



AEROSPACE INFORMATION REPORT

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Superseding AIR786A

(R) Elastomer Compatibility Considerations
Relative to Elastomeric Sealant Selection

RATIONALE

This document has not been significantly updated since its original release in 1965. Many of the fluid and elastomer specifications have changed since the original release date so this update provides updated specification listings.

FOREWORD

The document presents an empirical approach to the compatibility of the fluids and the elastomers listed in it. The information presented herein can be used to quickly eliminate grossly incompatible combinations but the reader is urged to either perform their own compatibility tests or consult with elastomer specialists before making the final selection of an elastomer material for their system.

1. SCOPE

This document contains data relative to the chemical nature of aerospace fluids and relates each to its empirical effect upon elastomeric components. Since the compatibilities of elastomers are determined by the compounding as well as the nature of the base polymer, the elastomers considered are limited to finished compounds for which material or performance specifications can be referenced.

1.1 Purpose

This SAE Aerospace Information Report (AIR) is intended to disseminate data relative to the compatibility of elastomers in order to aid in the elastomeric sealant selection. A secondary purpose relates to the selection of solvents and cleaning agents for components and systems containing elastomeric sealants.

2. APPLICABLE DOCUMENTS

The standards listed in Tables 2 and 3 form a part of this document to the extent specified herein. The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

An acceptable classification indicates only that no excessive swelling, shrinking or major tensile strength change should occur over the temperature range of -40 to +160 °F (-40 to +71.1 °C); exceptions to this rule are specifically indicated. Users of this AIR are urged to consult with elastomer specialists before reaching any final conclusions relative to elastomer selection since the empirical approach to compatibility does not factor in time, actual system temperatures and pressures or fluid additive chemistry.

4. BASE FLUID CLASSIFICATIONS

The fluids (Note 1) and greases have been assigned a number of classifications. These classifications indicate the predominant characteristic of the base fluid (Note 2). These classifications, their codes or abbreviations, and typical examples are shown in Table 1.

The various fluids and greases are listed in Table 2. Military specification products are presented first, followed by Federal specifications, commercial specifications and miscellaneous items. Where necessary, the characteristics of the base fluid from which the classification was derived are shown in the last column.

NOTES:

1. The term "fluid" includes aerospace hydraulic fluids, lubricants, solvents, fuels, oxidizers, vector control fluids, corrosion preventives, damping fluids, calibration fluids, anti-icing etc.
2. The base fluid is defined as fluid media before incorporation of thickeners or additives (provided they do not affect elastomer compatibilities).

5. ELASTOMER SELECTION

Twenty eight elastomer specifications are presented in Table 3 together with the 22 fluid classifications. Once the fluid classification has been found in Table 2 the suitability of these elastomers can be determined by referring to Table 3. Conversely, when a compatible solvent must be found for a component or system containing elastomeric seals, Table 3 will indicate which solvent classes are compatible with it.

In certain cases, notably with fuels, the elastomer choice is governed by other government documents. Users of this AIR are cautioned to investigate the possibility of such a conflict.

TABLE 1 - DESCRIPTION OF CLASSIFICATIONS

The various fluids and greases have been placed in a number of classifications in order that the elastomer selection can be simplified. The symbols indicate the predominant characteristic of the base fluid. Their meanings are as follows (typical products are shown):

Aromatics: The base fluid is highly aromatic. Typical: toluene.

ABF: Alcohol base fluid; usually contains castor oil or polyglycol as lubricant portion. Typical: AMS3002.

C-H: Chlorinated hydrocarbon. Typical: ASTM D4080.

E-A: Ester Aryl. Typical: MIL-H-19457.

E-N: Ester, Normal. Historically, the first fluids meeting these specifications were di-esters of dibasic acids, such as dioctyl sebacate, dioctyl azelate, octyl-decyl adipate, etc. However, some formulations contain esters of diethylene glycol or trimethylol propane (with a low molecular weight mono basic acid). Typical: MIL-PRF-7808.

