



imagination at work



SAE AS5780 Turbine Oil Specification

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Overview

Commercial Turbine Engine Lubricants

	Current	Next
Specifications	MIL-PRF-23699	SAE AS5780
Grades	STD, C/I, HTS	SPC, HPC
Viscosities	5 cSt	5 cSt
Performance Data	Insufficient	Coking, O-ring compatibility, high-temperature, long duration, etc.
Data quality	US NAVY	Independent lab verification
Change Control	US NAVY	Type Certificate Holder
Support	US NAVY	NAVY, FAA, EASA, OEMs, Oil Comps

Industry moves towards HPC, for high-temperature use, and low coking.

Executive Summary

SAE AS5780 specification

- FAA and EASA endorsement
- Wide range of test data on lubricants
- Two completely New Turbine Lubricants were approved in 2007
 - Reduced Coking
 - High Temperature Capability
- Type Certificate Holder responsibility

Engines stay on-wing for 20,000 flight hours or 6 years,
Those numbers will be going to 40,000 hours and 12 years.

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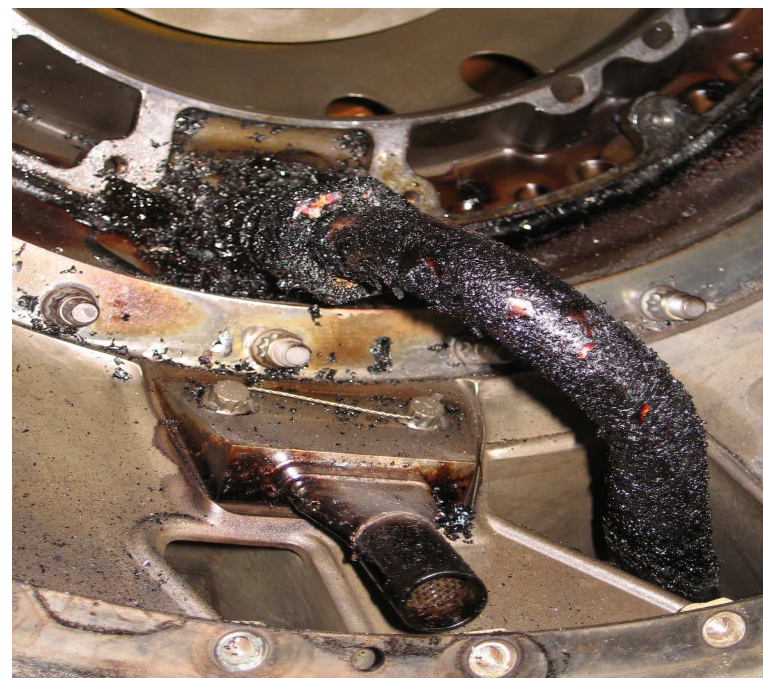
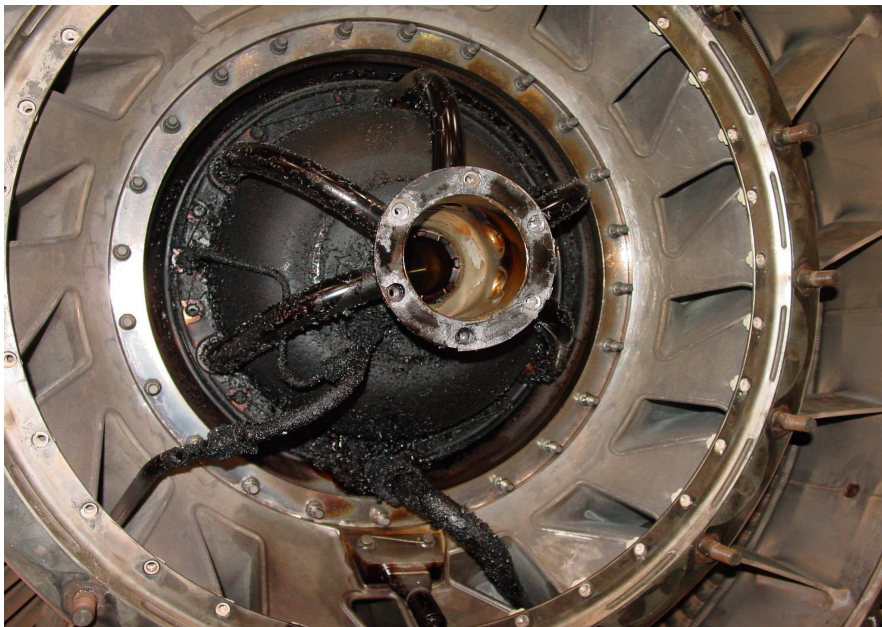
AS5780 specification – Background

- **Reasons for AS5780**

- Additional tests:
 - Several OEMs have additional test requirements over MIL-PRF-23699
 - Coking has caused IFSD and UER of RR engines
 - O-Ring deterioration with HTS lubricant use
 - Others: conductivity, specific heat, load carrying capability
- Quality.
- Traceability.
- Change control of existing products.
- US Navy resources directed to focus on DoD activities.

