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Lubricants, industrial oils and related products (class L) — Family H (hydraulic systems) — Specifications for categories HH, HL, HM, HV and HG

*Lubrifiants, huiles industrielles et produits connexes (classe L) — Famille H (systèmes hydrauliques) —
Spécifications des catégories HH, HL, HM, HV et HG*

[Revision of first edition (ISO 11158:1997)]

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Foreword

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ISO 11158 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 4, *Classifications and specifications*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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Lubricants, industrial oils and related products (class L) — Family H (hydraulic systems) — Specifications for categories HH, HL, HM, HV and HG

WARNING — The handling and use of products as specified in this International Standard may be hazardous, if suitable precautions are not observed. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies the minimum requirements for new mineral oil hydraulic fluids and is intended for hydraulic systems, particularly for hydrostatic hydraulic fluid power application. The purpose of this International Standard is for the guidance of suppliers and end users of mineral oil hydraulic fluids and for the direction of equipment manufacturers of hydraulic systems.

This International Standard is written in a general form so that its application can accommodate various climatic conditions throughout the world. This International Standard also stipulates the requirements of mineral oil hydraulic fluids at the time of delivery.

Classification of fluids used in hydraulic applications is defined in ISO 6743-4. Of the categories covered by ISO 6743-4, five types only of mineral oil-based fluids are embraced in this specification. These categories are: HH, HL, HM, HV and HG.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2049:1996, *Petroleum products — Determination of colour (ASTM scale)*

ISO 2160:1998, *Petroleum products — Corrosiveness to copper — Copper strip test*

ISO 2592:2000, *Petroleum products — Determination of flash and fire points — Cleveland open cup method*

ISO 2909:2002, *Petroleum products — Calculation of viscosity index from kinematic viscosity*

ISO 3016:1994, *Petroleum products — Determination of pour point*

ISO 3104:1994, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3105: 1994, *Glass capillary kinematic viscometers — Specifications and operating instructions*

ISO 3170:2004, *Petroleum liquids — Manual sampling*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

ISO 3675:1998, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method*

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ISO 4259:2006, *Petroleum products — Determination and application of precision data in relation to methods of test*

ISO 4263-1:2003, *Petroleum and related products — Determination of the ageing behaviour of inhibited oils and fluids — TOST test — Part 1: Procedure for mineral oils*

ISO 4406:1999, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 5598:1985, *Fluid power systems and components — Vocabulary*

ISO 6072: 2002, *Hydraulic fluid power — Compatibility between fluids and standard elastomeric materials*

ISO 6247:1998, *Petroleum products — Determination of foaming characteristics of lubricating oils*

ISO 6296:2000, *Petroleum products — Determination of water — Potentiometric Karl Fischer titration method*

ISO 6614:1994, *Petroleum products — Determination of water separability of petroleum oils and synthetic fluids*

ISO 6618:1997, *Petroleum products and lubricants — Determination of acid or base number — Colour-indicator titration method*

ISO 6619:1988, *Petroleum products and lubricants — Neutralization number — Potentiometric titration method*

ISO 6743-4:1999, *Lubricants, industrial oils and related products (Class L) — Classification — Part 4: Family H (hydraulic systems)*

ISO 7120:1987, *Petroleum products and lubricants — Petroleum oils and other fluids — Determination of rust-preventing characteristics in the presence of water*

ISO 9120:1997, *Petroleum and related products — Determination of air-release properties of steam turbine and other oils — Impinger method*

ISO 12937:2000, *Petroleum products — Determination of water — Coulometric Karl Fischer titration method*

ISO 13357-1:2002, *Petroleum products — Determination of the filterability of lubricating oils — Part 1: Procedure for oils in the presence of water*

ISO 13357-2:2005, *Petroleum products — Determination of the filterability of lubricating oils — Part 2: Procedure for dry oils*

ISO 14635-1:2000, *Gears — FZG test procedures — Part 1: FZG test method A/8,3/90 for relative scuffing load-carrying capacity of oils*

ISO 20763:2004, *Petroleum and related products — Determination of anti-wear properties of hydraulic fluids — Vane pump method*

ISO 20764:2003, Petroleum and related products – Preparation of a test portion of high-boiling liquids for the determination of water content – Nitrogen purge method

AFNOR XP T 60-183:1994, *Lubrifiants, huiles industrielles et produits connexes pour glissières de machines-outils — Pouvoir lubrifiant antisaccade (Lubricants, industrial oils and related products for machine tool slideways — Anti-stick-slip lubricating ability)*

CEC L-45-A-99¹⁾ Viscosity Shear Stability of Transmission Lubricants

3 Sampling

Sampling of hydraulic oils for the purpose of this International Standard shall be carried out in accordance with the pertinent procedure described in ISO 3170. The sample shall be evaluated on a representative portion.

NOTE Any drum, barrel, tanker compartment or any type of container delivered to the end user may be sampled and analysed at the discretion of the purchaser.

4 Definitions

For the purposes of this International Standard, the vocabulary in ISO 5598 applies.

1) This test method will become ISO 26422 *Petroleum and related products — Determination of shear stability of lubricating oils containing polymers – Four ball method using a tapered roller bearing.*

5 Requirements of mineral oil hydraulic fluids

For the purpose of this International Standard, oils shall be refined petroleum oils. The classification of these hydraulic oils shall be in accordance with ISO 6743-4.

Oils, when tested under prescribed methods, shall be in concurrence with limiting values set out in Table 1 to table 5, where applicable.

The appearance of the delivered oils shall be clear and bright and free of any visible particulate matter, under normal visible light at ambient temperature. The cleanliness level shall be expressed according to ISO 4406.

