

China Civil Aviation Technical Standard Order

This China Civil Aviation Technical Standard Order (CTSO) is issued according to Part 37 of the China Civil Aviation Regulations (CCAR-37). Each CTSO is a criterion which the concerned aeronautical materials, parts or appliances used on civil aircraft must comply with when it is presented for airworthiness certification.

Civil Aviation Engine Lubricating Oil

1. Purpose

This China Civil Aviation Technical Standard Order (CTSO) is for manufacturers applying for civil aviation engine lubricating oil CTSO authorization (CTSOA). This CTSO prescribes the minimum performance standards that civil aviation engine lubricating oil must first meet for approval and identification with the applicable CTSO marking.

2. Applicability

This CTSO is applicable for new applications since CTSO goes into effect. Major design changes to the civil aviation engine lubricating oil (hereinafter referred to as aviation lubricating oil) approved under this CTSO shall require a new authorization in accordance with CCAR-21.

Aviation lubricating oil includes civil aviation turbine engine lubricating oils (hereinafter referred to as turbine lubricating oil) and civil aviation piston engine oils containing ashless dispersant additives (hereinafter referred to as piston lubricating oil).

3. Requirements

- 3.1 Turbine lubricating oil
 - a. Composition

Turbine lubricating oil shall be based on polyol ester base-stock chemistry, the viscosity grade shall be 5 centistoke. Organic compounds containing barium and titanium are prohibited. If a tricresyl phosphate (TCP) additive is used, the TCP additive shall contain less than 0.20% by weight in total of mono, di and tri-ortho cresyl isomers of TCP.

All chemical ingredients contained in piston lubricating oil marked by this CTSO must comply with all environmental, toxicological and safety requirements of national laws and regulations. Safety data sheet for chemical products or other appropriate documents shall be established.

- b. Performance
- (1) Type tests

Type tests include physical, chemical, stability, deposition, tribological properties tests as well as other additional tests shall be conducted according to the requirements of this CTSO, the test results shall meet the requirements of Annex 1.

(i) Physical properties: viscosity (-40°C, 40°C and 100°C), viscosity stability, pour point, open cup flash point, evaporation, foaming tendency and shear stability.

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(ii) Chemical properties: total acid number, sediment/ash, oil compatibility, elastomer compatibility and trace metals.

(iii) Stability properties: oxidation and corrosion stability(175°C, 204°C, 218°C), thermal stability and corrosivity.

(iv) Deposition properties: dynamic coking, high temperature bearing deposition, vapor phase coking.

(v) Tribological properties: high speed gear load carrying capability.

(vi) Additional tests: acid assay, viscosity-temperature curve (-55°C, -20°C, 0°C, 70°C, 150°C, 200°C and 250°C), viscosity index, pressureviscosity coefficient, density-temperature curve (-55°C, -20°C, 0°C, 15°C, 40°C, 70°C, 100°C, 150°C, 200°C and 250°C), heat capacity-temperature curve (-55°C, -20°C, 0°C, 15°C, 40°C, 100°C, 150°C, 200°C and 250°C), thermal conductivity-temperature curve (40°C, 100°C, 150°C, 200°C and 250°C), electrical conductivity, hydrolytic stability, oxidative stability, elastomer compatibility (1800h), high temperature tube deposition, ALTE mild wear, ALTE severe wear, thermal aging (150°C, 180°C and 225°C), particulate generation, WAM load carrying capability and elastomer compatibility (days to failure).

(2) Quality control tests

The quality control tests shall be conducted on each batch of turbine lubricating oil after type tests accomplished, including viscosity (-40°C and 40°C), pour point, open cup flash point, foaming tendency, total acid

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number, sediment/ash, trace metals, oxidation and corrosion stability(204°C), thermal stability and corrosivity, dynamic coking, vapor phase coking. The test results shall meet the requirements of Annex 2.

c. Testing laboratory

All tests shall be conducted in testing laboratories approved by CAAC or under the supervision of CAAC.

d. Deviations

For using alternate or equivalent means of compliance to the criteria in this CTSO, the applicant must show that the product maintains an equivalent level of safety. The applicant must apply for a deviation under the provision of section 21.368(-) in CCAR-21.

3.2 Piston lubricating oil

a. Composition

All chemical ingredients contained in piston lubricating oil marked by this CTSO must comply with all environmental, toxicological and safety requirements of national laws and regulations. Safety data sheet for chemical products or other appropriate documents shall be established.

b. Performance

(1) Type tests

Type tests include physical and chemical, storage stability, single cylinder and full-size engine test shall be conducted according to the requirements of this CTSO. The test results shall meet the requirements

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of Annex 3.

(i) Physical and chemical properties: viscosity (40°C and 100°C), viscosity index, open cup flash point, closed cup flash point, pour point, sulfur, low temperature pumping viscosity, low temperature cold crank simulator viscosity, high temperature high shear viscosity, acid number, density, specific gravity, ash content, trace sediment, copper strip corrosion, foaming tendency, oil compatibility, elastomer compatibility and trace metal content.

(ii) Storage stability: Fourteen-day storage test shall store the piston lubricating oil at $5\pm1^{\circ}$ C and $-18\pm1^{\circ}$ C by daily transferring from one cold box to another for fourteen days and then checked for additive separation, deposits and unevenness in fluid texture. Six-month storage test shall store the piston lubricating oil away from light at $25\pm3^{\circ}$ C for six months and then checked for flocculent, waxy or cloudy insolubles.

