

FD.2873/46 Item 62
Bag 3996-1)

April 1945

Technical Specification for fuel F2BVM Test methods
edition 1940-5r
1942, and Nos.Technical Specification
Appearance and colourTL 147 - 281clear, free from un-
dissolved water and
solid impurities

7055	Density @ 15°C	0.820 - 0.860
7100 - 7113	Boiling Range:	
	I.B.P.	Between 40° and 70°C
	10% by vol. minimum F.B.P.	at 100°C below 360°C
7200 DIN 2 DVM 3763	Corrosion test	
	Copper Strip	negative
	Zinc Strip	4 mg. maximum
7150	Crystallisation commences	below -30°C
7225 - 7226	Lower heating value	9600 Kcal/kg. min.
7215 (1)	Phenol content	0.5 vol. % max.
7280 - 7281	Aromatic content	45 vol. % max.
8110	Conradson test	0.05 max.
	Water-soluble constituents	0
	Separation	no layer formation down to -30°C
	Miscibility with F1	must be miscible in any proportion with F1 over range -30 - +50
	Subsequent inspection	half-yearly

Special requirements: Pipes, barrels, tank-wagons and special containers coming in contact with F1 or F2 must be washed out before filling with any other aviation fuel so that mixture with them is avoided.

1) See Technical Instruction 2/45.

F.D. 2873/46

Item 63

3996 - 1a

SPECIFICATION FOR AVIATION FUELS B4 and C3.

Oberkommando der Luftwaffe.

TIR/M 2 III (A)

Sheet 22 issued November 1944 (1)

For Service use only.

No.	Method of Test as in BVM 40/42 Edn. Alterations as in technical information service of RLM-GL/A-M since Oct. '43.	Description of Test	
		B 4	C 3
	Technical Specification	TL 147 - 304 4	TL 147 - 330 4
	Appearance	Clear, free from undissolved water and acids. Must not contain solid impurities.	
	Colour	Blueish ⁽²⁾ corresponding to an 4.0-4.3 mg. Sudan Blue GN per litre of colourless fuel	Greenish addition of 0.5 mg. Sudan Blue GN and 0.5 mg. fluoroal
7070 - 7095	Octane Number	89 min. with 0.115 Vol. % T.E.L.	about 95
7230 & 7239	Single Cylinder Performance	In the region - 0.8 - 1.15 the curve must be above that of the comparison fuel.	
7055	Density at 15°C.	0.700 - 0.760	0.740 - 0.795
7106 - 7113	Boiling Range I.R.P. 10 Vol. % min. 35 " " 50 " " 90 " " 95 " " F.B.P.	not below 40°C. 75°C. 110°C. - 180°C. below 190°C.	not below 40°C. 80°C. - 120°C. 180°C. below 190°C.
7130 - 7138	Vapour Pressure	0.5 kg./cm ² max.	0.45 kg./cm ² max.
7150	Melting Point	- 50°C. max.	- 60°C. max.
7160	Evaporation Residue	10 mg./100 ml. max.	
7200	Corrosion Test	No grey or black spots or pitting in the copper strip test.	
7280 - 7282	Aromatic Content	35 Vol. % max.	45 Vol. % max.
7270 - 7271	T.E.L. Content	0.115 - 0.120 Vol. % ⁽³⁾	
7274	Ethylene Dibromide content	0.050-0.053 Vol. % ⁽⁴⁾	
7214	Inhibitor Content	-	0.01% by wt. ⁽⁵⁾
	Storage Stability	After 6 months' storage, examination should be carried out every 3 months.	

NOTES: (1) Sheet 22 renders invalid:

(a) Specifications for fuels B4 and C3 in sheet 1, issued May, '44, and sheet 2, issued April '44.

(b) Technical Regulations 8/44, 11/44 and 12/44.
These should be destroyed.

(2) When a mixed colour results on the addition of C3 to B4 a corresponding quantity of Sudan Blue GN (max. 2 mg./lt.) should be added.

(3) See also Techn. Regulation 3/44.

(4) " " " " 6/43.

(5) In special cases aviation fuel C3 delivered without inhibitor must not be held. However OKL Chef TLR/M 2 III should be informed.

Oberkommando der Luftwaffe
 Chef der Technischen Lufttrüstung
 Az. : 85 g. TLR/1-2 III (A)

FD.2873/46 Item 64
 (Ber. 3996-2)

Sheet 14 Issued Oct. 1944 (1)

