " "	Low order detonation	19
Kel-F	Ethylene oxide	Approved for temps to 160 F	3
Kel-F 81	FLOX-40 (40% F_2-60% O_2), gaseous	Class 1, to room temperature	39
Kel-F	Fluoramine family, liquid or gaseous	Grade 1	5-9
"	Fluorine: Liquid	Grade 3*, **	5-10
	Gaseous	Grade 2**	5-10
	*Not based on test results		
	**Unsatisfactory above	room temp	
Kel-F	Fluorine, gaseous	Acceptable at moderate pressures and low flow rates	3A
Kel-F	" " "	Class 1 to RT Class 4, >RT	2, 39
Kel-F 90	50/50 Fuel blend	Class D (60 F, 30 d.)	4
Kel-F (annealed)	" " "	Class A (60 F, 90 d.)	4
Kel-F-300 (unplasticized)	" " "	Class A (60 F, 180 d.)	4
" " " " "	" " "	Class B (80 F, 70 d.)	4
" " " " "	" " "	Class D (160 F, 30 d.)	4
Kel-F 300 unplastisized	" " "	Class B, slightly discolored, shrinks < 1% (360 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, stress cracks, surface attack (8 d. @ 70-80 F)	4B
" " " " "	" " "	Class D, blackened, became fragile (6 d. @ 160 F)	4B
" " " " "	" " "	Class B, slightly discolored, shrinks < 1% (30 d. @ 55-60 F)	4B
" " " " "	" " "	Class C, sample brown (270 d. @ 55-60 F)	4B
" " " " "	" " "	Class B (70 d. @ 70-80 F), hardened, cracking tendency	40
" " " " "	" " "	Class D (30 d. @ 160 F), blackened, became fragile	40
" " " " "	" " "	Class 2, to 60 F Class 4 at 80 F	39
Kel-F 300	" " "	Class A (180 d. @ 55-60 F) up to 3% H_2O	40
Kel-F 300, unfilled	" " "	Class 1, to 75 F	39
Kel-F 300, annealed	" " "	Class 3, to 60 F	39
Kel-F 300, 15% glass filled	" " "	Class 1, to 75 F	39
Kel-F 800	" " "	Class 4 at 75 F	39
Kel-F 3700; 5500	" " "	Class 4 at 75 F	39
Kel-F	Helium, gaseous	Suitable for use	3A
"	Halogen fluoride family	Grade 1; known to ignite. Expose to gaseous propellant before use; not to be exposed from metal more than .003 inch.	18
Kel-F elastomer	" " " "	Grade 3	5-8
Kel-F (unplasticized)	50/50 Hydrazine/UDMH	Class 1, general service Class 3, incompatible (160 F)	8 8
Kel-F	HEF-2	Satisfactory	1, 3
"	HEF-3	Satisfactory	1, 3
Kel-300	"	Satisfactory	3
Kel-F	HiCal-3	Satisfactory	1, 3
Kel-F-300, 500	"	Class 2, 120 F	2
" " "	"	Class 2, no change at 120 F	39

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kel-300	HiCal-3	Satisfactory	3
Kel-F	Hybaline A-5	Net % weight change, 500 hrs @ 50 C - 0.02	35
Kel-F, unplasticized	Hydrazine	Satisfactory	1, 3, 3A
Kel-F	"	Compatible	23
"	"	Class 1, 80 F	2
"	"	Class 4, 160 F	2
"	"	Compatible for long term application, <80 F	40
"	Hydrazine, liquid	Class 1, to 80 F Class 4, at 160 F	39
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
Kel-F (annealed)	Hydrazine family	Grade 2	5-5
Kel-F 300	" " "	Grade 3	5-5
Kel-F-300 (15% glass filled)	Hydrazine, liquid	Class 4 at 140 F	39
Kel-F 5500	Hydrazine family	Grade 3	5-5
Kel-F elastomer	Hydrazine	Incompatible	23
Kel-F	Hydrazoid B	Unsatisfactory; starts disintegrating in 120-150 d. at room temperature	31
"	Hydrocarbon fuels	Satisfactory	1, 3
"	Hydrogen: Liquid & cold gas	Grade 1	5-11
"	Hydrogen: Ambient gas	Grade 1	5-11
"	Hydrogen, liquid	Satisfactory	1, 3, 11
"	Hydrogen peroxide (long term use)	Satisfactory	1
"	Hydrogen peroxide	Class 1, acceptable	8
"	" " " "	Class 1, 2, 4	3
Kel-F, Alkane	Hydrogen peroxide (Concentrated)	Class 2, limited	8
Kel-F coating	Hydrogen peroxide, 90%	Class 1 at room temperature	39
Kel-F on 1060 aluminum - on 5254 aluminum - on 5652 aluminum	" " " "	Class 1 at 150 F	39
Kel-F-Dacron diaphragm-VL-1101m4	" " " "	Class 4 at 150 F	39
Kel-F "O" ring (CPD 7761-70)	" " " "	Class 2 at 150 F	39
Kel-F, Porous (15 micron pore)	" " " "	Class 2 at 150 F	39
Kel-F 550/800 (50/50)	Hydrogen peroxide (Concentrated)	Class 1 acceptable	8
Kel-F 800	" " "	Class 1, acceptable	8
Kel-F 820	" " "	Class 2, limited	8
Kel-F (unplasticized); Kel-F 800 (Lot 5649)	Hydrogen peroxide, 90%	Class 1 at 150 F	39
Kel-F 820 (G4028)	" " " "	Class 2 at 150 F	39
Kel-F 3700 gum	" " " "	Class 3 at 150 F	39
Kel-F 3700/Kel-F 800 (50/50)	" " " "	Class 2 at 150 F	39
Kel-F; 5160 diaphragm; 5500 (gray) diaphragm; 5500 (gray) on Dacron diaphragm	" " " "	Class 2 at 150 F	39
Kel-F 5500 gum	" " " "	Class 3 at 150 F	39
Kel-F 5500, unpigmented; 5500-121; 5500-61	" " " "	Class 2 at 150 F	39
Kel-F 5500/Kel-F 800 (50/50)	" " " "	Class 1 at 150 F	39
Kel-F 2140	IRFNA	Class 4 at 75 F	39
Kel-F-2140	"	Shore A, loss - 18 to 24 17% to 55% swell (7 d. @ RT)	34
" "	"	Shore A, loss - 26 to 51 46% to 99% swell (7 d. 160 F)	34
Kel-F 5500	"	Absorbed fuel; softened (-25% approx.)	14
" "	"	Shore A, loss - 6 to 15; 7% to 36% swell (7 d. @ RT)	34
" "	"	Shore A, loss - 15 to 24; 10% to 17% swell (14 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kel-F 5500	IRFNA	Shore A, loss - 20 to 29; 13% to 22% swell (21 d. @ RT)	34
" "	"	21 d. @ RT -- 13% swell	33
" "	"	Class 4 at 75 F	39
Kel-F	JP-4 Fuel	Little affected at 80 F or 160 F	27
Kel-F elastomer 3700 and 5500	" "	Exceptional resistance at R. T. immersion	27
Kel-F, unplasticized	Monomethyl hydrazine	Poor	8
" " " "	" " " "	Preferred (unspecified performance)	3A
Kel-F	Nitric acid,fuming	Satisfactory	1, 3
"	Nitrogen, gaseous	Suitable for use	3A
"	Nitrogen, liquid	Satisfactory	1, 3
Kel-F 5500	Nitrogen tetrafluoride	Promising compatibility	26
Kel-F	Nitrogen trifluoride, gaseous	Satisfactory for valve packing	8
"	Nitrogen tetroxide	Satisfactory	1, 3
"	" " "	Absorbs N_2O_4, becomes soft and flexible	10
"	" " "	Unsatisfactory	21
"	" " "	Class B/A, slight to satisfactory	14A
"	" " "	Withstands contact, among best	8
"	" " "	Incompatible	28
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Kel-F, annealed	Nitrogen tetroxide	Class C (60 F, 30 d.)	4
Kel-F, unplasticized	Nitrogen tetroxide (0.2-1.0% moist)	Class 1,to 160 F	2, 39
		Class 4 at 160 F	2, 39
Kel-F elastomer	Nitrogen tetroxide	Incompatible	8, 21, 30
Kel-F elastomer	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Kel-F 90	Nitrogen tetroxide	Grade 3	5-7
" "	" " "	Class D, Severe	14A
Kel-F 300	Nitrogen tetroxide (dynamic & static extended service)	Strength & stiffness decrease rapidly	10, 10A
Kel-F 300, unplasticized	Nitrogen tetroxide	Class C (60 F, 30 d.)	4
" " " " "	" " "	Class A (60 F, 30 d.)	4
" " " " "	" " "	Class C (80 F, 70 d.)	4
" " " " "	" " "	Grade 3	5-7
" " " " "	" " "	Class D, Shore D decrease 21 units, sample yellow (30 d. @ 55-60 F)	4B
" " " " "	" " "	Class D, Shore D decrease 29 units (1 d. @ 70-80 F)	4B
" " " " "	" " "	Class D, Shore D decrease 34 units, sample yellow (30 d. @ 55-60 F)	4B
" " " " "	Nitrogen tetroxide, liquid	Class C (70 d. @ 70-80 F) softened	40
" " " " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Kel-F 300, annealed	" " "	Class 4 at 60 F	39
Kel-F 500 and 500E	Nitrogen tetroxide	Strength & stiffness decrease more rapidly than 300	10
" " " "	Nitrogen tetroxide (dynamic & static extended service)	Strength & stiffness decrease rapidly	10A
" " " "	Nitrogen tetroxide	Grade 2	5-7
Kel-F-3700 and Kel-F-5500	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Kel-F 5500, 800	Nitrogen tetroxide	409 to 653% swell in 1 d.	19
Kel-F 5500, 820	" " "	700 + % swell in 1 d.	19
Kel-F (LOX grade)	" " "	Unsatisfactory	21
Kel-F sheet and O-rings	Oxygen	Grade 1	5-2
Kel-F 81	"	Spontaneous ignition temp - 425 C at 7500 psi; 431 C at 2000 psi	42

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kel-F elastomer 3700	Oxygen	Spontaneous ignition temp - 332 C at 7500 psi; 341 C at 2000 psi	42
Kel-F elastomer 5500	"	Spontaneous ignition temp - 340 C at 7500 psi; 352 C at 200 psi	42
Kel-F	Oxygen, liquid	Satisfactory	1, 3
"	" "	Insensitive, impact (0/20)	18
Kel-F primer: LL-1	" "	Insensitive, impact (0/10)	18
Kel-F primer: PN-25	" "	Insensitive, impact (0/10)	18
Kel-F sheet	" "	No reaction	18
Kel-F base elastomer (white), SR 24270	" "	Insensitive, impact (0/10)	18
Kel-F 700 elastomer	" "	Very sensitive, impact (2/2)	18
Kel-F 5500 elastomer	" "	Very sensitive, impact (2/2)	18
Kel-F elastomer	" "	Slightly sensitive, impact (3/10 - 40 ft lb); Sensitive, impact (5/10 - 50 ft lb)	33
Kel-F resin	" "	Insensitive, impact (0/6)	18
Kel-F gasket material	" "	No reaction	18
Kel-F, unplasticized (ACLAR)	" "	Impact insensitive; generally acceptable	32
Kel-F	Oxygen difluoride, liquid and gaseous	Grade 2	5-13
Kel-F 5909	Oxygen difluoride	Class 4, -109 F	39
Kel-F	Oxygen/Oxygen difluoride ($30\%\ O_2 + 70\%\ OF_2$)	Class 3, to 212 F	39
Kel-F	Pentaborane	Compatible for long term applications	3A, 40
Kel-F and glass yarn	" "	Compatible for long term applications	8, 22, 40
Kel-F and glass cloth	" "	Class 1,to 75 F	39
Kel-F 5500	" "	Class 1, to 75 F	39
" "	" "	Compatible for long term applications	3A, 8, 22, 40
Kel-F	Perchloryl fluoride	Satisfactory	3
Kel-F and Kel-F elastomer	Perchloryl fluoride dry	Class 2, 390 F	2
Kel-F	Perchloryl fluoride, liquid	Class 1, to 75 F Class 2, to 390 F	39
Kel-F elastomer	Perchloryl fluoride, gaseous	Class 2, to 390 F	39
Kel-F 5500	Perchloryl fluoride	Promising compatibility	26
Kel-F	Perchloryl fluoride (25)/chlorine trifluoride (75)	Class 3, to 85 F	39
Kel-F 5909, elastomer	Perchloryl fluoride (50)/tetrafluorohydrazine, gaseous	Class 2, to -109	39
" " " "	Perchloryl fluoride/-tetrafluorohydrazine	(Gaseous, 1 d.) -0.59* (Gaseous, 21 d.) -1.5*	20
" " " "	" " " "	Slight wt loss - slight solution (Gaseous, 21 d.)	20
	*Change in wt/unit area, mg/sq in.		
Kel-F	n-Propyl nitrate	Satisfactory	1, 3
"	RFNA	Outstanding resistance at room temperature and 160 F	27
Kel-F, coating	"	Class 1, to 75 F	39
" " "	"	Class 4 at 75 F	39
Kel-F 3700, elastomer	"	Withstood 500 hr, room temperature, least attack after acid	27
Kel-F 5500, elastomer	"	Withstood 500 hrs room temperature; withstood 8 hrs @ 160 F	27
Kel-F resin 800/Kel-F elastomer 5500 on Fiberglas	"	Stained yellow (7 d. @ RT)	38
Kel-F	U-DETA (MAF-4)	Unsatisfactory	8
Kel-F	U-DETA	Discolors	12
Kel-F 800	"	Unsatisfactory	12
Kel-F elastomer	"	Discolored, distorted, cracked & brittle	12

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kel-F	UDMH	Among best, but unspecified performance	3A
Kel-F, unplasticized	UDMH (liquid)	Class 1, 140 F	2
" " " "	UDMH (vapor)	Class 1, 140 F	2
" " " "	UDMH	Satisfactory	1, 3
" " " "	"	Compatible for long term storage, < 140 F	40
Kel-F X300, elastomer	UDMH (vapor)	Class 4, < 140 F	2
	UDMH (liquid)	Class 4, < 140 F	2
Kel-F 3700, elastomer	" "	Class 4, 80 F	2
Kel-F 5500, elastomer	" "	Class 4, 80 F	2
Kel-F 300-25	" "	Class 4, 140 F	2
" "	UDMH (vapor)	Class 4, 140 F	2
Kel-F, unfilled	UDMH	Class 2, good	8
Kel-F 300, 15% glass filled	"	Class 2, good	8
Kel-F 800	"	Class 3, fair	8
Kel-F, dispersion coating	WFNA	Class 2, slight corrosion rate, 75 F limit	2, 8, 38
Kel-Flo Polymers	Hydrogen peroxide	Class 2, 3	3
Klinger Acidit	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Klinger 721 (400)	UDMH	Class 2, good	8
Klinger acidit	"	Class 2, good	8
Klinger 1000	"	Class 2, good	8
Klinger Oilit	"	Class 2, good	8
Klingerit (pink)	"	Class 2, good	8
Kodapak II	IRFNA	Class 4 at 75 F	39
" "	"	Dissolved (7 d. @ RT)	34
" "	Nitrogen tetroxide	Disintegrated (1 d. @ RT)	34
" "	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Korda Flex (Teflon-coated glass fabric	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Koroseal	Aniline	Satisfactory	3
"	Halogen fluoride family	Grade 3	5-8
"	Hydrazine, liquid	Class 3, to 77 F	2, 39
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
Koroseal, vinylite	Hydrazine family	Grade 2	5-5
Koroseal	Hydrogen peroxide	Class 2 and 3	3
Koroseal: 116 and 117 (molded)	Hydrogen peroxide, 90%	Class 3 @ 150 F, very limited	8, 39
Koroseal 700	" " " "	Class 2 @ 150 F, limited	8, 39
Koroseal	Nitrogen tetroxide (water, >0.1%)	Class 3, 80 F	2
"	Nitrogen tetroxide	Limited service	30
"	Nitrogen tetroxide (0.2-1.0% moist)	Class 3 at 80 F	39
"	WFNA, liquid	Class 4 at 75 F	39
Kralite	Hydrogen peroxide, 90%	Class 3 at 150 F	8, 39
"K" Seal (Teflon and metal)	Nitrogen tetroxide	Grade 1	5-7
Kynar liner	Aerosine 50	Very resistant, but permeable (30 d. @ 100 F)	36A
Kynar	" "	Tensile, 81.0% ret (7 d. @ 100 F)	36C
"	" "	Tensile, 110% ret (30 d. @ 100 F)	36C
"	" "	Elongation, 82.5% ret (7 d. @ 100 F)	36C
"	" "	Elongation, 100+ ret (30 d. @ 100 F)	36C
"	" "	Hardness, -2 change (7 d. @ 100 F)	36C
"	" "	Hardness, -1 change (30 d. @ 100 F)	36C
"	Chlorine trifluoride	Tensile, 102.7% ret (7 d. @ 100 F)	36C
"	" " "	Tensile, 96.6% ret (30 d. @ 100 F)	36C

MATERIAL	FUEL	BEHAVIOR	REF
K			
Kynar	Chlorine trifluoride	Elongation, 100% ret (7 d. @ 100 F)	36C
"	" " " "	Elongation, 125.0% ret (30 d. @ 100 F)	36C
"	" " " "	Hardness, +4 change (7 d. @ 100 F)	36C
"	" " " "	Hardness, +3 change (30 d. @ 100 F)	36C
"	Chlorine trifluoride (liquid, at 30 C max temp, in Kel-F tube)	No apparent reaction up to 25 C	9
Kynar 1400	Hybaline A-5	Net % weight change (500 hrs @ 50 C) - 0.04	35
Kynar	50/50 Fuel blend	Class 2, to 80 F Class 4 at 160 F	39
"	" " "	Class B, Sample discolored (30 d. @ 70-80 F)	4B
"	" " "	Class A, (30 d. @ 70-80 F)	4B
"	" " "	Class D, swollen, cracked (30 d. @ 160 F)	4B
"	Nitrogen tetroxide	Compatible for long term applications, test temp 63-67 F	40
"	Nitrogen tetroxide (<.2% moist)	Class 1,to 80 F	39
Kynar liner	Nitrogen tetroxide	Very resistant, but permeable (30 d. @ 100 F)	36A
Kynar	" " "	Tensile, 83.2% ret (7 d. @ 100 F)	36C
"	" " "	Tensile, 115.0% ret (30 d. @ 100 F)	36C
"	" " "	Elongation, 100+ ret (7 d. @ 100 F)	36C
"	" " "	Elongation, 50% ret (30 d. @ 100 F)	36C
"	" " "	Hardness, -3 change (7 d. @ 100 F)	36C
"	" " "	Hardness, -11 change (30 d. @ 100 F)	36C
L			
Lactoprene	Hydrazine, anhydrous	Incompatible, Class C	8
" "	Hydrazine hydrate	Incompatible, Class C	8
" "	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
" "	Hydrazine family	Grade 3	5-5
" "	Hydrazine, liquid	Class 4 at 75 F	39
Laminac 4128	Oxygen, liquid	Impact sensitive (4/10)	18
Lankote Fluoro B	WFNA	Class 4, all temps	2
" " "	"	Class 3, 75 F	8
Lankote Fluoro B	U-DETA	Unsatisfactory	12
Lankote-KB	WFNA	Class 3, 75 F (Intermittent spillage)	2
Lexan	Aerozine 50	Unsatisfactory	21
"	50/50 Fuel blend	Class D, dissolved (10 d. @ 55-60 F)	4B
"	" " "	Class D, dissolved in 2 min (@ 70-80 F)	4B
"	" " "	Class D (60 F, 30 d.)	4
"	" " "	Class 4 at 60 F	39
"	50/50 Hydrazine UDMH	Class 3, incompatible	8
"	Hydrazine	Dissolved (7 d. @ RT)	34
"	IRFNA	Class 4 at 75 F	39
"	"	Dissolved (1 d. @ RT)	34
"	Nitrogen tetroxide	Class D (60 F, 30 d.)	4
"	" " "	Class D, Severe	14A
"	" " "	Unsatisfactory	21
"	" " "	Grade 3	5-7

MATERIAL	FUEL	BEHAVIOR	REF
L			
Lexan	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
"	n-Propyl nitrate	Tensile loss, 2100 psi; 39% volume swell (7 d. @ RT)	34
Lucite	Hydrazine family	Grade 3	5-5
"	Hydrazine, liquid	Class 2, to 80 F	2, 39
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class C	8
"	Hydrogen, liquid	Compatible for long term applications	8, 40
"	" " "	Class 1 or 2	2
"	Hydrogen: Liquid & cold gas	Grade 1	5-11
	Ambient gas	Grade 1	5-11
Lucoflex (PVC) (translucent or white)	Hydrogen peroxide, 90%	Class 3 at 150 F	8, 39
M			
Marlex 50	Aerozine 50	Slight absorption; stress cracking (20 hr @ 75 +5 F)	10
" "	" "	Unsatisfactory	21
" "	50/50 Fuel blend	Class B (60 F, 90 d.)	4
" "	50/50 Hydrazine/UDMH	Class 2, limited service	8
" "	Nitrogen tetroxide	Unsatisfactory	21
" "	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Marlex 5003	Nitrogen tetroxide, liquid	Class D (30 d. @ 70-80 F) became brittle	40
Marlex 5003	Nitrogen tetroxide	Class D (80 F, 30 d.)	4
Marvinal 218-200	Hydrogen peroxide	Class 4, not acceptable	8
Marvinal 218-200; 218-201; NG-3005; NR-6010	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Melamine - See also "Melmac"			
Melamine formaldehyde (American Cynamid)	Aerozine 50	Good (7 d. @ 70 F)	36
Melamine formaldehyde	Hydrazine, anhydrous	Limited service, Class B	8
" " " " "	Hydrazine, hydrate	Limited service, Class B	8
" " " " "	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
" " " " "	Hydrazine family	Grade 2	5-5
Melamine formaldehyde (American Cynamid)	Nitrogen tetroxide	(1) Good (2 d. @ 70 F) (2) Discolored (2 d. @ 70 F)	36
Melamine	Oxygen, liquid	Sensitive, impact (4/10)	18
Melamine, cellulose	" "	Very slight sensitive, impact (1/20)	18
Melamine, mineral filler	" "	Sensitive, impact (3/10)	18
Melamine, molded	" "	Sensitive, impact (3/10)	18
Melamine formaldehyde	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
Melamine resins	n-Propyl nitrate	Satisfactory	1, 3
Melamine formaldehyde	RFNA	Class 4 at 75 F	39
Melbestos G 31 (Melrath Gasket)	UDMH	Class 2, good	8
Melmac No. 1077	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Methyl methacrylate - See also "Lucite", "Plexiglas"			
Methyl methacrylate (Plexiglas)	Propellant 113	Little effect	13
Methyl methacrylate resins	RFNA	Class 4 at 75 F	39
Methyl styrene	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
Metlbond 402 (adhesive)	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Micarta	Hydrogen, liquid	Compatible for long term applications	8, 40

MATERIAL	FUEL	BEHAVIOR	REF
M			
Micarta	Hydrogen: Liquid & cold gas	Grade 1	5-11
	Ambient gas	Grade 1*	5-11
	*Not based on test results		
"	Hydrogen, liquid	Class 1 or 2	2
"	Nitrogen tetroxide	Grade 3	5-7
Modacrylic fiber - See also "Dynel"			
Mylar	Aerozine 50	Unsatisfactory	21
Mylar, seals	Boron hydride family	Grade 3	5-6
Mylar	50/50 Fuel blend	Class 4 at 60 F	39
Mylar A	" " "	Class 2, to 75 F	39
Mylar	" " "	Class D (30 d. @ 55-60 F) dissolved	4, 40
"	50/50 Hydrazine/UDMH	Class 3, incompatible	8
"	Hydrazine	Incompatible	23
Mylar, A	Hydrazine, liquid	Class 4 at 140 F	39
Mylar films	Hydrogen, liquid	Acceptable	1
" "	Hydrogen: Liquid & cold gas	Grade 3*	5-11
	Ambient gas	Grade 1	5-11
	*Not based on test results		
Mylar A and Mylar B	Hydrogen peroxide, 90%	Class 1 at 150 F	8, 39
Mylar	IRFNA	Class 4 at 75 F	39
"	"	Dissolved (7 d. @ RT)	34
"	Nitrogen tetroxide	Unsatisfactory	21
"	" " "	Incompatible	30
"	" " "	Disintegrated (1 d. @ RT)	34
"	" " "	Grade 3	5-7
"	" " "	Class D (60 F, 30 d.)	4
"	" " "	Class D, severe	13
"	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-60 F), dissolved	40
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Mylar films	Nitrogen, liquid	Satisfactory	3
Mylar	Oxygen, difluoride (Liquid)	Grade 2*	5-13
	*Gain in wt. indicating absorption		
"	Oxygen difluoride (Gas)	Grade 2	5-13
Mylar film	Oxygen, liquid	Flexes easily, impact strength good	17
Mylar film, aluminum faced	" " "	Flexes without breaking; good impact strength	17
Mylar film, w/polyester adhesive	" " "	Flexes without breaking; good impact strength	17
Mylar tape (Permacel 254)	" " "	Flexibility good; impact strength good	17
Mylar tape (#427)	" " "	Flexed without breaking; impact strength good	17
Mylar tape (Mystic tape)	" " "	Flexed without breaking; good impact strength	17
Mylar film/ to fiberglass cloth	" " "	Flexibility good; impact strength good	17
Mylar	" " "	Impact sensitive	32
Mylar rope strands	" " "	Very sensitive, impact (3/3)	18
Mylar/aluminum laminate	" " "	Positive detonation	18
Mylar	" " "	Very slight sensitive, impact (2/30)	18
"	Pentaborane	Incompatible	8, 22
		Class 4 at 75 F	39
Mylar A	U-DETA	Satisfactory	12
Mylar	U-DETA (MAF-4)	Satisfactory	8
"	UDMH (liquid)	Class 4, 75 F	2
Mylar A	UDMH	Class 2, good	8
Mystic tape A-117	Oxygen, liquid	Impact, moderate detonation	18

MATERIAL	FUEL	BEHAVIOR	REF
N			
Napco foam, F-10 and B-49	Pentaborane	Incompatible	22
Narmco X3168	50/50 Fuel blend	Class 4 at 60 F	39
" " "	" " "	Class D (at 55-60 F)	4B
Neoprene N-250	Aerozine 50	No visible change (24 hr @ 75 +5 F)	10
Neoprene	" "	No visible change (24 hr @ 75 F)	10A
"	" "	Unsatisfactory	21
Neoprene	Alcohols (methyl, ethyl, isopropyl)	Approved for use	3
"	Ammonia, anhydrous, liquid and gas (< 250° F)	Grade 2	5-12
"	Ammonia, anhydrous	3% shrink (7 d. @ RT)	33
"	" " " "	3% shrink (7 d. @ 160 F)	33
"	Ammonia, anhydrous, dry	Class 2, limited	8
"	Ammonia (dry)	Class 2, 75 F Class 4 at Hot	2
"	Ammonia, gaseous	Class 2, to 75 F Class 4 at Hot	39
Neoprene, seals	Boron hydride family	Grade 3	5-6
Neoprene	Chlorine trifluoride, gaseous	Class 1, to 75 F	39
"	Chlorine trifluoride	Class C, incompatible; swells and surface progressively attacked; used for protective clothing only.	8
"	" " " "	Satisfactory (protective clothing only)	3
Neoprene KNR	" " " "	No significant change after initial reaction (30 min @ room temperature)	19
Neoprene	Fluorine, gaseous	Class 4, all temps	2, 39
Neoprene, glass filled	Fluorine, gaseous	Class 4, >RT	39
Neoprene	Fluorine: Liquid	Grade 3	5-10
	Gas	Grade 3	5-10
Neoprene, glass filled	Fluorine: Liquid	Grade 3	5-10
	Gas	Grade 3	5-10
Neoprene	50/50 Fuel blend	Class D, fuel discolored red, 38% volume swell (30 d. @ 55-60 F)	4B
"	" " "	Class B, Shore A decrease 9 units (2 d. @ 70-80 F)	4B
"	" " "	Class D, Shore A decrease 12 units (9 d. @ 70-80 F)	4B
"	" " "	Class D (60 F, 90 d.)	4
"	" " "	Class 4 at 60 F	39
Neoprene, duPont 1158	" " "	Class 4 at 100 F	39
Neoprene, Goodrich G91	" " "	Class 2 at 100 F	39
Neoprene	50/50 Hydrazine/UDMH	Class 3, incompatible	8
"	Halogen fluoride family	Grade 3	5-8
"	Hi-Cal 3	Class 4, stiffened at 120 F	2, 39
"	Hydrazine	Incompatible	23
"	"	Class 2, 75 F	2
"	Hydrazine family	Grade 3	5-5
"	Hydrazine, liquid	Class 2, to 75 F Class 3, to 75 F Class 4, to 68 F	39
"	Hydrocarbon fuel	Satisfactory	1, 3
"	Hydrogen, liquid	Unsatisfactory	8
"	" " "	Class 4	2
"	Hydrogen: Liquid & cold gas	Grade 3*	5-11
	*Not based on test results		
	Ambient gas	Grade 1	5-11
Neoprene	Hydrogen peroxide	Class 4	3
Neoprene: pure gum and SR 365-B	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Neoprene rubber	Mixed amines	No apparent effect (7 d. @ RT)	38
Neoprene 318-70	Monomethylhydrazine	Intermediate	8
Neoprene	Nitrogen tetroxide	Incompatible	8, 21, 28