(iii) Single-cylinder engine test shall be conducted at least 40 hours in accordance with 3.8.1 of SAE J1899. A comparison of connecting rod bearing halves mass, viscosity and acid number, bearing halves and piston skirts (thrust and non-thrust) sides photos shall be reported.

(iv) Full-size engine test shall be conducted in accordance with SAE J1899 appendix B, including engine break in run, oil consumption run, pretest calibration run, 150-hour endurance test, post-test calibration run, sample analysis, engine disassembly and inspection. And the wear of

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crankshaft main journal, connecting rod journal, crankshaft main bearing, connecting rod bearing, piston pin, piston ring, intake and exhaust valve stem and other critical engine parts, carbonaceous deposits and coking degree on the oil wetted parts, changes of viscosity, total acid number and trace metal content of the oil shall be reported.

(2) Quality control tests

The quality control tests shall be conducted on each batch of piston lubricating oil after type tests accomplished, including viscosity (40°C and 100°C), viscosity index, open cup flash point, pour point, sulfur, low temperature cold crank simulator viscosity, acid number, density, specific gravity, ash content, trace sediment, copper strip corrosion, foaming tendency and trace metal content. The test results shall meet the requirements of Annex 4.

c. Testing laboratory

All tests shall be conducted in testing laboratories approved by CAAC or under the supervision of CAAC.

d. Deviations

For using alternative or equivalent means of compliance to the minimum performance standards requirement in this CTSO, the applicant must show that the product maintains an equivalent level of safety. Apply for a deviation under the provision of 21.368(-) in CCAR-21R4.

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4. Marking

a. The certificate of analysis and other applicable documents of aviation lubricating oil shall mark at least the following information.

(1) Brand and grade;

(2) CTSO and CTSOA number;

(3) Manufacturer designation and address;

(4) Manufacture date, quantity, batch number and expiry date;

b. Annex 3 and Annex 6 are examples of the certificate of analysis for turbine and piston lubricating oil respectively.

5. Documents requirements

The applicant shall submit the responsible documents as follows:

a. Documents for CTSOA application according to CCAR-21;

b. Description of feedstock;

c. Description of manufacturing process;

d. Safety data sheet for chemical products (SDS);

e. Other documents required by CAAC.

6. Application Note

After CTSOA authorization, the applicant shall obtain aircraft installation approval. If product standards have already listed in the type certificate data sheets (TCDS), supplemental type certificate (STC) or other design approval documents, the aviation lubricating oil is not essential for installation approval. 7. Referenced documents

a. GB standards are available from:

Standard Press of China, No.16, North Sanlihe Street, Fuxingmenwai,

Beijing. Tel: 010-68523946.

b. SH standards are available from:

China Petrochemical Press Co., Ltd., No. 58, Andingmenwai Street,

Dongcheng District, Beijing. Tel: 010-84271850.

c. ASTM standards are available from:

ASTM, 100 Barr Harbor Drive, West Conshohocken PA 19428-2959.

d. DEF STAN standards are available from:

Defence Procurement Agency, An Executive Agency of The

Ministry of Defence. UK Defence Standardization, Kentigern House, 65

Brown Street.

e. SAE standards are available from:

Society of Automotive Engineers, Inc. 400 Commonwealth Drive,

WARRENDALE, PA 15096-001, USA.

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Annex 1

Civil Aviation Turbine Engine Lubricating Oils Type Test Requirements

Property		Lin	nits	Toot Mothed	
Prope	rty	SPC	НРС	Test Method	
	Physic	cal Properties			
	100°C	4.9~	-5.4		
Viscosity, mm ² /s	40°C	≥2	3.0	GB/T 265 ASTM D445	
	-40°C	≤13	8000	ASTM D445	
Viscosity Stability, 721	n, -40°C, change%		6	GJB 1264.4 ASTM D2532	
Pour Point, °C		≤-	54	GB/T 3535 ASTM D97	
Open Cup Flash Point	, ℃	≥2	246	GB/T 3536 ASTM D92	
Evaporation, 6.5h, 2	04℃,wt change%	\leq	10	GB/T 7325 ASTM D972	
	24°C	≤2	5/0		
Foaming Tendency Aerated 5min,	93.5°C	≤25/0		GB/T 12579 ASTM D892	
Vol. after 1min	93.5°C/24°C	≤25/0			
Shear Stability ^a , 40°C	viscosity change%	$\leqslant 4$		NB/SH/T 0505 ASTM D2603	
	Chemi	ical Properties			
Total Acid Number, r	ng KOH/g	≤1.0		NB/SH/T 0946 SAE ARP5088	
	Sediment	Sedime	nt≤10		
Sediment/Ash, mg/L	Ash	Ash Sedime ash content sh	nt≤1.0	GJB 1264.5 FED-STD-791, Method3010	
	Dissolved Water	No dissol	ved water		
Oil Compatibility ^{b, c}	Sediment, mg/L	\$	10	GJB 562 FED-STD-791, Method3403	
	Turbidity	None		Def Stan 05-50(Part 61) Method 24	
Elastomer Compatibility, 72h, swell%	Fluorocarbon, 204°C	5-2	25	SH/T 0436 FED-STD-791, Method 3604	