Provisional specification for jet fuel J2 and
running-in fuel einlauf J2

Method of test	J2	Einlauf J2
EVL 1940/42 Ed.	VTL 147-286	
of Technical	2	
Information	Technical Specification	
Service No.	Appearance and colour	clear, free from undissolved water and acids, must not contain solid impurities
7055	Density @ 15°C. kg/lt.	0.800 min. 0.760 min.
7130-7138	Vapour pressure @ 37.8°C	0.2 kg/cm ² max. 0.5 kg/cm ² max.
	Viscosity @ +20°C	10 ³ min. 10 ³ min.
8070-3072	" 0°C	30 ³ max.
	" -20°C	80 ³ max.
8075	Pour Point (3)	below -25°C below 0°C
7190-7191	Sulphur content % wt.	1.5 max.
7214	Phenol content vol. %	1.0 max.
7280-7281	Aromatic content vol. %	45 max.
8110	Conradson-test % wt.	1.5 max.
8095	Ash content % wt.	0.5 max.
7225-7226	Lower Cal. value (2)	9000 K.Cal./Kg. min.
	Corrosion Test.	
7200	Copper Strip	negative
DIN 2 DV. 3763	Zinc Strip	4 mg. max.
(3)	Filtrability (2)	
	(Hammerich) at 400 mm.	120 secs. max. 120 sec. max.
	Vacuum	at -25°C at 0°C
	Re-examination	After a year

Storage

The fuels must be kept apart from one another and from other fuels (A5, B4, C3, E1) during storage. Admixture with the remains of other fuels and admixture of the latter with J2 in pipe-lines, barrels, etc. is strictly to be avoided.

- NOTES: (1) This sheet renders Sheet 14, March 1944 obsolete and the latter should be destroyed.
 (2) This is only to be carried out during acceptance tests.
 (3) See "Techn. Anord." 1/45 and 3.T.45.

FD2873,461t66

RLM
CL/A-M IIFD.2873/46 Item 65
(Bag 3996-2a)For Service Use Only
Sheet 2 issued April,
1944 (1)Specification for Aero Diesel Fuel K1

Method of Test	Description of Test	K1
BW 1940/42 Edn.	Technical Specification	TL 147-351 2
No.	Appearance	Clear, free from undissolved water and acids. Must not contain solid impurities
	Cetane Number	50 min.
7055	Density @ 20°C	0.810 min.
7100-7113 Water cooling	Boiling Range	I.B.P. about 160°C 95 vol. % min. at 350°C
8075	Pour point	-45°C max.
8670	Viscosity @ 20°C	1.10E min.
Pensky-Martens	Flash Point	above 50°C
8085	Acid Value	0.7 mg. KOH/g. max.
7190-7191	Sulphur content	1% by wt. max.
8095	Asn content	traces only
DIN " DVL 3763	Corrosion test	4 mg. max.
8110	Conradson test	0.1% by wt. max.
8105	Water content	traces only
	Storage Stability	After storage for 1 year, six-monthly tests are necessary

NOTES: (1) Sheet 2, April 1944 supersedes Sheet 2, May 1942.
Copies still in existence should be destroyed

Specification for aviation diesel fuel K1 and its constituents

August 1944

Test Methods and Nos.	Designation	Synthetic F-T		Mineral		Spindle Oil Distillate	Service Fuel K1
		Ruhrchemie DT 901	Other plants DT 902	DT 150	DT 151		
	Technical Specification	TL 147-391 1.	TL 147-392 1	TL 147-380 1	TL 147-381 1	TL 147-371 1	TL 147-351 1
	Appearance Composition	----- clear, free from undissolved water and acids, no solid impurity content -----					50% DT 150) 75% of 45% DT 901/902) this 5% Spindle oil) mixture and 25% DT 151
	Cetane No.	not under 70	not under 67	not under 40 *	not under 37	-	not under 50
7055	Density @ 20°C	" " 0.740	" " 0.740	" " 0.855	" " 0.875	not under 0.885	" " 0.810
7100-7115	Boiling range	about 160°C	about 160°C	about 200°C	about 240°C		about 160°C
	I.B.P.	not over 360	not over 350	not over 350	not over 350		not over 350
	95% by vol.	not over -38°C	not over -38°C	not over -60	not over -45	not over -10°C	not over -45°C
8075	Set Point	not under 1.05°C	not under 1.05°C	not under 1.30°C	not under 1.30°C	not under 12°C	not under 1.1°C
8070	Visc. @ 20°C	not under 37°C	not under 37°C	not under 55°C	not under 55°C		not under 50°C
Pensky-Martens	Flash point	not over 0.4 mg KOH/g.	not over 0.4 mg KOH/g.	not over 0.3 mg KOH/g.	not over 0.3 mg KOH/g.	not over 1.5 KOH/g.	not over 0.7 mg KOH/g.
8085	Neut. No.	(wt.%)	(wt.%)	not over 1.2	not over 1		not over 1
7190-7191	Sulphur cont.	no more than a trace					
8095	Ash content	not over 4 mg.					not over 4 mg.
DIN 2 DVM 3763	Corrosion test	not over 0.1 wt. %					not over 0.1 wt. %
8110	Conradson test	no more than a trace					
8105	Water cont.	can be stored together		separate storage necessary			not in galvanised drums
	Storage	test on first storing and when blending					After storing for one year test every 6 months
	Storage stability						

* If DT 150 supplied by Nova, Wien-Schwechat, cetane number of 37 is permitted.

Oberkommando der Luftwaffe
TLR/W 2 III (A)

FD.2873/46 Item 66
(Bag 3986-3)

Sheet 21, issued Nov. 1944
For Service use only.