MATERIAL	FUEL	BEHAVIOR	REF
N			
Neoprene	Nitrogen tetroxide	Grade 3	5-7
"	" " "	Class D, 60 F	4
"	" " "	Class D, decomposed in 4 hr. (at 70-80 F)	4B
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
"	Oxygen	Spontaneous ignition temp - 190 C at 7500 psi; 200 C at 2000 psi	42
"	Oxygen, liquid	Sensitive, impact (4/10 - 40 ft lb)	33
		Very sensitive (10/10 - 50 ft lb)	33
Neoprene rubber	" " "	Violent detonation (impact)	18
" " "	" " "	Sensitive, impact (8/30)	18
Neoprene	" " "	Very sensitive, impact (2/2)	18
Neoprene rubber, arctic	" " "	Very sensitive, impact (8/10)	18
Neoprene base adhesive (scotch tape)	" " "	Impact; 20/20 @ 10 Kg M	32
Neoprene, carbon filled	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Neoprene, coating	RFNA	Class 4 at 75 F	39
Neoprene latex	U-DETA (MAF-4)	Unsatisfactory	8, 12
Neoprene rubber	" " "	Unsatisfactory	8, 12
Neoprene, duPont 1158	UDMH	Class 3, fair	8
Neoprene, B. F. Goodrich, G91	"	Class 3, fair	8
Neoprene	UDMH (liquid)	Class 4, 32 F	2
Neoprene gasket, duPont	UDMH	Class 4, poor	8
Nitride rubber on nylon seals	Boron hydride family	Grade 3	5-6
Nitrile silicone, GE NSRX5602	50/50 Fuel blend	Class 4 at 85 F	39
Nitrile silicone, GE SE750	" " "	Class 4 at 130 F	39
Nitrile rubber	Hydrogen, liquid	Compatible for long term application	40
" "	" " "	Satisfactory	8
" "	" " "	Class 1 or 2	2
Nitrile silicone NSRX5602 (General Electric)	UDMH	Class 4, poor	8
Nitroso rubbers	Nitrogen tetroxide	Class D - Severe	14A
Nitroso terpolymers (cured with chromium trifluoroacetate)	" " "	Compatible, unaffected after 90 d. @ 160 F, in an unstressed state.	41
Nitride rubber on nylon	Pentaborane	Incompatible	8, 22
" " " "	" "	Class 4 at 75 F	39
Nylon - See also "Plaston"			
Nylon, seals	Fuels (general)	Acceptable for continuous use	16
Nylon	Aerozine 50	Satisfactory	21
Nylon Zytel 31	" "	Slight surface absorption (110 d. @ 75.5 F)	10
" " "	" "	Stress cracking, 60 d. @ 73 F and 24 hrs at 160 F. Crazes after 8 months.	10
" " "	" "	Compatible for long term applications (test temp 70-80 F)	40
Nylon Zytel 31, coating	" "	Unstressed material crazes in 223 d.	10A
Nylon Zytel 63	" "	Softens and slowly dissolves 75 F	10
Nylon Zytel 63, coating	" "	Softens and slowly dissolves	10A
Nylon Zytel 101	" "	Slight surface absorption, no visible change, 120 days, 75 F	10
" " "	" "	Stress cracking, 50 to 70 d. @ 75 F, and less than 45 hrs @ 160 F. Crazes after 8 mo.	10A
Nylon Zytel 101, coating	" "	Unstressed material crazes in 233 d.	10A
Nylon	Alkyl boranes (HiCal-3 and HEF-3)	Satisfactory	1
Nylon, seals	Boron hydride family	Grade 3	5-6
Nylon	Chlorine trifluoride	Incompatible	24
"	Ethylene oxide	Ambient temp, intermittent use	3
Nylon	50 50 Fuel blend	Eventual sharp drop in ultimate tensile (9 mo.	16

MATERIAL	FUEL	BEHAVIOR	REF
N			
Nylon Zytel	50/50 Fuel blend	Class A - (50 d. @ 70-80 F)	4B
" "	" " "	Class D - Crazed, cracked (60 d. @ 70-80 F)	4B
Nylon Zytel 3[illegible]	" " "	Class D crumbled (7 d. @ 160 F)	4B
" " "	" " "	Class A (110 d. @ 70-80 F) no visible change	40
" " "	" " "	Class D - crumbled (7 d. @ 160 F)	4B
" " "	" " "	Class A, 80 F 110 d.	4
Nylon Zytel 31, 63	" " "	Class D, 160 F, 7 d.	4
Nylon Zytel 63	" " "	Class 4 at 80 F	39
Nylon 101	" " "	Class D - dissolved (70-80 F)	4, 4B
Nylon Zytel 101	" " "	Class D (180 d. @ 55-80 F/2% H_2O) disintegrated	40
" " "	" "	Class 1, to 60 F	39
" " "	" "	Class 4 at 80 F	
" " "	" "	Class D (60 F, 180 d.)	4
" " "	" "	Class B (80 F, 120 d.)	4
" " "	" "	Class D (160 F, 7 d.)	4
" "	" "	Class A (360 d. @ 55-80 F)	4B
" " "	" "	Class B - Shore D decrease 6 units (50 d. @ 70-80 F)	4B
Nylon Zytel 31	50/50 Hydrazine/UDMH	Class D - crazed, cracked (55 d. @ 70-80 F)	4B
Nylon Zytel 63; Zytel 101; Zytel 211	" " " "	Class 1, general service	8
Nylon	Halogen fluoride family	Class 3(160 F) incompatible	8
"	HEF-3	Class 2, limited service	8
Nylon, Zytel 101-NC-10	HiCal-3	Grade 3	5-8
Nylon	"	Satisfactory	3
"	Hydrazine, anhydrous	Satisfactory	3
"	Hydrazine hydrate	Class 2, no change at 120 F	2, 39
	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
"	Hydrazine	Limited service, Class B	8
		Limited service, Class B	8
"		Compatible for long term application (<90)	40
"	Hydrazine family	Grade 2	5-5
"	Hydrazine, liquid	Class 3, to 75 F	39
	Hydrogen: Liquid & cold gas	Grade 1	5-1[illegible]
	Ambient	Grade 1	
"	Hydrogen, liquid	Satisfactory	3
"	Hydrogen bromide	Class 4, unacceptable	3, 8
"	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Nylon Zytel	IRFN	Dissolved (7 d. @ RT)	34
" "	"	Class 4 at 75 F	39
Nylon	Nitrogen, liquid	Satisfactory	3
"	Nitrogen tetroxide	Unsatisfactory	21
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 65 F	[illegible]
Nylon Zytel	Nitrogen tetroxide	Disintegrated 1 d. @ RT)	34
" "	" " "	Class D - severe	13
Nylon Zytel 101	" " "	Grade 3	5-7
" " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Nylon 101	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-80 F) broke apart	4, 40
Nylon felt	Oxygen	Grade 2	5-2
Nylon	Oxygen, liquid	Incompatible	8
"	" "	Impact sensitive, unacceptable	32
"	" "	Very sensitive (10/10)	18
"	" "	Positive detonation (at 110); Moderate detonation (at 60)	18
Nylon insulated thermocouple wire (type NN30DT)	" "	Positive detonation	18
Nylon epoxy	" "	Impact (17 % @ 10 Kgm)	32
Nylon jacket, polyvinyl chloride dielectric	" "	Sensitive, impact (8/10)	18

MATERIAL	FUEL	BEHAVIOR	REF
N			
Nylon potting molds	Oxygen, liquid	Very sensitive, impact (10/10)	18
Nylon inserts	" " "	Very sensitive, impact (10/10)	18
Nylon	Pentaborane	Incompatible	8, 22
		Class 4 at 75 F	39
"	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
Nylon 6, Plaskon	Propellant 113	No effect	15
Nylon 66, Zytel 101	" "	Little effect	13
Nylon	n-Propyl nitrate	Satisfactory	1, 3
"	RFNA	Class 4 at 75 F	39
"	UDMH, liquid	Class 1, 130 F	2
"	UDMH	Compatible for long term storage,	40
O			
Opalon 1219, 1220, 1444, 81222	50/50 Fuel blend	Class 4 at 60 F	39
Opalon 1219	Nitrogen tetroxide (<.2% moist)	Class 3, to 60 F	39
Opalon 1220; 1444; 81222	" " "	Class 4 at 60 F	39
Opalon 75219	RFNA	Fair resistance to acid; no decomposed after 72 hrs, room temperature	27
Orlon felt	Oxygen	Grade 2	5-2
Orlon	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Oxiron (for electrical protective coating): Oxiron - PMDA, Oxiron - NOVOLAC	Propellant system (general)	Satisfactory, but only when cured at 180 F and above	18
P			
Paraplex P-43	Aerozine 50	Unsatisfactory	21
" "	50/50 Fuel blend	Class D (60 F, 30 d.) decomposed	4, 4B
" "	50/50 Hydrazine/UDMH	Class 3, incompatible	8
" "	Hydrazine family	Grade 3	5-5
" "	Nitrogen tetroxide	Unsatisfactory	21
" "	" " "	Class D (60 F, 30 d.)	4
" "	" " "	Class D - dissolved (14 d. @ 55-60 F)	4B
Paraplex P-43, seals	" " "	Grade 3	5-7
Paraplex P-43	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Penton	Aerozine	Unsatisfactory	21
Penton 9215 (Hercules)	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Penton	Nitrogen tetroxide	Class D - severe	13
"	" " "	Unsatisfactory	21
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
"	Oxygen, liquid	Sensitive, impact (2/3)	18
Penton 9215	UDMH	Class 2, good	6
Perfluoraniline	Chlorine trifluoride	Promising compatibility	26
Perfluorobutyl, Acrylate	Perchloryl fluoride (dry)	Class 4 390 F	2
Perfluorobutyl acrylate - See also "Poly FPA"			
Perfluorobutyl acrylate (carbon filled)	Perchloryl fluoride,	Class 4 at 390 F	39
Perfluorocarbons	Nitric acid, fuming	Satisfactory	3
" " "	Oxygen, liquid	Satisfactory	3
Permatex No. 1, No. 2	Fluorine (Liquid)	Grade 3*	5-10
	Fluorine (Gaseous) *Not based on test results	Grade 3	5-10
" " " " "	Fluorine gas	Class 4, all temps	2
Permatex No. 3	" "	Class 3, < RT	2

MATERIAL	FUEL	BEHAVIOR	REF
P			
Permatex No. 3	Fluorine (Liquid)	Grade 3*	5-10
	Fluorine (Gaseous)	Grade 2	5-10
	*Not based on test results		
Permatex No. 2, Thread Composition	Halogen fluoride family	Grade 1	5-8
Permatex	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Phenol compounds - See also "Heresite"			
Phenol formaldehyde - See also "Insuroc"			
Phenol formaldehyde (U. S. Polymeric)	Aerozine 50	Faded, Wt change - +9.40% (7 d. @ 70 F)	36
" " " " "	" "	(1) Appearance good (2 d. @ 70 F)	36
		(2) Completely degraded (2 d. @ 70 F)	
Phenol formaldehyde resin system	" "	Completely dissolved (7 d. @ 60 F)	36A
Phenol formaldehyde	" "	Completely dissolves (7 d. @ 60 F)	36C
Phenol/glass filament	" "	Wt change, +2.82 (7 d. @ 60 F)	36C
" " " "	" "	Barcol, -29 (7 d. @ 60 F)	36C
" " " "	" "	Shear, 92.3% ret (7 d. @ 60 F)	36C
" " " "	" "	Wt change, +6.80 (7 d. @ 100 F)	36C
" " " "	" "	Barcol, -13 (7 d. @ 100 F)	36C
" " " "	" "	Shear, 91.5% ret (7 d. @ 100 F)	36C
Phenol formaldehyde	Ammonia, gaseous	Class 4 at 75 F	39
" " " "	Fluorine, gaseous	Class 4 at 75 F	39
" " " "	Hydrogen peroxide, 90%	Class 4 at 150 F, unacceptable	8, 39
Phenol formaldehyde (U. S. Polymeric)	Nitrogen tetroxide	Slightly faded	
		Wt change - +1.39 (7 d. @ 70 F)	36
" " " " "	" " "	(1) Good (2 d. @ 70 F)	36
		(2) Soft, mushy (2 d. @ 70 F)	
Phenol formaldehyde (Cincinnati test lab)	" " "	Too porous (2 d. @ 70 F)	36
Phenol formaldehyde resin system	" " "	Good, slight crazing (30 d. @ 60 F)	36A
		Poor, severe erosion (30 d. @ 100 F)	36A
Phenol formaldehyde/glass composite	" " "	Poor, complete delamination (1 mo @ 60 F)	36B
		Complete deterioration (1 mo. @ 100 F)	36B
Phenol formaldehyde	Nitrogen tetroxide	Flexure, 57.2% ret (7 d. @ 60 F)	36C
" " " "	" " "	Flexure, 63.3% ret (30 d. @ 60 F)	36C
" " " "	" " "	Flexure, 47.8% ret (90 d. @ 60 F)	36C
" " " "	" " "	Flexure, 44.2% ret (7 d. @ 100 F)	36C
" " " "	" " "	Flexure, 42.8% ret (30 d. @ 100 F)	36C
" " " "	" " "	Flexure, 24.5% ret (90 d. @ 100 F)	36C
" " " "	" " "	Hardness, +8 change (7 d. @ 60 F)	36C
" " " "	" " "	Hardness, +9 change (30 d. @ 60 F)	36C
" " " "	" " "	Hardness, +5 change (90 d. @ 60 F)	36C
" " " "	" " "	Hardness, +13 change (7 d. @ 100 F)	36C
" " " "	" " "	Hardness, +15 change (30 d. @ 100 F)	36C
" " " "	" " "	(Severe erosion) (90 d. @ 100 F)	36C
Phenol/glass filament	" " "	Delamination (7 d. @ 60 F)	36C
Phenol formaldehyde	RFNA	Class 4 at 75 F	39
Phenol furfurals	"	Class 4 at 75 F	39
Phenolic - See also "Haveg 41" "Bakelite" "Trevarno"			
Phenolic, paper-base - See also "Spauldite"			
Phenolic nitrile - See also "Metlbond 402"			
Phenolic-epoxy-silicone PT201G, coating	Aerozine 50	No visible change after immersion at 75±5 F for 25 hours	10, 10A

MATERIAL	FUEL	BEHAVIOR	REF
P			
Phenolic 37-9X; adhesive and coating	Aerozine 50	No visible change after immersion for 25 hrs @ 75+5 F	10
Phenolic SC1008, insulation	" "	Some attack, 24 hrs @ 75 +5 F	10, 10A
Phenolic F-120-55, insulation	" "	Some bleeding; no visible change after 4 hrs @ 75+5 F	10, 10A
Phenolic laminate	" "	Unsatisfactory	21
Phenolics	Ammonia, gaseous	Class 2, to Hot	2, 39
	Ammonia, liquid	Class 2, to Hot	
Phenolics	Ammonia, anhydrous, dry or moist, ambient temp.	Class 2, limited service	8
" "	Ammonia, anhydrous: Liquid	Grade 1	5-12
	Gas (< 250 F)	Grade 1	5-12
Phenolic-filled graphite	Chlorine trifluoride, liquid	Class 4 at 75 F	39
Phenolic, filled	Fluorine, liquid	Grade 3	5-10
	Fluorine, gaseous	Grade 3	5-10
" " "	Fluorine, gaseous	Class 4, all temps	2, 39
Phenolic cement	" " "	Class 4, all temps	2, 39
Phenolic-asbestos	50-50 Fuel blend	Class D (@ 55-60 F)	4B
" " "	" " "	Class 4 at 60 F	39
Phenolic-glass laminate	" " "	Class 4 at 60 F	39
" " " " "	" " "	Class C, fuel and sample discolored (30 d. @ 55-60 F)	4B
" " " " "	50/50 Fuel blend	Class D, fuel discolored, resin dissolving (90 d. @ 55-60 F)	4B
Phenolic laminate	" " "	Class D (30 d. @ 55-60 F) fuel red, resin removed	40
Phenolic-glass-laminate (Composition unknown)	" " "	Class C (60 F, 180 d.)	4
Phenolic glass laminate	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Phenolic	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
"	Hydrazine family	Grade 2	5-5
"	Hydrazine, liquid	Class 3, to 75 F	39
"	Nitrogen tetroxide	Grade 3	5-7
Phenolic SC 1008, insulaiion	" " "	Discolored in 4 hrs immersion	10
" " " " "	" " "	50 F continuous service, discolors in 4 hr immersion.	10A
Phenoiic, Trevarno F-120	" " "	Slightly bleeding during 24 hr immersion.	10, 10A
Phenolic F-120-55, insulation	" " "	1% weight loss, 4 hr immersion. No significant change, 500 F rating	10, 10A
Phenolic-epoxy-silicone, PT-201G	" " "	Extreme bleeding during splash, no further visible change during 24 hour immersion	10, 10A
Phenolic laminate	" " "	Unsatisfactory	21
Phenolic laminate	Nitrogen tetroxide (< 2% moist)	Class 2, to 60 F Class 4 at 75 F	39
Phenolic-glass laminate (composition unknown)	Nitrogen tetroxide	Class C (60 F, 30 d.)	4
" " " " " " "	" " "	Class B, sample was bleached (30 d. @ 55-60 F)	4B
Phenolic	Oxygen, liquid	Impact sensitive	32
"	" "	Moderate detonation, impact	18
Phenolic asbestos	" "	Very slightly sensitive, impact (2/40)	18
Phenolic epoxy	" "	Impact; 1/1 @ 10 KgM	32
Phenolic fiber	" "	Sensitive, impact (5/10)	18
Phenolic laminate, glass base	" "	Impact; 16/20, 2/22 @ 10 KgM	32
Phenolic-Fiberglas laminate	" "	Moderate detonation, impact	18
Phenolic-impregnated Fiberglas	" "	Impact; 2/2 @ 10 KgM	32
Phenolic laminated paper based sheets	" "	Sensitive, impact (6/10)	18
Phenolic laminated nylon cloth base sheets	" "	Sensitive, impact (6/10)	18

MATERIAL	FUEL	BEHAVIOR	REF
P			
Phenolic, molded	Oxygen, liquid	Very sensitive, impact (10/10)	18
" " "	" "	Incompatible	8
Phenolic resins	Perchloryl fluoride, gaseous	Class 2, to 390 F	2, 39
Phenolic resin, modified	" " " "	Class 4 at 390 F	2, 39
Phenolic, Bakelite	Propellant 113	Little effect	13
Phenolic resin, asbestos reinforced: Haveg 30, Haveg 41, Haveg 50	UDMH	Class 4, poor	8
Phenoline 315	RFNA	Class 2,to 75 F	39
Phenolic resins	WFNA, liquid	Class 4, unacceptable at all temps.	2, 8, 39
Phenoline 315 plus	" " *Intermittent contact	Class 1, to 75 F* spillage	39
Phenoline 315 plus	WFNA	Class 3, only fair corrosion resistance, 75 F limit	2, 8
Plaskon Alkyd 400 (Glass and polyester)	Oxygen, liquid	Impact sensitive; unacceptable	32
Plastic lead seal, insoluble	Hydrazine family	Grade 2	5-5
Plastic metal No. 22	Hydrogen peroxide, 90%	Class 3 at room temperature	39
Plast-O-Seal	Fluorine (Liquid)	Grade 3*	5-10
	Fluorine (Gaseous) *Not based on test results	Grade 2	
" "	Fluorine, gaseous	Class 3, < RT	2, 39
Plexiglas II, 55, CR-37	Aerozine 50	Unsatisfactory	21
Plexiglas	Boron hydride family	Grade 3	5-6
"	Fluorine, liquid	Grade 3	5-10
	Fluorine, gaseous		
"	" " "	Class 4, > RT	39
"	50/50 Fuel blend	Class D (60 F, 90 d.)	4
Plexiglas CR 39, II	" " "	Class D - completely dissolved (9 d. @ 55-60 F)	4B
		Class D - disintegrating (1 d. @ 70-80 F)	
Plexiglas CR 39	" " "	Class 4 at 60 F	39
Plexiglas II	" " "	Class 4 at 80 F	39
Plexiglas II, 55	50/50 Hydrazine/UDMH	Class 2, limited service	8
Plexiglas	HiCal 3	Class 4, became soft and sticky at 120 F	2, 39
"	Hydrogen peroxide (concentrated)	Class 4, unacceptable	8
Plexiglas II, 55, CR-39	Nitrogen tetroxide	Unsatisfactory	21
Plexiglas	" " "	Grade 3	5-7
"	" " "	Class D (60 F, 30 d.)	4
"	Nitrogen tetroxide, liquid	Class D, (30 d. @ 55-60 F) dissolved	40
Plexiglas II, CR-39; 55	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Plexiglas	Oxygen, liquid	Impact; 2/2 @ 10 KgM	32
"	Perchloryl fluoride, gaseous	Class 1, to 75 F	39
		Class 4 at 390 F	2, 39
Pliogard, coating	RFNA	Class 4 at 75 F	39
Polyacetal	Liquid oxygen	Insensitive, impact (70 ft lb, 6/20)	37
Polyacrylic ester resins	RFNA	Class 4 at 75 F	39
Polyacrylonitrile	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
Polyamide - See also "Nylon"; "Zytel"			
Polyamide film - See also "Capran"			
Polyamides	Hydrocarbon fuel	Satisfactory	1, 3
Polyamide-Nylon, Zytel 101	Nitrogen tetroxide	Class D - dissolving in minutes (55-60 F)	4B
Polyamide-Nylon, Capran 391	" " "	Class D - dissolved on contact (63-67 F)	4B
Polyamide	Oxygen, liquid	Impact; 2/2, 8/20, 13/20, 10/20, 3/20, 8/20, 2/2 @ 10 KgM	32
Polybutadiene - See also "Acushnet"			
Polybutadiene, hydrogenated - See also "Hydropol"			

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polybutadiene rubber, Acushnet BWK 422	50/50 Fuel blend	Class C (160 F, 30 d.)	4, 4B
" " " " " "	" " "	Class A - precipitate extracted, fuel discolored, tensile loss 8.3% (17 d. @ 160 F)	4B
Polybutadiene rubber, Acushnet SWK 849	" " "	Class C (160 F, 30 d.)	4, 4B
" " " " " "	" " "	Class B - slight turbidity (17 d. @ 160 F)	4B
" " " " " "	" " "	Class C - precipitate extracted, fuel discolored, tensile loss 41.9%	4B
Polybutadiene rubber, Acushnet SWK 850	" " "	Class C (160 F, 30 d.)	4, 4B
" " " " " "	" " "	Class C - precipitate extracted, (10 d. @ 160 F)	4B
" " " " " "	" " "	Class C - precipitate extracted, fuel discolored tensile loss 23.6%	4B
Polybutadiene rubbers, Acushnet SWK 851	" " "	Class C (160 F, 30 d.)	4, 4B
" " " " " "	" " "	Class B - slight precipitate extracted, no strength (160 F)	4B
Polybutadiene, Stillman EX 904-90, (Hydropol)	" " "	Class D - 29% swell, tensile loss 77.2% brittle (30 d. @ 160)	4, 4B
" " " " " "	" " "	Class C - heavy precipitate extracted (1 d. @ 160 F)	4B
Polybutadiene rubbers, BWK 422	" " "	Class C (30 d. @ 160 F) precipitate extracted	40
Polybutadiene rubber, Stillman EX 904-90 (Hydropol)	" " "	Class D (30 d. @ 160 F) 29% volume swell; tensile loss 77.2% brittle	40
Polybutadiene rubber (Cis-4)	" " "	Compatible (dynamic testing, 10,000 cycles)	19
Polybutadiene	Hydrazine	Shore A, loss - 0 to 4; 2% shrink to 6% swell (7 d. @ RT)	34
" "	"	Shore A, loss - 2; 4% swell (21 d. @ RT)	34
" "	"	Shore A, gain - 13; 3% swell (42 d. @ RT)	34
" "	"	Shore A, gain - 8; 3% swell (3 mo. @ RT)	34
" "	"	Shore A, gain - 3; 5% swell (5 mo. @ RT)	34
" "	"	Shore A, loss - 5; 1% swell (7 d. @ 160 F)	34
" "	"	Shore A, loss - 6; 1% swell (21 d. @ 160 F)	34
" "	"	Shore A, gain - 13; 1% swell (3 mo. @ 160 F)	34
" "	Hydrazine, liquid	Class 2, to 75 F Class 4 at 160 F	39
" "	Hydrazine family	Grade 3	5-5
Polybutadiene (Cis-4)	Hydrazine	4% swell (21 d. @ RT)	33
" " " "	"	5% swell (5 mo. @ RT)	33
" " " "	"	1% swell (3 mo. @ 160 F)	33
" " " "	"	Compatible	19
Polybutadiene (Cis-1, 4)	Hydrazine-type fuel	Compatible (performs satisfactory as sealant)	25
" " " " "	" " " "	Compatible	26
Polybutadiene	JP-X	Shore A, loss - 12 and 13; 83% and 97% swell (7 d. @ RT)	34
Polybutadiene, formulas 24-27	Nitrogen tetroxide	Class D (80 F, 7 d.)	4
Polybutadiene	" " "	Class D - severe	14A
" "	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
" "	" "	Insensitive, impact (70 ft lb, 0/20)	37
" "			

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polybutadiene	Propyl nitrate	Shore A, loss - 3; (7 d. @ RT) 57% swell	34
" "	" "	Shore A, loss - 4; (7 d. @ 160 F) 107% swell	34
" "	UDMH	Shore A, loss - 2 to 9; 7% to 29% swell (7 d. @ RT)	34
" "	"	Shore A, loss - 6 and 23; 8% and 15% swell (14 d. @ RT)	34
" "	"	Shore A, loss - 18; 10% swell (21 d. @ RT)	34
" "	"	Shore A, loss - 2; 4% swell (3 mo. @ RT)	34
" "	"	Shore A, loss - 0 to 2; 5% shrink and 7% swell (6 mo. @ RT)	34
" "	"	Shore A, loss - 6 and 7; 16% and 25% swell (7 d. @ 160 F)	34
" "	"	Shore A, loss - 0 to 3; 2% shrink to 33% swell (60 min @ 350 F)	34
" "	"	Shore A, loss - 2 to 23; 12% to 39% swell (60 min @ 400 F)	34
Polybutadiene (Cis-4)	"	9% swell (7 d. @ RT)	33
" " " "	"	4% swell (3 mo. @ RT)	33
" " " "	"	5% shrink (6 mo. @ RT)	33
" " " "	"	15% swell (7 d. @ 160 F)	33
" " " "	"	12% swell (60 min @ 400 F)	33
Polycarbonate - See also "Lexan"			
Polycarbonate, Lexan	Hydrazine family	Grade 3	5-5
" " " "	Nitrogen tetroxide	Class D - dissolved in 1 hr (70-80 F)	4B
Polycarbonate	" " "	Decomposed, brief exposure	7
Polycarbonate resin	Oxygen, liquid	Impact; 20/20	32
Polychloroprene	Nitrogen tetroxide	Insensitive, impact (70 ft lb, 0/20)	37
" " "	Oxygen, gaseous	Insensitive, impact (70 ft lb, 0/20)	37
" " "	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
Polychlorotrifluoroethylene (CTFE) - See also "Kel-F", "Halon (VK and TVS)", "Genetron"			
polychlorotrifluoroethylene	Perchloryl fluoride, gaseous	Class 2, to 390 F	39
Poly (cyanoethyl) siloxane	Oxygen, liquid	Slightly sensitive, impact (70 ft lb; 1/20; 1/10)	37
Polydichlorostyrene	Hydrazine family	Grade 3	5-5
Polydimethylsiloxane	Nitrogen tetroxide	Insensitive, impact (70 ft lb, 1/20)	37
Polydimethylsiloxane	Oxygen, gaseous	Insensitive, impact (70 ft lb, 0/20)	37
" " " "	Oxygen, liquid	Insensitive, impact (70 ft lb, 1/30)	37
" " " "	" "	Incompatible	8
Polyepoxide	Aerozine 50	Flexure, 175.0% ret (7 d. @ 60 F)	36C
" "	" "	Flexure, 84.2% ret (30 d. @ 60 F)	36C
" "	" "	Flexure, 121.0% ret (90 d. @ 60 F)	36C
" "	" "	Flexure, 120.0% ret (7 d. @ 100 F)	36C
" "	" "	Flexure, 74.4% ret (30 d. @ 100 F)	36C
" "	" "	Flexure, 67.0% ret (90 d. @ 100 F)	36C
" "	" "	Hardness, +5 change (7 d. @ 60 F)	36C
" "	" "	Hardness, 0 change (30 d. @ 60 F)	36C
" "	" "	Hardness, -3 change (90 d. @ 60 F)	36C
" "	" "	Hardness, 0 change (7 d. @ 100 F)	36C
" "	" "	Hardness, -13 change (30 d. @ 100 F)	36C

