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ISO 12922

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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

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12922 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 4, *Classifications and specifications*.

This second edition cancels and replaces the first edition (ISO 12922:1999), which has been technically revised. It also incorporates the Technical Corrigendum ISO 12922:1999/Cor.1:2001.

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 International Standard can 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 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 International Standard: 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 “less-flammable” fluids.

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

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 760:1978, *Determination of water — Karl Fischer method (General method)*

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

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

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*

ISO 3733:1999, *Petroleum products and bituminous materials — Determination of water — Distillation method*

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

ISO 4263-2:2003, *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 4263-3:2010, *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*

ISO 4404-1:2012, *Petroleum and related products — Determination of the corrosion resistance of fire-resistant hydraulic fluids — Part 1: Water-containing fluids*

ISO 4404-2:2010, *Petroleum and related products — Determination of the corrosion resistance of fire-resistant hydraulic fluids — Part 2: Non-aqueous fluids*

ISO 5598:2008, *Fluid power systems and components — Vocabulary*

ISO 6072:2011, *Rubber — Compatibility between hydraulic 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 content — Potentiometric Karl Fischer titration method*

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 7745:2010, *Hydraulic fluid power — Fire-resistant (FR) fluids — Requirements and guidelines for use*

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

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

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 14935:1998, *Petroleum and related products — Determination of wick flame persistence of fire-resistant fluids*

ISO 15029-1:1999, *Petroleum and related products — Determination of spray ignition characteristics of fire-resistant fluids — Part 1: Spray flame persistence — Hollow-cone nozzle method*

ISO/TS 15029-2:2012, *Petroleum and related products — Determination of spray ignition characteristics of fire-resistant fluids — Part 2: Spray test — Stabilized flame heat release method*

ISO 20623:2003, *Petroleum and related products — Determination of the extreme-pressure and anti-wear properties of fluids — Four ball method (European conditions)*

ISO 20763:2004, *Petroleum and related products — Determination of anti-wear properties of hydraulic fluid — 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*

ISO 20783-1:2011, *Petroleum and related products — Determination of emulsion stability of fire-resistant fluids — Part 1: Fluids in category HFAE*

ISO 20783-2:2003, *Petroleum and related products — Determination of emulsion stability of fire-resistant fluids — Part 2: Fluids in category HFB*

ISO 20823:2003, *Petroleum and related products — Determination of the flammability characteristics of fluids in contact with hot surfaces — Manifold ignition test*

ISO 20843:2011, *Petroleum and related products — Determination of pH of fire-resistant fluids within categories HFAE, HFAS and HFC*

ISO 20844:2004, *Petroleum and related products — Determination of the shear stability of polymer-containing oils using a diesel injector nozzle*

EN 14832:2005, *Petroleum and related products — Determination of the oxidation stability and corrosivity of fire-resistant phosphate ester fluids*

EN 14833:2005, *Petroleum and related products — Determination of the hydrolytic stability of fire-resistant phosphate ester fluids*

3 Sampling

Sampling of hydraulic fluids for the purposes of this International Standard 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.

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

For the purposes of this International Standard, 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. 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 HFDU 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, which covers the use of precision data in the interpretation of test results, shall be used in cases of dispute.

Table 1 — Requirements for fluids in categories HFAE and HFAS

Characteristic or test	Unit	Specification		Test method
		Category HFAE[abcd]	Category HFAS[abcd]	
Composition:		oil-in-water emulsions typically containing ≥ 95 % water (*m/m*), (+5 °C to +50 °C; ISO 7745)	chemical solutions in water typically containing ≥ 95 % water (*m/m*), (+5 °C to +50 °C; ISO 7745)	
Appearance		[e]	[f]	
Viscosity at 40 °C .... maximum	mm^2/s	5	5	ISO 3104
Water content	% (*m/m*)	95	[g]	ISO 3733
	% (*m/m*)	[g]	95	ISO 6296[l]
Foaming tendency/stability at				ISO 6247
+25 °C .... maximum	ml/ml	300/10	300/10	
+50 °C .... maximum	ml/ml	300/10	300/10	
+25 °C .... maximum	ml/ml	300/10	300/10	
pH at 20 °C		6,7 to 10,0	6,7 to 10,0	ISO 20843
Emulsion stability (50 °C/600 h)	rating	2A to 2R	[g]	ISO 20783-1
— free oil .... maximum	% (*V/V*)	trace	[g]	
— cream .... maximum	% (*V/V*)	0,5	[g]	
Corrosion protection				ISO 4404-1
— visual rating of metals .... maximum	rating	3	3	
— visual rating of the fluid	rating	[h]	[h]	
— mass changes of metal strips ... maximum	mg			
— steel, copper and brass		+5 to −11	+5 to −11	
— aluminium		+5 to −5	+5 to −5	
— zinc		+5 to −22	+5 to −22	
Elastomer compatibility: NBR 1[i], EPDM 1[i] and FKM 2[i] elastomers, 60 °C/168 h				ISO 6072
— relative volume change .... minimum	%	0	0	
.... maximum	%	+7	+7	
— relative hardness change .... minimum	IRHD[j]	−7	−7	
.... maximum	IRHD[j]	+2	+2	
— change in tensile strength	%	[k]	[k]	
— elongation at break	%	[k]	[k]	