E-TS: Ester, thermally stable. Esters of pentaerythritol or trimethylol propane (higher molecular weight than E-N). Typical: MIL-PRF-81322.

E-S: Ester, Silicate, silicate esters, alkoxy siloxanes, hexaalkoxy-disiloxanes. Typical: MLO-8200.

E-S, E-N Blend: A Blend of E-S and E-N. Typical: MLO-8515.

E-P: Ester, phosphate. Typical: Skydrol 500B4.

E-PLD: Ester, phosphate, low density. Typical: Hyjet 5.

F-A: Fuel, Aliphatic. Typical: MIL-PRF-7024, Type I.

F-B: Fuel, blended, 40% or less aromatics. Typical: MIL-DTL-5624, GRADE JP-4.

Fluorocarbons: Containing a fluoroethylene component. Typical: MIL-PRF-27617.

HCS: Hydrocarbon, Synthetic. Typical: MIL-PRF-83282 (USAF)

IPA: Isopropyl alcohol. Typical: TT-I-735

P-L: Petroleum base, low aniline point. Typical: MIL-PRF-5606

P-M: petroleum base, medium aniline point. Typical: MIL-PRF-6086, Grade M.

P-H: Petroleum base, high aniline point. Typical: MIL-PRF-21260, Grade 50.

Silicone: Those classes of fluids normally called silicones, such as dimethyl silicone (polydimethyl siloxane), methyl-phenyl silicones, etc. Typical: DC-200.

Hydrazine: Hydrazine, unsymmetrical dimethyl hydrazine and similar fluids.

W-G: Water-Glycol fluids. Sometimes called "Hydrolubes". Typical: MIL-H-22072.

Special: Certain "one of a kind" items

TABLE 2 - BASE FLUID CLASSIFICATIONS

SPECIFICATION	TITLE	CLASSIFICATION	CHARACTERISTICS OF BASE FLUID
MIL-PRF-680	Solvent, Dry Cleaning		
	Type I 100° F (38 °C) Solvent (Stoddard Solvent)	F-B	Low Aromatic
	Type II 140 °F (60 °C) Solvent	F-B	Low Aromatic
MIL-PRF-2104	Lubricating Oil, General Purpose, Preservative Grade 10 (SAE 10W-20)	P-M	6 cs @ 210 °F (98.9 °C)
	Grade 30 (SAE 30)	P-M	10 cs @ 210 °F (98.9 °C)
	Grade 50 (SAE 50)	P-H	17 cs @ 210 °F (98.9 °C)
MIL-PRF-3150	Lubricating Oil, Preservative, Medium	P-M	185-255 SUS @ 130 °F (54.4 °C)
MIL-DTL-4339	Corrosion Preventive, Soluble Oil	P-M	100-400 SUS @ 100 °F (37.8 °C)
MIL-DTL-5020	Liquid, Compass, Aircraft	F-A	Non-Fluorescing
MIL-PRF-5606	Hydraulic Fluid, Petroleum Base, Aircraft and Ordnance	P-L	4.5 CS @ 100 °F (37.8 °C)*
MIL-DTL-5624	Jet Fuel Grade JP-3	F-B	Aromatics Allowed
	Grade JP-4	F-B	Aromatics Allowed
	Grade JP-5	F-B	Aromatics Allowed
MIL-PRF-6081	Oil Lubricating; Jet Engine Grade 1005	P-L	5cs @ 100 °F (37.8 °C)
	Grade 1010	P-L	10cs @ 100 °F (37.8 °C)
MIL-PRF-6083	Hydraulic Fluid, Petroleum Base, Preservative		
	Type I Ready Mix	P-L	4.5cs @ 100 °F (37.8 °C)*
	Type II Concentrate	P-L	4.5 cs @ 100 °F (37.8 °C)*
MIL-PRF-6085	Lubricating Oil, Aircraft Instrument, Low Volatility	E-N	
MIL-PRF-6086	Lubricating Oil, Gear, Petroleum Base		
	Grade L Light	P-M or L	23-34 CS @ 100 °F (37.8 °C)
	Grade M Medium	P-M	60-82 CS @ 100 °F (37.8 °C)
MIL-C-6529	Corrosion-Preventive, Aircraft Engine		
	Type I Concentrate Material	P-H	90-110 SUS @ 210 °F (98.9 °C)
	Type II Ready-Mixed Material for Reciprocating Aircraft Engines	P-H	90-110 SUS @ 210 °F (98.9 °C)
	Type III Ready-Mixed Material for Turbojet Aircraft Engines Which Use Specification MIL-PRF-6081 Lubricating Oil	P-L or M	96 SUS @ 100 °F (37.8 °C)*