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyepoxide	Aerozine 50	Hardness, -22 change (90 d. @ 100 F)	36C
Polyepoxide/epoxy	" "	Flexure, 96.0% ret (7 d. @ 60 F)	36C
" " "	" "	Flexure, 47.0% ret (30 d. @ 60 F)	36C
" " "	" "	Flexure, 66.3% ret (90 d. @ 60 F)	36C
" " "	" "	Flexure, 80.4% ret (7 d. @ 100 F)	36C
" " "	" "	Flexure, 24.1% ret (30 d. @ 100 F)	36C
" " "	" "	Flexure, 35.4% ret (90 d. @ 100 F)	36C
" " "	" "	Hardness, +7 change (7 d. @ 60 F)	36C
" " "	" "	Hardness, +6 change (30 d. @ 60 F)	36C
" " "	" "	Hardness, +4 change (90 d. @ 60 F)	36C
" " "	" "	Hardness, +2 change (7 d. @ 100 F)	36C
" " "	" "	Hardness, -10 change (30 d. @ 100 F)	36C
" " "	" "	Hardness, -19 change (90 d. @ 100 F)	36C
Polyepoxide/glass filament	" "	Shear, 62.4% ret (7 d. @ 60 F)	36C
" " " " "	" "	Shear, 43.7% ret (30 d. @ 60 F)	36C
" " " " "	" "	Shear, 46.8% ret (90 d. @ 60 F)	36C
" " " " "	" "	Shear, 39.7% ret (7 d. @ 100 F)	36C
" " " " "	" "	Shear, 33.7% ret (30 d. @ 100 F)	36C
" " " " "	" "	Shear, 28.2% ret (90 d. @ 100 F)	36C
" " " " "	" "	Flexure, 73.7% ret (7 d. @ 60 F)	36C
" " " " "	" "	Flexure, 69.6% ret (30 d. @ 60 F)	36C
" " " " "	" "	Flexure, 59.5% ret (90 d. @ 60 F)	36C
" " " " "	" "	Flexure, 42.5% ret (7 d. @ 100 F)	36C
" " " " "	" "	Flexure, 56.3% ret (30 d. @ 100 F)	36C
" " " " "	" "	Flexure, 55.0% ret (90 d. @ 100 F)	36C
Polyepoxide/glass composite	" "	Fair; slight swelling and delamination (1 mo @ 60 F)	36B
		Good to fair, no delamination to considerable delamination (1 mo @ 100 F)	36B
Polyepoxide resin system	" "	Good slight erosion (30 d. @ 60 F)	36A
		Fair, severe erosion (30 d. @ 100 F)	36A
Polyepoxide; Bisphenol A (Koppers)	" "	Appearance good (2 d. @ 70 F)	36
" " " " "	" "	Appearance good	36
		Wt change - + 0.36% (7 d. @ 70 F)	
Polyepoxide/Bisphenol A resin system	" "	Fair; slight erosion (30 d. @ 100 F)	36A
" " " " " " "	Nitrogen tetroxide	Fair, slight erosion (30 d. @ 100 F)	36A
Polyepoxide resin system	" " "	Good, no crazing (30 d. @ 60 F)	36A
		Fair, slight corrosion (30 d. @ 100 F)	36A
Polyepoxide/glass composite	" " "	Poor, considerable to complete delamination (1 mo. @ 60 F)	36B
		Complete deterioration (1 mo at 100 F)	36B
Polyepoxide; Bisphenol A (Koppers)	" " "	Appearance good	
		Wt change - +0.81% (7 d. @ 70 F)	36
" " " " " " "	" " "	Slight surface attack (2 d. @ 70 F)	36
Polyepoxide	" " "	Flexure, 118.5% ret (7 d. @ 60 F)	36C
" "	" " "	Flexure, 58.8% ret (30 d. @ 60 F)	36C
" "	" " "	Flexure, 66.0% ret (90 d. @ 60 F)	36C
" "	" " "	Flexure, 70.6% ret (7 d. @ 100 F)	36C
" "	" " "	Flexure, 52.0% ret (30 d. @ 100 F)	36C
" "	" " "	Flexure, 69.5% ret (90 d. @ 100 F)	36C

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyepoxide	Nitrogen tetroxide	Hardness, +6 change (7 d. @ 60 F)	36C
" "	" " "	Hardness, +5 change (30 d. @ 60 F)	36C
" "	" " "	Hardness, +6 change (90 d. @ 60 F)	36C
" "	" " "	Hardness, +3 change (7 d. @ 100 F)	36C
" "	" " "	Hardness, +8 change (30 d. @ 100 F)	36C
" "	" " "	Hardness, +11 change (90 d. @ 100 F)	36C
Polyepoxide/epoxy	" " "	Flexure, 76.7% ret (7 d. @ 60 F)	36C
" " "	" " "	Flexure, 26.0% ret (30 d. @ 60 F)	36C
" " "	" " "	Flexure, 46.7% ret (90 d. @ 60 F)	36C
" " "	" " "	Flexure, 24.5% ret (7 d. @ 100 F)	36C
" " "	" " "	Flexure, 25.5% ret (30 d. @ 100 F)	36C
" " "	" " "	Flexure, 32.7% ret (90 d. @ 100 F)	36C
" " "	" " "	Hardness, +8 change (7 d. @ 60 F)	36C
" " "	" " "	Hardness, +6 change (30 d. @ 60 F)	36C
" " "	" " "	Hardness, +4 change (90 d. @ 60 F)	36C
" " "	" " "	Hardness, +2 change (7 d. @ 100 F)	36C
" " "	" " "	Hardness, +8 change (30 d. @ 100 F)	36C
" " "	" " "	Hardness, +9 change (90 d. @ 100 F)	36C
Polyepoxide/glass filament	" " "	Shear, 22.2% ret (7 d. @ 60 F)	36C
" " " " "	" " "	Delamination (30 d. @ 60 F)	36C
" " " " "	" " "	Flexure, 25.9% ret (7 d. @ 60 F)	36C
Polyester film - See also "Mylar", "Scotch tape", etc.			
Polyester RFP - See also "Laminac"			
Polyester (American Cyanamid)	Aerozine 50	Completely degraded (2 d. @ 70 F)	36
Polyester laminate	" "	Unsatisfactory	21
Polyester	Ammonia, gaseous	Class 4 at 75 F	39
"	Fluorine Gas	Class 4, all temps	2, 39
"	Fluorine, liquid	Grade 3	5-10
	Fluorine, gaseous	Grade 3	5-10
Polyester, Mylar	50/50 Fuel blend	Class D - dissolved (10 d. @ 55-60 F)	4B
" " "	" " "	Class D - dissolved (1 d. @ 70-80 F)	4B
Polyester-glass laminate (composition unknown)	" " "	Class D (60 F, 30 d.) delaminated	4, 4B
Polyester-glass laminate	" " "	Class 4 at 60 F	39
Polyester glass	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Polyester	Hydrazine, anhydrous	Incompatible, Class C	8
"	Hydrazine hydrate	Incompatible, Class C	8
"	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
Polyester, Mylar	Hydrazine family	Grade 3	5-5
Polyester	Hydrazine, liquid	Class 4 at 75 F	39
Polyester (American Cyanamid)	Nitrogen tetroxide	Completely degraded (2 d. @ 70 F)	36
Polyester	" " "	Grade 3	5-7
Polyester, Mylar	" " "	Class D - dissolved (1 d. @ 55-60 F)	4B
Polyester-glass laminate	" " "	Class D, delaminated (30 d. @ 55-60 F)	4, 4B
Polyester laminate	" " "	Unsatisfactory	21
Polyesterlaminate	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Polyester-glass	Oxygen, liquid	Sensitive, impact (4/10)	18
" " "	" " "	Impact; 2/5 @ 10 Kgm	32
Polyester-fiber glass laminate	" " "	Moderate detonation	18

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyester film	Oxygen, liquid	Impact; 2/22, 2/7, 8/10, 1/2, 2/2, 2/2, 2/3, 2/20, 2/11, 2/20, 2/20, 2/20, 2/4, 4/20, 2/20, 4/20	32
Polyester film, aluminized	" "	Impact; 4/20, 5/20, 2/25, 2/23, 1/1, 1/1, 1/1, 1/1, 2/2, 2/2, 2/8 @ 10 KgM	32
Polyester, chlorinated, adhesive	" "	Impact; 7/10, 9/10 @ 10 KgM	32
Polyester resins	RFNA	Class 4 at 75 F	39
Polyester fiber, DuVerre 22 (Greer Industries)	UDMH	Class 4, poor	8
Polyester binder, Fiberglas	UDMH (Liquid)	Class 4, 75 F	2
Polyethylene - See also "Marlex 50", "Alathon", "Hi-Fax" "Dylan" "Plax"			
Polyethylene and butene - See also "Marlex 5003"			
Polyethylene, irradiated - See also "Irrathene"			
Polyethylene	Aerozine 50	Good resistance (30 d. at 100 F)	36A
" "	" "	Tensile, 126.0% ret (7 d @ 100 F)	36C
" "	" "	Tensile, 117.0% ret (30 d. @ 100 F)	36C
" "	" "	Elongation, 132.0% ret (7 d. @ 100 F)	36C
" "	" "	Elongation, 124.0 ret (30 d. @ 100 F)	36C
" "	" "	Hardness, 0 change (7 d. @ 100 F)	36C
" "	" "	Hardness, -15 change (30 d. @ 100 F)	36C
" "	" "	Unsatisfactory	41
Polyethylene, irradiated	" "	Unsatisfactory	21
Polyethylene Marlex 50	Aerozine 50 (Dynamic or static extended service)	Some absorption, subject to rapid stress crack	10A
Polyethylene Marlex 50, as coating	Aerozine 50	Slight absorption; no other change in 22 hrs.	10A
Polyethylene, low-density	" "	Compatible for long term applications (test temp 55-60 F)	40
Polyethylene-backed tape	" "	No visible change 4 hrs @ 75± 5 F. Adhesive failure, 24 hrs @ 75.5 F	10, 10A
Polyethylene	Alcohols (methyl, ethyl, isopropyl, furfuryl)	Acceptable for use	3
Polyethylene	Ammonia, anhydrous, moist, ambient temp	Class 2, limited service	8
" "	Ammonia, anhydrous, dry, ambient temp	Class 2, limited service	8
" "	Ammonia, gaseous	Class 2, to Hot	39
" "	Ammonia, liquid	Class 2, to Hot	39
" "	Ammonia dry	Class 2, hot	2
" "	Ammonia moist	Class 2, hot	2
" "	Ammonia, anhydrous: Liquid	Grade 1	5-12
	Gas (< 250 F)	Grade 1	5-12
Polyethylene, seals	Boron hydride family	Grade 1	5-6
Polyethylene	Chlorine trifluoride	Incompatible	24
" "	" " "	Class C, incompatible, reacts violently	8
Polyethylene film, conventional	" " "	Ignited on contact	19
Polyethylene, linear	Chlorine trifluoride	Discoloration; no apparent damage	19
Polyethylene tubing	Fluoramine family	Grade 1, or Grade 3	5-9
Polyethylene	Fluorine (Liquid)	Grade 3	5-10
" "	Fluorine (Gaseous)	Grade 3	5-10
" "	Fluorine, gaseous	Class 4, all temps	2, 39
Polyethylene, low density	50 50 Fuel blend	Class A (60 F, 30 d.)	4

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyethylene, low density	50/50 Fuel blend	Class A - (360 d. @ 55-60 F)	4B
		Class 1, to 60 F	39
Polyethylene, high-density	" " "	Class 2, to 60 F	39
		Class 4 at 160 F	
" " " " "	" " "	Class C (160 F, 30 d.)	4
" " " " "	" " "	Class D - Shrinks 10.8% (30 d. @ 160 F)	4B
Polyethylene, Marlex 50	" " "	Class 1, to 60 F	39
Polyethylene, Marlex 50, hi-density	" " "	Class A - (270 d. @ 55-60 F)	4B
		Class B - Shrinks <1% (360 d. @ 55-60 F)	4B
Polyethylene, irradiated	" " "	Class A - (90 d. @ 55-60 F)	4B
		Class D - Shrinks >10% (270 d. @ 55-60 F)	4B
		Class D - Shrinks 9% (180 d. @ 55-60 F)	4B
Polyethylene 7028	" " "	Class 2, to 80 F	39
Polyethylene	Halogen fluoride family	Grade 3	5-8
Polyethylene tubing	HiCal 3	Class 3, turns yellow at 120 F	2, 39
Polyethylene	Hydrocarbon fuel	Satisfactory	1, 3
" "	Hydrogen peroxide (concentrated, 90%)	Class 2, limited service (for service <100 F)	8, 39
Polyethylene foam	" " "	Essentially no change	14
Polyethylene	Hydrazine	Class 1, 80 F	2, 39
" "	"	Class 4, 160 F	2, 39
" "	"	Compatible for long term application, <80 F	40
" "	Hydrazine family	Grade 1 (liquid use only)	5-5
Polyethylene, high density	Hydrazine	Acceptable	3A
" " " " "	"	Satisfactory	1, 3
Polyethylene high density (and Teflon)	"	Satisfactory	3
Polyethylene	Hydrazine, anhydrous	General service, Class A	8
" "	Hydrazine, hydrate	General service, Class A	8
" "	Hydrazine/hydrazine nitrate/water	General service, Class A	8
" "	Hydrazoid B	Unaffected, 150 d. at room temperature (Compatible for limited service)	31
" "	IRFNA	Tensile increase, 500 psi (7 d. @ RT)	34
		Tensile increase, 500 psi (14 d. @ RT)	34
Polyethylene, Alathon 2-P-1000	JP-4 Fuel	Good resistance at 80 F	27
Polyethylene, Alathon 10	"	Good resistance at 80 F	27
Polyethylene, Hi-density	"	Superior property retention	27
Polyethylene, Marlex 50 plus Super Dylan	"	After 72 hrs at 160 F	27
Polyethylene, (5 mil) clear, on "Nygen"	Mixed amines	Stained brown (7 d. @ RT)	38
Polyethylene, (5 mil) clear, on nylon	" "	No apparent effect (7 d. @ RT)	38
Polyethylene, (12 mil) black, on "Nygen"	" "	No apparent effect (7 d. @ RT)	38
Polyethylene, (12 mil) black, on nylon	" "	No apparent effect (7 d. @ RT)	38
Polyethylene (4.5 mil), clear, on "Nygen"	" "	No apparent effect (7 d. @ RT)	38
Polyethylene	Monomethylhydrazine	Good	8
Polyethylene, high density	" " " "	Preferred (unspecified performance)	3A
Polyethylene	Nitric acid, fuming	Satisfactory	1, 3
Polyethylene	Nitrogen tetroxide	Badly degraded (7 d. @ 100 F)	36A
" "	" " "	Unsatisfactory	21
" "	" " "	Limited service	30
" "	" " "	Satisfactory for limited use	1, 3
" "	" " "	Withstands contact, among best	8
" "	" " "	Grade 3	5-7
" "	" " "	Tensile gain, 500 psi (7 d. @ RT)	34
" "	" " "	Shredded (17 d. @ RT)	34
" "	" " "	Badly degraded (7 d. @ 100 F)	36C

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyethylene	Nitrogen tetroxide	Class C, Slight	14A
Polyethylene	Nitrogen tetroxide, liquid	Class C (30 d. @ 55-60 F) sample turned brown	40
" "	Nitrogen tetroxide (water, > 0.1%)	Class 3, 80 F	2
" "	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	36
" "	Nitrogen tetroxide (0.2-1.0% moist)	Class 3 at 80 F	39
Polyethylene, crosslinked	Nitrogen tetroxide (liquid)	Promising	25
Polyethylene, branched	Nitrogen tetroxide	Insensitive, impact (70 ft lb, 0/10)	37
Polyethylene irradiated	" " "	Unsatisfactory	21
" " " "	" " "	Class C (60 F, 30 d.)	4
" " " "	" " "	Class C - No visible change, "C" rating because of 48% loss in strength (90 d. @ 55-60 F)	4B
" " " "	" " "	Class D - Fell apart (270 d. @ 55-60 F)	4B
" " " "	Nitrogen tetroxide (<.2% moist)	Class 3, to 60 F	39
		Class 4, at 60 F	39
Polyethylene, high density	Nitrogen tetroxide	Class C (60 F, 30 d.)	4
Polyethylene, high density	Nitrogen tetroxide (liquid)	-26% swell 1 d., no apparent change	19
Polyethylene, low density	Nitrogen tetroxide	Class C (60 F, 30 d.)	4
" " " " "	" "	Class B - Shore D decrease 9 units (30 d. @ 55-60 F)	4B
		Class D - Fell apart (90 d. @ 55-60 F)	4B
" " " " "	Nitrogen tetroxide, (liquid)	-19% swell, 1 d.; 19% swell 7 d. No change in appearance	19
" " " " "	" " "	-11% swell in 1 d., 19% swell in 4 d., no apparent change	19
Polyethylene, low density; high	Nitrogen tetroxide (<.2% moist)	Class 2, to 60 F	39
		Class 4 at 60 F	
Polyethylene, low density, Vistanex 1000	Nitrogen tetroxide	-37% swell 7 d.; no apparent change	19
Polyethylene, linear	" " "	Insensitive, impact (70 ft lb, 0/20)	37
Polyethylene coatings on Viton B, O-Rings	" " "	Limited protection (1 d.)	26
Polyethylene coating on rubber O-ring	Nitrogen tetroxide (liquid)	Protects for 24 hrs.	25
Polyethylene, Marlex 50	Nitrogen tetroxide	Oxidized brittle in 4 days short term, 1 hr) only (Brief exposure)	10, 10A
" " " " "	" " "	Class B- Shore D decrease 4 units, sample slightly yellow (30 d. @ 55-60 F)	4B
" " " " "	" "	Class D - Brittle and broke during handling (90 d. @ 55-60 F)	4B
" " " " "	" " "	Class B - Shore D decrease 8 units (4 d. @ 70-80 F)	4B
Polyethylene, Vistanex	Nitrogen tetroxide, (liquid)	26% swell, 1 d., 48% swell, 4 d.	19
Polyethylene, Formula 29	Nitrogen tetroxide	Class C (80 F, 30 d.)	4
Polyethylene and isobutylene, formula 53	" " "	Class A (80 F, 30 d.)	4
Polyethylene and carbon black, formula 68	" " "	Class D (80 F, 30 d.)	4
Polyethylene	" "	Satisfactory in gaseous service	8
" "	Nitrogen trifluoride, gaseous	Satisfactory for lines, fittings, storage vessels	8
" "	Oxygen, liquid	Sensitive, impact	18
" "	" "	Impact sensitive, unacceptable	32
" "	" "	Impact, 4.7 @ 10 KgM	32
" "	" "	Moderate detonation, impact	18
Polyethylene, branched	Oxygen, gaseous	Insensitive, impact (70 ft lb, 0/20)	37

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyethylene, branched	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
Polyethylene, dyed	" "	Impact; 4/11 @ 10 KgM	32
Polyethylene film	" "	Positive detonation, impact	18
Polyethylene, irradiated	" "	Insensitive, impact (1/50)	18
" " " " "	" "	Suitable	8
Polyethylene, linear	" "	Insensitive, impact (70 ft lb 0/20)	37
Polyethylene, low density	" "	Incompatible	8
Polyethylene potting molds	" "	Very sl. sensitive, impact (1/40)	18
Polyethylene, Plax	" "	Sensitive, impact (2/2)	18
Polyethylene sheet	" "	Unsensitive, impact (0/10)	18
Polyethylene tubing	" "	Impact; 2/11 @ 10 KgM	32
Polyethylene	Pentaborane	Compatible for long term applications	40
" "	Perchloryl fluoride, gaseous	Class 1, to 75 F	39
		Class 4 at 80 F	2, 39
" "	Propellant 113	Slight gain in weight	13
" "	n-Propyl nitrate	Satisfactory	1, 3
" "	RFNA	Class 4 at 75 F	39
Polyethylene, Alathon 2-P-1000	"	Resistant at 80 F for 168 hrs.	27
Polyethylene, Alathon 10	"	Resistant at 80 F for 168 hrs.	27
Polyethylene, Marlex 50 plus Super Dylan	"	Resistant 1 hr at 160 F	27
Polyethylene-Vistanex coated Fortisan	"	Substrate embrittled and partially separated from coating (7 d. @ RT)	38
Polyethylene	U-DETA	Absorbs fuel	12
" "	UDMH	Satisfactory	1, 3
" "	"	Compatible for long term storage, <80 F	40
" "	"	Among best, but unspecified performance	3A
" "	"	Class 2, good	
" "	UDMH (Liquid)	Class 1, 80 F	2
" "	" "	Class 4, 160 F	2
" "	WFNA, liquid	Class 4 at 75 F	39
Polyformaldehyde, Delrin	Hydrazine family	Grade 3	5-5
	Nitrogen tetroxide	Class D, reaction in 1 hr (55-60 F)	4B
Poly FBA (Poly-1, 1-dihydro perfluorobutyl acrylate)	JP-4 Fuel	Exceptional resistance at room temperature immersion	27
Poly FBA	RFNA	Not seriously affected in 500 hr. immersion @ 80 F	27
" "	"	Withstood 500 hrs at room temperature	27
" "	UDMH (liquid)	Class 4, 80 F	2
Polyformaldehyde - See also "Delrin"			
Polyfluoroethylenepropylene (FEP) - See also "Teflon 100X"			
Polyfurfuryl alcohol	Fluorine (liquid)	Grade 3	5-10
	Fluorine (gaseous)	Grade 3	
	Fluorine (gaseous)	Class 4, all temps	2
Poly (hexafluoropropylene-vinylidene fluoride	Oxygen, liquid	Suitable	8
Polyimide - See also "H-Film", "HT"			
Polyimide film	Oxygen, liquid	Impact, 0/20, 2/20, 3/40, 0/40, 1/20, 4/4, 2/2, 2/2, 0/20	32
Polyisobutylene - See also "Vistanex"			
Polyisobutylene, Vistanex	Hydrocarbon fuel	Unsatisfactory	3
Polyisobutylene	Nitrogen tetroxide	Grade 3	5-7
" " "	" "	19% swell 1 d. (softened, collapsed, not badly degraded)	19
" " "	" " "	Not chemically compatible	8
Polyisobutylene, Formula 69-72	" " "	Class D (80 F, 7 d.)	4
Polyisoprene	Oxygen, gaseous	Insensitive, impact (70 ft lb, 0/20)	37
" "	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyisobutylene	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
Polyisobutylene and copolymers	Nitrogen tetroxide	Class D - severe	14A
Polyisobutylene-polyethylene blends	RFNA	Withstood 500 hrs at room temperature	27
Polyisobutylene-PE blends (with high molecular weight)	"	Withstood 8 hours at 160 F	27
Polyisobutylene/PE blends (Vistanex plus Super Dylan)	"	Least change in physical appearance, 500 hrs at RT, 72 hrs at 80 F	27
Polymethyl methacrylate - See also "Plexiglas"			
Polymethyl methacrylate	Fluorine, gaseous	Class 4, all temps	2, 39
" " " " "	Fluorine (liquid	Grade 3	5-10
" " " " "	Fluorine (gaseous)	Grade 3	5-10
Polymethyl methacrylate, Plexiglas	Hydrazine family	Grade 3	5-5
Polymethyl methacrylate, Plexiglas CR-39	Nitrogen tetroxide	Class D - dissolving in 1 hr (70-80 F)	4B
Polymethyl methacrylate	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
Polyolefin, irradiated - See also "Raythene N"			
Polyolefin, white insulation	50/50 Fuel blend	Class A - 30 d. @ 160 F)	4, 4B
Polyolefin, black insulation	" " "	Class C - Fuel discolored in 1 hr (30 d. @ 160 F)	4, 4B
Polyolefin, white insulation	" " "	Class 1, to 160 F	39
Polyolefin, black insulation	" " "	Class 3, to 160 F	39
Polyolefin, black	Hydrazine family	Grade 3	5-5
Polyolefin, white	" " "	Grade 1 55-65 F	5-5
Polyolefin, Raythene N, irradiated	Nitrogen tetroxide	Class A - sample flexible (48 d. @ 55-65 F) Class D - cracked (63 d. @ 55-65 F)	4, 4B
Polyolefin, white and black insulation	" " "	Class A - slight dimensional change (30 d. @ 63-67 F)	4, 4B
Polyolefin, DPDB 6169	" " "	Class D (80 F, 7 d.)	4
Polyolefin, Formula 110	" " "	Class D (80 F, 7 d.)	4
Polypropylene - See also "Pro-Fax"			
Polypropylene	Aerozine 50	Good resistance (30 d. @ 100 F)	36A
" "	" "	Unsatisfactory	21
" "	" "	Tensile, 66.8% ret (7 d. @ 100 F)	36C
" "	" "	Tensile, 115.0% ret (30 d. @ 100 F)	36C
" "	" "	Elongation, < 10% ret (7 d. @ 100 F)	36C
" "	" "	Elongation, 20% ret (30 d. @ 100 F)	36C
" "	" "	Hardness, -1 change (7 d. @ 100 F)	36C
" "	" "	Hardness, 0 change (30 d. @ 100 F)	36C
Polypropylene, Pro-Fax	Aerozine 50 (Dynamic or static short extended service)	No significant change in 217 d. (75 F)	10A
Polypropylene, Pro-Fax (coating)	" " " "	Slight absorption, no other change (218 d. at 75 F)	10A
Polypropylene, seals	Boron nitride family	Grade 1	5-6
Polypropylene	50/50 Fuel blend	Retains high ultimate tensile	16
" "	" " "	Class 1, to 160 F Class 2, to 60 F	39
Polypropylene (from Hercules)	" " "	Class A (60 F, 90 d.)	4
Polypropylene (from Chicago Molded Products)	" " "	Class A (160 F, 30 d.)	4
Polypropylene (from Hercules)	" " "	Class A - (180 d. @ 55-60 F) Class B - Shrinks 0.5% (270 d. @ 55-60 F)	4B
Polypropylene (from Chicago Molded Products)	" " "	Class A - 5.1% tensile loss (30 d. @ 160 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polypropylene, Pro-Fax	50/50 Hydrazine/UDMH	Class 2, limited service	8
Polypropylene, seals	Fuels (general)	Acceptable for continuous use	16
Polypropylene	Hydrazine family	Grade 1	5-5
" "	Nitrogen tetroxide	Unsatisfactory	21
" "	" " "	Badly deteriorated (7 d. @ 100 F)	36A, 36C
" "	" " "	Class B - shrinks 3%, (30 d. @ 55-60 F)	4B
" "	" " "	Discolored, brief exposure	7
" "	" " "	2 mo. exposure; tank rupture (excessive swell)	7
" "	" " "	13 mo. exposure; decomposed	7
" "	" " "	Insensitive, impact (70 ft lb, 0/20)	37
" "	" " "	Class B, shrinks 3% (30 d. @ 55-60 F)	4B
" "	" " "	Class D, Shore D decreases 21 units (90 days @ 55-60 F)	4B
" "	" " "	Class B, Shore D decreases 9 units (2 days @ 70-80 F)	4B
		Blistered (8 days @ 70-80 F)	4B
" "	Nitrogen tetroxide (<.2% moist)	Class 2, to 60 F Class 4 at 60 F	39
" "	Nitrogen tetroxide, (liquid)	0%-1 d.; 19%-7 d.; no apparent change	19
Polypropylene, Pro-Fax	Nitrogen tetroxide (Dynamic or static short term service)	Shore term (hours) only	10A
" " " " "	Nitrogen tetroxide	Brief exposure; short term (hours) only	10
Polypropylene	" " "	Grade 3	5-7
Polypropylene (all types)	" " "	Class C - slight	14A
Polypropylene (from Hercules)	" " "	Class C (60 F, 30 d.)	4
Polypropylene	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
" "	Pentaborane	Compatible for long term applications	40
Polystyrene - See also "Polyflex"			
Polystyrene, expanded - See also "Styrofoam"			
Polystyrene	Ammonia, gaseous	Class 4 at 75 F	39
Polystyrene, seals	Boron hydride family	Grade 1	5-6
Polystyrene	Fluorine, gaseous	Class 4, all temps	39
" "	Fluorine (liquid)	Grade 3	5-10
" "	Fluorine (gaseous)	Grade 3	5-10
" "	Hydrazine family	Grade 3	5-5
Polystyrene and polydichlorostyrene	Hydrazine, anhydrous	Incompatible, Class C	8
" " " " " " "	Hydrazine hydrate	Incompatible, Class C	8
" " " " " " "	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
Polystyrene	Hydrogen peroxide, (concentrated)	Class 2, limited service	8
Polystyrene, Polyflex	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Polystyrene	Liquid oxygen	Slightly sensitive, impact (70 ft lb, 2/11, 0/6)	37
" "	" "	Positive detonation, impact	18
Polystyrene, Styrofoam	Liquid oxygen	Positive detonation, impact	18
Polystyrene	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
" "	Propellant 113	Little effect	13
" "	RFNA	Class 4 at 75 F	39
Polysulfide rubber - See also "Thiokol"			
Polysulfide sealant - See also "Proseal"			
Polysulfide, sealant	50-50 Fuel blend	Class D - dissolved in few hours (30 d. @ 55-60 F)	4B
Polysulfide rubbers	Nitrogen tetroxide	Class D - severe	14A
Polysulfide, sealer	Oxygen, liquid	Sensitive, impact (5/10)	18

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polytetrafluoroethylene - See also "Teflon TFE", "Halon (TFE)"			
Polytetrafluoroethylene-hexafluoropropylene - See also "Teflon FEP"			
Polytetrafluoroethylene	Oxygen, liquid	Suitable	8
" " " " "	" "	Impact; 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/40, 0/20, 0-2/20, 0/20, 0/40 @ 10 KgM	32
Polytetrafluoroethylene + aluminum	" "	Impact; 0/40 @ 10 KgM	32
Polytetrafluoroethylene with silicone adhesive	" "	Impact; 3/20 @ 10 KgM	32
Polytetrafluoroethylene	RFNA	Class 3 to 75 F	39
Polytrifluorochloroethylene	Oxygen, liquid	Impact; 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20, 0/20 @ 10 KgM	32
" " " " "	RFNA	Class 3,to 75 F	39
Poly(trifluoropropyl)methylsiloxane	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
Polytrifluorovinylchloride	" "	Suitable	8
Polyurethene coating, paint	50-50 Fuel blend	Class D - stipped off (30 d. @ 55-60 F)	4, 4B
Polyurethane paint, coating	50/50 Fuel blend	Class D (60 F, 30 d.)	4, 4B
Polyurethane	Nitrogen tetroxide	Grade 3	5-7
Polyurethane, paint	Nitrogen tetroxide, liquid	Class D (30 d. @ 55-60 F) stripped	40
Polyurethane	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
" "	Perchloryl fluoride, gaseous	Class 4 at 60 F	39
" "	Oxygen, liquid	Impact; 2/7 @ 10 KgM	32
Polyurethane adhesive, Adiprene L-100	" "	Impact; 5/5 @ 10 KgM	32
Polyurethane wiping material	" "	Impact; 2/3 @ 10 KgM	32
Polyurethane foam	" "	Positive detonation	18
Polyurethane	" "	Sensitive, impact (3/20)	18
Polyvinyl alcohol	Hydrazine, anhydrous	Incompatible, Class C	8
" " "	Hydrazine hydrate	Incompatible, Class C	8
" " "	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
" " "	Hydrogen, liquid	Unsatisfactory	8
" " "	Hydrazine, liquid	Class 4 at 75 F	39
Polyvinyl butyral	Ethylene oxide	Ambient temp. intermittent use	3
Polyvinyl carbazole resins	RFNA	Class 4 at 75 F	39
Polyvinyl chloride - See also "Boltron", "Exon", "Geon", "Lucoflex", "Marvinal", "Opalon" "Tygon"			
Polyvinyl chloride (PVC)	Alcohols (methyl, ethyl, isopropyl, furfuryl)	Approved for use	3
" " " " "	Fluorine, gaseous	Class 4, > RT	39
" " " " "	50/50 Fuel blend	Class 4 at 60 F	39
" " " " "	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Polyvinyl chloride pipe (Easton)	HiCal 3	Class 2, no change @ 120 F	2, 39
Polyvinyl chloride	Hydrogen, liquid	Unsatisfactory	8
" " "	Hydrazine, liquid	Class 3, to 75 F	39
" " "	Nitrogen tetroxide	Not chemically compatible	8
" " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
" " "	Oxygen, liquid	Moderate detonation, impact	18
" " "	" "	Very sensitive, impact (10/10)	18
" " "	" "	Incompatible	8
" " "	" "	Insensitive, impact (70 ft lb) 0/20)	37