	Fluorocarbon, 200°C	≤10/15	≤11/15		
	LCS Fluorocarbon, 200°C	≤10/20 ≤12/20			
Elastomer Compatibility,	Nitrile, 130°C	≤19.5/22 ≤19/19.5		SH/T 0436 Def Stan 05-50(Part	
24/120h, wt %	Silicone, 175°C	≤16.5/16.0	≤14.5/14.5	61) Method 22	
	Perfluoroelastomer 200°C	_	≤2/2		
	Al	\$	≦2		
	Fe	\$	≦2		
	Cr	\$	≦2		
	Ag	\$	≦1		
	Cu	\$	≦1		
	Sn	\$	≦4	GB/T 17476	
Trace Metals, mg/L	Mg	≤2		ASTM D5185	
	Ni	\$	≦2	ASTM D6595	
	Ti	\$	≦2		
	Si	≤10			
	Pb	≤2			
	Мо	≤3			
	Zn	≤2			
	Stabil	ity Properties			
	Viscosity Change, %	-5~15	0~10		
	TAN Change mgKOH/g	≤2.0	≤1.0	1	
Oxidation and	Sediment mg/100mL	≤50	≤25	GJB 563	
Corrosion Stability ^d 72h, 175℃	Metal Wt. Change mg/cm ² Steel	-0.2~0.2	-0.2~0.2	FED-STD-791, Method 5308 ASTM D4636 proc 2	
	Silver	-0.2~0.2	-0.2~0.2		
	Aluminum	-0.2~0.2 -0.2~0.2	-0.2~0.2 -0.2~0.2		
	Magnesium	-0.2~0.2 -0.4~0.4	-0.2~0.2 -0.4~0.4		
	Copper				

Oxidation and Corrosion Stability ^d -525 022.5 TAN Change mgKOH/g ≤ 3.0 ≤ 2.0 Sediment mg/100mL ≤ 50 ≤ 2.0 Metal Wt. Change mg/cm ² $-0.2-0.2$ $-0.2-0.2$ Steel $-0.2-0.2$ $-0.2-0.2$ Silver $-0.2-0.2$ $-0.2-0.2$ Aluminum $-0.2-0.2$ $-0.2-0.2$ Magnesium $-0.2-0.2$ $-0.2-0.2$ Copper $-0.4-0.4$ $-0.4-0.4$ Viscosity Change, % ≤ 120 ≤ 60 TAN Change mgKOH/g ≤ 15 ≤ 10 Sediment mg/100mL ≤ 50 ≤ 25 GJB 563 FED-STD-791, Method 5308 ASTM D4636 proc 2 Sediment mgKOH/g ≤ 15 ≤ 10 Sediment mg/00mL ≤ 50 ≤ 25 Metal Wt. Change mg/cm ² $Metal Wt. Changemg/cm2 Metal Wt. Changemg/cm2 Steel -0.2-0.2 -0.2-0.2 ASTM D4636 proc 2 Silver -0.2-0.2 -0.2-0.2 ASTM D4636 proc 2 Silver -0.2-0.2$	0~22.5		Viscosity		
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Oxidation and Corrosion StabilitydChange, % ≤ 120 ≤ 60 Oxidation and Corrosion StabilitydSediment mg/100mL ≤ 15 ≤ 10 Metal Wt. Change mg/cm2 ≤ 50 ≤ 25 GJB 563Metal Wt. Change mg/cm2 $mg/cm2$ $mg/cm2$ $Method 5308$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $ASTM D4636 \text{ proc } 2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$	-0.4~0.4	-0.4~0.4	Copper		
Oxidation and Corrosion StabilitydChange, % ≤ 120 ≤ 60 Oxidation and Corrosion StabilitydSediment mg/100mL ≤ 15 ≤ 10 Metal Wt. Change mg/cm2 ≤ 50 ≤ 25 GJB 563Metal Wt. Change mg/cm2 $mg/cm2$ $mg/cm2$ $Method 5308$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $ASTM D4636 \text{ proc } 2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$					
TAN Change mgKOH/g ≤ 15 ≤ 10 Oxidation and Corrosion StabilitydSediment mg/100mL ≤ 50 ≤ 25 GJB 563 FED-STD-791, Method 530872h, 218°CMetal Wt. Change mg/cm²-0.2~0.2-0.2~0.2-0.2~0.2Steel-0.2~0.2-0.2~0.2-0.2~0.2Silver-0.2~0.2-0.2~0.2-0.2~0.2Aluminum-0.2~0.2-0.2~0.2-0.2~0.2Titanium(2 pieces)-0.2~0.2-0.2~0.2-0.2~0.2	≤60	≤120	-		
Oxidation and Sediment ≤ 50 ≤ 25 GJB 563 Corrosion Stabilityd Metal Wt. Change FED-STD-791, Metal Wt. Change Metal Wt. Change Method 5308 mg/cm ² -0.2~0.2 -0.2~0.2 Silver -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2	<10				
Oxidation and Corrosion Stability ^d $mg/100mL$ ≤ 50 ≤ 25 $Garber 500$ Metal Wt. Change mg/cm ² Metal Wt. Change mg/cm ² Method 5308 ASTM D4636 proc 2 Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Aluminum $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$	≤10	≤15	mgKOH/g		
Corrosion Stability ^d Metal Wt. Change mg/cm ² FED-STD-791, Metal Wt. Change mg/cm ² Steel -0.2~0.2 -0.2~0.2 Silver -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2	< 25	< 50		Oridation and	
72h, 218°C Metal Wt. Change mg/cm ² Method 5308 Steel -0.2~0.2 -0.2~0.2 Silver -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2	<23	≤30	mg/100mL		
Steel -0.2~0.2 -0.2~0.2 ASTM D4636 proc 2 Silver -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2				-	
Silver -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2			-	72 n , 218 C	
Aluminum -0.2~0.2 -0.2~0.2 Titanium(2 pieces) -0.2~0.2 -0.2~0.2	-0.2~0.2	-0.2~0.2			
Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$	-0.2~0.2	-0.2~0.2			
0.2 0.2 0.2	-0.2~0.2	-0.2~0.2			
	-0.2~0.2	-0.2~0.2			
	·5.0	-5.0	Viscosity		
Change, % -5.0~5.0 GJB 1264.1				Thermal Stability	
and Corrosivity $TAN Change mgKOH/g \leq 6.0 FED-STD-791,$.0	\leq		and Corrosivity	
96h, 274°C Metal Wt. Change Method 3411				96h, 274℃	
mg/cm ² -4.0~4.0	4.0	-4.0			
Deposition Properties		tion Properties	Deposi		
Dynamic Coking, 20h ≤ 4.0 ≤ 0.4 GJB 1263A Annex C	≤0.4	≪4.0	20h	Dynamic Coking,	
	≤0.6		40h	375℃, Deposit, mg	
Deposit Rating ≤ 80 ≤ 40	≪40	≪80	Deposit Rating		
Filter Deposits, g ≤ 3.0 ≤ 1.5	≤1.5	≤3.0	Filter Deposits, g		
High TemperatureOil Consumption,FED-STD-791,Method 3410	<4000	<2000	Oil Consumption,	High Temperature Bearing Deposit ^e	
Bearing Deposit ^e mL ≤2000 ≤4000 Method 3410 or Alternative Method	~+000	~2000	mL		
40°C Viscosity % -5~30 0~35	0~35	-5~30	40℃ Viscosity %		
TAN, mgKOH/g ≤ 2.0 ≤ 2.0		≤2.0	TAN, mgKOH/g		
Vapor Phase Coking ^f , 371 °C , Tube GJB 1263A Annex D	≤2.0				
Deposit, mgReportSAE ARP5921			Vapor Phase Coking ^f , 371 $^{\circ}$ C , Tube		