* Typical

TABLE 2 - BASE FLUID CLASSIFICATIONS (CONTINUED)

SPECIFICATION	TITLE	CLASSIFICATION	CHARACTERISTICS OF BASE FLUID
MIL-PRF-7024	Fluids, Calibrating, for Aircraft Fuel System Components Type I Normal Heptane Type II Special Run Stoddard Solvent	F-A F-B	Non-aromatic 2-4% Aromatic
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	E-N	
MIL-PRF-7870	Lubricating Oil (General Purpose, Low Temperature)	P-L	10 CS @ 100 °F (37.8 °C)
MIL-PRF-8188	Corrosion Preventive Oil, Gas Turbine, Aircraft	E-N	
MIL-PRF-9000	Lubricating Oil, Internal Combustion Engine, Diesel	P-M, P-H	SAE 10-50
MIL-PRF-10924	Grease, General Purpose, No. 2	P-M	75-100 SUS @ 210 °F (98.9 °C)
MIL-PRF-14107	Lubricating Oil, for Aircraft Weapons	E-S	
MIL-L-15719	Lubricating Grease (High-Temperature, Electric Motor, Ball and Roller Bearings)	SILICONE	
MIL-DTL-17111	Fluid, Power Transmission	P-L	8-15 cs @ 100 °F (37.8 °C)*
MIL-DTL-17331 & AM. #1	Lubricating Oil, Steam Turbine (Non-corrosive) Symbol 2190-TEP	P-M	82-110 cs @ 100 °F (37.8 °C)*
MIL-PRF-17672	Lubricating Oil, Hydraulic and Light Turbine, Non-corrosive Symbol 2110 Symbol 2135	T-HP-M T-HP-M	5.12 cs @ 210 °F (98.9 °C) 7.29 cs @ 210 °F (98.9 °C)
MIL-G-18709	Grease, Ball and Roller Bearing	P-M	
MIL-PRF-18458	Grease, Wire Rope - Exposed Gear	P-H	25-250 SSF @ 210 °F (98.9 °C)
MIL-H-19457	Hydraulic Fluid, Fire Resistant	E-A	
MIL-L-19701(1)	Lubricant, All-Weather, Semi-Fluid, for Aircraft Ordnance	E-N ⁽¹⁾	55% SILICONE, 40%E-N
MIL-PRF-21260	Lubricating Oil, Internal Combustion Engine, Preservative Grade 10 (SAE 10W-20) Grade 30 (SAE 30) Grade 50 (SAE 50)	P-M P-M P-H	6 cs @ 210 °F (98.9 °C) 10 cs @ 210 °F (98.9 °C) 17 cs @ 210 °F (98.9 °C)
MIL-H-22072	Hydraulic Fluid, Catapult	W. G.	
MIL-DTL-23549	Grease, General Purpose	P-M	
MIL-PRF-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	E-TS	
MIL-PRF-23827	Grease, Aircraft & Instrument, Gear & Actuator Screw	E-N	
MIL-G-25013	Grease, Ball & Roller Bearing, Extreme High Temperature	SILICONE	
MIL-DTL-25524	Fuel, Aircraft Turbine & Jet Engine Thermally Stable	F-B	25% Max. Aromatic
MIL-G-25537 & AM. #1	Grease, Aircraft; Helicopter Oscillating Bearing	P-L	40-45 SUS @ 100 °F (37.8 °C)*