MATERIAL	FUEL	BEHAVIOR	REF
P			
Polyvinyl chloride	Oxygen, liquid	Impact; 2/2, 2/2, 2/3 @ 10 KgM	32
Polyvinyl chloride, irradiated	" "	Impact; 2/4 @ 10 KgM	32
Polyvinyl chloride	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
Polyvinyl chloride dielectric, Nylon jacket	Oxygen, liquid	Sensitive, impact (6/10)	18
Polyvinyl chloride tubing	Hydrogen peroxide (conc)	Class 3 - Very limited	8
	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Polyvinyl tape, black, Fibron #1	Oxygen, liquid	Slightly sensitive, impact (2/20)	18
Polyvinyl tubing	" "	Very sensitive, impact (10/10)	18
Polyvinyl fluoride - See also "Tedlar", "Teslar"			
Polyvinylidene chloride - See also "Saran", "Sarankote"			
Polyvinylidene chloride	Nitrogen tetroxide	13 mo exposure; absorbed, some chemical reaction, discolored, very brittle	7
" " " "	" " "	Not affected	7
" " " "	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
Polyvinylidene fluoride - See See also "Kynar"			
Polyvinylidene fluoride RC2525	Chlorine trifluoride, gaseous	Class 1, 85 F	39
Polyvinylidene fluoride	Hydrazine	Not affected, brief exposure	7
		Embrittled, discolored	7
" " " "	Nitrogen tetroxide	2 mo exposure; absorbed, discolored, no permanent effect	7
" " " "	" " "	Not affected, brief exposure	7
" " " "	" " "	13 mo exposure; absorbed, softened, bleached - no chemical reaction; no effect on tensile strength	7
" " " "	" " "	Insensitive, impact (70 ft lb, 0/14)	37
Polyvinylidene fluoride	Liquid oxygen	Insensitive, impact (70 ft lb, 0/20)	37
Polyvinyl pyrolidone	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
Polyvistanex	50/50 Hydrazine/UDMH	Class 2, limited service	8
Polyvistanex	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Proseal 793	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Proseal 333	Nitrogen tetroxide (<.2% moist)	Class 1, to 60 F	39
Proseal 793	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
R			
RTV-20, silicone rubber	Aerozine 50	Unsatisfactory	21
" " " " "	50/50 Fuel blend	Class D (60 F, 30 d.)	4
RTV 20, Potting compound	" " "	Class D - shrinks 6.9% Shore A decrease 13 units (30 d. @ 55-60 F)	4B
" " " " "	" " "	Class A - (3 d. @ 70-80 F)	4B
RTV-20	Nitrogen tetroxide	Unsatisfactory	21
"	" " "	Class D (60 F, 30 d.)	4
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
RTV 20, Seals	Nitrogen tetroxide	Grade 3	5-7
RTV 20, Potting compound	" " "	Class D - dissolved (14 d. @ 55-60 F)	4B
" " " " "	" " "	Class D - dissolved (1 d. @ 70-80 F)	4B
Rayco, Teflon & metal	" " "	Grade 1	5-7
Rayon	Perchloryl fluoride (dry)	Class 4, 390 F	2

MATERIAL	FUEL	BEHAVIOR	REF
R			
Rayon	Perchloryl fluoride, gaseous	Class 1, to 75 F Class 4 at 390 F	39 39
Raythene N, irradiated	Nitrogen tetroxide (<.2% moist)	Class 1, to 65 F Class 4 at 65 F	39 39
Reinholt F120-55	Aerozine 50	Unsatisfactory	21
Reinholt F120-55	Nitrogen tetroxide	Unsatisfactory	21
Resin-X,Concrete protective coating	Fuming nitric acid	Satisfactory	1-3
Resinox, SC 1008	Aerozine 50	Unsatisfactory	21
Resinox SC 1013	" "	Unsatisfactory	21
Resinox SC 1008	Nitrogen tetroxide	Unsatisfactory	21
Resinox SC 1013	" " "	Unsatisfactory	21
Resinox SC1008 and SC1013	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Resistazine 74, Ethylene propylene rubber	" " "	Class 3,to 65 F	39
Rezklad 1, 2, and 3, coating	Nitrogen tetroxide	Class D - concrete coating, binder dissolved (1 d. @ 55-60 F)	4B
Rezklad 1, 2, and 3	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Rubatex No. G-207-N	Boron hydride family	Grade 3	5-6
Rubatex No. R-103-J	" " " "	Grade 3	5-6
Rubatex No. G-207-N	Pentaborane	Incompatible	22
Rubatex No. R-103-J	" "	Incompatible	22
Rubatex G-207N and R-103J	" "	Class 4 at 75 F	39
Rubber, ethylene propylene - See also "EPR"			
Rubber, Natural	Aerozine 50	Unsatisfactory	21
Rubber, U. S. Polymeric 37-9X	" "	Unsatisfactory	21
Rubber, Precision 18007	A-50 Fuel blend	Disintegrated completely	14
Rubber, Precision 18057	" " "	Disintegrated completely	14
Rubber, Precision, 940X559	" " "	Blistered	14
Rubber	Alcohols (methyl, ethyl, isopropyl)	Approved for use	3
Rubber, Natural	Ammonia (dry)	Class 2, 75 F	2
" " "	" " "	Class 4, Hot	2
" " "	Ammonia, gaseous	Class 2, to 75 F	39
" " "	" " " "	Class 4 at Hot	
" " "	Ammonia, anhydrous, (dry, ambient temp)	Class 2, limited service	8
" " "	Ammonia, anhydrous: Liquid	Grade 2	5-12
	Gaseous (<250 F)	Grade 2	5-12
Rubber, hard linings	Ammonia, gaseous	Class 4 at 75 F	2, 39
" " " "	Ammonia, liquid	Class 3, to 75 F	
Rubber, soft linings	Ammonia, gaseous	Class 4 at 75 F	2, 39
" " " "	Ammonia, liquid	Class 4 at 75 F	
Rubber, natural, seals	Boron hydride family	Grade 3	5-6
Rubber, GRS	" " " "	Grade 3	5-6
Rubber (All common types)	Chlorine trifluoride	Incompatible	24
Rubber	Fluorine, gaseous	Class 1, to 75 F	39
		Class 4, all temps	2, 39
"	Fluorine (liquid)	Grade 3	5-10
"	Fluorine (gaseous)	Grade 3	5-10
Rubber, natural	HiCal 3	Class 4, softened, easily torn at 120 F	2, 39
Rubber, Acushnet BWK-442; SWK-849; SWK-850	50/50 Fuel blend	Class 3, to 160 F	39
Rubber, Acushnet SWK-851	" " "	Class 2, to 160 F	39
Rubber, Cohrlastic 500	" " "	Class 4 at 60 F	39
Rubber, Connecticut hard, 3601	" " "	Class 4 at 85 F	39
Rubber, Firestone, D-404, 430, 431, 432	" " "	Class 4 at 85 F	39
Rubber, Firestone, D-406, 405, 408, 409, 410	" " "	Class 4 at 145 F	39
Rubber, Goshen 1357	" " "	Class 3, to 80 F	39
Rubber, Hadbar 58789-23GT	" " "	Class 4 at 80 F	39
Rubber, Hadbar XB800-71	" " "	Class 1, to 160 F	39
Rubber, Linear 7806-70	" " "	Class 4 at 80 F	39

MATERIAL	FUEL	BEHAVIOR	REF
R			
Rubber, P&RP 805-70, 805-90	50/50 Fuel blend	Class 4 at 85 F	39
Rubber, Parco B318-7	" " "	Class 4 at 60 F	39
Rubber, Parco 823-70	" " "	Class 3, to 80 F	39
Rubber, Parco 805-70	" " "	Class 4 at 80 F	39
Rubber, Parker 37-014, 37-024	" " "	Class 2, to 85 F	39
Rubber, Parker B480-7	" " "	Class 4 at 80 F	39
Rubber, Parker B496-7	" " "	Class 3, to 60 F	39
Rubber, Parker 318-70	" " "	Class 3, to 160 F	39
Rubber, Precision 907-90, 925-70	" " "	Class 4 at 85 F	39
Rubber, Precision 9357; 214-907-9; 9257	" " "	Class 4 at 80 F	39
Rubber, Precision 18007, 18057	" " "	Class 4 at 160 F	39
Rubber, Sirvene 9623 and 9694	" " "	Class 4 at 145 F	39
Rubber, Sirvene 9617 and 20316	" " "	Class 4 at 85 F	39
Rubber, Stillman SR 613-75	" " "	Class 2, to 80 F Class 3, to 160 F Class 4 at 85 F	39
Rubber, Stillman EX 904-90	" " "	Class 4 at 160 F	39
Rubber, Stoner	" " "	Class 4 at 85 F	39
Rubber, SRP 50x8655 and 50223	" " "	Class 4 at 85 F	39
Rubber, Thiokol 3000 St.	" " "	Class 4 at 130 F	39
Rubber, Thiokol C42986-1	" " "	Class 2, to 85 F Class 4, to 145 F	39
Rubber, Thiokol C 55935	" " "	Class 4 at 85 F	39
Rubber, Formula 120; 121 (resin cured)	" " "	Class 3, to 160 F	39
Rubber, natural and synthetic	Helium, gaseous	Suitable for use	3A
Rubber, natural	Hydrazine, liquid	Class 2, to 80 F Class 4 at 75 F	2, 39 39
Rubber, Natural gum	Hydrazine family	Grade 3	5-5
Rubber, natural gum	Hydrazine, anhydrous	Incompatible, Class C	8
" " " "	Hydrazine hydrate	Incompatible, Class C	8
" " " "	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
Rubber, synthetic	Hydrazine, anhydrous	Limited service, Class B	8
" " "	Hydrazine, hydrate	Limited service, Class B	8
" " "	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
Rubber, U. S. L7825	Hydrazine, liquid	Class 2, to 77 F	2, 39
Rubber, U. S. No. M-20995	" " "	Class 2, to 77 F	2, 39
Rubber, Natural	Hydrocarbon fuel	Unsatisfactory	3
Rubber, synthetic (except neoprene, Buna N)	" " "	Unsatisfactory	3
Rubber, natural	Hydrogen, liquid	Unsatisfactory	8
" " "	" " "	Class 4	2
" " "	Hydrogen: Liquid & cold gas	Grade 3*	5-11
	Ambient gas	Grade 3	5-11
	*Not based on test results		
Rubber, Polyvinyl Chloride Rubatex	Hydrogen peroxide, 90%	Decrease in tensile strength, swelled to approx 150% of original volume	14
Ensolite		Same reaction	
Rubber, Precision, 18007	IRFNA	Absorbed fuel, softened (approx. 1/3)	14
Rubber, Precision 1217	JP-X	Shore A, loss - 37; 20% swell (7 d. @ RT)	34
" " " " "	"	Shore A, loss - 15 (7 d. @ 160 F)	34
Rubber, Precision, 18007	MON	Smelled badly	14
Rubber, Precision, 18057	"	Smelled badly	14
Rubber, Precision, 940x559	"	Smelled badly, many blisters	14
Rubber, natural, 606-70	Monomethylhydrazine	Intermediate (fair)	8
Rubber, natural and synthetic	Nitrogen, gaseous	Suitable for use	3A
Rubber	Nitrogen tetroxide	Class D - blistered in 1 hr (70-80 F)	4B
Rubber, natural	" " "	Unsatisfactory	21
" " "	" " "	Class D - broke up in 30 sec (70-80 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
R			
Rubber, natural	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
Rubber, ethylene-propylene	Nitrogen tetroxide	Maintains appearance and retains strength and elasticity after 1 week in liquid N_2O_4; low volume swell	25
Rubber, ethylene propylene, Formula 132	Nitrogen tetroxide (<.2% moist)	Class 4 at 67 F	39
Rubber, Stillman SR13-75	" " "	Class 4 at 65 F	39
Rubber, Stillman 11092-3A and TC-419-19A	" " "	Class 4 at 80 F	39
Rubber, Stillman TH1057	" " "	Class 4 at 65 F	39
Rubber, Stillman EX774M-1	" " "	Class 4 at 67 F	39
Rubber, U. S. Polymeric 37-9X	Nitrogen tetroxide	Unsatisfactory	21
Rubber, gum	Oxygen, liquid	Violent detonation, impact	18
Rubber impregnated asbestos sheet	" "	Moderate detonation, impact	18
Rubber, red	" "	Sensitive, impact (5/10)	18
Rubber, black	" "	Sensitive, impact (8/10)	18
Rubber	" "	Slight sensitive, impact (2/10)	18
Rubber, AN 931	" "	Very sensitive, impact (8/10)	18
Rubber, natural	Pentaborane	Incompatible	8, 22
		Class 4 at 75 F	39
Rubber, Dow Corning 9383	" "	Class 4 at 75 F	39
Rubber, natural	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Rubber, reclaimed, carbon filled	" " " "	Class 4 at 390 F	2, 39
Rubber, foam	" " " "	Class 4 at 390 F	39
Rubber, hard	RFNA	Class 4 at 75 F	39
Rubber, Goodyear Redwing	U-DETA	Absorbed fuel	12
Rubber, Goodyear, Pliowold	"	Absorbed fuel	12
Rubber, Buna N	"	Absorbed fuel very excessive	12
Rubber, graphite coated	"	Conditional	12
Rubber, Hewitt	"	Absorbs fuel	12
" " "	U-DETA (MAF-4)	Unsatisfactory	8
Rubber, Goodyear Redwing	" " "	Unsatisfactory	8
Rubber, Goodyear Pliowold 1551	" " "	Unsatisfactory	8
Rubbers, natural:	UDMH	Class 3, fair	8
Firestone D-405 black sulfur cure			
Firestone D-408 peroxide cure	"	Class 3, fair	8
Firestone D-409 sulfur cure	"	Class 3, fair	8
Firestone D-410 black sulfur cure	"	Class 3, fair	8
Rubber, acid seal	UDMH (liquid)	Class 4, 75 F	2
Rubber	WFNA	Class 4, unacceptable, all temps	2, 8
Rubbers	WFNA, liquid	Class 4, all temps	39
Rulon, Teflon base	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Rulon A	Oxygen	Spontaneous ignition temp - 465 C at 7500 psi; 463 C at 2000 psi	42
Rulon B	"	Spontaneous ignition temp - 460 C at 7500 psi; 466 C at 2000 psi	42
Rulon C	"	Spontaneous ignition temp - 465 C at 7500 psi; 458 C at 2000 psi	42
Rulon	Perchloryl fluoride, gaseous	Class 4 at 80 F	2, 39
S			
SBR, Styrene-butadiene rubber	Hydrazine, liquid	Class 1, to 75 F Class 4, to 160 F	39
SBR (Sympol 1707)	Hydrazine	Shore A, loss - 5; 14% swell (7 d. @ 160 F)	34
" " "	"	Shore A, gain - 35; 7% swell (14 d. @ 160 F)	34
" " "	"	Shore A, loss - 5; 10% swell (21 d. @ 160 F)	34
SBR (Sympol 1708)	"	Shore A, loss - 2; 4% swell (7 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
S			
SBR (Synpol 1708)	Hydrazine	Shore A, gain - 8; 3% swell (14 d. @ RT)	34
" " "	"	Shore A, gain - 8; 3% swell (21 d. @ RT)	34
" " "	"	Shore A, loss - 1; 4% swell (7 d. @ 160 F)	34
" " "	"	Shore A, no change; 4% swell (14 d. @ 160 F)	34
" " "	"	Shore A, loss - 2; 3% swell (21 d. @ 160 F)	34
SBR (Synpol 8000B)	"	Shore A, no change 8% swell (7 d. @ RT)	34
" " " "	"	Shore A, loss - 2 14% swell (7 d. @ 160 F)	34
SBR	"	Shore A, loss - 20; 10% swell (60 min @ 400 F)	34
SBR	"	Shore A, loss - 5 to gain - 3; 7% to 15% swell (7 d. @ 160 F)	34
"	"	Shore A, loss - 0 to 5; 12% and 13% swell (14 d. @ 160 F)	34
"	"	Shore A, gain - 2; 12% swell (21 d. @ 160 F)	34
"	"	Shore A, gain - 0 to 1; 8% swell (3 mo. @ 160 F)	34
"	"	Shore A, gain - 2; 5% swell (6 mo. @ 160 F)	34
"	"	9% swell (21 d. @ RT)	33
"	"	10% swell (42 d. @ RT)	33
"	"	12% swell (14 d. @ 160 F)	33
"	"	10% swell (60 min. @ 400 F)	33
"	"	Shore A, loss - 1 to gain - 9; 6% to 11% swell (7 d. @ RT)	34
"	"	Shore A, gain - 1 to 6; 4% to 9% swell (14 d. @ RT)	34
"	"	Shore A, loss - 5 to gain - 3; 4% to 9% swell (21 d. @ RT)	34
"	"	Shore A, gain - 3 and 4, 9% and 10% swell (42 d. @ RT)	34
"	"	Shore A, gain - 3; 11% swell (84 d. @ RT)	34
"	"	Shore A, loss - 2 and 5, 9% and 14% swell (3 mo. @ RT)	34
"	"	Shore A, no change; 10% swell (6 mo. @ RT)	34
SBR (Synpol 1551)	"	Shore A, loss - 3; 16% swell (7 d. @ RT)	34
" " "	"	Shore A, gain - 5; 13% swell (14 d. @ RT)	34
" " "	"	Shore A, gain - 22; 25% swell (21 d. @ RT)	34
" " "	"	Shore A, loss - 1 and 4; 9%, 12% swell (7 d. @ 160 F)	34
" " "	"	Shore A, loss of -3; 9% swell (14 d. @ 160 F)	34
" " "	"	Shore A, loss - 3; 4% swell (21 d. @ 160 F)	34
SBR	Nitrogen tetrafluoride	Promising compatibility	26
"	Perchloryl fluoride	Promising compatibility	26
"	UDMH	Shore A, loss - 5; 23% swell (7 d. @ RT)	34
SBR (Synpol 1551)	"	Shore A, loss - 24; 58% swell; (60 min. @ 400 F)	34
Saran	Aerozine 50	Unsatisfactory	21
Saran (seals)	Boron hydride family	Grade 3	5-6
Saran, Haveg 41	Bromine trifluoride, liq.	Class 4 at 75 F	39
Saran	Chlorine trifluoride	Incompatible	24
"	50/50 Fuel blend	Class 3, to 80 F	39
"	" " "	Class D (60 F, 30 d.)	4

MATERIAL	FUEL	BEHAVIOR	REF
S			
Saran	50/50 FL 1 blend	Class D - sample rubbery (10 d, @ 55-60 F)	4B
"	" " "	Class C - discolored in 2 hr (70-80 F)	4B
Saran rubber	" " "	Class 4 at 75 F	39
Saran rubber 300, cured or uncured	" " "	Class 4 at 100 F	39
Saran	50/50 Hydrazine/UDMH	Class 3, incompatible	8
"	Halogen fluoride family	Grade 3	5-8
"	Hydrazine family	Grade 3	5-5
"	Hydrazine, liquid	Class 4 at 68 F	2, 39
"	Hydrazine, anhydrous	Incompatible, Class C	8
"	Hydrazine hydrate	Incompatible, Class C	8
"	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
"	Hydrogen, liquid	Unsatisfactory	8
"	" " "	Class 4	2
"	Hydrogen: Liquid & cold gas	Grade 3	5-11
	Ambient gas	Grade 3	5-11
"	Hydrogen peroxide (concentrated)	Class 2, limited service	8
"	Hydrogen peroxide, 90%	Class 2 at 150 F, limited service	8, 39
Saran rubber Q-167	" " " "	Class 4 at 150 F	39
Saran rubber Q-1875	" " " "	Class 3 at RT	39
Saran	IRFNA	Brittle (7 d, @ RT)	34
Saran 281	JP-4 Fuel	Some shrinkage (72 hrs at 80 F)	27
Saran	Nitrogen tetroxide	Unsatisfactory	21
"	" " "	Grade 3	5-7
"	" " "	Class D (60 F, 30 d.)	4
"	" " "	Limited service	30
"	" " "	Tensile loss, 1500 psi (1 d, @ RT)	34
"	Nitrogen tetroxide (water >0.1%)	Class 3, 80 F	2
"	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
"	Nitrogen tetroxide (0.2-1.0% moist)	Class 3, to 80 F	39
"	Pentaborane	Incompatible	8, 22
		Class 4 at 75 F	39
"	Perchloryl fluoride, dry	Class 2, 80 F	2
"	Perchloryl fluoride, gaseous	Class 1, to 75 F	39
		Class 2, to 80 F	
Saran 281	RFNA	Good resistance to immersion - 168 hr. at 80 F; after 8 hr at 160 F	27
Saran rubber 300, uncured (Dow Corning)	UDMH	Class 4, poor	8
Saran rubber 300, cured (Dow Corning)	"	Class 4, poor	8
Saran rubber (Dow Corning)	"	Class 4, poor	8
Saran	WFNA, liquid	Class 4 at 75 F	39
Sarankote, coating	RFNA	Class 4 at 75 F	39
Sarankote A-1088	WFNA	Class 4 - unaccept, all temps	2, 8
Scotch tape	Oxygen, liquid	Impact, 3 4 @ 10 KgM	32
Scotch electric tape	" "	Impact, 3 4 @ 10 KgM	32
Scotch electric tape (black vinyl)	" "	Impact, 2 4 @ 10 KgM	32
Scotch electric tape (white glass)	" "	Impact, 4 5 @ 10 KgM	32
Scotch pressure sensitive tape	" "	Impact, 17 20 @ 10 KgM	32
Silastic	Hydrazine family	Grade 2	5-5
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine, hydrate	Limited service, Class B	8
"	Hydrazine hydrazine nitrate water	Limited service, Class B	8
Silastic 167	Hydrazine, liquid	Class 2, to 75 F	39
Silastic LS-53	" " "	Class 4 at 140 F	39
Silastic 625, elastomer	50 50 Hydrazine UDMH	Class 2, limited service	8
Silastic 152, 160, 161, 181, 281, 675, 7-160	Hydrogen peroxide, 90%	Class 3 @ 150 F	39
Silastic 250 and 160 O-ring	" " " "	Class 4 at 150 F	39

MATERIAL	FUEL	BEHAVIOR	REF
S			
Silastic: 240; 6-128; 9711; HR-9711; 9711 welded with S-2200; S-2000-4-480	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Silastic 152	Hydrogen peroxide (concentrated)	Class 3, very limited service	8
Silastic 240	" " "	Class 2, limited service	8
Silastic 9711	" " "	Class 2, limited service	8
Silastic DC-9711 on Dacron diaphragm	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Silastic LS-53	Nitrogen tetrafluoride	Promising compatibility	26
Silastic LS-53	Nitrogen tetroxide, liquid	245% swell in 1 hr, 280% swell in 1 d., 385% swell in 7 d.; rubbery, good appearance	
Silastic LS-422	" " "	310 to 391% swell in 1 d., 2 comps became transparent in test liquid	26
Silastic LS-53	" " "	Swells excessively in first hour; recovers, not degraded	25
Silastic	Oxygen	Grade 3	5-2
Silastic 81813	Oxygen, liquid	Very sensitive, impact (5 5)	18
Silastic 2007, uncured	" "	Insensitive, impact (0 10)	18
Silastic 2007, cured	" "	Insensitive, impact (0 10)	18
Silastic base elastomer TH 1057	" "	Sensitive, impact	18
Silastic RTV 501	" "	Sensitive, impact (6 10)	18
Silastic, Dow Corning 80-24-480	Pentaborane	Class 4 at 75 F	39
Silastic, Garlock 250	" "	Class 4 at 75 F	39
Silastic, Dow Corning No. 50-24-480	" "	Incompatible	8, 22
Silastic, Dow Corning No. 80-24-480	" "	Incompatible	8, 22
Silastic LS-53	Perchloryl fluoride	Promising compatibility	26
Silastic 152 and 250	U-DETA (MAF-4)	Unsatisfactory	8
Silastic-167, -180, -181	WFNA, liquid	Class 4 at 75 F	39
Silicone - See also "Silastic			
Silicone Coatings: DC-936	Aerozine 50	No visible change in 24 hrs @ 75 F	10, 10A
Silicone Coating DC-904	" "	No visible change in 24 hrs @ 75 F	10, 10A
Silicone Q-3-0121	" "	No visible change after immersion for 24 hrs at 75 ± 5 F	10
Silicone laminate	" "	Unsatisfactory	21
Silicone resins	Ammonia, gaseous	Class 3, to 75 F	2, 39
Silicone elastomer	" "	Class 2, to 75 F	2, 39
Silicone elastomer and glass fabric	" "	Class 2, to Hot	2, 39
Silicone rubber, glass fabric	Ammonia, anhydrous (dry, ambient temp)	Class 2, limited service	8
Silicone elastomer	" "	Class 2, limited service	8
Silicone elastomer glass fabric	" "	Class 2, limited service	2, 8
Silicone elastomer	Ammonia, anhydrous Liquid	Grade 1	5-12
	Gaseous (- 250 F)	Grade 1	5-12
Silicone resin, sealant	Ammonia, anhydrous Liquid	Grade 3	5-12
	Gaseous (- 250 F)	Grade 3	5-12
Silicone impregnated-w glass fibers	Ammonia, anhydrous Liquid	Grade 2	5-12
	Gaseous (- 250 F)	Grade 2	5-12
Silicones	Boron hydride family	Grade 3	5-6
Silicone, Dow Corning (e.g., R-7062 and R-7001)	" "	Grade 3	5-6
Silicone, Dow Corning Silastic, 50-24-480 and 80-24-480	" "	Grade 3	5-6
Silicone	50/50 Fuel blend	50% loss in ultimate tensile (5 min.)	16
Silicone R-7001	" "	Class D (RT, 70 F)	4B
	" "	Class 4 at 82 F	39
Silicone-glass laminate	" "	Class 3, to 60	25
Silicone glass laminate (composition unknown)	" "	Class C (60 F, 150 d.)	4
	" "	Class A (RT, 5 d. @ 55-60 F)	4B
	" "	Class C (parts delaminated (90 d. @ 55-60 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
S			
Silicone rubber, Dow LS-53	50/50 Fuel blend	Class 4 at 100 F	39
Silicone rubber, DC-152	" " "	Class 4 at 75 F	39
Silicone, Teflon modified, Nichols LS-53	" " "	Class 4 at 85 F	39
Silicone potting compound, elastomer, RTV 20	50/50 Hydrazine/UDMH	Class 1, general service	8
Silicones and fluorosilicones	Halogen fluoride family	Grade 3	5-8
Silicone rubber	Hi-Cal 3	Class 4, deteriorated to a powder at 120 F	2, 39
Silicone	Hydrazine	Shore A, gain - 2; 12% swell (7 d. @ RT)	34
Silicone rubber	Hydrazine, liquid	Class 2 at 75 F	2, 39
Silicone DC-710	" " "	Class 3, to 70 F	2, 39
Silicone elastomer, Precision Product 11536	Hydrazine/MMH/Water, Fuel Blend	Complete deterioration in 2 to 3 days	14
Silicone rubber	Hydrogen, liquid	Satisfactory	8
" " "	" " "	Class 1 or 2	2
" " "	" " "	Compatible for long term application	40
Silicone rubber	Hydrogen: Liquid and cold gas	Grade 3*	5-11
	Ambient gas	Grade 1	
	*Not based on test results		
Silicone	Hydrogen peroxide	Class 4	3
Silicone	" " "	Shore A, gain -10; loss - 5; volume swell - none to 4% (7 d. @ RT)	34
Silicone	Hydrogen peroxide (2.5% active oxygen loss)	9% swell (7 d. @ RT)	33
Silicone rubber	Hydrogen peroxide	<One week	1
Silicone rubber SE 450	" " "	Shore A, no change; 9% swell (7 d. @ RT)	34
Silicone rubber SE 450, 59711, 56128, Y1749	" " "	Class 2 and 3	3
Silicone rubber, SE 450, unpigmented	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Silicone rubber: GE 407B-217-1; GE 12601; GE 12670; GE 12670, pigmented brown	" " " "	Class 4 at 150 F	39
Silicone rubber: GE 1240; GE 81223; GE 12650, unpigmented	" " " "	Class 2 at 150 F	39
Silicone rubber: GE 12602; GE 12650, pigmented red; GE 15060, GE 15080; GE X-7181	" " " "	Class 3 at 150 F	39
Silicone 407-B-217-1	Hydrogen peroxide (concentrated)	Class 3, very limited service	8
Silicone SR 5550	" " "	Class 2, limited service	8
Silicone Y-1749	" " "	Class 2, limited service	8
Silicone: 407-B-217-1; HT 656; X-7181	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Silicone: 407-B-437-1; SR 5550; SR 5570; SR 5550; SR 5570; Y-1749	" " " "	Class 2 at 150 F	39
Silicone seal washer 9711 (DC A4094 adhesive on aluminum)	" " " "	Class 3 at 150 F	39
Silicone seal washer 9711 (DC Chem-loc 607 adhesive on aluminum)	" " " "	Class 3 at 150 F	39
Silicone (silastic)	Hydrogen peroxide	Shore A, no change, 8% swell (7 d. @ RT)	34
Silicone rubber GE X7181	Hydrogen peroxide (concentrated)	Class 3, very limited service	8
Silicone rubber EG 1240	" " " "	Class 2, limited service	8
Silicone rubber GE 12601	" " " "	Class 4, unacceptable	8
Silicone rubber	Monomethylhydrazine	Intermediate (fair)	8
Silicone rubber 7170	" " " "	Intermediate	8
Silicones	Nitrogen tetroxide	Class D - severe	14A
Silicones	" " "	Not chemically compatible	8
Silicone rubber	" " "	Grade 3	5-7
" "	" " "	Class D - severe	14A