Specification for aviation fuel A3

Method of Test as in BVM 40/48 Edn. and alterations as in technical infor- mation service of RLM-CL-A-2 ⁷ since Oct. '43 No.	Specification	TL 147-257 4
7070-7094	Appearance	Clear, free from undissolved water and acids, must contain no solid impurities
	Colour	Blueish, corresponding to 1.6-2.6 mg. of Sudan Blue CN per litre of colourless fuel at least 80 with 0.045 Vol% T.E.L.
7055	Octane Number	0.700 - 0.770
	Density @ 15°C	I.E.P. - not below 40°C 50% vol. point - about 100°C
7100 - 7113	Boiling Range	F.E.P. - below 190°C Distillation loss 2% Vol. max. Reaction of residue - trace of acidity only
7130-7138	Vapour pressure	0.5 kg.cm ² max.
7150	Freezing point	as determined by initial crystallisation point, must not be above -50°C.
7160	Evaporation residue	10 mg./100 ml. max.
7200	Corrosion test	no grey or black spots or pitting in the copper strip test (3 hrs. @ 50°C)
7200-7211	Methanol content	30 vol. % (13 vol. %)
7270-7271	T.E.L. content	0.045 vol.% min. (up to 0.120 permitted for use at the Front)
7280-7282	Aromatic content	35 vol. % max.

Storage and
Storage Stability

Containers of black plate or burnt lacquer treated.
No zinc treatment. Since the alcohol content is accompanied by a certain danger of separation of the fuel, it is essential to keep out water. The specified "water safety value" (see Taggt-KZ: I C qc. No. 4 Lfd. No. 342/44) is at least 0.7 vol. %. A mixture of B4 and C3 with A3 in storage tanks is in all cases prohibited. A monthly examination of A3 is necessary

NOTE: Earlier delivery specifications for A3 are hereby superseded.

FD 2873,46 It 67

FD.2873/40 Item 67
(Bag 3996-4)

Technical Instruction No. 12/44

Freezing Properties of A.3 and B.4

Notwithstanding existing Technical Instructions, the Freezing Point of fuels A.3 and B.4, determined according to BVM 7150, must not be higher than -50°C .

Abschrift ZG/Ap.
15.9.1944

FD.2873/46 Item 68 pt.
(Bag 3996-5 pt.)

Technical Delivery Specifications of the
Zentralburo fur Mineralol G.m.b.H.

Diesel Fuel

- | | |
|----------------------------------|--|
| 1. External Appearance | The fuel shall be free from undissolved water (not over 0.05%) and solid impurities. |
| 2. Specific gravity | not below 0.800 at 15°C.
not over 0.885 at 15°C. |
| 3. Ignition Quality (cetane no.) | as high as possible. |
| 4. Viscosity at 20°C | not below 1.1°C.
not over 2.6°C. |
| 5. Commencement of Wax Sepn. | |
| (a) Summer grade | not over +10°C. |
| (b) Winter grade | not over ± 0°C. |
| 6. Pour point | |
| (a) Summer grade | not over -10°C. |
| (b) Winter grade | not over -20°C. |
| 7. Filterability | |
| (a) Summer grade | 200 mls. in not over 60 sec. / -5°C. |
| (b) Winter grade | " " " " " " / -15°C. |
| 8. Flash point | not below 21°C. |
| 9. Distillation | at least 80% vol. up to 360°C. |
| 10. Acid value | not above 0.4 |
| 11. Zinc Corrosion | loss in weight not more than 4.0 mg. |
| 12. Sulphur content | not above 1.0% by weight |
| 13. Ash content | not above 0.05% by weight |
| 14. Carbon residue | not above 0.05% by weight
(Conradson test) |
| 15. Lower Calorific value | not below 9.700 cals./kg. |

The above figures apply insofar as no relaxation has been agreed upon with the individual works through the appropriate industrial association (Arbeitsgemeinschaft).

Technical Delivery Specifications of the
Zentralburo fur Mineralol G.m.b.H.Carburettor Fuels

1. General The fuel shall be clear and free from undissolved water and solid impurities
2. Colour Water White
3. Specific gravity not specified
4. Boiling range
 - (a) Summer grade

Up to 75°C.	including dist. losses not more than 25% by vol.*
" " 100°C.	" " " not below 30% " "
" " 200°C.	" " " " " 95% " "
 - (b) Winter grade

Up to 75°C.	including dist. losses not more than 40% by vol.*
" " 100°C.	" " " not below 30% " "
" " 200°C.	" " " " " 95% by vol.
5. Vapour pressure
 - (a) Summer grade Not more than 0.60 kg./per cm.²
 - (b) Winter grade Not more than 0.80 kg./per cm.²

From 1st Oct.-15th Nov. Not less than 0.6 kg./per cm.²
6. C₃ content The fuel shall be practically free from C₃ hydrocarbons (not over 0.1 % by wt.)
7. Evaporation residue Not more than 10 mg./100 ml. at 110°C.
8. Storage stability
(bomb test) Not more than 20 mg. gum/100 ml.
9. Acid value Not more than 2.0
10. Corrosion The fuel shall not attack copper
11. Sulphur content Not over 0.2% by weight.
12. Octane Number (Motor) As high as possible.