* Typical

TABLE 2 - BASE FLUID CLASSIFICATIONS (CONTINUED)

SPECIFICATION	TITLE	CLASSIFICATION	CHARACTERISTICS OF BASE FLUID
MIL-DTL-25576	Rocket Fuel, Grade RP-1	F-B	AROMATIC ALLOWED
MIL-PRF-26087	Lubricating Oil, Reciprocating Compressor, Ground Support	P-M	105-135 CS @ 100 °F (37.8 °C)*
MIL-G-27343	Grease, Ball & Roller Bearing, for Temperature Ranging from -100 to +400 °F	SILICONE	
MIL-PRF-26087	Lubricating Oil, Reciprocating Compressor, Ground Support	P-M	105-135 cs @ 100 °F (37.8 °C)*
MIL-PRF-27617	Grease, Aircraft Fuel & Oil Resistant	FLUOROCARBON S	
MIL-PRF-32033	Lubricating Oil, General Purpose, Preservative	P-L	12cs @ 100 °F (37.8 °C)*
MIL-L-46000	Lubricating Oil, Semi-Fluid Automatic Weapons	E-N	
MIL-PRF-46002	Lubricating Oil, Contact & Volatile Corrosion Inhibited	P-M	
MIL-PRF-46167	Lubricating Oil, Internal Combustion Engine, Artic	P-L	1-3 CS @ 100 °F (37.8 °C)*
MIL-PRF-46170	Hydraulic Fluid, Rust Inhibited, Fire Resistant, Synthetic Hydrocarbon Base, Nato Code No. H-544	P-L	
MIL-PRF-46176	Brake Fluid, Silicone, Automotive, All Weather, Operational And Preservative	SILICONE	
MIL-PRF-53074	Lubricating Oil, Steam-Cylinder, Mineral	P-M	
MIL-H-81019	Hydraulic Fluid, Petroleum Base, Ultra Low Temperature	P-L	3 cs @ 100 °F (37.8 °C)*
MIL-PRF-81322	Grease, Aircraft, General Purpose, Wide Temperature Range	E-TS	
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft	HCS	16.5 CS @ 100 °F (37.8 °C)*
MIL-PRF-83261	Grease, Aircraft, Extreme Pressure, Antiwear	FLUOROCARBON S	
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile	HCS	6.7 CS @ 104 °F (40 °C)*
FEDERAL SPECIFICATIONS			
A-A-857	Thinner, Dope and Lacquer Special		(42% Ketones & Esters 30% Alcohols; 49% Hydrocarbons, 20% Aromatic)
A-A-50493	Oil, Penetrating (For Loosening Frozen Metallic Parts)	P-L	35-60 SUS @ 100 °F (37.8 °C)*
A-A-52624	Antifreeze, Multi-Engine Type Type I Ethylene Glycol Type II Propylene Glycol	W. G.	
A-A-59290	Hydraulic Fluid, Arresting Gear	W.G.	Ethylene Glycol
A-A-59354	Hydraulic Fluids, Petroleum Base, For Machine Tools	P-M	
DOD-G-24508	Grease, High Performance, Multipurpose (Metric)	P-M	
TT-I-735	Fluid, Anti-Icing (Isopropyl Alcohol) IPA 985	IPA	

* Typical

(1) Due to the unusual nature of this blend, use E-N recommendations with caution.