Tribological Properties					
High Speed Gear Load Carrying Capability ^g , 74°C Add		Comparative analysis with similar commercial oils itional Tests	FED-STD-791, Method 6508 or Alternative Method		
	Add	itional Tests			
Acid Assay, mole%		Report	GJB 1264.2 FED-STD-791, Method 3500		
	-55°C				
	-20°C				
	0°C				
Viscosity- Temperature Curve	70°C	Report	GB/T 265 ASTM D445		
	150°C				
	200°C				
	250°C				
Viscosity Index	RoomTemp.~175°C	Report	GB/T 1995 ASTM D2270		
	40°C				
	70°C				
Pressure-Viscosity Coefficient	100°C	Report	SAE ARP6157		
Coefficient	130°C				
	150°C				
	-55°C				
	-20°C				
	0°C				
	15°C				
Density-	40°C		GB/T 1884		
Temperature Curve, kg/m ³	70°C	Report	ASTM D4052		
	100°C				
	150°C				
	200°C				
	250°C				
Heat Capacity-	-55°C		NB/SH/T 0632		
Temperature Curve	-20°C	Report	ASTM E1269		

J/kg·°C	0°C				
	15°C				
	40°C				
	100°C				
	150°C				
	200°C				
	250°C				
	40°C				
Thermal	100°C				
Conductivity-	150°C	Re	port	ASTM D2717	
Temperature Curve, W/m·K	200°C				
	250°C				
Electrical	20°C				
Conductivity,	80°C	Report		ASTM D2624	
μ S/cm				Def Stan 05-50(Part	
Hydrolytic Stability	90°C	Report		61) Method 6	
Oxidative Stability					
	E Temp. °C	≥185	≥190	_	
Terrer	A Temp.°C	≥190	≥190		
Temperature Parameters, 192h	V Temp.°C	≥185	≥190		
	B Temp.℃	≥190	≥205		
	Z Temp.°C	≥190	≥210		
	Volat. Loss, h	≥ 90			
Effective Life, 200℃	Acidity loss, h	≥100		Def Stan 05-50(Part 61) Method 9	
Effective Effec, 200 C	Viscosity loss, h	≥60			
	Insolu. Increase. ,h	≥225			
	Volat. Loss, h	≥3	≥4.9		
Effective Life, 250°C	Acidity loss, h	≥0.5	≥1.4		
	Viscosity loss, h	≥1.0	≥1.9		
	Insolu. Increase. ,h	≥20 ≥22			
Elastomer	100°C	≤20	≤20	SU/T 0426	
Compatibility ^h	120°C	≤20	≤20	SH/T 0436 Safran Method	
1800h, swell %	140°C	No	No		

