INTERNATIONAL STANDARD

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Lubricants, industrial oils and related products (class L) — Family H (Hydraulic systems) — Specifications for categories HETG, HEPG, HEES and HEPR

Lubrifiants, huiles industrielles et produits connexes (classe L) — Famille H (Systèmes hydrauliques) — Spécifications pour les catégories HETG, HEPG, HEES et HEPR

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15380 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 4, *Classifications and specifications*.

Annexes A, B and C of this International Standard are for information only.

Introduction

The specifications for hydraulic fluids based on mineral oils (H) are described in ISO 11158 [1] and the specifications for fire-resistant hydraulic fluids (HF) are given in ISO 12922 [2]. Test methods and criteria for performance are relatively well defined for these two categories of hydraulic fluids compared to the relatively new class of environmentally acceptable hydraulic fluids (HE). This last type has come into existence mainly because of the need for non-toxic biodegradable fluids which are compatible with the environment.

Despite the great interest in HE, the lack of standards and technical language describing these fluids has impeded the growth of the market for these types of fluids. The emergence of the environmentally acceptable lubricants has been based on the premise that they are environmentally friendly and less toxic; however, a non-contentious and well-accepted description and definition of toxicity and biodegradability still eludes us. Part of the difficulty in gaining acceptance for environmentally acceptable hydraulic fluids is that the measurement of the environmental impact requires the close contact of two heterogeneous media ; viz., environmentally acceptable lubricants and the biological system.

This International Standard contains three informative annexes. Annex A contains guidelines for changing fluids from mineral-based oils to environmentally acceptable fluids. Annex B contains additional information on shear stability and the yellow metal test. Annex C covers the disposal of hydraulic fluids.

Lubricants, industrial oils and related products (class L) — Family H (Hydraulic systems) — Specifications for categories HETG, HEPG, HEES and HEPR

WARNING — The handling and use of products 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 International 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 requirements for environmentally acceptable hydraulic fluids and is intended for hydraulic systems, particularly hydraulic fluid power systems. The purpose of this International Standard is to provide guidance for suppliers and users of environmentally acceptable hydraulic fluids, and for the direction of original equipment manufacturers of hydraulic systems.

This International Standard stipulates the requirements for environmentally acceptable hydraulic fluids at the time of delivery.

Classification of fluids used in hydraulic application is defined in ISO 6743-4. Of the categories covered by ISO 6743-4, only four types of environmentally acceptable fluids are embraced in this International Standard. These categories are HETG, HEPG, HEES and HEPR.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

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

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

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 3170:1988, *Petroleum products — Manual sampling*

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

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

ISO 4259:1992, *Petroleum products — Determination and application of precision data in relation to methods of test*

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

ISO 5884:1987, *Aerospace — Fluid systems and components — Methods for system sampling and measuring the solid particle contamination of hydraulic fluids*

ISO 6072:—[2] , *Hydraulic fluid power — Compatibility between elastomeric materials and fluids*

ISO 6245:2001, *Petroleum products — Determination of ash*

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 6341:1996, *Water quality — Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea) – Acute toxicity test*

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 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 7346-2:1996, *Water quality — Determination of the acute lethal toxicity of substances to a freshwater fish [Brachydanio rerio Hamilton-Buchanan (Teleostei, Cyprinidae)] — Part 2: Semi-static method*

ISO 8192:1986, *Water quality — Test for inhibition of oxygen consumption by activated sludge*

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

ISO 9439:1999, *Water quality — Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium — Carbon dioxide evolution test*

ISO 12185:1996, *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method*

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

ISO 14593:1999, *Water quality — Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium — Method by analysis of inorganic carbon in sealed vessels (CO_2 headspace test)*

DIN 51354-2:1990, *Testing of lubricants; FZG gear test rig; method A/8,3/90 for lubricating oils*

DIN 51389-2:1982, *Determination of lubricants; mechanical testing of hydraulic fluids in the vane-cell-pump; method A for anhydrous hydraulic fluids*

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1) To be published. (Part 1 of the revision of ISO 4263:1986)

2) To be published. (Revision of ISO 6072:1986)

DIN 51554-3:1978, *Testing of mineral oils; test of susceptibility to ageing according to Baader; testing at 95 °C*

IP 281/80, *Determination of anti-wear properties of hydraulic fluids — Vane pump method*

ASTM D943-99, *Standard test method for oxidation characteristics of inhibited mineral oils*

ASTM D2532-93, *Standard test method for viscosity and viscosity change after standing at low temperature of aircraft turbine lubricants*

ASTM D6081-98, *Standard practice for aquatic toxicity testing of lubricants: Sample preparation and results interpretation*

CETOP RP67H:1999[3)], *Anti-wear vane pump test for hydraulic fluids*

3 Sampling

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

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

4 Requirements for environmentally acceptable hydraulic fluids

For the purpose of this International Standard, hydraulic fluids shall be vegetable oil, polyglycols, synthetic esters, polyalphaolefins and related hydrocarbon products. The classification of these hydraulic oils shall be in accordance with ISO 6743-4 for categories HETG, HEPG, HEES and HEPR.