[a] These products are normally supplied as concentrates and are diluted with water by the end user. To ensure the rapid and complete mixing of the finished fluid, the viscosity of the concentrate at 20 °C should be 350 mm^2/s maximum.

[b] The limits given in this table can be applied at the dilution recommended by the supplier when using water selected from one of the following sources:
1) test waters listed in ISO 4404-1 and in ISO 20783-1; or
2) distilled or de-ionized water; or
3) mains water supplied by the user.

Tests should be carried out before commercial use and the results, if reported, shall indicate the type of (test) water and the dilution level used.

[c] The viscosity of these fluids is very low and they may be used only in equipment especially designed for such products.

[d] As a result of their very high water content, these fluids are expected to possess excellent fire resistance.

[e] Report the appearance. With HFAE fluids this can vary from transparent to opaque depending on the formulation and the composition of the diluent.

[f] HFAS fluids are transparent. When examined under daylight at ambient temperature using a clear glass container of approximately 10 cm in diameter, they should be clear and bright and free from any visible particulate matter.

[g] The requirement is not relevant to this fluid type.

[h] Test limits are be negotiated between the supplier and the user.

[i] NBR 1, EPDM 1 and FKM 2 are standard reference elastomers, the compositions of which are given in ISO 6072. They are the elastomer types most widely used, but not exclusively so, with the above fluids. While providing a useful guide to compatibility with HFAE and HFAS fluids, they can give results that are different from commercially available rubbers of the same nominal type. If doubt exists as to their compatibility, contact the elastomer manufacturer.

[j] International Rubber Hardness Degree.

[k] Report only on request.

[l] ISO 6296 covers the mass fraction range 0,003 % (*m/m*) to 0,100 % (*m/m*). To use ISO 6296 to measure the water content of HFAS fluids, proceed as follows:
- use a 100 µl syringe to take the test sample;
- dry the 100 µl syringe as described in ISO 6296:2000, 7.2.3;
- withdraw a 50 µl to 100 µl sample and titrate in accordance with ISO 6296:2000, 7.2.5.

Note that the precision of this procedure may differ from the values given in ISO 6296.