	shrinkage	shrinkage	
160°C	No shrinkage	No shrinkage	
Tube Deposit, mg			
Tube Deposit Rating			
Viscosity	Rej	port	SAE ARP8462
2			
KOH/g			
Filter Deposits, mg			
g Ball load, mm	Rej	port	
ALTE Severe Wear, Ball load, 1.5mm WSD, kg		port	SAE ARP6255
150°C	Report	≥50	
180°C	Report	≥15	
150°C	Report	≤0.5	
180°C	Report	≤1.0	
150°C	≤10	≤5	
180°C	≤25	≤15	SAE ARP6299
150°C	≪8	≪4	
180°C	≤15	≤10	
150°C	$\leqslant 8$	≤2	
180°C	≤15	≤5	
150°C	≤70	≤25	
180°C	≤85	≤50	
Acidity Change mgKOH/g		≤20	SAE ARP6299
Flash Point Change, °C		≤100	5112711(1027)
Particulate Generation (862kPa, 329.5°C,		120	SAE ARP6223
18h), mg WAM Load Carrying Capability, Load			
, <u></u>	Report		SAE ARP6156
Fluorocarbon 200°C	Rej	port	SH/T 0436
	Tube Deposit, mg Tube Deposit, mg Rating Viscosity Change% TAN Increase, mg KOH/g Filter Deposits, mg g Ball load, mm Ball load, 1.5mm Jabe Deposits, mg Jabe Deposit, mg <t< th=""><th>160°C No shrinkage Tube Deposit, mg Prive Deposit Rating Tube Deposit Rating Prive Deposit Report Tube Deposity Change% Prive Deposits, mg TAN Increase, mg KOH/g Report Ball load, nm Report Ball load, 1.5mm Report 150°C Report 180°C Seport 180°C Seport 180°C Seport 180°C Seport 180°C Set 180°C Set 180°C Set 180°C Set Set Set 180°C Set Set Set</th><th>InterpretationNo shrinkageNo shrinkage160°CNo shrinkageNo shrinkageTube Deposit, Rating$Restring = 1000$Viscosity Change%$Restring = 1000$TAN Increase, mg KOH/g$Restring = 1000$Filter Deposits, mg$Restring = 1000$gBall load, mm$Restring = 10000$Ball load, 1.5mm$Restring = 100000000000000000000000000000000000$</br></th></t<>	160°C No shrinkage Tube Deposit, mg Prive Deposit Rating Tube Deposit Rating Prive Deposit Report Tube Deposity Change% Prive Deposits, mg TAN Increase, mg KOH/g Report Ball load, nm Report Ball load, 1.5mm Report 150°C Report 180°C Seport 180°C Seport 180°C Seport 180°C Seport 180°C Set 180°C Set 180°C Set 180°C Set Set Set 180°C Set Set Set	InterpretationNo shrinkageNo shrinkage160°CNo shrinkageNo shrinkageTube Deposit, Rating $Restring = 1000$ Viscosity Change% $Restring = 1000$ TAN Increase, mg

Embrittlement, Days to Failure	LCS Fluorocarbon 200°C	Report	Def Stan 05-50(Part 61) Method 22			
	Nitrile, 130°C	Report				
	Silicone, 175°C	Report				
	Perfluoroelastomer 200°C	Report				
Other Requirements						

^a When test according to NB/SH/T 0505 and ASTM D2603, shall calibrate the instrument to achieve $11.5\% \pm 0.5\%$ viscosity loss to a 30 mL sample of ASTM Reference Fluid A when irradiated for 5

minutes. Using the same power setting, irradiate a 30 mL sample of the turbine lubricant for 30 minutes;

^b When test according to GJB 562 and FED-STD-791 Method 3403, upon completion of the 168 hour oven period, the test flasks shall be stored in the dark at room temperature 24 °C \pm 5 °C (75 °F \pm 10 °F) for 21 days before visual inspection for turbidity;

^c The reference oil shall be selected among the oils already be approved to use in civil aviation markets;

^d When test according to GJB 563, FED-STD-791 Method 5308 and ASTM D4636 proc 2, the test time, temperature and test metal square shall conform to the requirements of this table, and the condenser water temperature shall be maintained at $18^{\circ}C \pm 2.5^{\circ}C$;

^e Test duration is 100 hours for SPC oils and 200 hours for HPC oils;

^f Except for tube deposit determination, the 40°C viscosity change% and TAN change between before and after test shall be also reported;

^h The term, "no shrinkage", shall be taken as meaning no reduction in the % swell of the test pieces as the test progresses;

ⁱ Tests are terminated at 504 hours for SPC oils and 672 hours for HPC oils and each of the degradation parameters determined. Each of the degradation parameters shall also be determined and reported after test durations of 168 and 336 hours for a 504 hour test, and 168, 336, and 504 hours for a 672 hour test by sub-sampling during the test from the reaction vessel in accordance with the method.

Civil Aviation Turbine Engine Lubricating Oils Quality Control Test

Prope	rty	SPC	НРС	Test Method	
Viscosity, mm ² /s	40°C	≥2	23.0	GB/T 265	
· 15005109, 11111 /5	-40°C	≤1	3000	ASTM D445	
Pour Point, °C		≤	-54	GB/T 3535 ASTM D97	
Open Cup Flash Point	,°C	≥	246	GB/T 3536 ASTM D92	
Evaporation, 6.5h, 204	°C, wt change%	<	10	GB/T 7325 ASTM D972	
Fooming Tondonor	24°C		25/0		
Foaming Tendency Aerated 5min,	93.5°C		25/0	GB/T 12579 ASTM D892	
Vol. after 1min	93.5°C/24°C		25/0		
Total Acid Number, m	g KOH/g	≤1.0		NB/SH/T 0946 SAE ARP5088	
	Sediment	Sedim	ent≤10		
Sediment/Ash, mg/L	Ash	Sedime	n≤1 ent≤1.0 hall be waived	GJB 1264.5 FED-STD-791, Method3010	
	Dissolved Water	No dissolved water			
	Al	\$	≦2		
	Fe	\$	≦2		
	Cr	<	≦2		
	Ag	Ę	≦1	GB/T 17476	
Trace Metals, mg/L	Cu	<	≦1	ASTM D5185	
	Sn	≪4		ASTM D6595	
	Mg	≤2			
	Ni	<	≦2		
	Ti	≤2			