The precision (repeatability and reproducibility) of the test methods for this International Standard and the interpretation of the results shall be dictated by ISO 4259 and shall be consulted in instances of uncertainty or disputes.

Detailed specifications of each category mentioned in this international Standard are provided hereafter in Table 1 to Table 5 and as indicated below.

Table No.	Category
1	HH
2	HL
3	HM
4	HV
5	HG

Composition, properties and typical applications of each category are reported at the head of each table. These elements are taken from ISO 6743-4.

NOTE For the purposes of this International Standard, the term “% (m/m)” is used to represent the mass fraction of a material.

Table 1 — Specifications for category HH mineral oil hydraulics fluids

Characteristics	Non-inhibited mineral oils									
	Units	Requirements								Test Method
Viscosity grade (ISO 3448)		VG 10	VG 15	VG 22	VG 32	VG 46	VG 68	VG 100	VG 150	
Kinematic viscosity at 40 °C:minimum-maximum	mm ² /s ¹⁾	9,00 – 11,0	13,5 – 16,5	19,8 – 24,2	28,8 – 35,2	41,4 – 50,6	61,2 – 74,8	90,0 – 110	135 – 165	ISO 3104 and ISO 3105
Viscosity index	—	2)	2)	2)	2)	2)	2)	2)	2)	ISO 2909
Density at 15 °C	kg/m ³	2)	2)	2)	2)	2)	2)	2)	2)	ISO 3675
Colour ³⁾	—	2)	2)	2)	2)	2)	2)	2)	2)	ISO 2049
Appearance at 25 °C ⁴⁾	—	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Visual
Cleanliness		5)	5)	5)	5)	5)	5)	5)	5)	
Flash point: — Cleveland open cup, minimum	°C	125	140	165	175	185	195	205	215	ISO 2592
Pour point,maximum	°C	–15	–12	–9	–6	–6	–6	–6	–6	ISO 3016
Acid number, maximum	mg KOH/g	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	ISO 6618 or ISO 6619
Water content, maximum	% (m/m)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	ISO 6296 or ISO 12937 or ISO 20764
Water separation: — time to 3 ml emulsion at 54 °C, .maximum	min	2)	2)	2)	2)	2)	2)	—	—	ISO 6614
— time to 3 ml emulsion at 82 °C, .maximum	min	—	—	—	—	—	—	2)	2)	
Elastomer compatibility ⁶⁾		2)	2)	2)	2)	2)	2)	2)	2)	ISO 6072
NBR 1, 100 °C, 168 h										

1) Square millimetres per second (mm²/s) is equivalent to centistokes (cSt).
 2) Report
 3) For the purposes of identification, dye may be used by agreement between the supplier and the end-user.
 4) Clear-bright is abbreviated as Clbr.
 5) The requirements of the cleanliness of the hydraulic fluid is system dependent. Cleanliness level expressed according to ISO 4406 may be established by agreement between the supplier and the end-user. It should be noted that the fluid is exposed to various influences during transport and storage – the cleanliness level required for the system should be guaranteed by careful filtering of the hydraulic fluid when filling.
 6) The definition of compatibility for types of elastomers other than NBR 1 (e.g. FPM, EPDM, AU) can be agreed between the supplier and the end users.

Table 2 — Specifications for category HL mineral oil hydraulics fluids

Characteristics	Oils of HH type with improved anti-rust and anti-oxidation properties									
	Units	VG 10	VG 15	VG 22	VG 32	VG 46	VG 68	VG 100	VG 150	Test Method
Viscosity grade (ISO 3448)	—									
Kinematic viscosity at:	mm ² /s ¹⁾									ISO 3104 and ISO 3105
— 20 °C,maximum		600	—	—	—	—	—	—	—	
0 °C,maximum		90	150	300	420	780	1400	2560	4500	
40 °C,minimum - maximum		9,00 – 11,0	13,5 – 16,5	19,8 – 24,2	28,8 – 35,2	41,4 – 50,6	61,2 – 74,8	90,0 – 110	135 – 165	
100 °C,minimum		2,50	3,20	4,10	5,00	6,10	7,80	9,90	14,0	
Viscosity index	—	2)	2)	2)	2)	2)	2)	2)	2)	ISO 2909
Density at 15 °C	kg/m ³	2)	2)	2)	2)	2)	2)	2)	2)	ISO 3675
Colour ³⁾	—	2)	2)	2)	2)	2)	2)	2)	2)	ISO 2049
Appearance at 25 °C ⁴⁾	—	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Clbr	Visual
Cleanliness		5)	5)	5)	5)	5)	5)	5)	5)	
Flash point:										
— Cleveland open cup,minimum	°C	125	140	165	175	185	195	205	215	ISO 2592
Pour point,maximum	°C	–30	–27	–21	–18	–15	–12	–12	–12	ISO 3016
Acid number,maximum ⁶⁾	mg KOH/g	2)	2)	2)	2)	2)	2)	2)	2)	ISO 6618 or ISO 6619
Water content,maximum	% (m/m)	0,025	0,025	0,025	0,025	0,025	0,025	0,025	0,025	ISO 6296 or ISO 12937 or ISO 20764
Water separation: ⁷⁾										
— time to 3 ml emulsion at 54 °C,.....maximum	min	30	30	30	30	30	30	—	—	ISO 6614
— time to 3 ml emulsion at 82 °C,.....maximum	min	—	—	—	—	—	—	30	30	
Copper corrosion, 100°C, 3 h,maximum	class	2	2	2	2	2	2	2	2	ISO 2160

Full standard: <https://standards.iteh.ai/catalog/standards/sist/f7e07fe6-2c5e-41f4-9695-d9b29af6bcb2/iso-11158-2009>