* For synthetic benzine; not above 45% by volume

These specifications hold in so far as no special concessions have been agreed upon by the individual works with the appropriate organisation (Arbeitsgemeinschaft).

RLM GL/A-M II

Specifications for carburettor and diesel fuels for delivery
to the services (Summer 1944)
(according to the OKH, Wa Prüf 6 (IVa), 15.3.44)

FD.2873/46 Item 69
(Bag 3996-6)
For Service Use Only
Sheet 5, issued April 1944

CARBURETTOR FUELS

Designation

"Fahrbenzin
Tel""Gemisch-Bc" "Gemisch-Bc"
Tel" (20% wt. (35% wt.
Benzole min.) Benzole min.)

Designation

General

The fuel must be clear, free from undissolved water and solid impurities and shall not attack copper.

General

Colour

red

Density @ 15°C

Density @ 15°C.

0.720 - 0.780

0.740 - 0.780

0.753-0.780(1)

Visc. @ 20°C (Vogel-Ossag)

Cetane No. (Motor)

72 (2)

72 (2)

72 (2)

Pour Point

Distillation:

up to 75°C. incl. loss 25% vol. max. 25% vol. max. 25% vol. max.

Filterability

" " 100°C.

30% " min.

38% " min.

45% " min.(3)

" " 200°C.

95% " "

95% " "

95% " "

Reid Vapour Pressure
at 40°C.0.20 - 0.60 kg./cm²

Flash Point (P.M.)

Evaporation Residue

not over 10 mg./100 mls. (220°C)

Acid Value

Cold Test

free from crystals down to -20°C. (4)

Zinc Corrosion

Calorific Value

7,500 cal./lt 7,650 cal./lt 7,700 cal./lt

Sulphur Content

Sulphur content

not over 0.2% by wt.

Lower Cal. Value

Lead Content

not over 0.04% Vol. T.E.L.

Ignition Quality

Water content

Ash content

Carbon Residue

Note:

- (1) Relaxed provisionally to 0.795.
- (2) Minimum O.N. 71.5
- (3) The distillation loss is included in all distillate figures.
- (4) A cloud point caused by dissolved water should be noted in the inspection report.
- (5) Temporary relaxation - not over 0.06% Vol. of T.E.L.
- (6) The present sheet supersedes that issued in May 1943, any copies of which still existent should be destroyed.

Distillation

Miscibility

Note:

- (1) This may be relaxed to 0.800.

DIESEL FUELS

Diesel Fuel

Special Diesel
Fuel 2

The diesel fuel must be free from solid impurities

0.810 (1) - 0.365

1.1 - 2.0°C

15.3-30.4 : not over -30°C

from 1.5 : " " -10°C.

15.3-30.4 : 200 ml. in not

over 60 sec./-25°C

from 1.5 : ditto /-5°C.

not below 55°C not below 21°C

not over 0.4

not over 4.0 mg. loss in weight

not over 1.0% by wt.

not below 9,900 cal./kg.

" " 45 Cetane No.

Not over 0.5% by wt.

" " 0.05% " "

not over 2.0% by wt. coke and

hard asphalt (Hagermann/

Hammerich) or not over 0.05%

by wt. in the Conradson Test

at least 80% by vol. up to

360°C.

all diesel fuels must be

miscible with each other.

(For Nov. '44 spec. of B4 see FD.2873/46 Item 63
" " " " " A3 " " " " " 66TECHNICAL DELIVERY SPECIFICATIONS FOR AVIATION FUELS A3 and B4
AND THEIR CONSTITUENTS

