



AEROSPACE INFORMATION REPORT

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Superseding AIR786B

(R) Elastomer Compatibility Considerations Relative to Elastomer Selection

RATIONALE

This Aerospace Information Report has been revised as part of a Five-Year Review. Minor technical and editorial changes have been made to the document, including changes such as the removal of company proprietary and obsolete materials, the addition of specification MIL-DTL-83133, and the grouping of the fluid specifications based on the specification publishing organization.

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 SAE Aerospace Information Report (AIR) 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 document 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 1 through 6 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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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

See Tables 1 through 6.

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

See Tables 1 through 6.

2.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

See Tables 1 through 6.

3. GENERAL

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 Tables 2 to 6. 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 fluid classifications are based on the chemistry of the base fluid, defined as the composition of the fluid media before incorporation of thickeners or additives. In some cases, certain thickeners or additives can negatively impact elastomer compatibility, so this document should be used only for general guidance.

5. ELASTOMER SELECTION

Twenty eight elastomer specifications are presented in Table 7 together with the 22 fluid classifications. Once the fluid classification has been found in Tables 2 to 6, the suitability of these elastomers can be determined by referring to Table 7. Conversely, when a compatible solvent must be found for a component or system containing elastomeric seals, Table 7 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.

5.1 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-PHD:	Ester, phosphate, high density. Typical: AS1241 Type IV, Class 2.
E-PLD:	Ester, phosphate, low density. Typical: AS1241 Type IV, Class 1 and AS1241, Type V.
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, MIL-PRF-87257.
IPA:	Isopropyl alcohol. Typical: TT-I-735.
IRFNA:	Inhibited red fuming nitric acid.
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.
UDMH:	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 1 - Military specification 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) Type II 140 °F (60 °C) Solvent	F-B F-B	Low Aromatic Low Aromatic
MIL-PRF-2104	Lubricating Oil, General Purpose, Preservative		
	Grade 10 (SAE 10W-20)	P-M	6 cst @ 210 °F (98.9 °C)
	Grade 30 (SAE 30)	P-M	10 cst @ 210 °F (98.9 °C)
	Grade 50 (SAE 50)	P-H	17 cst @ 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 cst @ 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 Grade 1010	P-L P-L	5 cst @ 100 °F (37.8 °C) 10 cst @ 100 °F (37.8 °C)
MIL-PRF-6083	Hydraulic Fluid, Petroleum Base, Preservative		
	Type I Ready Mix Type II Concentrate	P-L P-L	4.5 cst @ 100 °F (37.8 °C)* 4.5 cst @ 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 Grade M Medium	P-M, P-L P-M	23-34 cst @ 100 °F (37.8 °C) 60-82 cst @ 100 °F (37.8 °C)
MIL-C-6529	Corrosion-Preventive, Aircraft Engine		
	Type I Concentrate Material Type II Ready-Mixed Material for Reciprocating Aircraft Engines	P-H P-H	90-110 SUS @ 210 °F (98.9 °C) 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, P-M	96 SUS @ 100 °F (37.8 °C)*
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	

* Typical

Table 1 - Military specification base fluid classifications (continued)

Specification	Title	Classification	Characteristics of Base Fluid
MIL-PRF-7870	Lubricating Oil (General Purpose, Low Temperature)	P-L	10 cst @ 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 cst @ 100 °F (37.8 °C)*
MIL-DTL-17331	Lubricating Oil, Steam Turbine (Non-corrosive) Symbol 2190-TEP	P-M	82-110 cst @ 100 °F (37.8 °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 cst @ 210 °F (98.9 °C) 10 cst @ 210 °F (98.9 °C) 17 cst @ 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 (Some MIL-PRF-23827 greases contain di-ester based oils which have had some negative impacts on elastomeric materials.)	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	Grease, Aircraft, Helicopter Oscillating Bearing	P-L	40-45 SUS @ 100 °F (37.8 °C)*
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 cst @ 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 cst @ 100 °F (37.8 °C)*
MIL-PRF-27617	Grease, Aircraft Fuel & Oil Resistant	Fluorocarbons	

* Typical

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

Table 1 - Military specification base fluid classifications (continued)

Specification	Title	Classification	Characteristics of Base Fluid
MIL-PRF-32033	Lubricating Oil, General Purpose, Preservative	P-L	12 cst @ 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 cst @ 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 cst @ 100 °F (37.8 °C)*
MIL-PRF-81322	Grease, Aircraft, General Purpose, Wide Temperature Range,	E-TS	
MIL-DTL-83133	Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37)	F-B	Aromatics Allowed
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft	HCS	16.5 cst @ 100 °F (37.8 °C)*
MIL-PRF-83261	Grease, Aircraft, Extreme Pressure, Antiwear	Fluorocarbons	
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile	HCS	6.7 cst @ 104 °F (40 °C)*

* Typical

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Table 2 - Federal specifications fluid classifications

Specification	Title	Classification	Characteristics of Base Fluid
A-A-857	Thinner, Dope and Lacquer Special	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	W-G	
	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) IPA985	IPA	
TT-N-95	Naptha; Aliphatic	F-B	Low Aromatic
TT-N-97	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	P-M	750 SUS @ 100 °F (37.8 °C)*
	Grade 2 – Wheel Bearing	P-M, P-L	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)	P-M	150-170 SUS @ 100 °F (37.8 °C)*
	Type II for Reciprocating Type Refrig. Compressors (Freon-12, CH ₃ Cl, NH ₃)	P-M	285-320 SUS @ 100 °F (37.8 °C)*
	Type III for Special Application such as Two Stage Rotary Type Compressors	P-H	105-125 SUS @ 210 °F (98.9 °C)
VV-P-236	Petrolatum	P-H	
VV-D-1078	Damping Fluid, Silicone Base (Dimethylpolysiloxane)	Silicone	

* Typical

Table 3 - Aerospace material specifications fluid classifications

Specification	Title	Classification	Characteristics of Base Fluid
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

Table 4 - Aerospace specifications fluid classifications

Specification	Title	Classification	Characteristics of Base Fluid
AS1241	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft AS1241 Type IV, Class 1 and Type V AS1241 Type IV, Class 2	E-PLD E-PHD	
AS5780	Core Requirement Specification for Aircraft Gas Turbine Engine Lubricants,	E-TS	
AS8660	Silicone Compound NATO Code Number S-736	Silicone	

Table 5 - ASTM specifications fluid classifications

Specification	Title	Classification	Characteristics of Base Fluid
D471	IRM 901 IRM 902 IRM 903 Reference Fuel A Reference Fuel B Reference Fuel C	P-M P-L P-L F-A F-B F-B	255° Aniline point 199° Aniline point 158° Aniline point 30% Aromatic 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, P-M	12 cst @ 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	