

HVLP hydraulic oils

Minimum requirements

DIN
51 524
Part 3

Druckflüssigkeiten; Hydrauliköle; Hydrauliköle HVLP; Mindestanforderungen

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

1 Field of application

This standard specifies HVLP hydraulic oils¹⁾ that are recommended for use in hydrostatic fluid power systems where high thermal stresses are likely, water-induced corrosion is to be expected and where the design or operating conditions of their pumps or hydraulic engines require the use of oils that contain additives for reducing wear in the mixed friction range and oils, the viscosity of which is less influenced by temperature.

HVLP hydraulic oils may also be used in hydrodynamic fluid power systems if they meet the operating requirements of such systems.

2 Concept

For the purposes of this standard, HVLP hydraulic oils are pressure fluids produced from mineral oils which contain additives intended to improve their corrosion-inhibiting properties, reduce the influence of temperature on their viscosity, increase their resistance to ageing, and reduce wear in the mixed friction range.

3 Designation

Designation of an HVLP 68 hydraulic oil:

Hydraulic oil DIN 51 524 – HVLP 68

4 Requirements and testing

See table on page 2.

Verification of compliance of HVLP hydraulic oil with the specifications of this standard shall be based on DIN 51 848 Part 1, using the methods of test listed in table 1.

¹⁾ The symbols are as defined in DIN 51 502. The equivalent symbols as used in DIN 51 502 and ISO 6743-4 are shown in table 2 (cf. Explanatory notes).

Continued on pages 2 to 4

Table 1.

Hydraulic oil type ¹⁾ (symbol as in DIN 51 502)	Requirements					Testing as in		
	HVLP 15	HVLP 32	HVLP 46	HVLP 68	HVLP 100			
ISO viscosity class as in DIN 51 519 ²⁾	ISO VG 15	ISO VG 32	ISO VG 46	ISO VG 68	ISO VG 100	-		
Kinematic viscosity ⁴⁾ , in mm ² /s,	at -20 °C ³⁾		To be specified by supplier.		-	-	DIN 51 550, in conjunction with DIN 51 562 Part 1 or DIN 51 569	
	at 0 °C ³⁾		To be specified by supplier.					
	at 40 °C		≤ 16,5	≤ 35,2	≤ 50,6	≤ 74,8		≤ 110
	at 100 °C		≥ 13,5	≥ 28,8	≥ 41,4	≥ 61,2		≥ 90
Viscosity index	≥ 140				≥ 120	ISO 2909		
Pour point, in °C	≤ -39	≤ -30	≤ -27	≤ -24	≤ -21	ISO 3016		
Flash point, in °C	≥ 125	≥ 175	≥ 180	≥ 180	≥ 190	ISO 2592		
Undissolved matter content, as a percentage by mass	Below limit of quantifiability. ⁵⁾					Cf. Explanatory notes.		
Water content, as a percentage by mass	Below limit of quantifiability. ⁶⁾					ISO 3733		
Corrosion-inhibiting properties with regard to steel	Maximum corrosion rating: 0 - A DIN 51 585					DIN 51 585		
Corrosive effect on copper	Maximum corrosion rating: DIN 51 759 - 2 - 100 A3					DIN 51 759 Part 1		
Ageing behaviour (increase in neutralization number after 1000 h ¹²⁾), in mg KOH/g	≤ 2,0 ⁷⁾					DIN 51 587		
Effect on SRE- NBR 1 elastomer as specified in DIN 53 538 Part 1, after 7 days (±2 h) at (100 ± 1) °C ¹²⁾	Relative change in volume, as a percentage	0 to 15	0 to 12	0 to 10		DIN 53 521		
	Change in Shore hardness A	0 to -8	0 to -7	0 to -6		DIN 53 521, in conjunction with DIN 53 505		
Air release property at 50 °C ⁸⁾	Not exceeding	5 min		10 min	14 min	DIN 51 381		
Foam volume, in ml,	at 25 °C		≤ 150/0			DIN 51 566		
	at 95 °C		≤ 75/0					
	at 25 °C after test at 95 °C		≤ 150/0					
Minimum demulsification capacity at 54 °C ⁹⁾	min	≤ 30	≤ 40	≤ 60		DIN 51 599		
Behaviour in FZG gear rig test ¹²⁾	Rating	9)	≥ 10			DIN 51 354 Part 2		
Loss of mass, in mg, after mechanical test by vane-pump method ¹²⁾	Ring	9)	≤ 120 ¹⁰⁾			DIN 51 389 Part 2		
	Vane		≤ 30 ¹⁰⁾					
Relative viscosity loss due to shear (250 cycles) at 40 °C ¹³⁾ , as a percentage	To be specified by supplier.					DIN 51 382		
Density at 15 °C ¹¹⁾ , in g/ml	To be specified by supplier.					DIN 51 757		
Ash content (oxide ash) ¹¹⁾ or sulfate ash, as a percentage by mass	To be specified by supplier.					EN 7 DIN 51 575		
Neutralization number ¹¹⁾ (acid or alkaline), in mg KOH/g	To be specified by supplier.					DIN 51 558 Part 1		

For 1), see page 1, and for 2) to 13), see page 3.