Table 2 — Requirements for fluids in categories HFB and HFC

Characteristic or test	Unit	Specification		Test method
		Category HFB[a]	Category HFC[a]	
Composition		water-in-oil emulsions, typically containing ≥ 40 % water (% *m/m*) (+5 °C to +50 °C, ISO 7745)	water polymer solutions, typically containing ≥ 35 % water (% *m/m*) (–20 °C to +50 °C, ISO 7745)	
Viscosity grade (ISO 3448)		46; 68; 100	22; 32; 46; 68	
Appearance		[b]	[c]	
Water content	% (*m/m*)	[b]	35	ISO 6296[m]
	% (*m/m*)	40	[b]	ISO 3733
Density at 15 °C	kg/m^3	[d]	[d]	ISO 3675 ISO 12185
pH at 20 °C		[b]	6,7 to 10,0	ISO 20843
Viscosity at 40 °C	mm^2/s	[d]	[d]	ISO 3104
Corrosion protection:				ISO 4404-1
— visual assessment of the metals ..... maximum	rating	3	3	
— visual assessment of the fluid	rating	[e]	[e]	
— mass changes of strips ..... maximum	mg			
— steel, copper and brass		+5 to –11	+5 to –11	
— aluminium		+5 to –5	+5 to –5	
— zinc		+5 to –22	+5 to –22	
Foaming tendency/stability at				ISO 6247
+25 °C ..... maximum	ml/ml	[b]	300/10	
+50 °C ..... maximum	ml/ml	[b]	300/10	
+25 °C ..... maximum	ml/ml	[b]	300/10	
Air release at 50 °C ..... maximum	min	[b]	20; 20; 25; 25	ISO 9120
Emulsion stability:				ISO 20783-2
1) 1 000 h at 20 °C,				
— surface oil ..... maximum	ml	10	[b]	
— accumulated free water ..... maximum	ml	2	[b]	
— change in water content at 425 ml .... maximum	%	5	[b]	
— change in water content at 125 ml .... maximum	%	5	[b]	
2) 48 h at 70 °C				ISO 20783-2
— surface oil ..... maximum	ml	3	[b]	
— accumulated free water ..... maximum	ml	1	[b]	
3) 336 h at -10 °C/168 h at +20 °C				ISO 20783-2
— surface oil ..... maximum	ml	2	[b]	
— accumulated free water ..... maximum	ml	1	[b]	
— change in water content at 5 ml ..... maximum	%	15	[b]	
— mean change in water content at 5 ml ..... maximum	%	10	[b]	
Shear stability: 17,5 MPa (175 bar)/250 cycles[f]				ISO 20844
— viscosity change at 20 °C ..... maximum	%	± 15	[d]	
— viscosity change at 40 °C ..... maximum	%	± 15	[d]	
— viscosity change at 100 °C ..... maximum	%	[b]	[b]	
— pH change ..... maximum		[b]	± 1,0	
— water content change ..... maximum	%	5	8	
— acid number change ..... maximum	mg KOH/g	± 0,50	[b]	ISO 6618 ISO 6619

Table 2 (*continued*)

Characteristic or test	Unit	Specification		Test method
		Category HFB[a]	Category HFC[a]	
Elastomer compatibility: 60 °C/168 h				ISO 6072
— NBR 1 elastomer[g]				
— relative volume change ..... minimum	%	0	0	
— ..... maximum	%	+7	+7	
— relative hardness change ..... minimum	IRHD	–7	–7	
— ..... maximum	IRHD	+2	+2	
— change in tensile strength	%	h	h	
— elongation at break	%	h	h	
Fire resistance				
Spray ignition characteristics[i]				
— time to extinguishment of flame ..... maximum	s	30	30	ISO 15029-1[i]
— ignitability factor ..... minimum	RI[j]	e	e	ISO/TS 15029-2[i]
Wick flame persistence				ISO 14935
— mean flame persistence ..... maximum	s	60	60	
Manifold ignition test				ISO 20823
— ignition temperature ..... minimum	°C	650	600	
— flame propagation ..... minimum	rating	d	d	
Ageing properties[k]				ISO 4263-2
— pH value after test ..... minimum		b	4	
— insolubles ..... maximum	%	b	4	
Lubrication performance				
Vane pump				ISO 20763
— total of ring and vane wear ..... maximum	mg	b	l	
4-ball machine				ISO 20623
— wear scar diameter ..... maximum	mm	e	e	
FZG gear test				ISO 14635-1
— failure load stage ..... minimum	load stage	b	e	

[a] These fluids are supplied as the finished product.

[b] The requirement is not relevant to this fluid type.

[c] The appearance of the delivered fluid shall be clear and bright and free of any visible particulate matter, when examined in daylight at ambient temperature, using a clear glass container of approximately 10 cm in diameter.

[d] Value to be reported by the supplier. No limit is specified.

[e] Test limits are to be negotiated between the supplier and the user.

[f] For fluids with a viscosity greater than 10 mm^2/s at 20 °C.

[g] NBR 1 is a standard reference elastomer, the composition of which is given in ISO 6072. It is the type of elastomer most widely used with the above fluids, but not exclusively so. It provides a useful guide to the compatibility of this seal type with HFB and HFC fluids, but can give results that are different from commercially available elastomers of the same nominal type. If doubt exists as to the compatibility, contact the elastomer manufacturer.

[h] Report only on request.