MATERIAL	FUEL	BEHAVIOR	REF
S			
Silicone rubber	Nitrogen tetroxide (water > 0.1%)	Class 3, 80 F	2
" " "	Nitrogen tetroxide (0.2-1.0% moist)	Class 3, to 80 F	39
Silicone-glass laminate, composition unknown	Nitrogen tetroxide	Class D, delaminated (30 d. @ 55-60 F)	4, 4B
Silicone laminate	" " "	Unsatisfactory	21
" " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Silicone, RTV 60	Nitrogen tetroxide	Various one specimen held up for 1 hr	10
Silicone (O-Ring) with Kel-F cover	" " "	Class D (65 F, 63 d.)	4
Silicone	Oxygen, liquid	Impact; 2/8, 5/5, 2/2 @ 10 KgM	32
Silicone, Silastics	" "	Impact; 2/3, 8/10, 7/10, 2/10, 2/2, 2/7, 2/3, 2/8, 2/3, 2/2, 3/20 @ 10 KgM	32
Silicone rubber (spec ")	" "	Satisfactory	1, 3
Silicone rubber	" "	Violent detonation, impact	18
Silicone rubber	" "	Impact 2/2, 20/20 @ 10 KgM	32
Silicone and glass	" "	Impact 2/2 @ 10 KgM	32
Silicone rubber backing on aluminized glass fabric	" "	Sensitive, impact (8/10)	18
Silicone resin on glass cloth	" "	Very sensitive, impact (10/10)	18
Silicone fiberglass laminate	" "	Moderate detonation, impact	18
Silicone rubber on fiberglass, silver-cloth	" "	Very sensitive, impact (5/5)	18
Silicone rubber on fiberglass, redcloth	" "	Very sensitive, impact (5/5)	18
Silicone paint on Asbestos	" "	Very sensitive, impact (2/3)	18
Silicone paint, XP-7-1003 (dried and baked)	" "	Questionable sensitivity (0/2)	18
Silicone rubber, Dow Corning 916	Pentaborane	Incompatible	22
Silicone foam, Dow Corning R-7002, R-7903	" "	Incompatible	22
Silicone rubber	Perchloryl fluoride, gaseous	Class 4 at 390 F	2, 39
Silicone rubber, on glass cloth	" " " "	Class 2, to 390 F	2, 39
Silicone glass cloth	" " " "	Class 4 at 390 F	2, 39
Silicone	RFNA	Class 3, to 75 F	39
Silicone rubber, AMS 3305	U-DETA (MAF-4)	Satisfactory	8, 12
Silicone DC 160 and SE 450-24/4B	" " "	Unsatisfactory	8
Silicone rubber	UDMH (liquid)	Class 4, 32 F	2
Silicone rubber	UDMH (vapor)	Class 4, 32 F	2
Silicone LS-53 (Dow Corning)	UDMH	Class 4, poor	8
Silicone DC 152 (Dow Corning)	"	Class 4, poor	8
Silicone SE 750, (General Electric)	"	Class 4, poor	8
Silicone SE 565; SE 361; SE 452; SE 750; XE 5701; XE 404 (General Electric)	"	Class 4, poor	8
Silicone, modified: Nichols Engineering: Teflon modified silicone, LS-53	"	Class 4, poor	8
Siloxane (polydimethyl siloxane)	Oxygen, liquid	Very sensitive, impact (3/3)	18
Siloxane (fluorinated) LS-53	" "	Slightly sensitive, impact (2/5)	18
Sivrene 1080; 9031	50/50 Hydrazine/UDMH	Class 2, limited service	8
Spauldite, phenolic, paper-base	IRFNA	Class 4 at 75 F	39
Spauldite	IRFNA	Dissolved (7 d. @ RT)	34
Spauldite	Nitrogen tetroxide	Disintegrated (1 d. @ RT)	34
Spauldite	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Spiratallic, Teflon and metal	Nitrogen tetroxide	Grade 1	5-7
Spiratellic 911-44, gasket	Oxygen, liquid	No reaction, impact	18
Strippable, TeeChem 556	" "	Low detonation, impact	18
Strippable, CVAC 2-10	" "	Moderate detonation, impact	18
Strippable, 3M	" "	Moderate detonation, impact	18
Styrene (Hi-styrene sheet)	IRFNA	Vigorously attacked (7 d. @ RT)	34
Styrene, Hi, sheet	"	Class 4 at 75 F	39
Styrene (Hi-styrene sheet)	Nitrogen tetroxide	1 d. @ RT -- Disintegrated	34
Styrene, modified	RFNA	Class 4 at 75 F	39

MATERIAL	FUEL	BEHAVIOR	REF
S			
Styrene-Butene (Emerson & Cuming)	Aerozine 50	Appearance good (2 d. @ 70 F)	36
" " " " " " "	Nitrogen tetroxide	Completely degraded (2 d. @ 70 F)	36
Styrene-butadiene rubber - See also: "SBR"; "Synpol"			
T			
TFNMTFE*	Chlorine trifluoride	Promising compatibility	26
" "	Nitrogen tetroxide	Incompatible	26
" "	" " "	Volume swell, with loss of physical properties	25
" "	Nitrogen tetroxide (<.2% moist)	Class 4 at 80 F	39
	*Trifluoronitrosomethane tetrafluoroethylene		
Tedlar	50/50 Fuel blend	Class 2, to 60 F	39
"	" " "	Class B - shrinks 4.3% after 30 days, swells 9.3% after 180 days (180 d. @ 55-60 F)	4B
"	Nitrogen tetroxide (<.2% moist)	Class 1, to 67 F	39
"	Oxygen, liquid	Impact sensitive, unacceptable	32
Teflon-asbestos - See also "Fluorobestos"			
Teflon and aluminum silicate fibers - See "Duroid 5600, 5650"			
Teflon and metal - See also "Spiratallic", "K Seal", "Rayco"			
Teflon-coated glass - See also "Armalon", "Korda-flex"			
Teflon/glass fibers - See also "Chemelic", "Duroid 5813, 5870"			
Teflon/glass/ceramic - See also "Fluorogreen"			
Teflon tapes - See also "Fluorolin"			
Teflon, (FEP and TFE)	Aerozine 50	Compatible for long term applications (test temp 70-80 F)	40
Teflon 100 (now FEP)	" "	No effects (60 d. @ 75+5 F) Slight harding on air dry	10
Teflon liner	" "	Very resistent, but permeable (30 d. @ 100 F)	36A
Teflon 1	" "	No effects (125 d. @ 75+5 F)	10
Teflon 100	Aerozine 50 (Dynamic or static extended service)	No significant change in 189 d. at 75 F	10A
Teflon 1	" " " "	No significant change in 240 d. at 75 F	10A
Teflon liner	Aerozine 50	Tensile, 98.2% ret (7 d. @ 100)	36C
" "	" "	Tensile, 119% ret (30 d. @ 100 F)	36C
" "	" "	Elongation, 80.5% ret (7 d. @ 100 F)	36C
" "	" "	Elongation, 118.0% ret (30 d. @ 100 F)	36C
" "	" "	Hardness, -2 change (7 d. @ 100 F)	36C
" "	" "	Hardness, -1 change (30 d. @ 100 F)	36C
Teflon with steel primer	" "	No visible change in 24 hrs.	10A
Teflon-backed tape, XIIII	" "	No visible change, 30 d.	10A
Teflon-backed tape, 549	" "	No visible change, 1-1/2 hr.	10A
Teflon-backed tape, 7503	" "	No visible change, 1/2 hr	10A
Teflon-backed tape, SL28011, Lot 306	" "	No visible change, 20 days	10A
Teflon insulation; Teflon 100	" "	Good to 500 F	10, 10A
Teflon insulation (other grades)	" "	Good to 700 F, short time heat exposure	10, 10A

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon filled with asbestos	Aerozine 50	Compatible for long term applications (test temp 55-60 F)	40
Teflon filled with graphite	" "	Compatible for long term applications (test temp 55-60 F)	40
Teflon filled with molydisulfide	" "	Compatible for long term applications (Test temp 55-60 F)	40
Teflon	Alcohols (methyl, ethyl, isopropyl, furfuryl)	Approved for use	3
"	Ammonia, anhydrous	Satisfactory	3
"	Ammonia, anhydrous (dry, ambient temp)	Class 1, acceptable, or Class 2, limited service	8 8
"	Ammonia, anhydrous: Liquid	Grade 1	5-12
	Gas (<250 F)	Grade 1	5-12
"	Ammonia, gaseous	Class 1, to hot	2, 39
Teflon-film	Ammonia, anhydrous: Liquid	Grade 1	5-12
	Gas (< 250 F)		
Teflon	Aniline	Satisfactory	3
Teflon (seals)	Boron hydride family	Grade 1	5-6
Teflon	Bromine trifluoride, liquid	Class 2, to 75 F	39
"	Chlorine trifluoride	Approved, except for flow conditions	3
"	" " " "	Class A, general service	8
"	" " " "	Compatible under static (non flow) conditions; must be free of impurities, limited service	24
"	" " " "	Compatible, under static conditions only; long term application	40
"	" " " "	No effect at 160 F for 312 hours	31
"	Chlorine trifluoride (gas) *May be sensitive to high flow rates	Class 2, room temperature*	2
Teflon	Chlorine trifluoride, gaseous	Class 1, to 75 F	39
"	Chlorine trifluoride, liquid	Class 1, to 85 F	39
Teflon, unfilled	Chlorine trifluoride (in stainless steel cylinder)	Unchanged: (31.5 hrs @ 70-80 C) Unchanged: (333 hrs @ 25 C)	9
Teflon filled with CaF_2 (Garlock)	" " " "	Unchanged (333 hrs at 25 C)	9
" " " " " "	" " " "	Unchanged (71 hrs at 25 C)(31.5 hrs at 70-80 C)	9
" " " " " "	" " " "	Lighter in color (17 hrs at 25 C) (3 hrs at 70-80 C)	9
Teflon liner	Chlorine trifluoride	Tensile, 104.0% ret (7 d. @ 100 F)	36C
" "	" " " "	Tensile, 112.8% ret (30 d. @ 100 F)	36C
" "	" " " "	Elongation, 97.2% ret (7 d. @ 100 F)	36C
" "	" " " "	Elongation, 94.5% ret (30 d. @ 100 F)	36C
" "	" " " "	Hardness, +7 change (7 d. @ 100 F)	36C
" "	" " " "	Hardness, +7 change (30 d. @ 100 F)	36C
Teflon tape, Permacel	Chlorine trifluoride (Liquid, at 30 C, max. temp, in Kel-F tube)	Unchanged after 1-1/2 hr @ 25 C	9
Teflon	Ethylene oxide	Approved for temps to 180 F	3
Teflon FEP	FLOX-40 (40%F_2-60%O_2) gaseous	Class 1, to RT	39
Teflon TFE	" " " "	Class 1, to RT	39
Teflon	Fluoramine family: Gaseous	Grade 1	5-9
	Liquid	Grade 1	5-9

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon tape	Fluoramine family: Gaseous	Grade 2**	5-9
	Liquid	Grade 2**	5-9
	**Very little data; use sparingly		
Teflon	Fluorine, gaseous	Acceptable at moderate pressures and low flow rates	3, 3A
"	" " "	Class 1 to 390 F* Class 4, > 390 F	39
*Material is pressure sensitive, can be tolerated at RT.	Class 2 below 390 F and	15-psi pressure. Higher pressures	
Teflon	Fluorine, gaseous	Class 1, 390 F** Class 4, 390 F	2 2
	**Material is pressure sensitive		
Teflon	Fluorine, liquid	Grade 3*, ***	5-10
"	Fluorine, gaseous	Grade 2***	5-10
	*Not based on test results		
	***Limited use below 390 F, 15 psi, Higher pressures tolerated @ RT.		
Teflon, seals	Fuels (general)	Acceptable for continuous use; not satisfactory where premeability is a consideration.	16
Teflon, cured	50/50 Fuel blend	No discoloration; very slight weight loss	15
Teflon FEP	" " "	Class A - Shore D increase 6 units (180 d. @ 55-60 F)	4, 4B
" "	" " "	Class B - (270 d. @ 55-60 F)	4, 4B
" "	" " "	Class A - (60 d. @ 70-80 F)	4, 4B
" "	" " "	Class D - shrinks 15.8%, (30 d. @ 160 F)	4B
" "	" " "	Class A (60 d. @ 70-80 F)	40
" "	" " "	Class B (30 d. @ 160 F)	40
" "	" " "	Class 1, to 60 F; Class 4 at 160 F	39
" "	" " "	Retains high ultimate tensile	16
Teflon (TFE)	" " "	Class A - (270 d. @ 55-60 F)	4B
" "	" " "	Class A - (125 d. @ 70-80 F)	4B
" "	" " "	Class B - shrinks 4.5%, 7% tensile loss (30 d. @ 160 F)	4B
" "	" " "	Class 1, to 80 F	39
" "	" " "	Class 2, to 160 F	39
" "	" " "	Class A (125 d. @ 70 F)	40
" "	" " "	Class B (30 d. @ 160 F)	40
Teflon filled with asbestos	" " "	Class 1, to 60 F	39
" " " " "	" " "	Class A (360 d. @ 55-60 F)	4B
Teflon filled with graphite	" " "	Class 1, to 60 F	39
" " " " "	" " "	Class A (360 d. @ 55-60 F)	4B
Teflon filled with MoS_2	" " "	Class 1, to 60 F	39
" " " " "	" " "	Class A (360 d. @ 55-60 F)	4B
Teflon, TFE-felt 7550	" " "	Class B - Fuel discolored (270 d. @ 55-60 F)	4B
" " " "	" " "	Class 2, to 60 F	39
Teflon tape (unsintered)	" " "	Class A - (1 d. @ 70-80 F)	4B
Teflon 100	50/50 Hydrazine/UDMH	Class 1, general service	8
		Class 2, limited service	8
Teflon 1	" " " "	Class 1, general service	8
		Class 2, limited service	8
Teflon, 25% glass filled	" " " "	Class 1, general service	8
Teflon	Halogen fluoride family	Class 1. Known to ignite. Expose gasket to gaseous propellant before use. Should not be exposed from metal surface more than .003-inch	5-8
Teflon, CaF_2 filled	" " " "	Grade 1	5-8
Teflon	HEF-2	Satisfactory	1, 3
"	HEF-3	Satisfactory	1, 3
"	Helium, gaseous	Suitable for use	3A
"	HiCal-3	Satisfactory	3
"	"	Class 2, no change @ 120 F	2, 39

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon asbestos packing	HiCal-3	Class 3, weight gain at 120 F	2, 39
Teflon TFE	Hybaline A-5	Net % weight change (500 hrs @ 50 C) - 0.02	35
Teflon	Hydrazine	Satisfactory	1, 3
"	"	Acceptable	3A
"	"	Compatible	23
"	"	Compatible for long term application < 140 F	40
Teflon 100-X	"	Compatible for long term application	40
" "	"	Compatible	23
Teflon 100X	Hydrazine family	Grade 1	5-5
Teflon	" " "	Grade 1	5-5
Teflon	Hydrazine, liquid	Class 1, to 140 F	2, 39
Teflon, cured	Hydrazine	No discoloration; slight weight loss	15
Teflon FEP	"	Not affected, brief exposure	7
" "	Hydrazine family	Grade 1	5-5
Teflon	Hydrazine, anhydrous	Compatible, Class A, general service	8
"	Hydrazine, hydrate	Compatible, Class A, general service	8
"	Hydrazine/hydrazine nitrate/water	Compatible. Class A, general service	8
Teflon, filled with asbestos	Hydrazine family	Grade 1	5-5
Teflon, filled with graphite	" " "	Grade 1	5-5
Teflon, filled with molydisulfide	" " "	Grade 1	5-5
Teflon tape, (unsintered)	" " "	Grade 2	5-5
Teflon, TFE-felt	" " "	Grade 3	5-5
Teflon	Hydrazoid B	Unaffected, 150 d. at room temperature (Compatible for limited service)	31
"	Hydrocarbon fuel	Satisfactory	1, 3
"	Hydrogen, liquid	Satisfactory	1, 3, 8, 11
"	" " "	Compatible for long term applications	40
"	" " "	Class 1 or 2	2
"	Hydrogen: Liquid and cold gas	Grade 1	5-11
	Ambient gas	Grade 1	5-11
Teflon tape	Hydrogen: Liquid and cold gas	Grade 1*	5-11
	Ambient gas	Grade 1*	5-11
	*Not based on test results		
Teflon	Hydrogen peroxide	Long term use	1
"	" " "	Class 1, 2, 3	3
Teflon, white	Hydrogen peroxide, 90%	Class 1 at 150 F	39
Teflon, glass filled	Hydrogen peroxide (concentrated)	Class 1, acceptable	8
Teflon cloth, 25 grade	Hydrogen peroxide, 90%	Class 3 at 150 F	39
" " " "	" " " "	Class 2 at 150 F	39
Teflon cloth, 40 grade	" " " "	Class 3 at 150 F	39
Teflon cloth T-2300	" " " "	Class 3 at 150 F	39
Teflon cloth T-2305	" " " "	Class 2 at 150 F	39
Teflon, coating	" " " "	Class 1 at room temperature	39
Teflon, white	Hydrogen peroxide (concentrated)	Class 1, acceptable	8
Teflon, dispersions	" " " "	Class 1, acceptable	8
Teflon, porous (9 micron pore)	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Teflon, cured	IRFNA	Appeared to shred immediately	15
Teflon	"	Class 1, to 75 F	39
Teflon (15 mils)	"	Tensile loss, 700 psi (7 d. @ RT)	34
Teflon (8 mils)	"	Tensile loss, 1600 psi (14 d. @ RT)	
" " "	"	Tensile loss, 1100 psi (1 d. @ 160 F)	34
" " "	"	Tensile loss, 800 psi (7 d. @ 160 F)	34
Teflon FEP (7 mils)	"	Tensile loss, 240 psi (8 d. @ RT)	34

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon FEP (7 mils)	IRFNA	Tensile loss, 670 psi (14 d. @ RT)	34
" " " "	"	Tensile loss, 370 psi (21 d. @ RT)	34
" " " "	"	Tensile loss, 570 psi (1 d. @ 160 F)	34
" " " "	"	Tensile loss, 370 psi (7 d. @ 160 F)	34
Teflon (primed; 7.5 mil)	"	Tensile increase, 900 psi (21 d. @ RT)	34
Teflon (10% CaF_2) (P5110)	"	Tensile gain, 100 psi (7 d. @ RT)	34
Teflon (10% CaF_2) (P4110)	"	Tensile loss, 340 psi (7 d. @ RT)	34
Teflon (20% CaF_2) (P1120)	"	Tensile loss, 202 psi (7 d. @ RT)	34
Teflon (CaF_2-Commercial)	"	Tensile loss, 200 psi (7 d. @ RT)	34
		Tensile gain, 800 psi (7 d. @ 160 F)	34
Teflon, graphited	"	Tensile loss, 200 psi (7 d. @ RT)	34
" " "	"	Tensile gain, 250 psi (7 d. @ 160 F)	34
Teflon-glass	"	Tensile loss, 150 psi (7 d. @ RT)	34
" "	"	Tensile gain, 750 psi (7 d. @ 160 F)	34
Teflon	JP-X	Shore C, loss - 5 (60 min @ 350 F)	34
"	"	Shore C, loss - 20 (60 min. @ 400 F)	34
Teflon coated Fiberglas	Mixed amines	No apparent effect (7 d. @ RT)	38
Teflon-coated steel	MON*	Slight weight increase; no other changes	14
	*Mixed oxides of nitrogen		
Teflon, cured	MON	Bleached white; slight weight gain	15
Teflon	Monomethylhydrazine	Intermediate	8
"	" " " "	Preferred (unspecified performance)	3A
"	Nitric acids, fuming	Satisfactory	3
"	Nitrogen, liquid	Satisfactory	1, 3
"	Nitrogen, gaseous	Suitable for use	3A
Teflon-backed tape, X-1111	Nitrogen tetrafluoride	No visible change in 1/2 hr	10A
Teflon	Nitrogen tetroxide	Satisfactory	1, 3, 21
"	" " "	Compatible	30
"	" " "	Withstands contact, among best	8
"	" " "	Moderate adhesive failure	10A
"	" " "	No visible change	10A
Teflon 1	" " "	Strength and stiffness decrease slowly.	10A
"	" " "	Satisfactory	21
"	" " "	Grade 1	5-7
Teflon 100	Nitrogen tetroxide (Dynamic or static extended service)	Strength and stiffness decrease slowly, equilibrium obtained, 10-12 d.	10A
Teflon	Nitrogen tetroxide (<.2% moist)	Class 1, to 57 F	39
"	Nitrogen tetroxide (water, >0.1%)	Class 1, 160 F	2
"	Nitrogen tetroxide (0.2-1.0% moist)	Class 1, to 160 F	39
"	Nitrogen tetroxide (liquid)	2% swell (7 d. @ RT)	33
		7% swell (21 d. @ RT)	33
Teflon, cured	Nitrogen tetroxide	Bleached white; slight weight gain	15
Teflon	" " "	Tensile, no change (1 d. @ RT)	34
"	" " "	Tensile, no change (7 d. @ RT)	34
"	" " "	Tensile loss, 2400 psi (14 d. @ RT)	34
"	" " "	Tensile loss, 700 psi (21 d. @ RT)	34
"	" " "	Tensile loss, 500 psi (42 d. @ RT)	34
Teflon FEP	" " "	13 mo exposure; absorbed, swelled, no chemical reaction.	7
" "	" " "	Not affected, brief exposure	7
" "	" " "	Grade 2	5-7
" "			

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon FEP	Nitrogen tetroxide	Class A, satisfactory	14A
" "	" " "	4% volume increase 15% drop in ultimate tensile	16
" "	" " "	Class C (60 F, 30 d.)	4
" "	" " "	Class A (67 F, 30 d.)	4
" "	" " "	Class A (80 F, 90 d.)	4
" "	" " "	Class A (160 F, 7 d.)	4
" "	" " "	Class A - (30 d. @ 63-67 F)	4B
" "	" " "	Class A - (7 d. @ 160 F)	
" "	" " "	Class B - Shore D decrease 8 units (30 d. @ 55-60 F)	
" "	" " "	Class D - Shore D decrease 11 units, sample yellow (80 d. @ 55-60 F)	
" "	" " "	Tensile gain, 1330 psi (7 d. @ RT)	34
" "	" " "	Tensile loss, 970 psi (14 d. @ RT)	34
" "	" " "	Tensile loss, 570 psi (21 d. @ RT)	34
" "	" " "	Tensile gain, 330 psi (42 d. @ RT)	34
" "	" " "	Tensile gain, 1830 psi (3 mo. @ RT)	34
" "	" " "	Tensile loss, 670 psi (7 d. @ 160 F)	34
" "	" " "	Compatible for long term applications, test temp 70-80 F (less permeable by nitrogen tetroxide than TFE)	40
" "	Nitrogen tetroxide, liquid	Class A (90 d. @ 70-80 F) Class A (30 d. @ 63-67 F)	40
" "	Nitrogen tetroxide (<.2% moist)	Class 1, to 160 F Class 2, to 60 F Class 4, to 60 F	39
Teflon TFE	Nitrogen tetroxide	Class B (60 F, 30 d.)	4
" "	" " "	Class A (67 F, 30 d.)	4
" "	" " "	Class B (80 F, 100 d.)	4
" "	" " "	Class A - (30 d. @ 63-67 F)	4B
" "	" " "	Class B - Shore D decrease 6 units, sample slightly yellow (180 d. @ 55-60 F)	4B
" "	" " "	Grade 1	5-7
" "	" " "	Class A, satisfactory	14A
" "	" " "	Compatible for long term application, Test temp 63-67 F (Nitrogen tetroxide premeated and was absorbed)	40
Teflon "	Nitrogen tetroxide, liquid	Class B (100 d. @ 70-80 F) softened Class B (30 d. @ 55-60 F) 1 - 3% moisture, softened	40
Teflon "	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F Class 2, to 60 F	39 39
Teflon TFE Felt	Nitrogen tetroxide	Satisfactory	21
" " "	" " "	Grade 3	5-7
" " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F Class 4 at 60 F	39
Teflon, TFE felt 7550	Nitrogen tetroxide	Class D - sample coming apart (30 d. @ 55-60 F)	4, 4B
Teflon liner	" " "	Very resistant, but permeable (30 d. @ 100 F)	38A
" "	" " "	Tensile, 83% ret (7 d. @ 100 F)	38C
" "	" " "	Tensile, 120% ret (30 d. @ 100 F)	38C
" "	" " "	Elongation, 89.8% ret (7 d. @ 100 F)	38C
" "	" " "	Elongation, 83.5% ret (30 d. @ 100 F)	38C
" "	" " "	Hardness, 0 change (7 d. @ 100 F)	38C
" "	" " "	Hardness, -8 change (30 d. @ 100 F)	38C
Teflon 100, insulation	" " "	Good for 500 F	10, 10A

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon insulation, other grades	Nitrogen tetroxide	Good for 700 F; short term heat exposure	10, 10A
Teflon and Metal	" " "	Successful as pipe flange seals	10
Teflon tape	" " "	Grade 3	5-7
Teflon tape, unsintered	" " "	Class A - (1 d. @ 70-80 F)	4B
" " " " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 80 F	39
Teflon-backed tape, 549	Nitrogen tetroxide	Moderate adhesive failure after 1-1/2 hr immersion	10A
Teflon-backed tape, 7503	" " "	Moderate adhesive failure after 1/2 hr immersion	10A
Teflon-backed tape, SL28011, Lot 303	" " "	No visible change, 1/2 hour. Adhesive failure after 1 hr immersion	10A
Teflon, for sliding vanes	" " "	Incompatible (through swelling)	28
Teflon TFE coating on rubber O-rings	" " "	Protective	25
Teflon FEP coating on rubber O-rings	" " "	Protective	25
Teflon with steel primer coating	" " "	No visible change, 24 hours	10A
Teflon, silica primed	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Teflon, silica primed	Nitrogen tetroxide	Tensile gain, 1400 psi (42 d. @ RT)	34
		Tensile gain, 1400 psi (3 mo. @ RT)	34
Teflon/glass	" " "	Shore A, no change (7 d. @ RT)	34
" "	" " "	Shore A, gain - 1 (16 d. @ RT)	34
" "	" " "	Shore A, no change (21 d. @ RT)	34
" "	" " "	7% swell (7 d. @ RT)	34
" "	" " "	2% swell (16 d. @ RT)	34
" "	" " "	4% swell (21 d. @ RT)	34
Teflon filled with glass	Nitrogen tetroxide	Compatible for long term application, test temp 70-80 F	40
" " " "	Nitrogen tetroxide (<.2% moist)	Class 1, to 80 F	39
Teflon-Fiberglas (LNP)	Nitrogen tetroxide	Compatible	30
Teflon filled with glass	" " "	Class A (21 d. @ 70-80 F)	4B
" " " "	" " "	Grade 1	5-7
Teflon with asbestos	" " "	Satisfactory	21
Teflon filled with asbestos	" " "	Class A (180 d. @ 55-60 F)	4B
" " " " "	" " "	Compatible for long term application, test temperature 55-60 F	40
Teflon asbestos	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F	39
Teflon + asbestos or glass	Nitrogen tetroxide	Compatible	30
Teflon filled with calcium fluoride	" " "	Compatible for long term applications, test temp 70-80 F	40
" " " " " "	" " "	Class A (21 d. @ 70-80 F)	4B
Teflon filled with CaF_2	Nitrogen tetroxide (<.2% moist)	Class 1, to 80 F	39
Teflon (CaF_2)	Nitrogen tetroxide	Shore A, no change; 2% swell (7 d. @ RT)	34
" "	" " "	Shore A, no change; 3% swell (16 d. @ RT)	34
" "	" " "	Shore A, loss - 1; 7% swell (21 d. @ RT)	34
Teflon (10% CaF_2) (P5110)	" " "	Tensile loss, 400 psi (7 d. @ RT)	34
Teflon (20% CaF_2) (P-1120)	" " "	Tensile loss, 104 psi (7 d. @ RT)	34
Teflon with ceramics	" " "	Most compatible of materials used	28
Teflon, graphited	" " "	Satisfactory	21
" " "	" " "	Shore A, gain - 1 (7 d. @ RT)	34
" " "	" " "	Shore A, loss - 2 (16 d. @ RT)	34
" " "	" " "	Shore A, gain - 1 (21 d. @ RT)	34
" " "	" " "	4% swell (1 d. @ RT)	34
" " "	" " "	3% swell (16 d. @ RT)	34
" " "	" " "	3% swell (21 d. @ RT)	34
Teflon filled with graphite	" " "	Class A (60 F, 90 d.)	4
" " " " "	" " "	Grade 1	5-7
" " " " "	" " "	Class B - Shore D decrease 9 units (180 d. @ 55-60 F)	4B

