

Pressure fluids  
**Hydraulic oils**  
 HL hydraulic oils  
 Minimum requirements

**DIN**  
**51 524**  
 Part 1

Druckflüssigkeiten; Hydrauliköle; Hydrauliköle HL; Mindestanforderungen

Supersedes DIN 51 524,  
 December 1971 edition  
 withdrawn in 1984.

*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 applies to HL hydraulic oils<sup>1)</sup> for predominantly hydrostatic fluid power systems<sup>2)</sup>, where high thermal stresses would result in unduly short service lives of H hydraulic oils and/or where corrosion is to be expected, for example as a result of the ingress of water.

HL hydraulic oils may also be used in hydrodynamic fluid power systems, provided that they meet the requirements of these systems.

### 2 Concept

HL hydraulic oils are pressure fluids consisting of petroleum products with active ingredients to enhance corrosion protection and ageing resistance.

### 3 Designation

Designation of an HL hydraulic oil, type HL 32:

Hydraulic oil DIN 51 524 – HL 32

### 4 Requirements and testing

See table 1 on page 2.

DIN 51 848 Part 1 is to be applied when deciding whether an HL hydraulic oil meets the requirements specified in this standard. This applies to all test results obtained when testing in accordance with standards listed in the last column of the table.

- 1) The symbols are as defined in DIN 51 502, November 1979 edition. The allocation of the symbols both in the withdrawn standard (February 1972 edition), replaced by the current edition of DIN 51 502, and in ISO 6743/4 – 1982 is shown in table 2 (see Explanatory notes).
- 2) If an H hydraulic oil not subject to particular requirements is required for predominantly hydrostatic fluid power systems, an oil as specified in DIN 51 517 Part 1 may be used. If an HLP hydraulic oil is required for predominantly hydrostatic fluid power systems, where high thermal stresses arise and where corrosion is to be expected as a result of the ingress of water and/or where pumps or hydraulic motors require oils with anti-wear additives for mixed friction, owing to their design or the operating conditions, an oil as specified in DIN 51 524 Part 2 may be used.

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Table 1.

Type of hydraulic oil (coding as specified in DIN 51502)	Requirements						Testing as specified in		
	HL 10	HL 22	HL 32	HL 46	HL 68x	HL 100			
ISO viscosity class as specified in DIN 51519 <sup>3)</sup>	ISO VG 10	ISO VG 22	ISO VG 32	ISO VG 46	ISO VG 68	ISO VG 100	—		
Kinematic viscosity <sup>4)</sup> , in mm <sup>2</sup> /s	at -20 °C max.	600	—	—	—	—	DIN 51 550 in conjunction with DIN 51 561, DIN 51 562 Part 1 or DIN 51 569		
	at 0 °C max.	90	300	420	780	1400		2560	
	at 40 °C	max.	11,0	24,2	35,2	50,6		74,8	110
		min.	9,0	19,8	28,8	41,4		61,2	90,0
	at 100 °C min.	2,4	4,1	5,0	6,1	7,8		9,9	
Pour point equal to or lower than	°C	-30	-21	-18	-15	-12	-12	ISO 3016	
Flash point higher than	°C	125	165	175	185	195	205	ISO 2592	
Contents of undissolved matter, expressed as a proportion by mass, in %	Below the limit of quantitative detectability <sup>5)</sup>						DIN 51 592*)		
Water content, expressed as a proportion by mass, in %	Below the limit of quantitative detectability <sup>6)</sup>						ISO 3733		
Corrosive effect on steel	Not exceeding degree of corrosion DIN 51 585-0-A						DIN 51 585		
Corrosive effect on copper	Not exceeding degree of corrosion 2 DIN 51 759-100 A 3						DIN 51 759		
Ageing properties <sup>7)</sup> (maximum increase in neutralization number after 1000 h), in mg KOH/g	2,0 <sup>8)</sup>						DIN 51 587		
Behaviour towards the SRE-NB R1 sealant speci- fied in DIN 53 538 Part 1, after 7 days $\pm$ 2 h at (100 $\pm$ 1) °C <sup>7)</sup>	Relative change in volume %	0 to 18	0 to 15	0 to 12	0 to 10		DIN 53 521		
	Change in Shore A hardness	0 to -10	0 to -8	0 to -7	0 to -6		DIN 53 521 in conjunction with DIN 53 505		
Air release properties, in min, at 50 °C	Not exceeding	5		10		14	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							
Demulsification capacity, in min, at 54 °C max.	30	40			60		DIN 51 599		
Density at 15 °C <sup>9)</sup> , in g/ml	To be specified by the supplier.						DIN 51 757		
Ash (oxide ash) <sup>9)</sup> , expressed as a proportion by mass, in %	To be specified by the supplier.						EN 7		
Neutralization number <sup>9)</sup> (acid or alkaline), in mg KOH/g	To be specified by the supplier.						DIN 51 558 Part 1		

\*) At present at the stage of draft.

<sup>3)</sup> The code numbers correspond to the rounded values of the mid-point viscosity, in mm<sup>2</sup>/s, at 40,0 °C. They are derived from the viscosity classes specified in ISO Standards, see DIN 51 519.