Requirements

	Si	\leq	10		
	Pb	\$	§ 2		
	Мо	Ś	€3		
	Zn	≤2			
	Viscosity Change, %	-5~25	0~22.5		
	TAN Change mgKOH/g	≤3.0	≤2.0		
Oxidation and	Sediment mg/100mL	≤50 ≤25		GJB 563 FED-STD-791,	
Corrosion Stability ^a 72h, 204°C	Metal Wt. Change mg/cm ² Steel	-0.2~0.2	-0.2~0.2	Method 5308 ASTM D4636 proc 2	
	Silver	-0.2~0.2	-0.2~0.2		
	Aluminum	-0.2~0.2	-0.2~0.2		
	Magnesium	-0.2~0.2 -0.4~0.4	-0.2~0.2 -0.4~0.4		
	Copper Viscosity Change, %	-5.0~5.0		CID 12(4.1	
Thermal Stability and Corrosivity	TAN Change mgKOH/g	\leq	6.0	GJB 1264.1 FED-STD-791,	
96h, 274°C	Metal Wt. Change mg/cm ²	-4.0	~4.0	Method 3411	
Dynamic Coking,	20h	≪4.0	≪0.4	GJB 1263A Annex C	
375℃, Deposit, mg	40h		≤0.6	SAE ARP5996	
Vapor Phase Coking ^b , 371°C, Tube Deposit, n	ng	Report		GJB 1263A Annex D SAE ARP5921	

^a When test according to GJB 563, FED-STD-791 Method 5308 and ASTM D4636 proc 2, the test time, temperature and test metal square shall conform to the requirements of this table, and the condenser water temperature shall be maintained at $18^{\circ}C \pm 2.5^{\circ}C$;

b. Except for tube deposit determination, the 40°C viscosity change% and TAN change between before and after test shall be also reported.

Civil Aviation Turbine Engine Lubricating Oil Certificate of Analysis

)			
Brand: CTOSA number: Manufacturer designa Product quantity: Manufacture date:	Grade: CTSO: CTSO-2C704 Manufacturer address: Batch number: Expiry date:					
D		Liı	nits			
Property		SPC	HPC	Results	Test Method	
Viscosity, mm²/s	40°C	\geq	23.0		GB/T 265	
viscosity, iiiii /s	-40°C	≤1	3000		ASTM D445	
Pour Point, °C		\$	-54		GB/T 3535 ASTM D97	
Open Cup Flash Point	, °C	≥	246		GB/T 3536 ASTM D92	
Evaporation, 6.5h, 204°C, wt change%		≤10			GB/T 7325 ASTM D972	
Factoria Tandanan	24°C	≤25/0				
Foaming Tendency Aerated 5min,	93.5℃	≤25/0			GB/T 12579 ASTM D892	
Vol. after 1min	93.5°C/24°C	≤25/0				
Total Acid Number, m	ng KOH/g	≤1.0			NB/SH/T 0946 SAE ARP5088	
	Sediment	Sedimo	ent≤10			
Sediment/Ash, mg/L	Ash	Ash≤1 Sediment≤1.0 ash content shall be waived			GJB 1264.5 FED-STD-791, Method3010	
	Dissolved Water	No dissol	lved water			
	Al	\$	≦2			
Trace Metals, mg/L	Fe	\$	≦2		GB/T 17476	
	Cr	\$	≦2		ASTM D5185	
	Ag	\$	≦1		ASTM D6595	
	Cu		≦1			

(Example)

		1		-	,
	Sn	Ś	<u></u>		
	Mg		2		
	Ni	≤2			
	Ti	\$	<u></u>		
	Si	\leq	10		
	Pb	\$	\$2		
	Мо	\$	3		
	Zn	\$	2		
	Viscosity Change, %	-5~25	0~22.5		
	TAN Change mgKOH/g	≤3.0	≤2.0		
Oxidation and	Sediment mg/100mL	≤50	≤25		GJB 563 FED-STD-791, Method 5308 ASTM D4636 proc 2
Corrosion Stabilityª 72h, 204℃	Metal Wt. Change mg/cm ² Steel	-0.2~0.2	-0.2~0.2		
	Silver	-0.2~0.2	-0.2~0.2		
	Aluminum	-0.2~0.2 -0.2~0.2	-0.2~0.2 -0.2~0.2		
	Magnesium Copper	-0.4~0.4	-0.4~0.4		
	Viscosity Change, %	-5.0~5.0			
Thermal Stability and Corrosivity	TAN Change mgKOH/g	TAN Change <60			GJB 1264.1 FED-STD-791,
96h, 274℃	Metal Wt. Change mg/cm ²	-4.0~4.0			Method 3411
Dynamic Coking,	20h	≤4.0	≤0.4		GJB 1263A Annex
375℃, Deposit, mg	40h		≤0.6		C SAE ARP5996
Vapor Phase Coking ^b , 371℃, Tube Deposit, mg		Report			GJB 1263A Annex D SAE ARP5921
Conclusion:	Tested by:			Approved	by:
Reviewed by:					

