



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) Grade 50 (SAE 50)	P-M P-H	10 cst @ 210 °F (98.9 °C) 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 Grade JP-5	F-B F-B	Aromatics Allowed 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