TABLE 2 - BASE FLUID CLASSIFICATIONS (CONTINUED)

SPECIFICATION	TITLE	CLASSIFICATION	CHARACTERISTICS OF BASE FLUID
TT-N-95	Naptha; Aliphatic	F-B	Low Aromatic
TT-N-97 & AM #2	Naptha; Petroleum, Aromatic	AROMATIC	
TT-I-735	Isopropyl Alcohol	IPA	
TT-T-656	Aryl Phosphate	E-A	
VV-G-632	Grease; Lubricating, Automotive & Industrial Type A – Intended Primarily for Automotive Use. Grade 1 – Chassis Grade 2 – Wheel Bearing	P-M P-M or L	750 SUS @ 100 °F (37.8 °C)* 75-100 SUS @ 100 °F (37.8 °C)*
VV-G-671	Grease, Graphite, Grades 1, 2 And 3	P-M	300-400 SUS @ 100 °F (37.8 °C)*
VV-L-825	Lubricating Oil, Refrigerant Compressor Type I for Reciprocation Type Refrig. Compressors (SO ₂) Type II for Reciprocating Type Refrig. Compressors (Freon-12, CH ₃ Cl, NH ₃) Type III for Special Application such as Two Stage Rotary Type Compressors	P-M P-M P-H	150-170 SUS @ 100 °F (37.8 °C)* 285-320 SUS @ 100 °F (37.8 °C)* 105-125 SUS @ 210 °F (98.9 °C)
VV-P-236	Petrolatum	P-H	
VV-D-1078	Damping Fluid, Silicone Base (Dimethylpolysiloxane)	SILICONE	
	AEROSPACE MATERIAL SPECIFICATIONS		
AMS1424	Deicing/Anti-Icing Fluid, Aircraft, SAE Type I	W.G.	88% 1,2 Glycols
AMS3002	Alcohol, Denatured Ethyl	ABF	
AMS3004	Alcohol, Methyl	ABF	
AMS3006	Alcohol, Water Mixtures	ABF	
AMS3020	Oil, Reference, for “L” Stock Rubber Testing	P-L	
AMS3021	Fluid, Reference, for Testing Di-Ester (Polyol) Resistant Material	E-N	
AMS3023	Fluid, Reference for Testing Polyol Ester (and Diester) Resistant Materials	E-TS	
AMS3161	Oil, Odorless Heavy Solvent	F-A	Very Low Aromatic
AMS-G-4343	Lubricating Grease, Pneumatic System	Special	
	AEROSPACE SPECIFICATIONS		
AS5780	Core Requirement Specification for Aircraft Gas Turbine Engine Lubricants,		
AS8660	Silicone Compound Nato Code Number S-736	Silicone	

TABLE 2 - BASE FLUID CLASSIFICATIONS (CONTINUED)

SPECIFICATION	TITLE	CLASSIFICATION	CHARACTERISTICS OF BASE FLUID
	ASTM SPECIFICATIONS		
D471	IRM 901	P-M	255° Aniline pt.
	IRM 902	P-L	
	IRM 903	P-L	199° Aniline pt
	Reference Fuel A	F-A	158° Aniline pt.
	Reference Fuel B	F-B	30% Aromatic
	Reference Fuel C	F-B	50% Aromatic
D910	Standard Specification for Aviation Gasoline	F-B	
D1655	Standard Specification for Aviation Turbine Fuels	F-B	
D3487	Standard Specification for Mineral Insulating Oil Used in Electrical Apparatus	P-L or M	12 cs @ 100 °F (37.8 °C) Max.
D3699	Standard Specification for Kerosene	F-B	Low Aromatic
D4080	Standard Specification for Trichloroethylene, Technical and Vapor-Degreasing Grade	C. H.	
	OTHER PRODUCTS		
MATERIALS LABORATORY OILS	MLO-7243	P-M	15% E-N in E-S BLEND
	MLO-7277	P-M	
	MLO-7557	P-M	
	MLO-8200	E-S	
	MLO-8515	E-S, E-N	
Silicones	DC-200, 510, 550, 710	Silicone	
	Versilube F 50, 81644, 81717	Silicone	
Fire Resistant Fluids	Hyjet IVA+	E-PLD	
	Hyjet V	E-PLD	
	Skydrol 500B4	E-P	
	Skydrol LD4	E-PLD	
	Skydrol V	E-PLD	
	Skydrol PE5	E-PLD	
	Fluorocarbons	Fluorocarbons	