Civil Aviation Piston Engine Oils Containing Ashless Dispersant Additives

Ducas	A	Multigrade		Viscosi	ty Grade		Tort Mathad	
Proper	ty	Oil	30	40	50	60	Test Method	
	100℃	a	9.3~12.5	12.5~16.3	16.3~21.9	21.9~26.1	GB/T 265	
Viscosity, mm ² /s	40°C	Report	Report	Report	Report	Report	ASTM D445	
Viscosity Index		≥100	≥100	≥100	≥95	≥95	GB/T 1995 GB/T 2541 ASTM D2270	
Open Cup Flash Poir	nt, °C	≥220	≥220	≥225	≥243	≥243	GB/T 3536 ASTM D92	
Closed Cup Flash Po	int, °C	Report	Report	Report	Report	Report	GB/T 261 ASTM D93	
Pour Point, °C			≤-24	≤-22	≪-18	≤-18	GB/T 3535 ASTM D97 ASTM D5949 ASTM D5950 ASTM D5985	
Sulfur, wt%		≪0.6	≤0.6	≪0.8	≤1.0	≤1.2	GB/T 17476 SH/T 0689 ASTM D129 ASTM D1552 ASTM D2622 ASTM D4951 ASTM D5185	
Low Temperature Pu Viscosity, mPa•s	Low Temperature Pumping Viscosity, mPa•s			_	_	_	GB/T 9171 ASTM D4684	
Low Temperature Co Simulator Viscosity,		a	_				GB/T 6538 ASTM D5293	
High Temperature H Viscosity, 150°C, mPa	-	a 2.9 3.7 3.7 3.7		3.7	SH/T 0618 ASTM D4683 ASTM D4741 ASTM D5481			
Acid Number ^{b,} mgK	OH/g			≤1.0			GB/T 7304 ASTM D664	
Density, 15°C, g/mL		Report			SH/T 0604 ASTM D4052 SH/T 0604 ASTM D1298			
		Report			ASTM D4052 GB/T 508			
Ash Content, wt%		≤0.011			ASTM D482			
Trace Sediment, mL/	/100mL	≤0.005			ASTM D2273			
Copper Strip Corrosion ^e , 3h	100℃ 204℃	≤1 ≤3			GB/T 5096 ASTM D 130			
Foaming Tendency	24°C			≤50/0			GB/T 12579 ASTM D 892	
Aerated 5min,	93.5℃			≤50/0			AS I WI D 892	

Type Test Requirements

V.1 . 6 10			
Vol. after 10min,	93.5℃/24℃	\leqslant 50/0	
mL			GJB 562
Oil Compatibility ^d		pass	ASTM D6922
	Nitrile, 70°C	-5~10	SH/T 0436 FED-STD- 791, Method 3604
Elastomer	Fluoroelastomer 150℃	-5~5	
Compatibility ^e ,72h, swell%	Fluorosilicone 150℃	-5~5	
	Silicone 121 °C	0~20	
	Al	≤7	
	Fe	≤5	1
	Cr	≤5	
	Ag	≤2	
	Cu	≤3	
	Sn	≤10	GB/T 17476 ASTM D5185
Trace Metal	Mg	≤3	
Content, mg/L	Ni	≤3	
	Ti	≤2	
	Si	≤25	
	Pb	≤5	
	Мо	≤4	
	Zn	≤10	1
	Fourteen-day storage test -18°C and 5°C	No additive separation, deposits and flow unevenness	- SAE J1899 第4.5.1条
Storage Stability	Six-month storage test 25°C, away from light	No flocculent, waxy or cloudy insolubles	
Single-Cylinder		Mass loss of connecting rod bearing halves, viscosity (40°C and	SAE J1899
Engine Test	40h, 135°C	100°C) and acid number change before and after the test, photos of bearing halves and piston skirts (thrust and non-thrust) sides	第3.8.1条
	Engine break in		
Full Size Engine	Oil		SAE J1899 附录B
	consumption	No abnormal wear of crankshaft main journal, connecting rod	
	Pretest	journal, crankshaft main bearing, connecting rod bearing, piston	
	calibration	pin, piston ring, intake and exhaust valve stem and other critical	
Test	150-hour	engine parts, and no abnormal phenomenon of carbonaceous	
	endurance test	deposits and coking degree on the oil wetted parts, and changes of	
	post-test	viscosity, TAN and trace metal content of the oil.	
	calibration run		
Note:	1		l

 $^{\rm a}$ Oil shall meet the viscosity requirements of GB/T 14906 or SAE J 300 for the designated grade;

^b Titrate to a pH 11 end point;

^c Test temperature shall satisfy the requirements of this table when use GB/T 5096 or ASTM D130;

^d The reference oil shall be selected among the oils already be approved to use in civil aviation markets;

^e Test procedures shall be conducted according to SH/T 0436, FED-STD-791 Method3604, and the test temperature shall conform to the requirements of this table.