Test Method BVM 1940/42 Edn. and published modifications in RLM Technical Circulars since Oct. '43.	Designation Technical Delivery Specification Summary	BASIC GASOLINE										FRONT FUELS			
		VT 302	VT 100	VT 810	VT 811	VT 812	VT 702	VT 708	VT 705	VT 707	B4	A3			
		TL 147-150	TL 147-100	TL 147-154	TL 147-155	TL 147-162	TL 147-152	TL 147-158	TL 147-153	TL 147-157	TL 147-304	TL 147-257			
		1	3	2	1	1	3	3	2	2	3	3			
No.		Bituminous coal product.	Pure straight- run gasoline	German hydro gasoline without additive								The blending ratio of the components must be as given on sheet 4 of "Blending In- structions for the components of aviation fuels A3,B4,C3"			
	Colour	Water clear, free from undissolved water and acids, no extraneous solids										Clear, blue			
7070 - 7094	Octane No. unleaded " with 0.115 Vol.% TEL	min.	72 89	67 89 (with addn. of 10 vol.% VT 302)	70 89	70 89	70 89	70 89	72 89	72 89	min. 89 with 0.115 Vol.% T.E.L.	min. 80 with 0.045 vol.% T.E.L.			
7055	Density at 15°C	min. 0.875	0.710-0.755	0.715-0.725	0.725-0.750	0.720-0.740	0.715-0.730	0.710-0.740	0.730-0.745	0.720-0.740	0.710-0.760				
7100-7113	Boiling Range:														
	I.B.P. °C	not under 80	not under 40	not under 35	not under 40	not under 40	not under 40	not under 40	not under 40	not under 40	not under 40				
	10 vol.% min.		at 70°C	at 65°C	at 70°C	at 70°C	at 70°C	at 70°C	at 70°C	at 70°C	at 75°C				
	50 Vol.% min.		100°C	95°C	105°C	110°C	95°C	100°C	100°C	100°C	110°C				
	75 vol.% min.	at 100°C													
7130-7138	90 vol.% min.														
	95 vol.% min.	145°C	150°C	135°C	145°C	150°C	130°C	150°C	145°C	145°C	160°C				
	F.B.P. °C		below 170	below 150	below 165	below 165	below 145	below 170	below 165	below 165	below 170				
	Distillation residue										max. 2 vol.%				
	Reaction of residue														
7190-7191	Roid Vapour Pressure	max. 0.25	the residue remaining in the test flask must be neutral										max. 2 vol.%		
7220	Sulphur cont. wt.%	max. 0.08	max. 0.5										max. 0.5		
7150	Iodine No. g/100 g.	Bromine No.	max. 5	max. 0.05										max. 0.45	
		max. 1.0		max. 3										max. 4	
	Melting point °C	not under -10	the melting point of the fuel cooled to crystallisation point, not above -60°C										max. 3		
	Corrosion test		no grey or black specks or pitting on the copper strip												
	Evaporation residue		max. 5												
7160	mg/100 cm. ³														
7280-7281	a) for new mixtures										a) max. 10				
	b) permissible in										b) see Techn. Instr.				
	front fuels										1/43 of 22.1.43				
	Aromatic cont. vol.%	100	max. 25	11-15	6-15	max. 15	max. 15					max. 25			
	Aniline pt. Original			max. 52°C	max. 52°C	44-54°C	max. 52°C	max. 55°C	max. 50°C	max. 50°C					
7270-7271	T.E.L. vol.%														
7274	Ethylene bromide vol.%														
7230-7239	Supercharge test	The supercharge curve of fuels after addition of 0.120 vol.% T.E.L., when tested in the supercharge test engine according to RLM/GL/A-M II must be above the curve for B4 fuel tested in the same day within the range of excess air ratio (λ) 0.75 - 1.3. Fuel VT 810 should be tested as a blend of 90% VT 810 plus 10% VT 302 and (undecipherable) T.E.L. (Next note also undecipherable)										0.115-0.120	0.045-0.05		
	Storage	separate storage necessary										0.050-0.053	0.019-0.022		
	Storage stability	(undecipherable) materials may be stored together										Separate storage necessary			
		(undecipherable)										After storing for 6 months,			
												testing every 3 months necessary			

NOTES: undecipherable.

Technical Instruction 7/44

Test Method and-number		VT 303	VT 345	ET 120
	Appearance	the fuel must be water-tight, free from solid impurities, undissolved water and acid		
7070-7094	Octane number, unleaded, minimum	-	77	92
	Octane number with 0.09 vol. % T.E.L. min.	-	88	-
	Octane number with 0.115 vol. % TEL, min.	-	91	-
7055	Density @ 15°C	0.860 - 0.880	0.755-0.780	0.700-0.720
7100-7113	I.B.P. not under 170°C	170°C	40°C	80°C
	10% vol. min. @	-	75°C	-
	50% vol. min. @	-	125°C	-
	95% vol. min. @	183°C	90% vol. 160°C	-
	F.B.P. below 185°C	185°C	180°C	200°C
	Dist. loss, max. 2 vol. %	2 vol. %	2 vol. %	2 vol. %
	Reaction of residue	neutral		
7130-7138	Reid Vapour press., max	-	0.45 at	0.25 at
7160	Evaporation residue max	-	5 mg./100 ccm	5 mg/100 ccm
7190-7191	Sulphur cont. max.	-	0.05 wt. %	-
7220	Iodine No.	-	4 g/100 g	3 g/100 g
7150	Melting point	the melting point of the fuel cooled to crystallisation should not be above -60°C		
7280-7281	Aromatic cont. max.	-	42 vol. %	-
7200	Corrosion	no grey or black flecks or attack in copper lead strip test		
7214	Inhibitor cont.	-	ZV2 0.025 wt. %	ZV1 0.01 %

The foregoing technical instruction cancels T.I. 4/43, 9th October 1943.
Designation VT 345 in Instruction 4/43 is deleted.

Berlin, 27th June 1944

App. 4952

Technical Instruction 6/44

Subject: Colorimetric method for determination of inhibitor content of aviation fuels.

Reagents: p-nitraniline solution (0.1725 g. p-nitraniline dissolved in 38.8 ccm. n/l HCl brought up to 250 ccm. with distilled water)

Potassium nitrite 5 g. in 50 ccm. distilled water (drop funnel)

n/l HCl

n/l NaOH

Qualitative determination: 5 cc. gasoline are put into a test tube with 5 cc. water. After adding 2 drops NaOH with the mixture shake vigorously. After addition of 5 ccm. p-nitraniline, potassium nitrite solution is added until the yellow colour of the p-nitraniline disappears (one or two drops is sufficient). After addition of p-nitraniline mixing of the two layers is difficult to avoid. Finally, 8 ccm. n/l NaOH is added. In the presence of inhibitor there is more or less strong red colouration of the solution according to the concentration of the inhibitor. In the absence of inhibitor the solution turns bright yellow.