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon graphite	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F Class 2, to 60 F	39
Teflon, molybdenum sulfide	Nitrogen tetroxide	Satisfactory	21
Teflon filled w/molybdenum disulfide	" " "	Grade 1	5-7
" " " " " " "	" " "	Class A (60 F, 90 d.)	4
" " " " " " "	" " "	Class B - Shore D decrease 7 units (180 d. @ 55-60 F)	4B
Teflon MoS_2	Nitrogen tetroxide (<.2% moist)	Class 1, to 75 F Class 2, to 60 F	39
Teflon w/stainless steel	Nitrogen tetroxide	Most compatible of materials used	28
Teflon	Nitrogen trifluoride	Satisfactory in gaseous service	8
Teflon tape	" " "	Satisfactory in gaseous service	8
Teflon	Nitrogen trifluoride, gaseous	Satisfactory for valve seats, valve packing, gaskets	8
Teflon tape	" " " "	Satisfactory for screwed pipe connections	8
Teflon, seals	Oxidizers (general)	Acceptable for continuous service	16
Teflon, virgin	Oxygen	Spontaneous ignition temp - 465 C at 7500 psi; 469 C at 2000 psi	42
Teflon 100 X	"	Spontaneous ignition temp - 410 C at 7500 psi; 413 C at 2000 psi	42
Teflon sheet and O-rings	"	Grade 1	5-2
TFE Tape (Mil-T-27730)	"	Grade 1	5-2
Teflon tape	"	Grade 2	5-2
Teflon 100 FEP	Oxygen difluoride	Class 1, -109 F	39
Teflon 827 TFE	" " "	Class 2, -109 F	39
Teflon tape	Oxygen difluoride: Liquid	Grade 2	5-13
	Gaseous	Grade 1	5-13
Teflon	Oxygen/Oxygen difluoride (30% O_2 + 70% OF_2)	Class 1, to 212 F	39
"	Oxygen, liquid	Suitable	8
"	" " "	Satisfactory	1, 3
"	" " "	Impact; 0/20 @ 10 KgM	32
Teflon FEP	" " "	Impact insensitive; generally acceptable	32
Teflon TFE	" " "	Impact insensitive; generally acceptable	32
Teflon, FEP/TFE fabric, metalized	" " "	Impact; 0/20 @ 10 KgM	32
Teflon and adhesive	" " "	Impact, 2/3, 2/17 @ 10 KgM	32
Teflon/adhesive/aluminum foil	" " "	Impact; 2/3 @ 10 KgM	32
Teflon and copper	" " "	Impact 5/40 @ 10 KgM	32
Teflon and graphite, GN-10-5	" " "	Suitable	8
Teflon glass cloth	" " "	Impact 0/20 @ 10 KgM	32
Teflon/glass fiber	" " "	Impact; 2/2 @ 10 KgM	32
Teflon tape (Scotch)	" " "	Impact; 3/10, 0/10, 2/2 @ 10 KgM	32
Teflon/silicone adhesive (Scotch electrical adhesive)	" " "	Impact; 2/3, 2/2 @ 10 KgM	32
Teflon impregnated with silicone rubber	" " "	Impact; 2/3 @ 10 KgM	32
Teflon	Pentaborane	Compatible	22
"	" "	Approved for use	3A
"	" "	Compatible for long term applications	40
"	" "	Class 1 to 75 F	39
"	Perchloryl fluoride	Satisfactory	3
"	Perchloryl fluoride, dry	Class 2, 390 F	2
"	Perchloryl fluoride, gaseous	Class 1, to 75 F Class 2, to 390 F	39
Teflon tape Permacel	Perchloryl fluoride	Unchanged after 1 hr @ 25 C	9
Teflon	Perchloryl fluoride (25), chlorine trifluoride (75)	Class 3, to 85 F	39
Teflon, CaF_2 filled	" " " "	Class 1, to 85 F	39
Teflon 100 FEP	Perchloryl fluoride (50)/tetrafluorohydrazine(50), gaseous	Class 1, to -109	39
Teflon 827TFE	" " " "	Class 3, to -109	39

MATERIAL	FUEL	BEHAVIOR	REF
T			
Teflon	n-Propyl nitrate	Satisfactory	1, 3
Teflon, coating	RFNA	Class 1 to 75 F	39
Teflon	U-DETA	Satisfactory	12
Teflon-coated fiberglass cloth	"	Satisfactory	12
Teflon-coated cloth	U-DETA (MAF-4)	Satisfactory	8
Teflon	UDMH	Class 1, excellent	8
"	"	With reservations	1
"	"	Satisfactory	3
"	UDMH (vapor)	Class 1, 160 F	2
"	UDMH (liquid)	Class 1, 160 F	2
"	UDMH	Compatible for long term application, <160 F	40
"	"	Shore C, loss - 10 (60 min. @ 400 F)	34
"	"	Among best, but unspecified performance	3A
Teflon, cured	"	No discoloration, very slight weight loss	15
Teflon FEP	"	Compatible for long term storage	40
Teflon FEP (X100)	"	Class 1, excellent	8
Teflon FEP	"	Tensile loss, 570 psi; Shore A, loss - 5 (7 d. @ RT)	34
" "	"	Shore C, gain - 10 (60 min. @ 350 F)	34
" "	"	Shore C, gain - 5 (60 min @ 400 F)	34
Teflon-coated steel	"	Slight increase in weight; no other changes	14
Teflon	WFNA	Satisfactory	1
"	"	Class 2, slight corrosion rate, 80 F, limit	8
"	"	Class 2, 80 F	2
"	WFNA, liquid	Class 2, to 80 F	39
Tenite	UDMH (liquid)	Class 4, 75 F	2
Teslar	Aerozine 50	Unsatisfactory	21
"	50/50 Fuel blend	Class B (60 F, 30 d.)	4
Teslar 30	50/50 Hydrazine/UDMH	Class 2, limited service	8
" "	Hydrazine	Tensile gain, 2500 psi (7 d. @ RT)	34
Teslar 30; Teslar 40	IRFNA	Class 4 at 75 F	39
Teslar 30 (2 mils)	"	Dissolved (7 d. @ RT)	34
Teslar 40	"	Dissolved; gel (7 d. @ RT)	34
Teslar 30	Nitrogen tetroxide	Tensile loss, 2500 psi (7 d. @ RT)	34
" "	" " "	Tensile gain, 2500 psi (14 d. @ RT)	34
" "	" " "	Tensile gain, 1000 psi (21 d. @ RT)	34
" "	" " "	Tensile loss, 1000 psi (42 d. @ RT)	34
" "	" " "	Tensile loss, 1000 psi (3 mo. @ RT)	34
" "	" " "	Melted (7 d. @ 160 F)	34
Teslar	" " "	Unsatisfactory	21
"	" " "	Grade 1	5-7
"	" " "	Class D - severe	14A
Teslar 30	" " "	Class A (67 F, 30 d.)	4
" "	UDMH	Tensile gain 500 psi (7 d. @ RT)	34
Thiokol rubber	Ammonia, gaseous	Class 2, cold	2, 39
Thiokol	Ammonia, anhydrous: liquid	Grade 3	5-12
	gaseous	Grade 3	5-12
Thiokol rubber, seals	Boron hydride family	Grade 3	5-6
Thiokol rubber	Hydrogen peroxide	Class 4	3
Thiokol EC-801-LP2; 3000 FA; 3000 ST, 1620 AH	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Thiokol rubber	Oxygen, liquid	Violent detonation, impact	18
Thiokol rubber, PR 1422 (with Fluorolube GR-470 coating)	" " "	Sensitive, impact (2-10)	18

MATERIAL	FUEL	BEHAVIOR	REF
T			
Thiokol rubbers	Pentaborane	Grade 3 (shock sensitive), Hazardous (forms shock sensitive mixtures)	5-6 22
Thiokol LP-3 (polysulfide)	U-DETA	Unsatisfactory	12
Thiokol rubber	UDMH (liquid)	Class 4, 75 F	2
Thiokol rubber, 3000 St.	UDMH	Class 4, poor	8
Transflex tubing	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Trichlorofluoroethylene - See also "Trithene", "Fluorothene"			
Trithene A	IRFNA	Brittle (7 d. @ RT)	34
" "	"	Tensile loss, 500 psi (21 d. @ RT)	34
" "	"	Tensile loss, 1900 psi (1 d. @ 160 F)	34
" "	"	Tensile loss, 500 psi (7 d. @ 160 F)	34
" "	JP-X	Melted (60 min. @ 350 F)	34
" "	Mixed amines	No apparent effect (7 d. @ RT)	38
" "	Nitrogen tetroxide (.2% moist)	Class 2, to 80 F	39
" "	Nitrogen tetroxide	Tensile loss, 1100 psi (1 d. @ RT)	34
" "	" " "	Tensile loss, 2650 psi (14 d. @ RT)	34
" "	" " "	Tensile loss, 3000 psi (21 d. @ RT)	34
" "	" " "	Tensile loss, 1100 psi (42 d. @ RT)	34
" "	" " "	Tensile loss, 1400 psi (3 mo. @ RT)	34
" "	" " "	Tensile loss, 2900 psi (1 d. @ 160 F)	34
" "	" " "	Too brittle to test (7 d. @ 160 F)	34
" "	" " "	Class B - Shore C increase 10 units, loss in strength 20% (90 d. @ 70-80 F)	4B
" "	" " "	Class D - brittle (7 d. @ 160 F)	
" "	" " "	Class C (80 F, 90 d.)	4
	RFNA	Stiffened and opaque (7 d. @ RT)	38
Tygon	Fluorine, gaseous	Class 4, RT	39
"	Fluorine: Liquid	Grade 3	5-10
	Gaseous	Grade 3	5-10
"	50 50 Fuel blend	Class 4 at 80 F	39
	" " "	Class 4 at 75 F	39
Tygon R3603	" " "	Class D - coating blistered within 1 hr (160 F)	4, 4B
Tygon K, coating			
Tygon tubing	HiCal 3	Class 4, hardened at 120 F	39
Tygon	Hydrazine	Incompatible	23
"	" "	Class 2, 68 F	2
"	Hydrazine, liquid	Class 4 at 68 F	39
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine, hydrate	Limited service, Class B	8
"	Hydrazine hydrazine nitrate water	Limited service, Class B	8
"	IRFNA	Tensile increase, 1055 psi (rigid) (7 d. @ RT)	34
Tygon 2807	Hydrogen peroxide	Class 4	3
Tygon 3604A and 3604B	Hydrogen peroxide (concentrated)	Class 2 limited service	8
Tygon 3604B	Hydrogen peroxide	Class 2 and 3	3
Tygon 3604A and 3604B	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Tygon paint 7206 TP-81-clear and 71253 TP-107B	" " " "	Class 3 at RT	39
Tygon B-20, B-32, B-63, B-71, B-72, B-136	" " " "	Class 3 at 150 F	39
Tygon S-22-1, TL-103, 2807, 3400, 3603,	Hydrogen peroxide, 90%	Class 4 at 150 F	39
Tygon	Nitrogen tetroxide (water 0.1%)	Class 2, 80 F	2

MATERIAL	FUEL	BEHAVIOR	REF
T			
Tygon K	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Tygon	Nitrogen tetroxide (0.2-1.0% moist)	Class 2, to 80 F	39
"	Nitrogen tetroxide	Tensile loss, 2560 psi (1 d. @ RT)	34
		Tensile loss, 1900 psi (17 d. @ RT)	34
Tygon K	" " "	Grade 3	5-7
Tygon K, coating	" " "	Class D - Blistered within 20 min (75 F)	4, 4B
Tygon	Nitrogen trifluoride, gaseous	Satisfactory for lines, fittings, storage vessels	8
"	Pentaborane	Incompatible	8, 22
"	" "	Class 4 at 75 F	39
Tygon K (over Tygon primer)	U-DETA	Unsatisfactory	12
Tygon R 3603, U. S. Stoneware	UDMH	Class 4, poor	8
Tygon	UDMH, liquid	Class 4, 75 F	2
"	WFNA, liquid	Class 4 at 75 F	39
Tylac: 1650; 1640C; 1640D	Nitrogen tetroxide (<.2% moist)	Class 4 at 75 F	39
Tylac 1650; 1640C; 1640D	50/50 Hydrazine/UDMH	Class 3, incompatible	8
U			
Ultron	IRFNA	Tensile loss, 260 psi (7 d. @ RT)	34
		Tensile loss, 1160 psi (14 d. @ RT)	34
		Crumbled (7 d. @ 160 F)	34
"	Nitrogen tetroxide	Grade 3	5-7
"	" " "	Class D (60 F, 90 d.)	4
"	" " "	Class D (160 F, 7 d.)	4
"	" " "	Tensile gain, 1770 psi (1 d. @ RT)	34
"	" " "	Tensile loss, 168 psi (17 d. @ RT)	34
"	" " "	Tensile loss, 560 psi (21 d. @ RT)	34
"	" " "	Tensile gain, 640 psi (42 d. @ RT)	34
"	" " "	Tacky (3 mo. @ RT)	34
"	" " "	Tensile loss, 760 psi (1 d. @ 160 F)	34
"	" " "	Brittle (7 d. @ 160 F)	34
"	Nitrogen tetroxide (<.2% moist)	Class 2, to 80 F Class 4 at 80 F	39
Urea formaldehyde	RFNA	Class 4 at 75 F	39
Urethane*	DIPA	19% swell (72 hr @ RT)	33
"	"	4% swell (7 d. @ RT)	33
"	"	2.9% swell (7 d. @ 160 F)	33
	*Affected propellant stability excessively		
Urethane elastomer - See also "Adiprene", "Chemigum", "Disogrin"			
V			
Veloform	Hydrazine family	Grade 3	5-5
"	Hydrazine, anhydrous	Incompatible, Class C	8
"	Hydrazine hydrate	Incompatible, Class C	8
"	Hydrazine/hydrazine nitrate/water	Incompatible, Class C	8
Velumoid, seals	Boron hydride family	Grade 1	5-6
Vicon	Hydrogen peroxide (concentrated)	Class 2, limited service	8
Vinachrome: normal application	U-DETA	Unsatisfactory	12
baked	"	Satisfactory	12
Vinylkote	Liquid oxygen	Impact; 2/6 @ 10 KgM	32
Vinyl - See also "Vinylite"			

MATERIAL	FUEL	BEHAVIOR	REF
V			
Vinyl film - See also "Ultron"			
Vinyl copolymers	Ammonia, anhydrous (moist ambient temp)	Class 2, limited service	8
" " "	Ammonia, anhydrous (dry, ambient temp)	Class 2, limited service	8
Vinyl copolymers	Ammonia, gaseous	Class 2, to Hot	2, 39
" " "	Ammonia, liquid	Class 2, to Hot	2, 39
" " "	Ammonia, anhydrous: Liquid	Grade 1	5-12
	Gase (< 250 F)	Grade 1	5-12
Vinyl coating	50/50 Fuel blend	Cladd D - blistered (30 d. @ 55-60 F)	4, 4B
Vinyl	Hydrocarbon fuel	Satisfactory	1, 3
Vinyl 29139	Hydrogen peroxide (concentrated)	Class 2, limited service	8
Vinyl 79139	Hydrogen peroxide, 90%	Class 3 at 150 F	39
Vinyl-coated Fiberglas (gray-green)	" " " "	Class 3 at 150 F	39
Vinyl, plasticised	IRFNA	Tensile loss, 1710 psi (7 d. @ RT)	34
Vinyl, coating	Nitrogen tetroxide	Class D - blistered immediately (30 d. @ 55-60 F)	4, 4B
Vinyl paint	Nitrogen tetroxide, liquid	Class C (30 d. @ 55-60 F) blistered	40
Vinyl, seals	Nitrogen tetroxide	Grade 3	5-7
Vinyl	" " "	Tensile gain, 1180 psi (1 d. @ RT)	34
"	" " "	Tensile gain, 1640 psi (7 d. @ RT)	34
"	Nitrogen tetroxide (< .2% moist)	Class 4 at 60 F	39
Vinyl, high-built (protective coating)	Oxidizers (general)	Exceptionally compatible	16
Vinyl tubing	Oxygen, liquid	Impact; 2/8 @ 10 KgM	32
Vinyl resin tubing	" " "	Very sensitive, impact (21/30)	18
Vinyl tubing, high temperature	" " "	Very sensitive, impact (10/10)	18
Vinyl plastic tubing	" " "	Slightly sensitive, impact (1/7)	18
" " "	" " "	Moderate detonation, impact	18
Vinyl screening, Velon	" " "	Sensitive, impact (5/10)	18
Vinyl sealing compound	" " "	Violent detonation, impact	18
Vinyl covered nylon	" " "	Impact; 2/8 @ 10 KgM	32
Vinyl mastic, coating	RFNA	Class 1, to 75 F	39
Vinyl polymer	UDMH (liquid) C	Class 4, 75 F	2
Vinyl mastic	WFNA	Class 4, unacceptable, all temps	2, 8, 39
Vinyl acetate	Nitrogen tetroxide	Decomposed, brief exposure	7
Vinyl alcohol resins	RFNA	Class 4 at 75 F	39
Vinyl butyral resins	RFNA	Class 4 at 75 F	39
Vinyl chloride tape, transparent Fibron #3	Oxygen, liquid	Very sensitive, impact (10/10)	18
Vinyl chloride (at 40)	" " "	Insensitive, impact (0/10)	18
Vinyl chloride (at 50)	" " "	Sensitive, impact (7/10)	18
Vinyl chloride, coating	RFNA	Class 4 at 75 F	39
Vinyl chloride resins	"	Class 3, to 75 F	39
Vinyl-chloride-acetate	"	Class 3, to 75 F	39
Vinyl formal resins	"	Class 4 at 75 F	39
Vinyl rubbers	Oxygen, liquid	Impact; 2/20 A 10 KgM	32
Vinylidene chloride	Ammonia, gaseous	Class 3, to Cold	2, 39
" " " "	Ammonia, liquid	Class 3, to Cold	2, 39
" " " "	Anhydrous ammonia: Liquid	Grade 3	5-12
	Gaseous (< 250 F)	Grade 3	5-12
Vinylidene chloride (at 60)	Oxygen, liquid	Insensitive, impact (0/10)	18
Vinylidene chloride (at 70)	" " "	Slightly sensitive, impact (1/10)	18
Vinylidene chloride, coating	RFNA	Class 4 at 75 F	39
Vinylidene chloride resins	"	Class 3, to 75 F	39
Vinylidene fluoride, Kynar	Aerozine 50 (Dynamic or static extended service)	No siginificant change (90 d. @ 75 F)	10A
Vinylidene fluoride (Kynar)	Nitrogen tetroxide	No significant change (90 d. @ 75 F)	10A
Vinylidene fluoride	" " "	Class A (90 d. @ 70-80 F)	4B
Vinylidene fluoride	Oxygen, liquid	Insensitive, impact; 0/10 A 10 KgM	32

MATERIAL	FUEL	BEHAVIOR	REF
V			
Vinylidene fluoride/chlorotrifluoro-ethylene - See also "Kel-F Elastomer 3700", "Kel-F Elastomer 5500"			
Vinylidene fluoride/hexafluoropropy-lene - See also "Viton", "Fluorel"			
Vinylidene fluoride-hexafluoropropy-lene	Nitrogen tetroxide	Insensitive, impact (70 ft lb, 0/20)	37
" " " " " " "	Oxygen, gaseous	Insensitive, impact (70 ft lb, 0/20)	37
" " " " " " "	Oxygen, liquid	Insensitive, impact (70 ft lb, 0/20)	37
Vinylidene plastics, seals	Boron hydride family	Grade 3	5-6
Vinylite	Aniline	Satisfactory	3
"	Hydrazine, liquid	Class 2, to 75 F	2, 39
"	Hydrazine, anhydrous	Limited service, Class B	8
"	Hydrazine hydrate	Limited service, Class B	8
"	Hydrazine/hydrazine nitrate/water	Limited service, Class B	8
"	Hydrogen peroxide	Class 3	3
Vinylite VG 1914	Hydrogen peroxide (concentrated)	Class 2, limited service	8
Vinylite VU 1940	" " "	Class 3, very limited service	8
Vinylite VU 1900	" " "	Class 3, very limited service	8
Vinylite VG 1914 and VU 1940	Hydrogen peroxide, 90%	Class 2 at 150 F	39
Vinylite: VS 1310; VU 1900; UE 1907; VU 1920; VU1930; VU 1940	" " " "	Class 3 at 150 F	39
Vinylite	UDMH (liquid or vapor)	Class 4, 32 F	2
"	WFNA, liquid	Class 4 at 75 F	39
Vistanex	Hydrocarbon fuel	Unsatisfactory	3
"	UDMH (liquid)	Class 4, 80 F	2
Vistanex-polyethylene coated vinyon cloth	Mixed amines	No apparent effect (7 d. @ RT)	38
Viton A	Aerozine 50	Unsatisfactory	21
Viton B	" "	Unsatisfactory	21
Viton A and B	Boron hydride family	Grade 1	5-6
Viton A and B	Chlorine trifluoride	Promising compatibility	26
Viton	" " "	Compatible for at least 30 minutes, RT	19
"	" " "	Promising for contact; avoid compounding ingredients which may react	25
Viton A	" " "	Class C, incompatible, reacts violently	8
Viton B	" " "	Promising compatibility	26
Viton A*	DIPA	21% swell (72 hrs @ RT)	33
		4% swell (7 d. @ RT)	33
		70% swell (8 d. @ 160 F)	33
	*Affected propellant stability excessively		
Viton resins	Fluorine (gaseous)	Satisfactory at low or moderate pressure	3
Viton A and B	50/50 Fuel blend	Class 4 at 60 F	39
Viton A - 247M and 44-11 A-35	" " "	Class 4 at 85 F	39
Viton A and B	50/50 Hydrazine/UDMH	Class 3, incompatible	8
Viton A	Halogen fluoride family	Grade 3	5-8
"	Hydrazine	Incompatible	23
"	Hydrazine family	Grade 3	5-5
Viton 4411A-58	HiCal 3	Class 2, no change @ 120 F	39
Viton A 945-70 (P & R)	Hydrazine/MMH/water fuel blend (4:1:1)	Complete deterioration in 2 to 3 days	14
Viton 920-70 (Parko)	" " " "	Complete deterioration in 2 to 3 days	14
Viton 17107 (Precision Rubber Co)	" " " "	Complete deterioration in 2 to 3 days	14
Viton	Hydrogen peroxide	Class 2, 3	3
Viton A	" " "	Shore A, loss - 2; volume swell none (7 d. @ RT)	34
Viton A (411A4) (black)	Hydrogen peroxide, 90%	Class 3 @ 150 F	39
Viton A (V2717)	Hydrogen peroxide (concentrated)	Class 3 Very limited service	8

MATERIAL	FUEL	BEHAVIOR	REF
V			
Viton B (LD 234)	Hydrogen peroxide	Shore A, no change; volume swell, none (7 d. @ RT)	34
Viton B 805	Hydrogen peroxide (concentrated)	Class 3, Very limited service (not >120 F)	8
Viton A - HV	Hydrogen peroxide	Shore A, no change; volume swell none (7 d. @ RT)	34
Viton A - HV	Hydrogen peroxide (3.2% active oxygen loss)	No swell (7 d. @ RT)	33
" "	IRFNA	Class 4 at 75 F	39
" "	"	Shore A, loss - 12; 91% swell (7 d. @ RT)	34
Viton B, LD-234	"	Shore A, loss - 0 to 40; 15% to 48% swell (7 d. @ RT)	34
" " "	"	Shore A, loss - 20; 59% swell (14 d. @ RT)	34
Viton B	Nitrogen tetrafluoride	Promising compatibility	26
Viton A and B	Nitrogen tetroxide	Unsatisfactory	21
" " "	Nitrogen tetroxide (<.2% moist)	Class 4 at 60 F	39
Viton A	Nitrogen tetroxide	Compatible	30
"	" " "	186% to 641% swell in 1 d.	19
Viton B	" " "	Compatible	30
"	" " "	238% swell in 1 d.; one composition disintegrated	19
Viton	" " "	200% volume increase; rapid & large drop in ultimate tensile	16
"	" " "	High swell but good retention of properties	25
Viton-type sealant (RT curing compound, with 80 to 85% solids)	" " "	Satisfactory, 1000 hrs. @ 500 F; satisfactory, 500 hrs. @ 550 F	41
Viton A (virgin)	Oxygen	Spontaneous ignition temp - 300 C, at 7500 psi; 310 at 2000 psi	42
Viton B (virgin)	"	Spontaneous ignition temp - 316 C at 7500 psi; 325 C at 2000 psi	42
Viton	Oxygen, liquid	Insensitive, impact (0/10, 40 ft lb);	33
		Very slightly sensitive, impact (1/10, 50 ft lb)	33
Viton A	" " "	Insensitive, impact; 0/20 @ 10 KgM	32
"	" " "	Insensitive, impact (0/20)	18
Viton A on glass	" " "	Impact; 2/2 @ 10 KgM	32
Viton A on Dacron	" " "	Impact; 2/2 @ 10 KgM	32
Viton A elastomer	" " "	Impact; 0-4/20@ 10 KgM	32
Viton A with Teflon	" " "	Impact; 2/7 @ 10 KgM	32
Viton, Viton A	Pentaborane	Compatible for long term applications	40
Viton	" "	Class 1, to 75 F	39
Viton, Viton A	" "	Compatible	8
Viton, Viton A	" "	Compatible	22
Viton A	" "	Class 1, to 75 F	39
Viton A and B	" "	Approved for use	3A
Viton B	Perchloryl fluoride	Promising compatibility	26
Viton Fairprene 84-001	U-DETA (MAF-4)	Unsatisfactory	8
X			
Xylene glycol polyether	Perchloryl fluoride, gaseous	Class 4 at 80 F	39
" " " " "	Perchloryl fluoride (dry)	Class 4 at 80 F	2

SECTION 4. REFERENCES

REF

1. Plastics Technical Evaluation Center

   SUGGESTED PLASTIC MATERIALS FOR USE WITH LIQUID PROPELLANTS AND RELATED MATERIALS. Inquiry report, unnumbered, by Norman E. Beach, October 1961.

   IDENTIFICATION OF MATERIALS; Not specific.

   BASIS OF EVALUATION: Generalized statements based on source evaluations.

   REMARKS: Early work, which evolved into this report.

2. Defense Metals Information Center, Battelle Memorial Institute

   COMPATIBILITY OF ROCKET PROPELLANTS WITH MATERIALS OF CONSTRUCTION. DMIC Memorandum 65, 15 Sept 1960
   OTS PB 16125

   REMARKS: See reference 39, this report.

3. Office of the Director of Defense Research and Engineering

   THE HANDLING AND STORAGE OF LIQUID PROPELLANTS, March 1961

   IDENTIFICATION OF MATERIALS: None specific (generic or trade names)

   BASIS OF EVALUATION: Most frequently, those materials are listed which are acceptable, preferred, or hazardous to use. Some are classified according to the following:

   Class 1: Materials which are highly compatible and can be used for long-time contact. Typical uses for a material of this class would be in constructing long-time storage containers, tank cars or drums.

REF

3. (Continued)

Class 2: Usable in repeated short-time contact. The time of the limited contact should not exceed 4 hours at 160°F or 1 week at 70°F. Typical uses for materials of this class would be in valves and pumps in a peroxide-transfer line or in high-pressure storage tanks.

Class 3: These materials should be used only for short-time contact. They can be used for repeated contact, but no one period should exceed 1 minute at 160°F or 1 hour at 70°F prior to its immediate use. These materials might contaminate the solution enough to render it unsuitable for storage.

Class 4: These materials are not recommended for any use. They cause the chemical to decompose rapidly, are quickly attacked by it or form explosive mixtures with it.

REMARKS: This manual is published for information. It is intended that it can be used as a basis for the preparation of regulations governing the handling and storage of liquid propellants.

3A Office of the Director of Defense Research and Engineering

THE HANDLING AND STORAGE OF LIQUID PROPELLANTS, January 1963

4. Air Force Flight Test Center, Edwards Air Force Base, Calif

TITAN II STORABLE PROPELLANT HANDBOOK, Final Handbook, June 1961. AFFTC TR-61-32. Prepared by Bell Aerosystems Company; R. R. Liberto, author. Contract AF 04(611)-6079. Report No. 8111-933003.

IDENTIFICATION OF MATERIALS: Available specific identification given at citation in Section 3. (See also Appendix A, for identification of trade names.)

REF

4. (Continued)

BASIS OF EVALUATION:

Class A: Satisfactory for service under conditions indicated.

Class B: Use with knowledge that it will swell or shrink and/or change in hardness.

Class C: Satisfactory for ground support where preventative maintenance can be scheduled. Also good for actual missile service where slight discoloration of propellant and extracted residue is tolerable.

Class D: Unsatisfactory for use.

REMARKS: Summarized are the physical properties, materials compatibility, handling techniques, flammability and explosivity, and procedures for storing, cleaning, and flushing of the Titan II propellants, N_2O_4 as the oxidizer and a nominal 50/50 blend of UDMH and N_2H_4 as the fuel. The data presented was derived both from a literature survey and from a test program

Air Force Ballistic Systems Division, Los Angeles

(Also) ----------Revision A, March 1962. AFBSD- TR-62-2. Contract AF 04(694)-72

4A Air Force Ballistic Systems Division, Los Angeles

---------- Revision B, March 1963. AFBSD-TR-62-2. Contract AF 04(694)-72

5. Rocket Research Laboratories, Edwards, California

COMPATIBILITY OF MATERIALS..... Technical instructions, RRL TI No. 4-2-1 to RRL TI No. 4-2-13, as follows:

5-1 COMPATIBILITY OF MATERIALS - GENERAL; RRL TI No. 4-2-1, 1 June 1962

5-2 COMPATIBILITY OF MATERIALS WITH OXYGEN; RRL TI No. 4-2-2, 4 June 1962

5-3 COMPATIBILITY OF MATERIALS WITH PETROLEUM FUELS; RRL TI No. 4-2-3, 4 June 1962

REF

5-4 COMPATIBILITY OF MATERIALS WITH INERT GASES AND LIQUIDS; RRL TI No. 4-2-4, 4 June 1962

5-5 COMPATIBILITY OF MATERIALS WITH HYDRAZINE FAMILY; RRL TI No. 4-2-5, 4 June 1962

5-6 COMPATIBILITY OF MATERIALS WITH BORON HYDRIDE FAMILY; RRL TI No. 4-2-6, 4 June 1962

5-7 COMPATIBILITY OF MATERIALS WITH NITROGEN TETROXIDE; RRL TI No. 4-2-7, 22 June 1962

5-8 COMPATIBILITY OF MATERIALS WITH HALOGEN FLUORIDE FAMILY; RRL TI No. 4-2-8

5-9 COMPATIBILITY OF MATERIALS WITH FLUOROAMINE FAMILY; RRL TI No. 4-2-9, 22 June 1962, TENTATIVE

5-10 COMPATIBILITY OF MATERIALS WITH FLUORINE; RRL TI No. 4-2-10, 22 June 1962, TENTATIVE

5-11 COMPATIBILITY OF MATERIALS WITH HYDROGEN; RRL TI No. 4-2-11, 22 June 1962, TENTATIVE

5-12 COMPATIBILITY OF MATERIALS WITH ANHYDROUS AMMONIA, RRL TI No. 4-2-12, 22 June 1962

5-13 COMPATIBILITY OF MATERIALS WITH OXYGEN DIFLUORIDE, RRL TI No. 4-2-13, 22 June 1962, TENTATIVE

IDENTIFICATION OF MATERIALS: General references only, usually; some specific trade materials identified by number and trade-name.