Civil Aviation Piston Engine Oils Containing Ashless Dispersant Additives

Property		Multigrade	Viscosity Grade				Test	
		Oil	30	40	50	60	Method	
	100°C	a	9.3~12.5	12.5~16.3	16.3~21.9	21.9~26.1	GB/T 265 ASTM D445	
Viscosity, mm ² /s	40°C	Report	Report	Report	Report	Report		
Viscosity Index	Viscosity Index		≥100	≥100	≥95	≥95	GB/T 1995 GB/T 2541 ASTM D2270	
Open Cup Flash Poin	nt, °C	≥220	≥220	≥225	≥243	≥243	GB/T 3536 ASTM D92	
Pour Point, °C		_	≤-24	≤-22	≤-18	≤-18	GB/T 3535 ASTM D97 ASTM D5949 ASTM D5950 ASTM D5985	
Sulfur, wt%		≤0.6	≪0.6	≤0.8	≤1.0	≤1.2	GB/T 17476 SH/T 0689 ASTM D129 ASTM D1552 ASTM D2622 ASTM D4951 ASTM D5185	
Low Temperature Cold Crank Simulator Viscosity, mPa•s		a					GB/T 6538 ASTM D5293	
Acid Number ^{b,} mgKOH/g		≤1.0					GB/T 7304 ASTM D664	
Density, 15°C, g/mL			SH/T 0604 ASTM D4052					
Specific Gravity, 60°F , °API			SH/T 0604 ASTM D1298 ASTM D4052					
Ash Content, wt%			GB/T 508 ASTM D482					
Trace Sediment, mL	Trace Sediment, mL/100mL		≤0.005					
Copper Strip	100℃			≤1			GB/T 5096 ASTM D 130	
Corrosion ^c , 3h	204°℃			≤3				
Foaming Tendency	24°C			≤50/0			GB/T 12579 ASTM D 892	
Aerated 5min,	93.5℃			≤50/0				
Vol. after 10min, mL	93.5℃/24℃			≤50/0				
	Al			≤7				
	Fe	<5 <5						
Trace Metal	Cr							
Content, mg/L	Ag			≤2			GB/T 17476 ASTM D5185	
Contenty Ing/L	Cu			≤3				
	Sn			≤10				
	Mg			≤3				

Quality Control Test Requirements

Ni	≤3	
Ti	≤2	
Si	≤25	
РЬ	≤5	
Мо	≤4	
Zn	≤10	

^a Oil shall meet the viscosity requirements of GB/T 14906 or SAE J 300 for the designated grade;

^b The sulfur content shall be within $\pm 0.15\%$ mass of the qualification value;

^c Titrate to a pH 11 end point;

^d Test temperature shall satisfy the requirements of this table when use GB/T 5096 or ASTM D130.

Civil Aviation Piston Engine Oils Containing Ashless Dispersant Additives

				_						
Brand:				Grade:						
CTOSA number		CTSO:								
Manufacturer designation:				Manuf						
Product quantit		Batch 1								
Manufacture da	ite:			Expiry	date:					
P	roperty			Viscosi		Results	Mahad			
Multigrade oil			30 40 50 60			Results	Method			
X 7 *	100℃	а	9.3~12.5	12.5~16.3	16.3~21.9	21.9~26.1		GB/T 265		
Viscosity, mm ² /s	40°C	Report	Report	Report	Report	Report		ASTM D445		
Viscosity Index		≥100	≥100	≥100	≥95	≥95		GB/T 1995 GB/T 2541 ASTM D2270		
Open Cup Flash P	oint, °C	≥220	≥220	≥225	≥243	≥243		GB/T 3536 ASTM D92		
Pour Point, °C			≤-24	≤-22	≤-18	≤-18		GB/T 3535 ASTM D97 ASTM D5949 ASTM D5950 ASTM D5985		
Sulfur, wt%		≪0.6	≤0.6	≤0.8	≤1.0	≤1.2		GB/T 17476 SH/T 0689 ASTM D129 ASTM D1552 ASTM D2622 ASTM D4951 ASTM D5185		
Low Temperature Cold Crank Simulator Viscosity, mPa•s		а	_	_	_	_		GB/T 6538 ASTM D5293		
Acid Number ^{b,} mg	zKOH/g		1		GB/T 7304					
Density, 15°C, g/n				Report		ASTM D664 SH/T 0604 ASTM D4052				
Specific Gravity, 6			Report							
Ash Content, wt%				≪0.011		ASTM D4052 GB/T 508 ASTM D482				
Trace Sediment, mL/100mL			ASTM D2273							
Copper Strip	100℃			≤1				GB/T 5096		
Corrosion ^c , 3h	204°C			≤3				ASTM D 130		
Foaming Tendency	g Tendency 24°C			≤50/0						
Aerated 5min,	93.5℃			≤50/0				GB/T 12579		
Vol. after 10min, mL	93.5℃/24℃	≤50/0)/0			ASTM D 892		
Trace Metal	Al			≤7				GB/T 17476		

Certificate of Analysis (Example)

		Reviewed by:		
Conclusion:		Tested by:	Approved by:	
	Zn	≤10		
	Мо	≪4		
	Pb	≤5		
	Si	≤25		
	Ti	≤2		
	Ni	≤3		
	Mg	≤3		
	Sn	≤10		
	Cu	≪3		
	Ag	≤2		
	Cr	≤5		
Content, mg/L	Fe	≤5		ASTM D5185

(The English version is for reference only. In case of any discrepancy or ambiguity of meaning between this English translation and the Chinese version, the latter shall prevail.)