Quantitative determination: 3 g. gasoline or a corresponding quantity in ccm. after determining specific gravity, is put into a small separating funnel with 5 cc. n/l NaOH and vigorously shaken. When both layers have separated (1-2 minutes) the liquor is drawn off into a test tube. While the tube of the separating funnel is retained in the test tube it is washed out by putting 3 ccm. water in the separating funnel. 5 ccm. n/l HCl are then added to the contents of the test tube. After adding 5 ccm. p-nitraniline solution, potassium nitrite solution is then added until the yellow colour disappears (one or two drops is sufficient). Finally, 8 ccm. n/l NaOH is added. After mixing, the sample is compared with a similarly prepared reference solution of known inhibitor content (or a solution artificially made from methyl orange).

Reference solution: a phenol-free or de-phenolised gasoline is blended with a known quantity of inhibitor (1 kg. gasoline to 0.1 g. ZVI). From this reference solution quantities according to an inhibitor content of 0.006, 0.008, 0.01 and 0.012% ZVI are prepared. Reference solutions made up of these concentrations are satisfactory for all ordinary delivery inspections. Artificial reference solutions can be made up with a methyl orange - water solution. 0.01 g. methyl orange dissolved in 20 cc. water give the same intensity of colour as 0.01% by weight of ZVI as azo-die. These standard solutions have unlimited life.

FD.2873/46 Item 75
(Eag 3996-12)

TECHNICAL SPECIFICATIONS FOR AVIATION OILS S3,
ITS COMPONENTS, AND V2

RLM
GL/A-M II

Components of aviation oil S3

Sheet 8, issued May 1943
corrected March 1944

Test Method B7M 1938 Edn.	Designation	----- T H I N O I L -----							
		Shell SS 607		Vacuum SS 707		Nerag SS 807			
	Technical delivery specification	VTL 147-540	TL 147-560	TL 147-570	TL 147-580				
	Appearance	The oil must be clear, free from undissolved water and acid and must contain no solid impurities							
No.									
8060	Refractive Index max.	-	1.4995	1.4935	1.5010				
8065	Density @ 20°C max.	0.897	0.905	0.895	0.905				
8070	Viscosity		cSt	°E	cSt	°E	cSt	°E	
	@ 50°C min.	0.9-7.6	57.5-62.0	7.6-8.2	52-57.5	6.9-7.6	51.0-60.0	6.8-7.9	
	100°C min.	177	9.66	1.80	9.35	1.77	9.35	1.77	
	Pole Height max.	2.08	2.40	2.08	2.20				
	Slope max.	3.66	3.80	3.66	3.75				
8072	Viscosity Index min.	86	70	88	80				
8075	Setting Point °C max.	-15	-15	-15	-16				
8080	Flash point °C min.	225	225	225	222				
8081	Ignition point °C min.	258	265	258	258				
8085	Neutralisation No. mg.KOH/g. max.	0.06	0.03	0.06	0.07				
8090	Saponification No. mg.KOH/g. max.	0.17	0.10	0.17	0.17				
undecipherable	Evaporation Test (Norck) @ 250°C wt.% max.	9.0	9.0	14	12				
8110	Conradson test Wt.% max.	0.25	0.2	0.25	0.30				
8095	Ash content wt.% max.	0.01	0	0.01	0.01				
8109	Hard asphalt wt.%	0	0	0	0				
8105	Water content wt.%	0	0	0	0				

NOTE

NOTES: undecipherable

Components of aviation oil S3 (continued)

Test Method BVM 1938 Edn.	Designation	----- T H I C K O I L -----					
		Leuna		Shell		Pölitz	
		SS 906		SS 1006		SS 1106	
	Technical delivery specification	TL 147-600		TL 147-610		TL 147-620	
	Appearance	The oil must be clear, free from undissolved water and acid, and must contain no solid impurities					
No.							
8060	Refractive Index max.	1.4770		1.4860		1.4816	
8065	Density @ 20°C max.	0.862		0.875		0.870	
8070	Viscosity	cSt	°E	cSt	°E	cSt	°E
	@ 50°C 1 min.	334-352 44-46		300-380 40-50		min. 278 min. 33.5	
	@ 100°C min.	42.3 5.63		41.3-45.2 5.5-6.0		38 5.1	
	Pole height max.	1.73		1.75		1.65	
	Slope max.	3.05		3.05		3.0	
8072	Viscosity Index min.	107		105		107	
8075	Setting Point °C max.	-25		-20		-25	
8080	Flash point °C min.	225		293		280	
8081	Ignition point °C min.	263		325		330	
8085	Neutralisation No. mg.KOH/g. max.	0.08		0.06		0.06	
8090	Saponification No. mg.KOH/g. max.	0.2		0.1		0.2	
undecipherable	Evaporation test (Nack) @ 250°C wt.% max.	8		1		5.5	
8110	Conradson test wt.% max.	0.2		0.45		0.25	
8095	Ash content wt.% max.	0		0		0.01	
8100	Hard asphalt wt.%	0		0		0	
8105	Water content wt.%	0		0		0	

