

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 | | |
|--|----------|-----------------|---|--|--|
| Oxidation and Corrosion Stability ⁴ TAN Change mgKOH/g ≤ 3.0 ≤ 2.0 GJB 563 FED-STD-791, Metal Wt. Change mg/cm ² 72h, 204°C Metal Wt. Change mg/cm ² -0.2~0.2 -0.2~0.2 -0.2~0.2 Steel -0.2~0.2 -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 -0.2~0.2 Magnesium -0.2~0.2 -0.2~0.2 -0.2~0.2 Magnesium -0.2~0.2 -0.2~0.2 -0.2~0.2 Magnesium -0.2~0.2 -0.2~0.2 -0.2~0.2 Copper -0.4~0.4 -0.4~0.4 -0.4~0.4 Viscosity ≤ 120 ≤ 60 GJB 563 FED-STD-791, Change, % ≤ 120 ≤ 60 GJB 563 FED-STD-791, Metal Wt. Change mg/C0H/g ≤ 15 ≤ 10 GJB 563 FED-STD-791, Metal Wt. Change mg/cm ² Steel -0.2~0.2 -0.2~0.2 GJB 563 FED-STD-791, Method 5308 ASTM D4636 proc 2 Steel -0.2~0.2 -0.2~0.2 GJC-0.2 GJC-0.2 Silver -0.2~0.2 -0.2~0.2 -0.2~0.2 GJC-0.2 | 2 22.2 | -5~25 | - | | |
| Oxidation and Corrosion Stability ^d 72h, 204°C $\frac{mgKOH/g}{Sediment}$ $mg/100mL \leq 50 \leq 25 GJB 563FED-STD-791,Method 5308 Metal Wt. Changemg/cm^2Steel -0.2~0.2 -0.2~0.2 -0.2~0.2 -0.2~0.2 Silver -0.2~0.2 -0.2~0.2 -0.2~0.2 -0.2~0.2 Aluminum -0.2~0.2 -0.2~0.2 -0.2~0.2 Magnesium -0.2~0.2 -0.2~0.2 -0.2~0.2 Copper -0.4~0.4 -0.4~0.4 -0.4~0.4 Viscosity \leq 120 \leq 60 GJB 563 TAN ChangemgKOH/g \leq 15 \leq 10 GJB 563 FED-STD-791,Method 5308 Sedimentmg/100mL \leq 50 \leq 25 GJB 563 FED-STD-791,Method 5308 Sedimentmg/00mL \leq 50 \leq 25 GJB 563 FED-STD-791,Method 5308 STM D4636 proc 2 Steel -0.2~0.2 -0.2~0.2 Steel -0.2~0.2 -0.2~0.2 -0.2~0.2 ASTM D4636 proc 2 Silver -0.2~0.2 -0.2~0.2 -0.2~0.2 -0.2~0.2 Silver $ | | | | | |
| Oxidation and Corrosion Stabilityd 72h, 204°C Sediment mg/100mL ≤ 50 ≤ 25 GJB 563 FED-STD-791, Method 5308 Metal Wt. Change mg/cm ² -0.2-0.2 -0.2-0.2 -0.2-0.2 -0.2-0.2 Steel -0.2-0.2 -0.2-0.2 -0.2-0.2 -0.2-0.2 Aluminum -0.2-0.2 -0.2-0.2 -0.2-0.2 Magnesium -0.2-0.2 -0.2-0.2 -0.2-0.2 Copper -0.4-0.4 -0.4~0.4 -0.4~0.4 Viscosity ≤ 120 ≤ 60 GJB 563 TAN Change mgKOH/g ≤ 15 ≤ 10 GJB 563 FED-STD-791, Method 5308 Sediment mg/100mL ≤ 50 ≤ 25 GJB 563 FED-STD-791, Method 5308 Setel -0.2-0.2 -0.2-0.2 GJB 563 FED-STD-791, Method 5308 Steel -0.2-0.2 -0.2-0.2 GJB 563 Steel -0.2-0.2 -0.2-0.2 Steel -0.2-0.2 -0.2-0.2 Steel -0.2-0.2 -0.2-0.2 -0.2-0.2 -0.2-0.2 -0.2-0.2 Steel -0.2-0.2 <t< th=""><td>≤2.0</td><td>≤3.0</td><td>e</td><td></td></t<> | ≤2.0 | ≤3.0 | e | | |
| Oxidation and Corrosion Stability ^d 72h, 204°C $mg/100mL$ $\leqslant 50$ $\leqslant 25$ $GJB 563$ FED-STD-791, Method 5308 Metal Wt. Change mg/cm ² Steel $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ $ASTM D4636 \text{ proc } 2$ Silver $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ $ASTM D4636 \text{ proc } 2$ Magnesium $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ Magnesium $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ Copper $-0.4-0.4$ $-0.4-0.4$ $-0.4-0.4$ Viscosity ≤ 120 ≤ 60 $GJB 563$ TAN Change $mgKOH/g$ ≤ 15 ≤ 10 Sediment $mg/100mL$ ≤ 50 ≤ 25 Metal Wt. Change mg/cm^2 $Steel$ $-0.2-0.2$ Silver $-0.2-0.2$ $-0.2-0.2$ $Stim D4636$ proc 2 Steel $-0.2-0.2$ $-0.2-0.2$ $Stim D4636$ proc 2 Silver $-0.2-0.2$ $-0.2-0.2$ $Stim D4636$ proc 2 Silver $-0.2-0.2$ $-0.2-0.2$ $-0.2-0.2$ | | | | | |