Table (concluded).

- 2) The number in the symbol represents the rounded value of midpoint viscosity measured at 40 °C and expressed in mm²/s. It is based on the ISO viscosity classes (cf. DIN 51 519).
- 3) The viscosity at temperatures below +20 °C shall be determined by measurement and not by extrapolation.
- 4) The legal unit of kinematic viscosity is the m²/s, where 1 mm²/s equals 1 · 10⁻⁶ m²/s.
- 5) Draft Standard DIN 51 592 dealing with the determination of undissolved substances by the filter membrane method was withdrawn in 1985. For this reason, values can only be specified once a new draft (at present being prepared) has been published.
- 6) Reliable data on precision cannot be given for a water content of less than 0,1 %.
- 7) An increase in neutralization number of up to 2,0 mg KOH/g does not permit the various types of HVLP oil to be differentiated.
- 8) The values given do not apply to detergent hydraulic oils.
- 9) Method is not applicable for oil of the viscosity class in question. Use appropriate additives as specified for oil of viscosity classes ISO VG 32 to ISO VG 100.
- 10) A mass loss below the value given does not permit the various types of HVLP oil to be differentiated.
- 11) The test methods given serve to identify the oils on receipt. Since the applicability of the methods depends on the nature of the base oils and additives used, limiting values cannot be specified.
- 12) Since the test for determining these properties takes quite a long time, it should only be performed for type testing purposes, not for acceptance.
- 13) Further test methods of determining the relative viscosity loss due to shear are being prepared at European level.

Standards referred to

DIN 51 354 Part 2	Mechanical testing of lubricants by the FZG gear rig test method; method A/8,3/90 for testing lubricating oils
DIN 51 381	Determination of air release properties of lubricating oils and hydraulic fluids
DIN 51 382	Determination of shear stability of lubricating oils containing polymers by the Diesel injection nozzle method
DIN 51 389 Part 2	Mechanical testing of hydraulic fluids by the vane-pump method; method A for anhydrous hydraulic fluids
DIN 51 502	Designation of lubricants and marking of lubricant containers, lubricating equipment and lubrication points
DIN 51 519	ISO viscosity classes for industrial liquid lubricants
DIN 51 550	Viscometry; general principles
DIN 51 558 Part 1	Determination of neutralization number of petroleum products by colour indicator titration
DIN 51 562 Part 1	Determination of kinematic viscosity using the standard design Ubbelohde viscometer
DIN 51 566	Determination of foaming characteristics of lubricating oils
DIN 51 569	Determination of viscosity of mineral oils, liquid fuels and related liquids at temperatures from - 55 to approximately 10 °C using the Vogel-Ossag viscometer
DIN 51 575	Determination of sulfate ash of petroleum products
DIN 51 585	Testing the corrosion-inhibiting properties of steam turbine oils and hydraulic oils containing additives
DIN 51 587	Determination of the ageing behaviour of steam turbine oils and hydraulic oils containing additives
DIN 51 599	Determination of demulsification capacity of lubricating oils using the stirring method
DIN 51 757	Determination of density of petroleum products and related products
DIN 51 759 Part 1	Determination of the corrosive effect of liquid petroleum product on copper by the copper strip test
DIN 51 848 Part 1	Testing of petroleum products; precision; general introduction; terminology and its application to petroleum standards specifying requirements
DIN 53 505	Shore hardness testing A and D of rubber, elastomers and plastics
DIN 53 521	Determination of the resistance of rubber and elastomer to liquids, vapours and gases
DIN 53 538 Part 1	Standard reference elastomers; peroxide-cross-linked acrylonitrile-butadiene rubber for characterizing service fluids with respect to their action on NBR
EN 7	Determination of ash in petroleum products
ISO 2592:1973	Petroleum products; determination of flash and fire points; Cleveland open cup method
ISO 2909:1981	Petroleum products; determination of viscosity index from kinematic viscosity
ISO 3016:1974	Petroleum products; determination of pour point
ISO 3733:1976	Petroleum products and bituminous materials; determination of water; distillation method
ISO 6743-4:1982	Lubricants, industrial oils and related products (class L); classification Part 4: Family H (hydraulic systems)

Explanatory notes

This standard has been prepared by Technical Committee 651 *Anforderungen an Schmieröle und sonstige Öle* of the *Fachausschuß Mineralöl- und Brennstoffnormung* of the *Normenausschuß Materialprüfung* (Materials Testing Standards Committee).

Table 2. **Symbols** used in DIN 51 502 and ISO 6743-4 to designate lubricating oils

Standard	Symbols				
	HVLP 15	HVLP 32	HVLP 46	HVLP 68	HVLP 100
DIN 51 502	HVLP 15	HVLP 32	HVLP 46	HVLP 68	HVLP 100
ISO 6743-4	HV 15	HV 32	HV 46	HV 68	HV 100

International Patent Classification

F 15 B 21/06

G 01 N 33/26