<sup>4)</sup> The legal unit of kinematic viscosity is the m<sup>2</sup>/s (1 mm<sup>2</sup>/s = 1 · 10<sup>-6</sup> m<sup>2</sup>/s (formerly cSt; 1 cSt = 1 mm<sup>2</sup>/s)).

<sup>5)</sup> In view of precision, reliable values cannot be given for a proportion by mass of less than 0,03 %.

<sup>6)</sup> In view of precision, reliable values cannot be given for a proportion by mass of less than 0,1 %.

<sup>7)</sup> Because of the long duration of the test, these values should be determined not on acceptance, but only in type testing.

<sup>8)</sup> An increase in the neutralization number of up to 2,0 mg KOH/g of oil over the neutralization number of new oil does not allow a differentiated evaluation of HL hydraulic oils.

<sup>9)</sup> The test methods given serve to identify the oil on receipt. Since the applicability of the methods depends on the nature of the base oils and active ingredients used, general limiting values cannot be specified.

**Standards referred to**

DIN 51 381	Testing of lubricants and hydraulic fluids; determination of air release properties; impinger method
DIN 51 502	Lubricants and related materials; designation of lubricants and marking of lubricant containers, lubrication equipment and lubrication points
DIN 51 517 Part 1	Lubricants; lubricating oils; C lubricating oils; minimum requirements
DIN 51 519	Lubricants; ISO viscosity classes for industrial liquid lubricants
DIN 51 524 Part 2	Pressure fluids; hydraulic oils; HLP hydraulic oils; minimum requirements
DIN 51 550	Viscometry; determination of viscosity; general principles
DIN 51 558 Part 1	Testing of mineral oils; determination of neutralization number; colour indicator titration
DIN 51 561	Testing of mineral oils, liquid fuels and related liquids; measurement of viscosity using the Vogel-Ossag viscometer; temperature range: approximately 10 to 150 °C
DIN 51 562 Part 1	Viscometry; determination of kinematic viscosity using the standard design Ubbelohde viscometer
DIN 51 566	(at present at the stage of draft) Testing of lubricating oils; determination of foaming characteristics
DIN 51 569	Testing of mineral oils, liquid fuels and related liquids; measurement of viscosity using the Vogel-Ossag viscometer; temperature range: - 55 to approximately + 10 °C
DIN 51 585	Testing of lubricants; testing of the corrosive effect of steam turbine oils and hydraulic oils containing additives
DIN 51 587	Testing of lubricants; determination of ageing behaviour of steam turbine oils and hydraulic oils containing additives
DIN 51 592	(at present at the stage of draft) Testing of lubricants; determination of the content of undissolved matter in lubricating oils; membrane filter method
DIN 51 599	Testing of lubricating oils; determination of demulsification capacity by the stirring method
DIN 51 757	Testing of petroleum products and related materials; determination of density
DIN 51 759	Testing of liquid hydrocarbons; determination of the effect of corrosion on copper; copper strip test
DIN 51 848 Part 1	Testing of petroleum products; precision of test methods; general introduction; concepts and their application to petroleum standards specifying requirements
DIN 53 505	Testing of elastomers; Shore A and D hardness testing
DIN 53 521	Testing of rubber and elastomers; determination of their resistance to liquids, vapours and gases
DIN 53 538 Part 1	Standard reference elastomers; peroxide-cross-linked acrylonitrile/butadiene rubber (NBR) for characterizing service fluids with respect to their action on NBR
EN 7	Determination of ash from petroleum products
ISO 2592	Petroleum products; determination of flash and fire points; Cleveland open cup method
ISO 3016	Petroleum products; determination of pour point
ISO 3733	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)

**Previous editions**

DIN 51 524: 12.71

**Amendments**

The following amendments have been made in comparison with the December 1971 edition withdrawn in 1982:

- the requirements for H hydraulic oils have been deleted, because they are covered by the specifications given in DIN 51 517 Part 1;
- the allocation of the viscosity classes as specified in DIN 51 519 to the particular type of HL hydraulic oil has been added;
- the foaming characteristics, tested as specified in DIN 51 566, have been added;
- the text has been editorially revised, taking into account the specifications given in DIN 1310 and the DIN 820 standards series. In addition, the references to other standards have been brought up to date.

**Explanatory notes**

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

For appropriate selection, maximum values of viscosity at 0 °C or -20 °C for starting operation of engines and motors in winter have been specified instead of the viscosity index, and minimum values of viscosity at 100 °C for maximum loading of hydraulic oils in summer.

Table 2. Comparison of symbols

Standard	Symbols					
DIN 51 502 (November 1979 edition)	HL 10	HL 22	HL 32	HL 46	HL 68x	HL 100
ISO 6743/4	HL 10	HL 22	HL 32	HL 46	HL 68	HL 100
DIN 51 502 (February 1972 edition *)	H-L 9	H-L 16	H-L 16 H-L 25	H-L 25 H-L 36	H-L 36 H-L 49	H-L 68
*) Superseded by November 1979 edition.						

**International Patent Classification**

C 10 M 1/00  
C 10 M 3/00