BASIS OF EVALUATION: By a grading system, as follows:

Grade 1.	Suitable for general use
Grade 2.	Suitable for limited use
Grade 3.	Not suitable for use

REMARKS: Selection of materials for use with particular propellants presents a very grave problem. Improper selection of a material can easily result in a catastrophe. As more types of propellants are used concurrently, the problem becomes more difficult to control; therefore, only approved materials shall be used. This directive is NOT intended to restrict the engineering selection of new materials for use in development hardware but only to assure adequate control over materials to be selected and used on Rocket Research Laboratories in-house test projects.

REF

6. Back, A. L. (Catalytic Construction Company, Philadelphia)

"Rubber and plastics for process plants", in MECHANICAL ENGINEERING, October 1963, p. 47-50

IDENTIFICATION OF MATERIALS: No specific materials mentioned; information on generic families.

BASIS OF EVALUATION: General statements of how used and chemical resistance.

REMARKS: Tables are excellent for general reference.

7. G. T. Schjeldahl Company

EVALUATION OF THE COMPATIBILITY OF POLYVINYLIDENE FLUORIDE (KYNAR) WITH STORABLE LIQUID PROPELLANTS (NITROGEN TETROXIDE AND HYDRAZINE), by H. J. Fick. Prepared for Jet Propulsion Laboratory, Contract No. N1-120421, 30 January 1963.

IDENTIFICATION OF MATERIALS: Polyvinylidene fluoride available as Kynar from Pennsalt Chemical Company. Other materials not specifically identified.

BASIS OF EVALUATION: Statement of physical characteristics after storage. No adjectival evaluation, as such. The performance of the Kynar was considered to be equivalent or superior to that of Teflon FEP.

REMARKS: The objective of this contract was the evaluation of polymeric materials potentially usable to construct expulsion membranes for storable liquid propellants such as nitrogen tetroxide and hydrazine.

REF

8. Liquid Propellant Information Agency (now Chemical Propulsion Information Agency)

LIQUID PROPELLANT MANUAL, LPIA-LPM-1, prepared by individual units during 1961. (Confidential segments not cited or abstracted here).

IDENTIFICATION OF MATERIALS: As cited herein.

BASIS OF EVALUATION: Varied according to contributor; but citations include adjective ratings.

REMARKS: This is a summarization of otherwise completed and reported work.

9. Aeronautical Systems Division, Wright-Patterson Air Force Base

THE COMPATIBILITY OF MATERIALS WITH CHLORINE TRIFLUORIDE, PERCHLORYL FLUORIDE AND MIXTURES OF THESE. WADDTechnical Report 61-54, April 1961. Work by Pennsalt Chemicals Corporation: authors: J.C. Grigger and H.C. Miller, Contract: AF 33(616)-6796

IDENTIFICATION OF MATERIALS:

Polytetrafluoroethylene (Teflon)	The Garlock Packing Co.
Teflon, CaF_2-filled (25-35%)	The Garlock Packing Co.
Polychlorotrifluoroethylene (Kel-F)	Walter B. Gallagher Co., Conshohocken, Pa.

BASIS OF EVALUATION: Weight loss; in terms of change.

REMARKS: This report contains a literature survey. All fluorinated plastics showed weight gains on exposure to each of the three test liquids. The observed slow release of this absorbed chlorine trifluoride and perchloryl fluoride could present a corrosion problem for equipment with Teflon or Kel-F packings, gaskets, etc, during standby or atmospheric exposure periods.

REF

10. Aerojet-General Corporation, Sacramento

STORABLE LIQUID PROPELLANTS, NITROGEN TETROXIDE AND AEROZINE 50, Report No. LRP 198, Revision B, October 1960

IDENTIFICATION OF MATERIALS:

Zytel 101;31;63; Teflon 100; 1; w/steel primer	duPont, Wilmington
Marlex 50	Phillips Chemical Co., Bartlesville, Okla
Pro-Fax;Penton	Hercules Powder Co., Wilmington
Butyl elastomer: 823-70; 805-70	Plastics and Rubber Products Co., L.A.
Butyl elastomer: 9257 and 9357	Precision Rubber Products Co., Dayton
Butyl elastomer: B480-7	Parker Seal Co., L.A.
Butyl elastomer: 1357	Goshen Rubber Co., Goshen, Ind.
Neoprene N-250	Gates Engineering Co., Wilmington
Epoxy: EC-1469; EC-1470; EC-1595; EC-1596	3M Company, St. Paul
Phenolic: 37-9X	U.S. Rubber Co., L.A.
Epoxy: Epon VI w/A; VIII w/A; Epon 1031/BF_3(Novalac type)	Shell Chemical Co., SF
Silicone: Q-3-0121; DC 936, electrical varnish and DC 994, electrical varnish; and LS-531 fluorosilicone elastomer	Dow Corning Corporation, Midland
Mystik 7402-96272;759181-PP785; 7503	Mystic Adhesive Products, Inc. Chicago
Phenolic: SC 1008	Monsanto Chemical Co., St. Louis
Phenolic: F-120-55	Reinhold Engineering and Plastics Co. Norwalk
Kel-F 300; 500; 500E	3M Company, St. Paul
Butyl-Phenolic elastomers: XB-1235-10	Parker Seal Co., L.A.
Fluorosilicone elastomers: 1400-75;LS-53 Base; 58789-23HT; Shore 40	Hadbar Inc., Rosemead, Calif
Phenolic adhesive; Travarno F-120	Coast Manufacturing and Supply Company Livermore
Silicone: RTV 60	General Electric Co., Pittsfield
Tapes, aluminum backed: Y9040; 425; Polyethylene backed: 480; Teflon backed: XIIII, 549; SL 28011, Lot 36; lead foil backed: 420	3M Company, St. Paul
Phenolic-Epoxy-Silicon: PT201G	Products Techniques, Inc. Compton Calif.

REF

10. (Continued)

BASIS FOR EVALUATION: Change in physical properties and characteristics after immersion.

REMARKS: No general remarks.

10A. STORABLE LIQUID PROPELLANTS, NITROGEN TETROXIDE AND AEROZINE 50. Report No. LRP198, Second Edition, June 1962.

IDENTIFICATION OF MATERIALS: Included in citation of Ref 10, preceding, except:

Kynar	Pennsalt Chemicals Corporation, Phila.
Epoxy: EC-1630	3M Company, St. Paul
Epoxy filler and cement	W. J. Ruscoe Company, Akron
Epoxy: 4-184; 5-100-1; 8-31; 929	Shell Chemical Company, S. F.
Epoxy, modified: Epon 422; YP-100	Shell Chemical Company, S. F.
Silicon: QZ-8-09035	Dow Corning Corporation, Midland
Tape, teflon-backed: 7503	

BASIS FOR EVALUATION: Same as reference No. 10A, except from longer exposure time.

REMARKS: This report is a continuation of Reference 10.

11. Arthur D. Little, Incorporated

HYDROGEN HANDBOOK: A COMPILATION OF PROPERTIES, HANDLING AND TESTING PROCEDURES, COMPATIBILITY WITH MATERIALS, AND BEHAVIOR AT LOW TEMPERATURES. AFFTC TR-60-19, April 1960. Under contract with Parker Aircraft Co. Prepared for Air Force Flight Test Center; Contract AF 33(616)-6710. AD 242 285.

REF

11. (Continued)

IDENTIFICATION OF MATERIALS: None.

BASIS OF EVALUATION: None; general statements.

REMARKS: None.

12. Army Ballistic Missile Agency, Redstone

STUDIES ON U-DETA, by W.A. Riehl. ABMA Report RP-TR-2-60, 7 October 1960. Prepared by Engineering Materials Branch, George C. Marshall Space Flight Center, NASA, Huntsville.

IDENTIFICATION OF MATERIALS: Not formally or specifically identified.

BASIS FOR EVALUATION: From reported work and actual experiences.

REMARKS: U-DETA is a liquid composed of 60% (by weight) unsymmetrical dimethylhydrazine (UDMH) in diethylene triamine (DETA). This particular blend was used as the fuel in some of the Jupiter-C special mission missiles. The density and viscosity of this propellant were sufficiently similar to that of the alcohol-water fuel of the Redstone missile to permit substitution in the same propulsion hardware without appreciable redesign or modification. The report cited is a summary of the research and development studies which were done in order to provide a basis for safe and reliable use of U-DETA as a rocket propellant.

13. Defense Metals Information Center, Battelle Memorial Institute

COMPATIBILITY OF PROPELLANTS 113 AND 114B2 WITH AEROSPACE STRUCTURAL MATERIALS. DMIC Memorandum 151, 27 April 1962

REF
13. (Continued)

IDENTIFICATION OF MATERIALS:

Propellant 113 - 1, 1, 2-trichlorotrifluoroethane
Propellant 114B2 - 1, 2-dibromotetrafluoroethane
Source of other materials not identified.

BASIS OF EVALUATION: Reported as change in physical properties: size and weight

REMARKS: The plastics were measured and weighed before exposure for one week. Immediately on removing the plastic from the solvent, the measurements were redetermined. Two weeks later, the plastics were again measured to determine what permanent change had resulted from the 1-week exposure.

14. Bell Aerosystems Company

COMPILATION OF MATERIALS COMPATIBILITY TEST DATA WITH PROPELLANTS, by A. M. Gritzmacher. Report No. 2084-939-001, December 1962. Published and distributed under Contract AF 33(657)-8555

IDENTIFICATION OF MATERIALS:

Kel-F 5500
Precision Rubber Products Corporation, compound 18007
KX-2141 elastomer; Chemical Division of 3M Company (Fluorel compound)
Precision Rubber Compounds 18007, 18057, 940x559
Opalon; Monsanto: compounds 1219, 1220 and 1444
Teslar 30 - duPont
Kynar - Pennsalt
Rubatex, R-310V, polyvinyl chloride rubber
Ensolite, polyvinyl chloride rubber
Polyethylene foam - Dow Chemical Company
Viton A - Plastic and Rubber - Compound no. 945-70
Titon - Plastics Products Co. (Parco) - Compound no. 920-70
Butyl - Plastics Products Co. (Parco) - Compound no. 838-80
Viton - Precision Rubber Co. - Compound no. 17107
Silicone - Precision Rubber Co. - Compound no. 11536

REF
14. (Continued)

BASIS OF EVALUATION: Varied as to source.

REMARKS: This report is a compilation of interdepartmental communications containing materials compatibility information.

14A. Bell Aerosystems Company

SUMMARY OF MATERIALS COMPATIBILITY WITH NITROGEN TETROXIDE, by A.E. Pepe. Report No. 8133-90200 Revision A, October 1962. Published and distributed under Contract AF 33(657)-8555

IDENTIFICATION OF MATERIALS: As cited.

BASIS OF EVALUATION: Materials with A rating are suitable for unrestricted use; a B rating indicates suitability for restricted applications; a C rating indicates limited resistance to corrosion; and a D rating is assigned to materials not recommended for use.

Rating:	Class A*	Class B	Class C	Class D
Volume change %	0 to +25	-10 to +25	-10 to +25	< -10 or > +25
Change in durometer reading	±3	±10	± 10	< -10 or > +10
Effect on Propellant	None	None	Slight	Severe
Visual Examination	No change	No change	Slight change	Dissolved, blistered or cracked

* A 25 percent volume swell is not considered detrimental for a static seal, particularly when it is partially enclosed. However, materials which exhibit greater than 10 percent volume swell may cause excessive increases in frictional resistance or binding when used for dynamic seals.

REMARKS: An extensive survey of literature, laboratory results, and test data was conducted. On the basis of this survey, the specific characteristics of each material were defined and a compatibility rating is assigned to each.

REF

15. Bell Aerosystems Company

ANALYTICAL CHEMISTRY, by Peter Yin and W. L. Clark. Report No. BLR 62-20 (C) Revision A, April 1963. Published and distributed under Contract AF 33(657)-8555

IDENTIFICATION OF MATERIALS: Teflon - Knowlton 071962-A-6; Dacron

BASIS OF EVALUATION: Physical appearance of material and of fluid propellant; weight loss.

REMARKS: None

16. Berman, L. D. (The Martin Company)

"Compatibility of materials with storable propellants", in PROCEEDINGS OF THE FOURTH NATIONAL SAMPE SYMPOSIUMS ON MATERIALS COMPATIBILITY AND CONTAMINATION CONTROL PROCESSES, Hollywood, November 1962, p. 1 ff.

IDENTIFICATION OF MATERIALS: None (general discussion)

BASIS OF EVALUATION: Change in ultimate tensile strength; also general discussion.

REMARKS: A comprehensive summary of the compatibility of materials with amine fuels and nitrogen tetroxide is presented. This paper discusses the development of criteria and environments, formulation of test procedures for long- and short-term exposure, decontamination procedures, and data applicable to the compatibility of metals, nonmetallics, finishes, lubricants, and sealing systems for both airborne and ground equipment.

REF

17. Douglas Aircraft Company, Inc.

BEHAVIOR OF PLASTICS IN LIQUID OXYGEN, by L. Freeman. Materials and Process Engineering Laboratory Report MP 1130, 8-1-56.

IDENTIFICATION OF MATERIALS:

Mylar film, 2 mil, Ernest W. Dorn Co., LA
Mylar film, 2 mil, aluminum-faced; Henry M. Gibbel Co., LA
Mylar tape, Permacel 254, Permacel Tape Corporation, New Brunswick, N.J.
Mylar tape, Permacel 252, Permacel Tape Corporation, New Brunswick, N.J.
Mylar tape, #427, 2 mil. 3M Company, St.Paul
Mylar tape, Mystic Tape PP278, 2 mil; Mystic Adhesive Products, Chicago
Mylar film, 5 mil backed with fiberglass; Arvey Corporation, Jefferson City, N.J.
Polyvinyl chloride film, UV-1900, 8 mil; Bakelite Corporation, LA
Polyethylene film, 8 mil; Polyfab Company, LA
Polyester web, X-1053, 7 mil; 3M Company, St. Paul
Polyamide resin, Polyamide 115; General Mills Company, Minneapolis
Epoxide adhesive, Epon VI; Shell Chemical Company, LA
Sealant #718, thiokol type; Coast Pro-Seal Company, LA
Epoxide resin, Epon 828; Shell Chemical Company, LA

BASIS OF EVALUATION: Impact and bending tests performed after immersion in liquid oxygen. Physical change noted; also detonation or shattering characteristics.

REMARKS: None

18. Convair Astronautics; Division of General Dynamics Corporation

PROPERTIES OF ORGANIC MATERIALS AT LOW TEMPERATURE, INCLUDING COMPATIBILITY WITH LIQUID OXYGEN, by J. F. Watson. Report No. MRG-80, 19 June 1959

REF
18. (Continued)

IDENTIFICATION OF MATERIALS: (Selected)

Kel-F	Kellogg Company
HiTemp A, bondable Teflon insulation	HiTemp Wires, Inc.
Orange Teflon insulation	HiTemp Wires, Inc.
Revere Teflon wire insulation	Revere Corporation of America
Silicone resin on glass cloth	Connecticut Hard Rubber
Vinyl chloride tape, Fiberon	Irvington Varnish and Insulator Co.
Scotchkote;Scotchcast	3M Company
Fiberglas blanket with binder	Owens Corning
Teflon impregnated glass tape	Jacklin Mfg. Company
Teflon impregnated fiberglas braid	Packard Electric Division
Vinyl resin tubing	William Brand Company
Polyurethane foam	Smith Products, Inc.
Permalite	Perlite Division, the Whitmore Co.
Sabtocel	Monsanto Chemical Company
Styrofoam	Dow Chemical Company
Thermobestos	Johns-Manville
Stafoam 304; urethane	American Latex
Glyptol	General Electric Company
Fosterite insulation coating	Westinghouse Company
Silicon paint on asbestos	Dow Corning
Nylon	duPont
Polyethylene	Plax Corporation
Polyethylene film	Eckel Corporation
Teflon	duPont
Kel-F base elastomer, SR24270	Stillman Rubber Company
Silastic base elastomer, TH 1057	Stillman Rubber Company
Fluran J-10	U.S. Stoneware
Neoprene	duPont
Penton	Hercules Powder Company
Hypalon	duPont
Polystyrene	Dow Chemical Company
Aluminum-Mylar laminate	Milam Electric Mfg.
Asbestos phenolics	Raybestos-Manhattan
Cellulose Melamine	Olympia Plastics
Silastic RTV 501	Dow Corning
Nylon inserts	Cannon
Laminated phenolic nylon sheet	Continental Diamond Company
Molded phenolic	American Reinforced Plastics
Vinyl screening, Velon	Firestone
Melamine	Amphenol Company
Laminac 4128	American Cyanamid

REF
18. (Continued)

IDENTIFICATION OF MATERIALS: (Cont)

Aluminized glass fabric with silicone rubber backing	Connecticut Hard Rubber Company
Arctic Neoprene Rubber	Kaiser Aluminum Company
Rubber; red or black	Exacto Company
Adiprene L Sprayable formulation	duPont
Fluoro resin (Lankote)	J. Landan Company
Epon 92	Bloomingdale Rubber Company
Epon Adhesive (6 and 8)	Shell Chemical Company
Arochlor (1260, 1248)	Monsanto Chemical Company
Fluorolene G	Nuclear Products Company
Hoke Slic Seal	Hoke, Inc.
Fluorolubes	Hooker Electro-Chemical Company
Versilubes	General Electric Company
Dry Film Lubricant (615; M65)	Everlube Corporation
Florubes	Imperial Chemicals, Ltd.
Halo-carbons	Halo-carbon Products
Fluorocarbon ether, FC75	3M Company
Buna-N Base Sealant, HT-1	American Latex
Garlock gaskets	Garlock Packing Company
Spiratallic, gaskets	Johns -Manville
Nylon insulated thermocouple wire	Thermo Electric Company
Ceramic impregnated Teflon, coated	Redel Company
Ceramic impregnated Teflon, uncoated	Rogers Corporation
Pure Teflon collets	Titeflex Corporation
Porous Teflon, 107-50	Liquid Nitrogen Processing Corporation

BASIS OF EVALUATION: Reported as number of detonations out of total number of tests.

REMARKS: This report is intended to aid the missile designer in his efforts to select and specify the nonmetallic materials required in those missiles and space craft designed to use cryogenic fuels and operate in the extremely low temperatures encountered (under certain conditions) in outer space. Emphasis is given to high strength, light weight materials wherever possible. Data presented were obtained from a diversity of sources including the open literature, individual company publications, private communication with other laboratories, and test data obtained at the company plant.

REF

19. Green, Joseph and Nathan Levine (Thiokol Chemical Corporation)

"Polymer compatibility in rocket fuels and oxidizers", in PROCEEDINGS OF THE CONFERENCE ON ELASTOMER RESEARCH AND DEVELOPMENT, SIXTH JOINT ARMY, NAVY, AIR FORCE, Boston, 18-20 October 1960. Volume 2, p. 420-434.

IDENTIFICATION OF MATERIALS: None. General discussion of generic families.

BASIS OF EVALUATION: None. Report mostly covered review of literature; some individual work on volume swell.

REMARKS: This paper is a general review of information available, in evaluation of work still needed.

20. Astropower, Incorporated (Subsidiary of Douglas Aircraft Company)

COMPATIBILITY OF STRUCTURAL MATERIALS WITH HIGH PERFORMANCE) - F LIQUID OXIDIZERS, by W.D. English, S.W. Pohl, and N.A. Tiner. Report 112-QS. Contract AF 33(657)-9162. March 1963.

IDENTIFICATION OF MATERIALS: None beyond citations transcribed.

BASIS OF EVALUATION: Change in mechanical properties.

REMARKS: This report is on the compatibility of structural materials with fluorine oxide, perchloryl fluoride-tetrafluorohydrazine (1:1) blend, and ozone fluoride-LO_2 solutions.

21. The Martin Company, Denver

COMPATIBILITY OF MATERIALS IN STORABLE PROPELLANTS FOR XSM-68B AND SM-68B, by H.J. Brown and others. ME Report No. 76, 15 May 1961

REF
21. (Continued)

IDENTIFICATION OF MATERIALS:

Kel-F 5500	3M Company
Fluorel	3M Company
LS-53	Dow Corning
Viton A and B	duPont
Chorlastic 500	Connecticut Hard Rubber
Enjay 268 and 551	Enjay Butyl
Hycar 2202	B. F. Goodrich
Hypalon 20	duPont
Neoprene	Garlock Packing
58789-23HT	Harbad, Incorporated
XB-1235-10	Parker Seal Company
Teflon; Teflon 100X	duPont
Kel-F	3M Company
Armalon Felt; Armalon 7700, 7700B	duPont
Teflon-asbestos; Teflon-graphite; Teflon-molybdenum sulfide	Fluorocarbon Company
Marles	Phillips Chemical Company
Irradiated polyethylene	General Electric
Nylon 101	duPont
Mylar	duPont
Plexiglas	Rohm and Haas
Lexan	General Electric
Saran	Dow Chemical Company
Moplen	Seiberling Rubber Company
Delrin	duPont

BASIS FOR EVALUATION: The compatibility code is as follows:

S = satisfactory for long term exposure
U = unsatisfactory
* = limited (ME must be consulted before using)
M = satisfactory for less than one year, tests continuing

REMARKS: None

REF

22. U.S. Air Force Space Systems Division, Edwards Air Force Base

PENTABORANE HANDLING MANUAL. AF/SSD-TR-61-10, September 1961. Prepared by Rocketdyne, Contract AF 33(616)-6939.

IDENTIFICATION OF MATERIALS: None, other than cited in section 3.

BASIS OF EVALUATION: Straight listing of materials compatible, limited service, or incompatible.

REMARKS: This manual presents directly usable information for the safe handling of pentaborane. The properties of the propellant and techniques for hazard reduction and control are discussed in detail. Selection and preparation of equipment for use with the propellant are also presented and discussed. Propellant transfer procedures using both gas pressurization and pumping techniques are discussed. Other pertinent information such as transportation, storage, and equipment decontamination are also presented.

23. U.S. Air Force Space Systems Division, Edwards Air Force Base

HYDRAZINE HANDLING MANUAL. AF/SSD-TR-61-7, September 1961. Prepared by Rocketdyne, Contract AF 33(616)-6939.

IDENTIFICATION OF MATERIALS: None, other than cited in section 3.

BASIS OF EVALUATION: Straight listing of materials compatible, limited service, and incompatible.

REMARKS: This manual presents directly usable information for the safe handling of hydrazine. (See Ref. 22, "Remarks")

24. U.S. Air Force Space Systems Division, Edwards Air Force Base

CHLORINE TRIFLUORIDE HANDLING MANUAL. AF/SSD-TR-61-9, September 1961. Prepared by Rocketdyne, Contract AF 33(616)-6939.

REF

24. (Continued)

IDENTIFICATION OF MATERIALS: None, other than cited in section 3.

BASIS OF EVALUATION: Straight listing of materials compatible, limited service, and incompatible.

REMARKS: This manual presents directly usable information for the safe handling of chlorine trifluoride. (See Ref 22, "Remarks")

25. U.S. Air Force Aeronautical Systems Division, Wright-Patterson AFB

ELASTOMERIC AND COMPLIANT MATERIALS FOR CONTACT WITH LIQUID ROCKET FUELS AND OXIDIZERS, by Joseph Green and N. B. Levine. Thiokol Chemical Corporation, Contract AF 33(616)-7227. September 1961. ASD Technical Report 61-76, Part I.

IDENTIFICATION OF MATERIALS:

"Cis-4" Polybutadiene	Phillips Petroleum Company
Butyl rubber	Enjay Company, Inc.
Viton	duPont
Kel-F	3M Company
Silastic LS-53	Dow Corning Corporation
Bakelite DPDB-6169	Union Carbide Plastics Company
Teflon: TFE, FEP	duPont

BASIS OF EVALUATION: Generalities based on volume swell, strength retention, elasticity retention, and appearance.

REMARKS: Several elastomeric materials have been recommended for field testing in contact with hydrazine type fuels and nitrogen tetroxide.

See also:
Thiokol Chemical Corporation (Reaction Motors Division)

REF

25. (Continued)

ELASTOMERIC AND COMPLIANT MATERIALS FOR CONTACT WITH LIQUID ROCKET FUELS AND OXIDIZERS, by Joseph Green and Nathan Levine. Report RMD 2028-Q2, Report period: 1 August 1960 to 31 October 1960. Contract AF 33(616)-7227

26. U.S. Air Force Aeronautical Systems Division, Wright-Patterson AFB

ELASTOMERIC AND COMPLIANT MATERIALS FOR CONTACT WITH LIQUID ROCKET FUELS AND OXIDIZERS. ASD Technical Report 61-76, Part II. Prepared under Contract AF 33(616)-7227 by the Thiokol Chemical Corporation, Reaction Motors Division; Joseph Green and N.B. Levine, authors. April 1962.

IDENTIFICATION OF MATERIALS:

Viton B	duPont
EPR (ethylene propylene rubber)	Hercules Powder Company
SBR (Styrene butadiene rubber)	U.S. Chemical Company
Kel-F 5500	3M Company
Silastic LS-53	Dow Corning Corporation
Butyl Rubber	Enjay Company, Incorporated
TFNMTFE	Trifluoronitrosomethane-TFE; received from ASD
"H" film	Received from ASD
Dynamar	Received from ASD
Cyanosilicone	Union Carbide Corporation
"Cis-4" Polybutadiene	Phillips Chemical Company

BASIS OF EVALUATION: Generalities based on change in physical properties and in appearance.

REMARKS: This work is a continuation of Ref 25

REF
27. U.S. Air Force; Wright Air Development Center

EFFECT OF POTENTIAL ROCKET FUELS AND OXIDIZERS ON ELASTOMERS AND DEVELOPMENT OF ELASTOMERIC COMPOUNDS SUITABLE FOR RETENTION OF THESE MATERIALS. by C.J. Maloney and A.S. Kidwell. Work by the Connecticut Hard Rubber Company, Contract AF 33(616)-2962. WADC Technical Report 56-351, November 1956. AD 110 511

IDENTIFICATION OF MATERIALS:

Butyl rubber	Enjay Company, Inc.
Poly-FBA (poly-1, 1-dihydroper-fluoro-butyl acrylate)	3M Company
Hypalon (chlorosulfonated poly-ethylene)	duPont
Hycar 2202 (brominated butyl rubber)	B. F. Goodrich Chemical Co.
Acrylon EA-5 and BA-12	Borden Company
Kel-F compounds	M.W. Kellogg Company
Vistanex B-100 (polyisobutylene)	Enjay Company, Inc.
Alathon 2P-1000; Alathon lo (polyethylene)	duPont
Super Dylan 6600(white)S-1 (poly-ethylene)	Koppers Company, Inc.
Marlex 50 (polyethylene)	Phillips Chemical Co.
Opalon 75219 (polyvinyl chloride)	Monsanto Chemical Co.
Saran 281 (polyvinylidene chloride)	Dow Chemical Co.
Exon 400 XR-61 (chlorotrifluoro-ethylene)	Firestone Plastics Co.
Teflon	duPont

BASIS OF EVALUATION: General discussion, involving retention of physical characteristics of the materials after immersion.

REMARKS: This is a very early work in the field of compatibility.

28. American Institute of Aeronautics and Astronautics

"Titan II Propellant handling and compatibility problems", by O.C. Bender, (Martin Company). AIAA Space Flight Testing Conference, Cocoa Beach, Florida, 18-20 March 1963.

REF

28. (Continued)

IDENTIFICATION OF MATERIALS: None specifically identified

BASIS OF EVALUATION: General statements based on knowledge gained through experience, discussed in terms of most compatible, compatible for short term usage, and incompatible.

REMARKS: Significant progress has been made in recognizing and using compatible materials for the Titan II propellants. However, time and money could have been saved if the knowledge of material compatibility, especially in the area of nonmetallic seals, had been improved.

29. Allied Chemical Corporation, Plastics Division

PLASKON, PLASTICS AND RESINS, Technical Data Report CTI-3, undated.

IDENTIFICATION OF MATERIALS:

Plaskon CTFE 2200; Plaskon CTFE 2300; Plaskon CTFE 2400; Plaskon CTFE 3200

BASIS OF EVALUATION:

Excellent: recommended for use; completely resistant.
Good: Recommended for use. Slight loss of properties, discoloration, or swelling after a long period of time. May not be safe at a more elevated temperature or higher concentration.
Poor: Not recommended for use. Slow attack, but the material is resistant for short periods of time.
Severe: Not recommended for use. Rapid chemical attack or solvation.

REMARKS: None

REF

30. U.S. Air Force Space Systems Division, Edwards Air Force Base

NITROGEN TETROXIDE HANDLING MANUAL. AF/SSD-TR-61-8, September 1961. Prepared by Rocketdyne, Contract AF 33(616)-6939.

IDENTIFICATION OF MATERIALS: None, other than cited in Section 3.

BASIS OF EVALUATION: Straight listing of materials compatible, limited service, and incompatible.

REMARKS: This manual presents directly usable information for the safe handling of nitrogen tetroxide. (See Ref 22, "Remarks").

31. Picatinny Arsenal, Ammunition Engineering Directorate

THE COMPATIBILITY OF ADVANCED PACKAGEABLE ROCKET PROPELLANTS WITH MATERIALS OF CONSTRUCTION, by J.D. Clark, A.E. Boyce and S.P. Mobley. Technical Report 3115, October 1963.

IDENTIFICATION OF MATERIALS: None, as to identification of specific source.

BASIS OF EVALUATION:: General statements based on change in weight resulting from exposure at controlled temperatures.

REMARKS: The object of the investigation was to determine what materials of construction are compatible with the rocket propellants chlorine trifluoride and Hydrazoid P for extended periods of time.

32. NASA, George C. Marshall Space Flight Center

COMPATIBILITY OF MATERIALS WITH LIQUID OXYGEN, by C.F. Key and W.A. Riehl. MTP-P&VE-M-63-14, 4 December 1963.