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| 72h, 204°C mg/cm^2 $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $ASTM D4636 \text{ proc } 2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $ASTM D4636 \text{ proc } 2$ Aluminum $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $ASTM D4636 \text{ proc } 2$ Magnesium $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Magnesium $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Copper $-0.4 \sim 0.4$ $-0.4 \sim 0.4$ $-0.4 \sim 0.4$ $-0.4 \sim 0.4$ Viscosity ≤ 120 ≤ 60 ≤ 60 $FED-STD-791$ Method 5308 Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $error 0.2 \sim 0.2$ Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $error 0.2 \sim 0.2$ $error 0.2 \sim 0.2$ Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $error 0.2 \sim 0.2$ $error 0.2 \sim 0.2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $error 0.2 \sim 0.2$ $error 0.2 \sim 0.2$ Aluminum $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ $error 0.2 \sim 0.2$ $error 0.2 \sim 0.2$ | | | | | |
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| 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 < 120 < 60 Change, % < 15 < 10 TAN Change < 50 < 25 Metal Wt. Change $mg/100mL$ < 50 Metal Wt. Change mg/cm^2 $-0.2-0.2$ Metal Wt. Change $-0.2-0.2$ $-0.2-0.2$ Steel $-0.2-0.2$ $-0.2-0.2$ Steel $-0.2-0.2$ $-0.2-0.2$ Silver $-0.2-0.2$ $-0.2-0.2$ Aluminum $-0.2-0.2$ $-0.2-0.2$ Titanium(2 pieces) $-0.2-0.2$ $-0.2-0.2$ | -0.2~0.2 | -0.2~0.2 | • | , | |
| Aluminum Magnesium Copper $-0.2 \sim 0.2$ $-0.4 \sim 0.4$ $-0.2 \sim 0.2$ $-0.4 \sim 0.4$ $-0.2 \sim 0.2$ $-0.4 \sim 0.4$ Viscosity Change, % ≤ 120 ≤ 60 TAN Change mgKOH/g ≤ 15 ≤ 10 Sediment mg/100mL ≤ 50 ≤ 25 Metal Wt. Change mg/cm2 $=0.2 \sim 0.2$ Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Aluminum $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ | -0.2~0.2 | -0.2~0.2 | Silver | | |
| Magnestum Copper $-0.4 \sim 0.4$ $-0.4 \sim 0.4$ Copper $-0.4 \sim 0.4$ $-0.4 \sim 0.4$ Viscosity Change, % ≤ 120 ≤ 60 TAN Change mgKOH/g ≤ 15 ≤ 10 Sediment mg/100mL ≤ 50 ≤ 25 Metal Wt. Change mg/cm2 ≤ 50 ≤ 25 Metal Wt. Change mg/cm2 $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Steel $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Silver $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ Aluminum Titanium(2 pieces) $-0.2 \sim 0.2$ $-0.2 \sim 0.2$ | -0.2~0.2 | -0.2~0.2 | Aluminum | | |
| Viscosity Change, % ≤ 120 ≤ 60 TAN Change mgKOH/g ≤ 15 ≤ 10 Sediment mg/100mL ≤ 50 ≤ 25 Metal Wt. Change mg/cm2 $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ Steel $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ Silver $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ Silver $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ Aluminum $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ Titanium(2 pieces) $= 0.2 \sim 0.2$ $= 0.2 \sim 0.2$ | -0.2~0.2 | -0.2~0.2 | Magnesium | | |
| 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.)