
**Lubricants, industrial oils and
related products (class L) —
Family H (hydraulic systems) —
Specifications for hydraulic fluids
in categories HFAE, HFAS, HFB, HFC,
HFDR and HFDU**

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*Lubrifiants, huiles industrielles et produits connexes (classe L) —
Famille H (systèmes hydrauliques) — Spécifications applicables
aux fluides hydrauliques des catégories HFAE, HFAS, HFB, HFC,
HFDR et HFDU*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*, Subcommittee SC 4, *Classifications and specifications*.

This third edition cancels and replaces the second edition (ISO 12922:2012), which has been technically revised. The main changes compared with the previous edition are as follows:

- an introduction and a terms and definitions clause have been added;
- the methods specified for measuring water content in water-based fluid types HFA/HFB/HFC have been revised;
- the oxidation requirements for HFDU fluids have been increased.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Hydraulic fluids constitute the largest segment of the industrial lubricant market. Although mineral oil-based fluids are by far the most widely used type of hydraulic fluid, there are some applications where the use of these fluids could constitute a fire hazard. In order to reduce the risk to operatives in such circumstances, fire-resistant or less flammable fluids that increase operator safety have been developed. However, the following points should be noted.

- Even fire-resistant fluids can ignite at very high temperatures and the flammability behaviour of the fluids specified in this document covers a very wide range. It is therefore necessary to know the level of hazard in order to select the appropriate fluid.
- The properties of these fluids can be significantly different to those of conventional mineral oil-based products. For example, some fire-resistant fluids contain water. It might therefore be necessary to design the system for their use. It should also not be assumed that synthetic, non-aqueous fluids can replace mineral oil products without system modifications. Some fluids, for example, are incompatible with the elastomers used with mineral oils.

To enable the satisfactory operation of fire-resistant hydraulic fluids, it is recommended that this document is read in conjunction with ISO 7745.

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Lubricants, industrial oils and related products (class L) — Family H (hydraulic systems) — Specifications for hydraulic fluids in categories HFAE, HFAS, HFB, HFC, HFDR and HFDU

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

1 Scope

This document specifies the minimum requirements of unused fire-resistant and less flammable hydraulic fluids for hydrostatic and hydrodynamic systems in general industrial applications. It is not intended for use in aerospace or power-generation applications, where different requirements apply. It provides guidance for suppliers and end users of these less hazardous fluids and to the manufacturers of hydraulic equipment in which they are used.

Of the categories covered by ISO 6743-4, which classifies the different types of fluids used in hydraulic applications, only the following are detailed in this document: HFAE, HFAS, HFB, HFC, HFDR and HFDU.

Types HFAE, HFAS, HFB, HFC and HFDR are "fire-resistant" fluids as defined by ISO 5598. Most HFDU fluids, while displaying an improvement in combustion behaviour over mineral oil, fall outside this definition and are more appropriately considered as "less flammable" fluids.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 760, *Determination of water — Karl Fischer method (General method)*

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

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

ISO 3170, *Petroleum liquids — Manual sampling*

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

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

ISO 4259-2, *Petroleum and related products — Precision of measurement methods and results — Part 2: Interpretation and application of precision data in relation to methods of test*

ISO 4263-2, *Petroleum and related products — Determination of the ageing behaviour of inhibited oils and fluids — TOST test — Part 2: Procedure for category HFC hydraulic fluids*

ISO 4263-3, *Petroleum and related products — Determination of the ageing behaviour of inhibited oils and fluids using the TOST test — Part 3: Anhydrous procedure for synthetic hydraulic fluids*

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ISO 4404-1, *Petroleum and related products — Determination of the corrosion resistance of fire-resistant hydraulic fluids — Part 1: Water-containing fluids*

ISO 4404-2, *Petroleum and related products — Determination of the corrosion resistance of fire-resistant hydraulic fluids — Part 2: Non-aqueous fluids*

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

ISO 6072, *Rubber — Compatibility between hydraulic fluids and standard elastomeric materials*

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

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

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

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

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

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

ISO 7745, *Hydraulic fluid power — Fire-resistant (FR) fluids — Requirements and guidelines for use*

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

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

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

ISO 14935, *Petroleum and related products — Determination of wick flame persistence of fire-resistant fluids*

ISO 15029-1, *Petroleum and related products — Determination of spray ignition characteristics of fire-resistant fluids — Part 1: Spray flame persistence — Hollow-cone nozzle method*

ISO 15029-2, *Petroleum and related products — Determination of spray ignition characteristics of fire-resistant fluids — Part 2: Spray test — Stabilised flame heat release method*

ISO 20623, *Petroleum and related products — Determination of the extreme-pressure and anti-wear properties of lubricants — Four-ball method (European conditions)*

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

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

ISO 20783-1, *Petroleum and related products — Determination of emulsion stability of fire-resistant fluids — Part 1: Fluids in category HFAE*

ISO 20783-2, *Petroleum and related products — Determination of emulsion stability of fire-resistant fluids — Part 2: Fluids in category HFB*

ISO 20823, *Petroleum and related products — Determination of the flammability characteristics of fluids in contact with hot surfaces — Manifold ignition test*

ISO 20843, *Petroleum and related products — Determination of pH of fire-resistant fluids within categories HFAE, HFAS and HFC*

ISO 20844, *Petroleum and related products — Determination of the shear stability of polymer-containing oils using a diesel injector nozzle*

EN 14832, *Petroleum and related products — Determination of the oxidation stability and corrosivity of fire-resistant phosphate ester fluids*

EN 14833, *Petroleum and related products — Determination of the hydrolytic stability of fire-resistant phosphate ester fluids*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Sampling

The sampling of hydraulic fluids for the purposes of this document shall be carried out in accordance with the appropriate procedure described in ISO 3170. A representative sample shall be evaluated.

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

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5 Requirements for fire-resistant hydraulic fluids and less flammable hydraulic fluids

For the purposes of this document, fluids shall be classified according to ISO 6743-4. Guidelines for their selection and use can be found in ISO 7745 and CEN/TR 14489^[1]. The latter also includes information on health and safety requirements.

Where applicable and when tested in accordance with the specified methods, fluids shall meet the limit values indicated in [Table 1](#) (HFAE and HFAS fluids), [Table 2](#) (HFB and HFC fluids) and [Table 3](#) (HFDR and HFDR fluids). It should be noted that a significant variation exists in the level of fire-resistance displayed by the different fluid types.

The majority of test methods specified within [Tables 1](#) to [3](#) contain a statement of precision (repeatability and reproducibility). ISO 4259-2, which covers the use of precision data in the interpretation of test results, shall be used in cases of dispute.

NOTE For the purposes of this document, the terms “% (m/m)” and “% (V/V)” are used to represent, respectively, the mass fraction and the volume fraction of a material.