NOTES: indecipherable

Acceptance conditions for aviation oils S3 and V2

Method of Test	Military Name	S 3								V 2		
BVM (1)	Filling Station Mark	VK	VB	NM	WD	WH	RG	HL	WD	WH	WN	RG
		WN	WL	WR	WM	WY	WL	WR	WM	WG	WV	
		WV	WF	WB	WG		WF	WB	WG			
	Technical Specification	TL 147-502					TL 147-(561-563)					
	for Delivery	TL 147-503					TL 147-(571-573)					TL 147-503
		TL 147-506					TL 147-(581-583)					
	Appearance	The lubricating oil must be clear, free from undissolved water and mineral acids and must contain no solid impurities.										
No:-												
8060	Refractive Index max.	1.4995					1.4990					1.5070
8065	Density @ 20°C kg/ltr. max.	0.897					0.895					0.920
8070	Viscosity	cSt					cSt					cSt
	@ 50°C	125-137 (16.5-18.0)					125-143 (16.5-18.8)					133-144 (17.5-19.0)
	100°C min.	18.5 (2.70)					19.0 (2.75)					19.4 (2.80)
	Pole Height max.	2.04					1.95					1.9
	Slope max.	3.45					3.35					3.4
8072	Viscosity Index min.	92					98					95
8075	Setting point °C max.	-17 (2)					-20					-25
8080	Flash point °C min.	260					225					235
8081	Ignition point °C min.	300					255					270
8085	Acid Value mg.KOH/g. max.	0.06					0.06					0.1
8090	Saponification value mg.KOH/g. max	0.2					0.2					8.0
see note (1)	Evaporation test (Noack) @											
	250°C % wt. max.	3.0 (4)					11.0					5.0
8110	Conradson % wt. max.	0.35					0.25					0.5
8095	Ash content % wt. max.	0.01					0.01					0.02
8110	Hard asphalt % wt.	0					0					0
8105	Water content % wt.	0					0					0

- NOTES: (1) Constructional specifications for BVM aero-engines "Test regulation for aero-engine lub. oils for use in Otto engines". Can be obtained from the Scientific Reports Section (ZWE) of the DVL, Berlin-Adlershof, Radower Chaussee 16/25.
- (2) For S3, the filling station mark VK allows a max. setting point of -10°C. (3) "Angewandte Chemie" 1936. Vol.49 page 385.
- (4) For S3 — VK the max. Noack Test value is 5.0. (5) The present sheet 7 supersedes the "Technical acceptance conditions for Aero-Engine Lub.Oils" issued by the RLM L.C. 11 2e on 15.3.36. Abbreviations: V Vakuum, K Köln, B Bremen W Wifo.
- Prepared by Mineral Oil Section. Group GL/A-M II.

Technical Delivery Specifications for Aero-Engine Fuels
for Active Service Use

		----- Aviation Benzines -----		
Test	Designation	A3	B4	C3
Procedure	Technical Delivery	TL 147-257	TL 147-304	TL 147-330
BVM (1)	Specification	1	1	1
1940 Ed.	Appearance	Clear, free from undissolved water and acids, solid impurities shall be absent		
Ref. No.	Colour	Blue colouring corresponding to an addition of:	Green colouring corresponding to addition of 0.5 mg. Sudan Blue	Green colouring corresponding to addition of 0.5 mg. Sudan Blue
		2.0 mg. Sudan Blue G per 1000 ml. of undyed fuel	2.6 mg. Sudan Blue G per 1000 ml. of undyed fuel	2.6 mg. Sudan Blue G per 1000 ml. of undyed fuel
7070-7094	Octane Number	80 min. with 0.045 vol. % T.E.L.	89 min. with 0.115 vol. % T.E.L.	ca 95
7055	Density @ 15°C	0.710 - 0.755	0.760-0.795	IBP ca 45°C
7100-7113	Distillation:	up to 70°C	40-50% vol.	up to 100°C
	10% vol. min.	" " 100°C	up to 100°C	
	50% vol. min.	" " 160°C	below 180°C	
	90% vol. min.	below 170°C		
	F.B.P.			
	Distillation loss	2% vol. max.		
See note (2)	Reaction of the residue	the residue from dist. shall be neutral		
7130-7138	Vapour Pressure (Reid)	0.5 max.	0.45 max.	
7220 (3)	Iodine value g./100 g.	5 max.	4 max.	
7150	Melting Point	the m.p. of the fuel, after cooling to cryst. shall not be above -60°C		
7200	Corrosion test	no grey or black spots or pitting in the copper strip test		
7160	Evap. Residue mg/100 ml.	8 max.	10 max.	
7270-7271	T.E.L. % vol.	0.045-0.05	0.115 - 0.120	
	Storage Stability	When fuel is stored in large holders (over 100 m. ³) tests shall be carried out every 3 months after 6 months storage	After 3 months storage, tests shall be carried out monthly	

NOTES: (1) The appropriate test regulations, "Prüfverschriften für Flugmotoren Kraftstoffe", 1940 Edn. and "Prüfverschriften für Flugmotoren - Schmieröle zur Verwendung in Otto Motoren", 1935 Edn. can be obtained from the "Zentrale für wissenschaftliches Berichtswesen (ZWB of the DVL, 16/25 Rudower Chaussee, Berlin-Adlershof.