[i] The methods published as parts of ISO 15029 (see also Annex A) measure different fluid characteristics under conditions that are not necessarily comparable. However, performance under at least one test condition is required. The method is therefore to be agreed between the end user and the fluid supplier in accordance with national or other requirements. ISO/TS15029-2 is currently under development and limits have not yet been established. These are to be agreed between the end user and the fluid supplier. Where data are reported, reference shall be made to the method used.

[j] Ignitability factor

[k] The test duration is 200 h.

[l] In view of the non-availability of test cartridges from the original supplier, new sources are currently being investigated. As yet, no precision data are available on the alternative cartridges when testing the above fluid types and no limits can, therefore, be specified. Until these data are available, it is recommended that the limits previously specified in ISO 20763 be used for guidance only. For HFC fluids, this means a vane and ring mass loss of < 50 mg and < 180 mg, respectively.

[m] ISO 6296 covers the mass fraction range 0,003 % (m/m) to 0,100 % (m/m). To use ISO 6296 to measure the water content of HFC fluids, proceed as follows:

— use a 100 µl syringe to take the test sample;
— dry the 100 µl syringe as described in ISO 6296:2000, 7.2.3;
— withdraw a 50 µl to 100 µl sample and titrate in accordance with ISO 6296:2000, 7.2.5.

Note that the precision of this procedure may differ from the values given in ISO 6296.

Table 3 — Requirements for fluids in categories HFDR and HFDU

Characteristic or test	Unit	Specifications		Test method
		Category HFDR[a]	Category HFDU[a]	
Composition		synthetic fluids free of water consisting of phosphate esters (–20 °C to +70 °C/150 °C[b], ISO 7745)	synthetic fluids free of water and of other composition (–20 °C to +70 °C/150 °C[b], ISO 7745)	
Viscosity grade (ISO 3448)		15; 22; 32; 46; 68; 100	15; 22; 32; 46; 68; 100	
Appearance		[c]	[c]	
Acid number	mg KOH/g	[d]	[d]	ISO 6618 ISO 6619[e]
Water content ..... maximum	% (m/m)	0,1	0,1	ISO 760 ISO 20764[f]
Density at 15 °C	kg/m^3	[d]	[d]	ISO 3675 ISO 12185
Viscosity at 40 °C	mm^2/s	[d]	[d]	ISO 3104
Foaming tendency/stability at				ISO 6247
+25 °C ..... maximum	ml/ml	300/10	300/10	
+93 °C ..... maximum	ml/ml	300/10	300/10	
+25 °C ..... maximum	ml/ml	300/10	300/10	
Air release at 50 °C ..... maximum	min	8; 10; 12; 15; 25; 30	8; 10; 12; 15; 25; 30	ISO 9120
Corrosion protection				ISO 4404-2
— visual assessment of metals ..... maximum	rating	3	3	
— visual assessment of fluid	rating	[g]	[g]	
— mass changes of metal strip ..... maximum	mg			
— steel, copper and brass		+5 to –11	+5 to –11	
— aluminium		+5 to –5	+5 to –5	
— zinc		+5 to –22	+5 to –22	
Rust-preventing characteristics	rating	[d]	[d]	ISO 7120
Corrosiveness to copper	rating	[d]	[d]	ISO 2160
Shear stability, 17,5 MPa (175 bar)/250 cycles				ISO 20844
— viscosity change at 20 °C ..... maximum	%	± 10	± 10	
— viscosity change at 40 °C ..... maximum	%	± 5	± 5	
— viscosity change at 100 °C ..... maximum	%	± 7	± 7	
— acid number change..... maximum	mg KOH/g	± 0,5	± 0,5	ISO 6619
Elastomer compatibility: 100 °C/168 h				ISO 6072
— FKM 2[i], EPDM 1[i] types (HFDR fluids)				
— FKM 2[i], NBR 1[i], NBR 2[i] types (HFDU fluids)				
— relative volume change ..... minimum	%	0	0	
..... maximum	%	+7	+7	
— relative hardness change ..... minimum	IRHD	–7	–7	
..... maximum	IRHD	+2	+2	
— change in tensile strength	%	[h]	[h]	
— elongation at break	%	[h]	[h]	

Table 3 (*continued*)