Only AS5780 meets FAA and EASA requirements

Coking

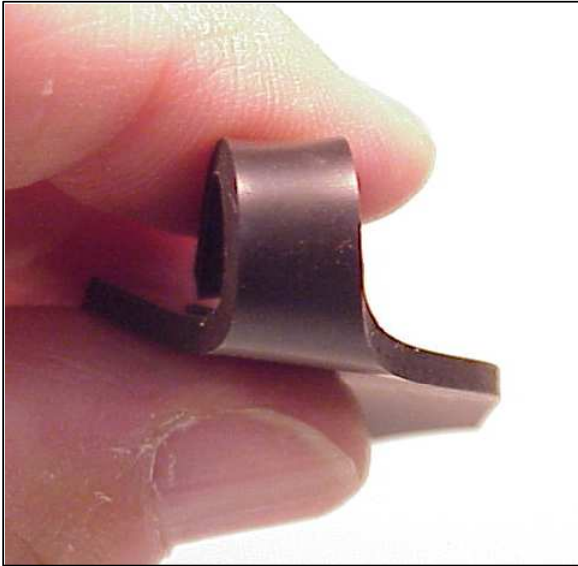


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Elastomer Compatibility

Air



Oil



Elastomers Tested:

Generic name	Example	Specification
Fluorocarbon (amine cure)	Viton A	AMS 7276
LCS Fluorocarbon (peroxide cure)	Viton GLT, GFLT	AMS 83485
Nitrile rubber		MIL-P-25732
(Fluoro) Silicone		
Perfluoroelastomer	Kalrez, Chemrez	AMS 7257
Fluorocarbon	AFLAS	AMS 7255



O-ring test

AS5780 specification – Background

- **FAA, EASA perspective:**
 - Lubricant is a Critical Part because all engines on one airplane may receive the same lubricant from the same batch/container.
 - Must have Quality Control of oil manufacturing process.
 - Must have Change Control of that process.
 - Must have Traceability of oil and oil components.
 - Type Certificate Holder is responsible for the turbine oil.

Type Certificate Holders for GE: CF34, CFM56, CF6, GEnx, GE90.
Analogy, Toyota: Corolla, Camry, Prius, Sienna, Tundra, Tacoma

Quality Control

- Specifications for components.
- Written procedures for processes, including equipment.
- Procedures for equipment maintenance and calibration.
- Personnel training procedures and requirements.
- Procedures for inspection.
- Procedures for disposition of “out-of-spec” materials.
- Procedures for identification, storage and handling.
- Procedures for shelf life.
- Procedures for Quality Audits.

Change Control

- No significant changes can be made to the product or manufacturing process without prior written approval.
- Suppliers of base stocks and additives must sign a document confirming their understanding of the above rule.
- Those documents must be kept on file and renewed from time to time.

No changes to be made without prior written approval.

Traceability

- A container of oil on the flight line must be traceable to a lubricant batch number.
- The lubricant batch number must be traceable to batch numbers of lubricant base oil and batch numbers of each of the components.
- The sales points of a lubricant batch number must be traceable.
- The sales points of lubricant batches containing a specific batch of base oil or additive must be traceable.
- The above information enables a quick determination to be made of which planes may be affected when suspicions are raised about a specific batch of lubricant, or base oil, or additive.

It is desirable to quickly minimize
the number of aircraft that may be affected.

Data for Traceability

an example

Process	Operator	Batch
1 Master Melt	A	
2 Blade Casting	B	1 2 3 4 5 6 7 8 9 10 11 12
3 Machining	C	1 2 3 4
4 Hole Drilling	D	2 3 4 5 6 7 8 9 10 11
5 Bond Coating	E	1 2 3 4 5 6 7 8 9 10
6 Top Coating	F	2 3 4
Suspect Part		3

Serial number, process, operator, machine, batch, day, are recorded for every step in the manufacturing process.

AS5780 specification – Status

- SAE AS5780 specification was issued October 2005.
- Oil companies participating:
 - BP, ExxonMobil, Shell, Anderol, Hatco, Nyco.
- OEM and User Groups participating:
 - Airbus, Boeing, British MoD, Honeywell, GE, Pratt & Whitney, Rolls-Royce, Snecma, US Navy.
- Initial Qualified Products List was issued in June, 2007.
- Seven lubricants have been approved.
- Change Notifications for two lubricants simultaneously approved.
- FAA approved QPG procedures.
- 2 New HPC oils were developed.