(2) The aqueous extract must not turn phenolphthalein solution red. After the addition of one drop of N/10 NaOH a red coloration must appear.

(3) 0.4 to 0.8 g. are weighed in and 5 ml. of Hanus solution added.

Aviation Diesel Fuels

Test Designation
 Procedure Technical Delivery
 EVM (1) Specification
 Appearance

DK1 K1
 TL 147-360 VTL 147-351
 1 1

Clear, free from undissolved water
 and acid, solid impurities shall
 be absent

Ignition de-
 lay procedure
 in BWA or IG
 test Diesel
 with Neumann
 Inertie In-
 dicator

Cetane Number 50 min. not below 60

7055
 7100-7118
 (Water-
 cooling)

Density @ 20°C
 Distillation:
 up to 300°C
 " " 350°C

0.840-0.880 not below 0.810

70% vol. min. I.B.P. ca 160°C
 90% vol. min. 95% vol. min.

8075
 8070

Pour Point
 Viscosity @ 20°C
 @ 50°C

not over -20°C not over -45°C
 1.2-1.8°C not below 1.1°C
 1.1°C min.

Pensky-
 Mertens

Flash Point

over 65°C over 50°C

8085

Acid value mg.KOH/g.

not over 0.2 not over 0.7

7190-7191

Sulphur content % wt.

not over 1

8095

Ash content

at the most only traces

DIN 2

Corrosion Test

negative

DMV 3763

Conradson Test % by wt.

0.1 max.

8110

Water content % wt.

at the most only traces

8105

Storage Stability

After storage for one year, test-
 ing shall be carried out every 6
 months

For NOTES see first page.

PROVISIONAL TECHNICAL DELIVERY SPECIFICATIONS FOR ARMY GEAR AND ENGINE OIL

Army Gear Oil 8#

Army Engine Oil
Oil
(Winter Grade)

A. Analytical Data

1. Appearance : dyed green (0.04% Fluorol 5G or 5GR) free from deposits or any separated material.
2. Volatility : not over 10%
3. Viscosity
 - a) @ -40°C : not over 50,000^{CE}. (extrap. or calc.)
 - b) @ +50°C : not below 8.0^{CE}. (extrap. or calc.)
4. Cold Test : pumpable at -40°C.
5. Pressure Resistance: minimum four ball machine load of 240 kg. for a one minute test period
6. Corrosion : after a 24 hour test at 100 C there must be no corrosion (faint 'tempering' colours shall not be regarded as corrosion)

1. Volatility not below 7% not above 20%
not above 14%
2. Viscosity
 - a) @ -15°C 1800^{CE} not above 560^{CE}
 - b) @ +100°C 1.9^{CE} min. 1.6^{CE} min.
 - c) Pole height 2.1 max. 2.0 max.
3. Total Insolubles
 - a) Hard Asphalt absent
 - b) Solid Impurities "
 - c) Combustible "
 - d) Ash trace
4. Acid Value not over 0.07
5. Sep. Value " " 0.25
6. Water Content nil
7. Flash Point (open) not below 200°C
8. Pour Point not required not over -25°C

B. Procedure

- For 1. The total sample shall be used. No separation or precipitation shall take place with the oil remaining after volatility estimation or after the corrosion test.
2. Volatility shall be determined in the HWA apparatus at 200°C. (Angew. Chemie, 49, 385, 1936).
 3. For determination at +20 and +90°C the Vogel-Ossag, Ubbelohde or Hopple precision viscometers shall be used with water as the bath liquid.
The value at -40 and +50°C shall be calculated from the Walther formula (cf. Ubbelohde, "Zur Viskometrie") or extrapolated from the Ubbelohde viscosity temperature chart (Hirzel Press, Leipzig 5th Ed.)
 4. Pumpability shall be measured in the apparatus developed by the Rhenania-Ossag. 100 ml. of oil must be delivered in 80 secs.
About 90% of the oil added must be pumped out of the container without a break.
 5. For testing lced properties only the four ball machine shall be used.
 6. The following materials shall be used in the corrosion test (24 hrs. at 100°C). 2 ball bearing balls (four ball machine type, 12 im. diam.): 1 aluminium strip and 1 bronze strip (Cu-Sn 88/12) each 110 x 10 ± 1 mm. polished with 00 grade emery.
The material shall be de-greased with benzine before the test. A 250 ml. beaker (tall form) shall be used. One ball shall be placed in a holder made from sheet aluminium (about 50 mm. high) with a central 8 mm. hole to take the ball. The other ball shall be placed on the bottom of the beaker. The oil under test shall be poured in up to the top edge of the holder so that half the ball is immersed. After the test, materials shall be rinsed in benzine and dried. They must not be wiped. NOTE: Present sheet supersedes sheet 6, Dec. 1942. Copies of the latter still existent should be destroyed.