Fluid classification should correspond to the major base stock component.

Fluids, when tested under prescribed methods, shall be in concurrence with limiting values set out in Tables 1 to 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 5884.

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

The environmental behaviour specifications for categories HETG, HEPG, HEES and HEPR are given in Table 1.

3) Available from Hydraulics Secretariat of CETOP, BFPA, Cheriton house, Cromwell Business Park, Chipping Norton, OX7 5SR, UK., Tel.: +44 (0) 1608 647900, Fax: +44 (0) 1608 647919.

Table 1 — Environmental behaviour requirements for categories HETG, HEPG, HEES and HEPR

Characteristics of tests	Units	Requirements	Test methods or Standards
Biodegradability, min.	%	60	ISO 14593 or ISO 9439
Toxicity[a]			
Acute fish toxicity, 96 h, LC50, min.	mg/l	100	ISO 7346-2
Acute Daphnia toxicity, 48 h, EC50, min.	mg/l	100	ISO 6341
Bacterial inhibition, 3 h, EC50, min.	mg/l	100	ISO 8192

NOTE The biodegradability and aquatic toxicity tests should be performed according to Good Laboratory Practice (GLP).

[a] Water-soluble fluids shall be tested according to the test method cited. Fluids with low water solubility shall be tested using water-accomodated fractions, prepared according to ASTM D6081.

All other detailed specifications of each category mentioned in this International Standard are provided in Tables 2 to 5 respectively and as indicated below.

Table	Categories
2	HETG
3	HEPG
4	HEES
5	HEPR

Composition, properties and typical applications of each category are described at the top of the tables. These items are taken from ISO 6743-4.

SAFETY PRECAUTIONS — This International Standard does not purport to address all of the safety problems associated with the use of environmentally acceptable fluids. It is the responsibility of users to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. The fluid shall not present any significant hazard to health when correctly used in hydraulic equipment observing suppliers handing recommendations.

Table 2 — Specifications for type HETG hydraulic fluids, triglycerides

Lubricants, Industrial Oils and Related Products
Group HE: Environmentally Acceptable Hydraulic Fluids

Characteristics of test	Units	Requirements				Test method or Standard
Viscosity grade		**22**	**32**	**46**	**68**	**ISO 3448**
Density at 15 °C	kg/m^3	—[a]	—[a]	—[a]	—[a]	ISO 12185 ISO 3675
Colour[b]		—[a]	—[a]	—[a]	—[a]	ISO 2049
Appearance at 25 °C[c]		Clbr	Clbr	Clbr	Clbr	
Ash content, max.	% (*m*/*m*)	—[d]	—[d]	—[d]	—[d]	ISO 6245
Flash point						
Cleveland open cup, min.	°C	165	175	185	195	ISO 2592
Kinematic viscosity						
at – 20 °C, max.	mm^2/s	—[d]	—[d]	—[d]	—[d]	ISO 3104
at 0 °C, max.	mm^2/s	300	420	780	1 400	
at 40 °C, min. to max.	mm^2/s	19,8 to 24,2	28,8 to 35,2	41,4 to 50,6	61,2 to 74,8	
at 100 °C, min.	mm^2/s	4,1	5,0	6,1	7,8	
Pour point, max.	°C	—[d]	—[d]	—[d]	—[d]	ISO 3016
Low temperature fluidity after 7 days	°C	—[d]	—[d]	—[d]	—[d]	ASTM D2532
Acid number [e], max.	mg KOH/g	—[d]	—[d]	—[d]	—[d]	ISO 6618
Water content, max.	mg/kg	1 000	1 000	1 000	1 000	ISO 12937 ISO 6296
Copper corrosion, 100 °C, 3 h, max.	rating	2	2	2	2	ISO 2160
Rust prevention, procedure A		Pass	Pass	Pass	Pass	ISO 7120
Foam at 24 °C, max.	ml	150/0	150/0	150/0	150/0	ISO 6247
at 93 °C, max.		75/0	75/0	75/0	75/0	
at 24 °C, max.		150/0	150/0	150/0	150/0	
Air release, 50 °C, max.	min	7	7	10	10	ISO 9120
Water separation						ISO 6614
Time to 3 ml emulsion at 54 °C, max.	min	—[d]	—[d]	—[d]	—[d]	