AS5780 QPL

	QPG	Specification/ Standard (Mouse over for description)	Product Code	Manufacturer's Name	Manufacturer's Designation	Test or Qualification Reference	City	State	Country	Original Listing Date	Expiration Date	QRN	Type of Part
1	Propulsion Lubricants	PRI-QPL- AS5780	BPTO 2197	Air BP Lubricants	BPTO 2197	PRI Approval Ltr #0201 dtd 25JUN07	Parsippany	New Jersey	United States	10-01- 2006	10-01-2008	BP02-1-1, BP02-2-1	HPC
2	Propulsion Lubricants	PRI-QPL- AS5780	BPTO 2380	Air BP Lubricants	BPTO 2380	PRI Approval Ltr #0202 dtd 25JUN07	Parsippany	New Jersey	United States	10-01- 2006	10-01-2008	BP01-1-1, BP01-2-1, BP01-3-1, BP01-4-1, BP01-5-1, BP01-6-1	SPC
3	Propulsion Lubricants	PRI-QPL- AS5780	MJO 254	ExxonMobil Lubricants & Petroleum Spec	MJO 254	PRI Approval Letter #0212 Dated August 27, 2007	Swedesboro	New Jersey	United States	04-01- 2007	04-01-2009	EM02-1-1	HPC
4	Propulsion Lubricants	PRI-QPL- AS5780	MJO 387	ExxonMobil Lubricants & Petroleum Spec	MJO 387	PRI Approval Ltr #226 Dtd 11/16/07	Swedesboro	New Jersey	United States	11-05- 2007	09-01-2012	EM03-1-1	HPC
5	Propulsion Lubricants	PRI-QPL- AS5780	MJO II	ExxonMobil Lubricants & Petroleum Spec	MJO II	PRI Approval Letter #0211 Dated August 27, 2007	Swedesboro	New Jersey	United States	10-01- 2006	10-01-2008	EM01-1-1	SPC
6	Propulsion Lubricants	PRI-QPL- AS5780	ASTO560	Shell Aviation Limited	ASTO560	PRI Approval Ltr #0244 dtd 23- JAN-08	London		United Kingdom	01-23- 2008	10-01-2008	SA02-1-1	SPC
7	Propulsion Lubricants	PRI-QPL- AS5780	AeroShell Ascender	Shell Aviation Limited	AeroShell Ascender	PRI Approval Letter #0214 Dated September 5, 2007	London		United Kingdom	09-05- 2007	09-05-2012	SA01-1-1	HPC

Organization

- SAE has a commercial arm called Performance Review Institute (PRI)
- PRI receives Applications with proprietary composition and performance information from oil companies for AS5780 inclusion
- Governing body is the Qualified Products Group (QPG)
- QPG Members / Member Companies have signed a PIA with PRI

Rep#	Org#	Organization	Representative	Position
1	1	Airbus	Williams, Alun	
2	2	Boeing	Parr, Mike	
3	2	Boeing	Ray, Jean	Chairman
4	3	British MoD	Tucker, Jerry	
5	4	General Electric	Bruce, Robert	Past Chair
6	5	Hamilton Sundstrand	Baker, Ken	
7	6	Honeywell	Fontana, Jim	Secretary
8	7	Pratt & Whitney	Spires, Larry	
9	8	Rolls Royce	Blackwell, Alan	
10	8	Rolls Royce	Bullock, Stuart	
11	8	Rolls Royce	Schwerin, Jennifer	
12	8	Rolls Royce	Shepherd, Tim	Vice Chair
13	9	Snecma	Gauthier, Gerard	
14	10	US Navy	Hille, Eric	
15	10	US Navy	McDonnell, Jim	
16	10	US Navy	Mearns, Doug	
17	10	US Navy	Meza, Oscar	

AS5780 – Future Developments

- Engines will continue to run hotter because of the fuel efficiency benefits.
- High temperature HPC oils will supersede standard oils.
- Turbine lubricant business is a relatively small business.
- A next generation of lubricant is probably not going to be backwards compatible, so the market will be very small and developing slowly.

Summary

- SAE AS5780 was issued.
- FAA and EASA endorse AS5780.
- Qualified Products List (QPL) issued.
- Additional data is available on all AS5780 lubricants.
- New High Performance Capability (HPC) lubricants were developed.

Specification: <http://www.sae.org>

QPL: <http://www.eauditnet.com>

Thank You!

Additional Tests

Requirements with limits

- Deposition Properties:
 - ERDCO Bearing
 - HLPS Dynamic Coking

Report Items

- Acid assay, Mole % FED-STD-791
- Viscosity @ 200C ASTM D341
- Viscosity Index ASTM D2270
- Pressure Viscosity coefficient Wedeven/rolling ball
- Density ASTM D4052
- Specific Heat ASTM D2766 or E1269

Not auto-ignition

Additional Tests (continued Report Items)

- Thermal Conductivity Holometrix
- Electrical Conductivity ASTM D2624
- Elastomer Compatibility 1800 hr Snecma
- Hydrolytic Stability Def Stan 05-50
- Vapor Phase Coking SAE ARP5921
- High temperature Deposit Alcor HTDT
- Severe Wear SAE AIR4978
- Mild Wear SAE AIR4978
- Thermal Aging 550 hrs Turbomeca
 - 150C and 180C: Anti-oxidant, Density, Viscosity, Acidity, Flash Point
- Thermal Aging 72 hours Turbomeca
 - 225C: Acidity, Flash Point
- Particulate Generation P&W