REF
32. (Continued)

IDENTIFICATION OF MATERIALS: Tabulations of data in this report include: "Material", "Manufacturer", and "Composition". Selection of data from this report was more controlled by the "Composition" than the other media of identification. Citations are by composition number. (See Appendix A, also)

BASIS OF EVALUATION: Data transcribed directly from source. This report, however, does provide functional evaluations, as follows:

S - Satisfactory for LOX service if cleaned and/or processed by applicable MSFC standards.

BT - Satisfactory as stated above, with the provisions that each manufacturer's batch of the product must be individually tested and found acceptable.

C - Conditional, insufficient test experience to rate sample adequately.

U - Unacceptable, capable of vigorous burning or exploding in contact with LOX.

REMARKS: In order to acceptance-test a material for use in LOX systems, twenty separate samples of the material submerged in LOX are subjected to 10 Kg-M (72 ft-lbs) impact energy delivered through a 1/2 inch diameter area. More than one indication of sensitivity is cause for immediate rejection. A single explosion, flash, or other indication of sensitivity during the initial series of twenty tests requires that an additional forty samples be tested without incident to insure acceptability of the material.

Two notes of caution are in order. (1) Wherever possible, a complete identification is made of the materials tested. Although some general conclusions can be drawn relative to certain classes or chemical families of materials, it is definitely unsafe to predict the behavior of any totally new product on this basis. Even materials normally inert to LOX can be rendered unsafe by minute amounts of processing additives, pigments, etc., that may be favored by one manufacturer or processor. It is equally unsafe to define a material for a specific application in liquid oxygen solely on the basis of a military or other specification for a general purpose product, since most such specifications do not limit sufficiently the chemical constitution of the product.

REF

33. U.S. Air Force, Aeronautical Systems Division (Wright-Patterson AFB)

HANDBOOK OF DESIGN DATA ON ELASTOMERIC MATERIALS USED IN AEROSPACE SYSTEMS, Technical Report No. ASD-TR-61-234, H January 1962. AD 273 880 (Prepared by Southwest Research Institute) authors: A.G. Pickett and M.M. Lemcoe.

IDENTIFICATION OF MATERIALS: None, other than cited in Section 3.

BASIS OF EVALUATION: None

REMARKS: This is a survey of the field, and information is taken from many sources. Thus, specific materials are not identified, and discussion of evaluation is general.

Of the great volume of data provided, only volume swell and LOX impact resistance were included here. Of the one, it is stated that volume swell data is suitable only for preliminary elastomer screening. A rule of thumb for evaluation is given:

Less than 16% - probably compatible
Less than 40% - may be compatible
Greater than 40% - incompatible

Concerning LOX impact resistance, this report states that it has no connection with the chemical or physical properties of most elastomers. Standard test measures the ability of the material to withstand an impact load in the presence of LOX. However, even an oily fingerprint can cause the sample to undergo detonation.

In general, this report stresses caution in the interpretation of compatibility data for elastomers.

34. U.S. Air Force, Wright Air Development Division (Wright-Patterson AFB)

RESEARCH ON RUBBER MATERIALS FOR APPLICATIONS INVOLVING CONTACT WITH LIQUID ROCKET PROPELLANTS, WADC Technical Report 57-651, Part III, May 1960. AD 240 874 (Prepared by The Connecticut Hard Rubber Company; authors: J.H. Baldrige and M.D. Inskeep) Contract AF 33(616)-5572

REF
34. (Continued)

IDENTIFICATION OF MATERIALS:

Butyl	Copolymer of isobutylene and isoprene	Enjay
Genetron GC	Modified chlorotrifluoroethylene polymer	General Chemical
HiFax	Linear polyethylene	Hercules
Hycar (1000-)	Butadiene-acrylonitrile copolymer	B. F. Goodrich Chemical
Hycar (2202)	Brominated butyl polymer	B. F. Goodrich Chemical
Hydropol	Hydrogenated polybutadiene	Phillips Chemical
Irrathene	Irradiated polyethylene	General Electric
Kel-F	Polymer of monochlorotrifluoroethylene and vinylidine fluoride	3M
Kodapak II	Cellulose acetate butyrate	Eastman Kodak
Lexan	Polycarbonate resin	General Electric
Mylar	Terephthalate polyester	duPont
SBR	Styrene-butadiene copolymer	---
Saran	Polyvinyl chloride	Dow Chemical
Spauldite	Paper-base phenolic	Spaulding Fiber
Synpol (700 -)	Oil-extended SBR	Texas-U.S. Chemical
Synpol 8000	Styrene-butadiene copolymer	Texas-U.S. Chemical
Stypol 1551	Cold SBR	Texas-U.S. Chemical
Teflon	Polytetrafluoroethylene	duPont
Teflon FEP	Perfluoroethylene propylene copolymer	duPont
Teslar	polyvinyl fluoride	du Pont
Trithene A	Chlorotrifluoroethylene polymer	Visking
Tygon	Polyvinyl chloride	U.S. Stoneware
Ultron	Polyvinyl chloride (unplasticized)	Monsanto
Viton	Fluoroelastomer	du Pont
Zytel	Nylon resins	du Pont

Compositions actually tested are further defined in the report

BASIS OF EVALUATION: Specific results given; no generalizations.

REMARKS: Elastomeric materials resistant to hydrazine, unsymmetrical dimethyl hydrazine and JP-X fuel mixture have been found for service at room temperature and 160°F. for immersion periods ranging from 21 days to 6 months. Among these is a new commercial polybutadiene elastomer. A semi-commercial elastomer resistant to n-proply nitrate up to 3 months at 160°F. has been found. Compounds which resist inhibited red fuming nitric acid up to 3 weeks at room temperature have been evaluated.

REF

34. (Continued)

Several flexible plastics have been found resistant to nitrogen tetroxide (3 months), inhibited red fuming nitric acid (3 weeks) at room temperature and liquid chlorine trifluoride at its boiling point (1 hour). No elastomers tested resisted nitrogen tetroxide or chlorine trifluoride.

35. U.S. Air Force Materials Laboratory (Wright-Patterson AFB)

THE COMPATIBILITY OF STRUCTURAL MATERIALS WITH HYBALINE A-5 and COMPOUND A. AFML Technical Report TR-64-391, December 1964. (By Pennsalt Chemicals Corporation; authors: J.C. Grigger and H.C. Miller. Contract AF 33(657)-8461.)

IDENTIFICATION OF MATERIALS:

Kel-F(3M)	Polychlorotrifluoroethylene	Plastic Seal and Gasket Co., Linden, N.J.
Kynal-(Pennsalt)	Polyvinylidene fluoride	Pennsalt Chemicals
Teflon (TFE)	Polytetrafluoroethylene	Plastic Seal and Gasket Co., Linden, N.J.

BASIS OF EVALUATION: None, specific values given.

REMARKS: Compatibility of three fluorinated plastics in Hybaline A-5 liquid and vapor at 50° was investigated. The plastics showed weight gains of 0.02 to 0.04% in 21-day exposures, and insignificant changes in appearance. No significant change in mechanical properties on 8-inch tensile specimens and no stress corrosion cracking on U-band stressed specimens occurred.

36. Aerojet-General Corporation, Von Karman Center

EXPLORATORY EVALUATION OF FILAMENT-WOUND COMPOSITES FOR TANKAGE OF ROCKET OXIDIZERS AND FUELS. Contract AF 33(615)-1671; QPR 0873-01-1, September 1964. For: Air Force Materials Laboratory.

REF
36. (Continued)

IDENTIFICATION OF MATERIALS:

Epoxy novolac	Shell Chemical
Epoxy novolac; bisphenol A	Shell Chemical
Epoxy novolac; bisphenol A	Dow Chemical
Epoxy novolac	Dow Chemical
Polyepoxide; bisphenol A	Koppers
Polyester	American Cyanamid
Melamine formaldehyde	American Cyanamid
Epoxy novolac	Dow Chemical
Phenol formaldehyde	U.S. Polymeric
Phenol formaldehyde	Cincinnati Testing Laboratory
Styrene-butene	Emerson & Cuming

BASIS OF EVALUATION: None; direct data

REMARKS: Literature survey indicated that very few of the resins commonly used in filament-wound structures possessed a high degree of compatibility with Aerozine 50, nitrogen tetroxide, pentaborane, or chlorine trifluoride. It was also noted that polymeric films were permeable to these fluids. Preliminary screening tests of the chemical compatibility of resins and liner materials confirm the literature reports and indicated the necessity for a barrier type liner. A metallic liner appears to be mandatory for the more corrosive propellants.

36A. Aerojet-General Corporation, Von Karman Center

EXPLORATORY EVALUATION OF FILAMENT-WOUND COMPOSITES FOR TANKAGE OF ROCKET OXIDIZERS AND FUELS. Contract AF 33(615)-1671; QPR 0873-01-2, December 1964. For: Air Force Materials Laboratory. AD 463 111.

IDENTIFICATION OF MATERIALS:

Resin systems:
Polyepoxide- Bisphenol A (Kopox 170/DER/BF_3-400)
Phenol formaldehyde (U.S. Polymeric No. 46)

REF
36A. (Continued)

Novolac epoxy (DEN 438/BF_3-400)
Polyepoxide (Kopox 170/BF_3-400)
Liner films:
Teflon; Kynar; Polyethylene; Polypropylene

BASIS OF EVALUATION: None; direct data given.

REMARKS: Data was accumulated on the compatibility of resins and liner materials with rocket fuels and oxidizers at two temperatures and over extended time periods.

36B. Aerojet-General Corporation, Von Karman Center

EXPLORATORY EVALUATION OF FILAMENT-WOUND COMPOSITES FOR TANKAGE OF ROCKET OXIDEIZERS AND FUELS. Contract AF 33(615)-1671; QPR 0873-01-3, March 1965. For: Air Force Materials Laboratory. AD 462 840.

IDENTIFICATION OF MATERIALS:

Composites (with S-HTS glass):	Resin content
Phenol formaldehyde (U.S. Polymeric No. 46)	20.5%
Novolac epoxy (DEN 438/BF_3-400)	19.8%
Polyepoxy (Kopox 170/BF_3-400)	18.8%

Liner films:
Teflon; Kynar; Polyethylene; Polypropylene

BASIS OF EVALUATION: None; direct data given.

REMARKS: Preliminary data and information on the effects of propellants and a simulated space environment on glass reinforced composites are presented. The results of these studies are reviewed to provide a basis for the selection of materials to be used.

REF
36C. Air Force Materials Laboratory (W-P AFB)

EXPLORATORY EVALUATION OF FILAMENT-WOUND COMPOSITES FOR TANKAGE OF ROCKET OXIDIZERS AND FUELS, By M. J. Sanger, R. Molho and W. W. Howard (Aerojet-General Corporation). AFML-TR-65-381, January 1966. Contract AF 33(615)-1671.

IDENTIFICATION OF MATERIALS:

Polyepoxide (Kopox 170 - Koppers)
Phenol formaldehyde (U.S. Polymeric)
Epoxy, novolac (Dow)
Teflon, (duPont)
Kynar (Pennsalt Chemicals)
Polyethylene (unidentified)
Polypropylene (unidentified)

BASIS OF EVALUATION: None, direct data given.

REMARKS: None of the resins evaluated in Phase I demonstrated complete compatibility with the propellants for extended exposures, but some resin systems were found that have moderate resistance. A novolac type epoxy resin was selected for use in the subscale tankage because of its favorable physical properties and chemical stability. In study of the liners, the fluorocarbons were found to be the most compatible with rocket fuels and oxidizers.

37. U.S. Air Force, Aeronautical Systems Division (Wright-Patterson AFB)

MECHANICALLY INITIATED REACTIONS OF ORGANIC MATERIALS IN MISSILE OXIDIZERS, Technical Report 61-324, October 1961. (Prepared by the Martin Company; authors: R. L. Hauser, G. E. Sykes, and W. F. Rumpel under Contract AF 33(616)-7271).

IDENTIFICATION OF MATERIALS:

Acrylonitrile-butadiene copolymer	Goodrich, Hycar 1000x132
Polyacetal	DuPont, Delrin
Polybutadiene	Firestone, Diene

REF
37. (Continued)

IDENTIFICATION OF MATERIALS: (Cont)

Polychloroprene	DuPont, Neoprene WB
Poly(cyanomethyl)siloxane	General Electric
Polydimethylsiloxane	Dow Corning
Polyethylene, 0.92	Spencer, 1504
Polyethylene, 0.96	Phillips, Marles 50
Polyisoprene	Firestone, Coral
Polypropylene	Hercules, ProFax
Polystyrene	Union Carbide
Poly(trifluoropropyl) methysiloxane	Dow-Corning
Polyvinyl Chloride	Union Carbide
Polyvinylidene fluoride	Pennsalt, Kynar
Vinylidene fluoride-hexafluoropropylene	DuPont, Viton A

BASIS OF EVALUATION: None, direct data.

REMARKS: Pure polymers, plasticizers, and antioxidants were studied and their threshold sensitivity levels and detonation energies were determined. Procedures and equations for calibrating impact testing machines were developed and used to calculate the rates of energy transfer into test materials. A full record of test procedures is included.

38. New York Naval Shipyard, Materials Laboratory

THE SUITABILITY OF ELASTOMERIC MATERIALS FOR USE IN THE DEVELOPMENT OF HOSES, GASKETS, AND DIAPHRAGMS FOR HANDLING ROCKET PROPELLANTS, by J. Mironov and A.D. Delman. Lab Project 5998-3, Final Report, 8 May 1959. NSSo33-200.

IDENTIFICATION OF MATERIALS:

Hypalon S-2 --- Surety Rubber Company, Carrollton, Ohio
Vistanex-Polyethylene coated Vinyon cloth --- Connecticut Hard Rubber Co.
Butyl Rubber Gloves, unsupported --- Bond Rubber Company, Derby, Conn.

REF

38. (Continued)

IDENTIFICATION OF MATERIALS: (Cont)
Polyethylene-Vistanex coated Fortisan --- Quartermaster R&D Center, Natick
Butyl coated cotton airplane cloth (white and black) --- Chemical Rubber Products, Inc., Beacon, New York
Boots, butyl rubber (Air Force handler's suit) --- Bristol Rubber Company, Bristol, Conn. Neoprene rubber (unknown)
Kel-F Resin 800 and Kel-F Elastomer 5500 on Fiberglass 116DD --- M.K. Kellogg Company, Jersey City, N.J.
Trithene A --- Visking Corporation, Chicago
Teflon Coated Fiberglass --- E.I. duPont deNemours & Co.
Polyethylene, clear and black, on "Nygen" or nylon --- Texileather Division of General Tire and Rubber Company
Armalon coated fabric --- E.I. duPont deNemours & Co.
Butyl rubber - Vistanex Compound No. 8 --- Chemical and Radiological Laboratory, Army Chemical Center

BASIS OF EVALUATION: None, direct observation as reported.

REMARKS: Thirty-two different elastomeric materials were investigated to determine their potential suitability for use in the fabrication of hoses, gaskets, and diaphragms necessary for shipboard handling and storage of red fuming nitric acid and mixed-amines. Results indicate that a fluorinated polymer is suitable for prolonged use with red fuming nitric acid. All of the materials are unsatisfactory for applications requiring prolonged contact with mixed-amines. Three specimens are suitable for short term use with red fuming nitric acid, while six of the elastomeric materials are suitable for interim use with mixed-amines.

39. Defense Metals Information Center, Battelle Memorial Institute

COMPATIBILITY OF MATERIALS WITH ROCKET PROPELLANTS AND OXIDIZERS. DMIC Memorandum 201, 29 January 1965.

IDENTIFICATION OF MATERIALS: As specified in individual transcriptions.

REF
39. (Continued)

BASIS OF EVALUATION: Ratings for nonmetals are also somewhat arbitrary but wherever possible they follow those described in the Titan II Storable Propellant Handbook. (Ref 4) The classifications are:

	Class 1	2	3	4
Volume Change, percent	0 to +25	-10 to +25	-10 to +25	< -10 or > +25
Durometer Reading Change	±3	±10	±10	< -10 or > +10
Effect on Propellant	None	Slight change	Moderate change	Severe
Visual Examination	No change	Slight change	Moderate change	Severly blistered, or cracked, dissolved
General Usage	Satisfactory use	Satisfactory for repeated short term use	Satisfactory for short time use	Unsatisfactory

REMARKS: This memorandum summarizes the available information on the compatibility of liquid rocket propellants with prominent materials of construction. It is pointed out that compatibility data for materials not ordinarily covered by the Defense Metals Information Center are included. These data were found during the search for information on materials that are within the scope of the DMIC, and are included for convenience. Fuels and oxidizers of current interest are discussed. The corrosion data which are presented will apply to storing, handling, and control equipment outside of missiles and to missile components excluding combustion chamber. The compatibility of materials with reaction products in combustion chambers, nozzles, etc., has not been considered. Included in the summary are data for many nonmetallic materials. These data were collected in conjunction with those obtained for metals but no concerted effort was made to secure compatibility data for nonmetals.

40. National Aeronautics and Space Administration

TECHNOLOGY SURVEY: ADVANCED VALVE TECHNOLOGY, NASA SP-5019, February 1965. Prepared by Midwest Research Institute; K.D. May, author.

REF
40. (Continued)

IDENTIFICATION OF MATERIALS: None other than individually stated.

BASIS OF EVALUATION: The classification code used is the same as the one used in the Bell Handbook (See Reference 4, this report).

REMARKS: In considering the compatibility of valve materials with propellants, many propellants of current interest for space application are taken into account. Consideration is given only to the materials that would be subjected to the propellant environment for long-term duration, or as would be experienced by the valves operating in industrial processes, storage facilities, transportation equipment, or on a space vehicle in an extended orbit of approximately two years. In general, materials that are considered acceptable are rated according to corrosion and impact tests that have been performed.

The materials selected as compatible with a given propellant are intended to be used as a guide to the valve designer. Disagreement in ratings of some materials by different sources of information may have resulted from inadequate test procedures, isolated adverse effects due to improper cleaning, etc. In many cases temperatures given are only test temperatures and are not necessarily limit temperatures needed to maintain an acceptable rating.

41. Tripartite Technical Cooperation Program

Statement: Minutes of the Eleventh Meeting of Working Panel, P-3; Sub-Group TTCP. Held at Canadian Armament Research and Development Establishment, Valcartier, Quebec. 26-28 October 1965.

IDENTIFICATION OF MATERIALS: Not specific, other than stated.

BASIS OF EVALUATION: Statement of Mr. Kelble, U.S. Air Force.

REMARKS: (Transcript of statement as reported by J. Matlack, Picatinny Arsenal, 13 December 1965, Travel report.)

REF
41. (Continued)

REMARKS: (Cont)

Mr. Kelble (USAF) spoke of the nitroso terpolymers cured with chromiumtrifluoroacetate catalyst which results in an elastomer compatible with N_2O_4. The nitroso elastomer in an unstressed state remained unaffected after 90 days in contact with N_2O4 at 160°F. The best butyl rubber, previously available, had a life of only 1 or 2 days under similar conditions. Prototype expulsion bladders, hose, seals and protective clothing are being developed as well as coating for metals. He reported on a Viton type fuel tank sealant which remains in satisfactory condition for 1000 hours at 500°F and for 500 hours at 550°F. It is a room temperature curing compound, with 80 to 85% solids content, requires no primer and has good adhesion to titanium and stainless steel.

42. Union Carbide Corporation, Linde Division

COMPATIBILITY OF MATERIALS WITH 7500 PSI OXYGEN, by G. J. Nihart and C. P. Smith. Aerospace Medical Research Laboratories report AMRL-TDR-64-76, October 1964. Contract AF 33(657)-11686.

IDENTIFICATION OF MATERIALS:

Teflon (Virgin TFE) - E.I. duPont de Nemours and Company, Inc.
Teflon 100X (FEP) - E.I. duPont de Nemours and Company, Inc.
Viton A(Virgin) - E.I. duPont de Nemours and Company, Inc.
Viton B (Virgin) - E.I. du Pont de Nemours and Company, Inc.
Rulon A (Reinforced TFE) - Dixon Corporation
Rulon B (Reinforced TFE) - Dixon Corporation
Rulon C (Reinforced TFE) - Dixon Corporation
Duroid 5600 (60% Teflon, 40% aluminum silicate ceramic fibers) - Rogers Corporation
Duroid 5650 (75% Teflon, 25% aluminum silicate ceramic fibers) - Rogers Corporation
Duroid 5870 (85% Teflon, 15% glass fibers) - Rogers Corporation
Duroid 5813 (60% Teflon, 40% glass fibers with MoS_2 filler) - Robers Corporation
Kel-F 81 (CTFE) - Minnesota Mining and Manufacturing Company
Kel-F Elastomer 3700 - Minnesota Mining and Manufacturing Company
Kel-F-Elastomer 5500 - Minnesota Mining and Manufacturing Company

BASIS OF EVALUATION: No special basis; data reported.

REF
42. (Continued)

REMARKS: This program was conducted to develop ignition data on thread lubricants, thread sealants, fluorocarbon plastics, and metals. Spontaneous ignition temperatures were determined in both 2000 psi and 7500 psi oxygen for all the above materials. The spontaneous ignition temperatures for these materials were found to be essentially the same in 7500 psi oxygen and in 2000 psi oxygen. Glass-filled polytetrafluoroethylene is usable only if tightly confined.

43. Thiokol Chemical Corporation, Reaction Motors Division

Work on Contract AF 33(657)-11093; N. B. Levine, J. Green, W. Sheehan; reported in CHEMICAL AND ENGINEERING NEWS, 14 February 1966.

IDENTIFICATION OF MATERIALS: Carboxylnitroso terpolymer (cured with metals salts of organix and fluorocarbon acids), epoxy compounds, and epoxy-metal oxide mixtures.

BASIS OF EVALUATION: Not given. Work involved total immersion.

REMARKS: Using a terpolymer containing 1.25 mole % perfluoro-nitrosobutyric acid, the group prepared several vulcanates containing from 0.5 to 10 parts by weight of chromium trifluoroacetate per hundred parts of carboxy nitroso rubber. The vulcanizates also contained 20 parts per hundred of rubber or Silstone 110 (10% silicone oil coated silica) as filler. Each was cured for 60 minutes at 200 F and oven postcured for six hours, stepwise, up to 300 F.

APPENDIX A. TRADE DESIGNATIONS APPEARING IN THIS REPORT

Aclar	Allied Chemical Corporation
Acrylon	The Bordon Chemical Co.
Acushnet	Acushnet Process Co.
Adiprene	E.I. du Pont de Nemoors & Co., Inc.
Alathon	E.I. du Pont de Nemours & Co., Inc.
Araldite	Ciba Products Corporation
Armalon	E.I. du Pont de Nemours & Co., Inc.
Bakelite	Union Carbide Plastics Company
Boltron	Chemical Plastics Division, General Tire & Rubber Co.
Capran	Allied Chemical Corporation
Chemelec	U.S. Gasket Co.
Chemigum	Goodyear Tire and Rubber Co.
Cohrlastic	Connecticut Hard Rubber Co.
Co-Polymer	Co-Polymer Chemicals, Inc.
Cordo	Cordo Division, Ferro Corporation
Cycolac	Marbon Chemical Division, Borg Warner Corporation
Dacron	E.I. du Pont de Nemours & Co., Inc.
Delrin	E.I. du Pont de Nemours & Co., Inc.
Disogrin	Disogrin Industries, Inc.
Duroid	Rogers Corporation
Dylan	Koppers Company, Inc.
Dynamar	3M Company
Dynel	Union Carbide Corporation
Enjay	Enjay Company, Inc.
Epon	Shell Chemical Company
Epoxylite	Epoxylite Corporation
Exon	Firestone Plastics Co.
Fairprene	E.I. du Pont de Nemours & Co., Inc.
Fiberglas	Owens-Corning Fiberglas Corp.
Fluorel	3M Company
Fluorobestos	Raybestos Manhattan, Inc.
Fluoroflex	Resistaflex Corp.
Fluorogreen	John L. Dore Co.
Fluorolin	Joclin Mfg. Co.
Fluorosint	Polymer Corporation
Fluorothene	Plax Corporation
Fluran	U.S. Stoneware Co.
Garlock	Garlock Packing Co.
Genetron	Allied Chemical Corporation
Gen-Flex	General Tire and Rubber Co.
Geon	B. F. Goodrich Chemical Company
Glyptal	General Electric Company
Goshen	Goshen Rubber Company, Inc.
H-film (also("HT")	E.I. di Pont de Nemours & Co., Inc.
Hadbar	Hadbar, Inc.
Halon	Allied Chemical Corp.

APPENDIX A. (Continued)

Haveg	Haveg Industries, Inc.
Heresite	Heresite and Chemical Co.
Hi Fax	Hercules Power Company
Hycar	B. F. Goodrich Chemical Company
Hydropol	Stillman Rubber Co.
Hypalon	E.I. du Pont de Nemours & Co., Inc.
Hysol	Houghton Laboratories, Inc.
Insuroc	The Richardson Company
Irrathene	General Electric Company
Kel-F	3M Company
Kodapak II	Eastman Kodak Co.
Korda-flex	Chicago Gasket Co.
Koroseal	B. F. Goodrich Industrial Products Co.
Kynar	Pennsalt Chemicals Corporation
Laminac	American Cyanamid Company
Lexan	General Electric Company
Linear	Linear, Inc.
Lucite	E.I. du Pont de Nemours & Co., Inc.
Marlex	Phillips Chemical Company
Marvinol	United States Rubber Company
Melbestos	Melrath Gasket
Melmac	American Cyanamid Company
Metlbond	Whittaker Corporation (Narmco)
Micarta	Westinghouse Electric Corp.
Mylar	E.I. du Pont de Nemours & Co., Inc.
Mystik	The Borden Chemical Company
Narmco	Narmco Resins and Coatings Co.
Neoprene	Delta Products
Nopco	Nopco Chemical Co.
Opalon	Monsanto Chemical Company
Orlan	E.I. du Pont de Nemours & Co., Inc.
Oxiron	FMC Corporation, Organic Chemicals Division
Paraplex	Rohm and Haas Co.
Parco	Plastics and Rubber Products Co.
Parker	Parker Seal Co.
Penton	Hercules Power Company
Plaskon	Allied Chemical Corp.
Plax	Monsanto Company
Plexiglas	Rohm and Haas Company
Plioweld	Goodyear Tire and Rubber Co.
Polyflex	Monsanto Company
Precision	Precision Rubber Products Corp.
Pro-Fax	Hercules Power Company
Pro-Seal	Coast Pro-Seal and Manufacturing Company
Raythene	Ray Chemical Corp.
Redwing	Goodyear Tire and Rubber Co.
Rezklad	Atlas Mineral Products
Rulon	Dixon Corporation

Saran	Dow Chemical Company
Sarankote	Dow Chemical Company
Scotchcast	3 M Company
Silastic	Dow Corning Corp.
Sivrene	Chicago Rawhide
Spauldite	The Spaulding Fiber Co.
Stillman	Stillman Rubber Co.
Styrofoam	Dow Chemical Co.
Synpol	Texas-U.S. Chemical Co.
Tedlar	E.I. du Pont de Nemours & Co., Inc.
Teflon	E.I. du Pont de Nemours & Co., Inc.
Tenite	Eastman Chemical Products, Inc.
Teslar	E.I. du Pont de Nemours & Co., Inc.
Thiokol	Thiokol Chemical Corporation
Trevarno	Coast Manufacturing and Supply Corp.
Trithene	Union Carbide Corporation
Tygon	U.S. Stoneware Company
Ultron	Monsanto Chemical Company
Vinylite	Union Carbide Corporation
Vistanex	Enjay Chemical Company
Viton	E.I. du Pont de Nemours & Co., Inc.
Vydax	E.I. du Pont de Nemours & Co., Inc.
Zytel	E.I. du Pont de Nemours & Co., Inc.

APPENDIX B. LIQUID PROPELLANTS, FUELS, AND OXIDIZERS INVOLVED IN THIS REPORT

Aerozine 50
Alcohols (methyl, ethyl, isopropyl, furfuryl)
Alkyl boranes (Hi-Cal, HEF-2, HEF-3)
Ammonia, anhydrous
Aniline
Boron hydride
Bromine trifluoride
Chlorine trifluoride
DIPA (diisopropylene acetylene)
Ethylene oxide
FLOX (liquid fluorine/ liquid oxygen)
Fluroine
50/50 Fuel blend (hydrazine/UDMH)
Halogen fluoride
HEF-2, HEF-3, HiCal-3 (alkyl-boranes)
Hybaline A-5
Hydrocarbon fuel
Hydrazine
Hydrazoid B
Hydrogen
Hydrogen peroxide
IRFNA (inhibited red fuming nitric acid)
JP fuels
Mixed amine fuels (MAF)
MON (mixed oxides of nitrogen)
Monomethyl hydrazine (MMH)
Nitric acid, fuming
Nitrogen; liquid nitrogen
Nitrogen tetrafluoride
Nitrogen tetroxide
Nitrogen trifluoride
Oxygen; liquid oxygen (LOX)
Oxygen difluoride
Oxygen/oxygen difluoride
Pentaborane
Perchloryl fluoride
Perchloryl fluoride / chlorine trifluoride
Perchloryl fluoride / tetrafluorohydrazine
n-Propyl nitrate
RFNA (red fuming nitric acid)
U-DETA (MAF-4) (unsymmetrical dimethyl hydrazine in diethylene triamine)
UDMH (unsymmetrical dimethyl hydrazine)
WFNA (white fuming nitric acid)

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13. ABSTRACT

Much has been published on the subject of the compatibility of plastics with liquid propellants, fuels and oxidizers, but invariably from the standpoint of the propellant or fuel. This report is a rearrangement of the published compatibility data from the standpoint of the plastic material. It is in the form of a tabulation, with primary arrangement by plastic (or elastomeric) material; and thereunder, by fuel. All arrangements are alphabetical, in the form given in the original reference; that is, either by generic or trade designation. The compatibility evaluation is in terms of the original document, briefly culled to show behavior of the material at a given temperature and for a given time. Elastomers are included (although they are not a stated concern of PLASTEC); but oils, lubricants and greases are omitted, even though based on polymers. The information has been drawn from 43 references, which are annotated so that the information extracted from them shall have additional significance.

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