Characteristic or test	Unit	Specifications		Test method
		Category HFDR[b]	Category HFDU[b]	
Fire resistance Spray ignition characteristics[j]				
— time to extinguishment of flame ..... maximum	s	30	30	ISO 15029-1[j]
— ignitability factor ..... minimum	RI	g	g	ISO/TS 15029-2[j]
Wick flame persistence				ISO 14935
— mean flame persistence ..... maximum	s	60	d	
Manifold ignition test				ISO 20823
— ignition temperature ..... minimum	°C	700	400	
— flame propagation ..... minimum	rating	d	d	
Oxidation stability				EN 14832
— acid number increase ..... maximum	mg KOH/g	1,5	k	
— mass losses ..... maximum	mg		k	
— iron		1		
— copper		2		
Oxidation life ..... minimum	h	k	100	ISO 4263-3
Hydrolytic stability				EN 14833
— acid number increase ..... maximum	mg KOH/g	d	d	
Lubrication performance				
Vane pump				ISO 20763
— total of ring and vane wear ..... maximum	mg	l	l	
4-ball wear test				ISO 20623
— wear scar diameter ..... maximum	mm	g	g	
FZG gear test				ISO 14635-1
— failure load stage ..... minimum	load stage	g	g	

[a] These fluids are supplied as the finished product.

[b] The higher temperature indicates the approximate upper limit for short-term operation. This will depend upon whether the application is hydrostatic or hydrodynamic and, for HFDU fluids, on the chemical composition of the fluid. Where doubt exists, clarification should be sought from the equipment manufacturer and/or fluid supplier.

[c] The appearance of the delivered fluid shall be clear and bright and free of any visible particulate matter, when examined in daylight at ambient temperature, using a clear glass container of approximately 10 cm in diameter.

[d] Value should be reported by the supplier. No limit is specified.

[e] For dyed fluids, ISO 6619 should be used.

[f] ISO 20764 is applied in instances where interference by certain chemicals is to be avoided

[g] Test limits are to be negotiated between the supplier and the user.

[h] Report only on request.

[i] EPDM 1, FKM 2, NBR 1 and NBR 2 are standard reference elastomers, the compositions of which are given in ISO 6072. They are the elastomer types most widely used with the above fluids, but not exclusively so. They will provide a useful guide to compatibility with HFDR and HFDU fluids, but may give results that are different from commercially available elastomers of the same nominal type. EPDM 1 and FKM 2 are normally suitable for use with HFDR fluids with the exception of the combination of FKM 2 and alkyl phosphate esters. The NBR 1 and NBR 2 reference elastomers are not suitable for use with HFDR fluids and NBR 1 might not be suitable for use with all HFDU fluids. If doubt exists as to their compatibility, contact the elastomer manufacturer.

[j] The methods published as parts of ISO 15029 (see also Annex A) measure different fluid characteristics under conditions that are not necessarily comparable. However, performance under at least one test condition is required. The method is therefore to be agreed between the end user and the fluid supplier in accordance with national or other requirements. ISO/TS 15029-2 is currently under development and limits have not yet been established. These are to be agreed between the end user and the fluid supplier. Where data are reported, reference shall be made to the method used.

[k] The requirement is not relevant to this fluid type.

[l] In view of the non-availability of test cartridges from the original supplier, new sources are currently being investigated. As yet, no precision data are available for alternative cartridges and therefore no limits can be specified. Until these data are available, it is recommended that the limits previously specified in ISO 20763 be used for guidance only. For both HFDR and HFDU fluids this means a vane and ring weight loss of < 30 mg and < 120 mg, respectively.

Annex A
(informative)

Spray ignition characteristics

Two different spray ignition test methods are currently in use. These are published as separate parts of ISO 15029: *Petroleum and related products — Determination of spray ignition characteristics of fire-resistant hydraulic fluids*, as follows:

— *Part 1: Spray flame persistence — Hollow-cone nozzle method*

— *Part 2: Spray test — Stabilized flame heat release spray method*

NOTE ISO 15029-1 has no precision data and none is anticipated. ISO 15029-2 is under development and is published as a Technical Specification while precision data are generated. When ISO 15029-2 becomes a full International Standard, it is anticipated that ISO 15029-1 will become a Technical Specification.

Bibliography

[1] CEN/TR 14489:2005, *Fire-resistant hydraulic fluids — Classification and specification — Guidelines on selection for the protection of safety, health and the environment*

ICS 75.120

Price based on 10 pages