TECHNICAL SPECIFICATION

ISO/TS 12927

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Lubricants, industrial oils and related products (class L) — Family M (Metalworking) — Guidelines for establishing specifications

Lubrifiants, huiles industrielles et produits connexes (classe L) — Famille M (Travail des métaux) — Lignes directrices pour l'établissement de spécifications

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this ISO/TS 12927 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 12927 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 Technical Specification are for information only.

Introduction

Considering the difficulties encountered in establishing an international specification for metalworking fluids, particularly because of the diversity of the applications and conditions of use, and because of the problems of simulating the actual conditions of use in the laboratory and hence of developing reliable laboratory methods and testing standards, it has been decided to publish guidelines for establishing specifications in the form of a Technical Specification. Therefore, all information provided by this Technical Specification is only informative, except the classifications by family and viscosity.

This Technical Specification contains, in annexes A to C, suggested methods to evaluate some properties of metalworking fluids which are not yet standardized or still subject to discussions.

Lubricants, industrial oils and related products (class L) — Family M (Metalworking) — Guidelines for establishing specifications

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

1 Scope

This Technical Specification has been prepared with the following purposes:

— to facilitate the application of the ISO 6743-7 classification standard and to precisely state the characteristics to be taken into account to establish specifications for a given application;

— these characteristics could serve as a basis for discussion between the end user and the supplier.

This Technical Specification does not cover specified requirements which should be examined separately with a view to a common agreement between the end user and the product supplier.

This Technical Specification also does not cover the health, safety, disposal and environmental areas which should be dealt with separately, according to the regulations or laws in force in each country.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Technical Specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Technical Specification 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:—[1)] *Petroleum products — Determination of flash and fire points — Cleveland open cup method*

ISO 2719:1988, *Petroleum products and lubricants — Determination of flash point — Pensky-Martens closed cup method*

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

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1) To be published. (Revision of ISO 2592:1973)

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

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 3771:1994, *Petroleum products — Determination of base number — Perchloric acid potentiometric titration method*

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

ISO 6293:1983, *Petroleum products — Determination of saponification number*

ISO 6320:1995, *Animal and vegetable fats and oils — Determination of refractive index*

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

ISO 6743-0:1981, *Lubricants, industrial oils and related products (class L) — Classification — Part 0: General*

ISO 6743-7:1986, *Lubricants, industrial oils and related products (class L) — Classification — Part 7: Family M (Metalworking)*

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

NF T60-187:1991, *Aqueous machining fluids — Emulsifying and solubilising suitability and stability at rest*

NF T60-195:1993, *Aqueous machining fluids — Opacity under diluted form*

NF T60-196:1994, *Non aqueous machining fluids — Assessment of the tendency to form oil sprays*

NF T60-197:1993, *Aqueous and non aqueous metal working fluids — Short and long term storage stability*

3 Explanations of symbols used

3.1 General

In the column headed "ISO-L", in the following tables, the various categories are designated under abbreviated form. Where the complete designation should be ISO-L-MHA or ISO-L-MAA, it is generally permissible to design a product under abbreviated form L-MHA, L-MAA or even MHA, MAA.

In the complete designation, the prefix letter "L" designates the class "Lubricants, industrial oils and related products" according to ISO 6743-0. The letter "M" indicates the family "Metalworking" according to ISO 6743-7.

3.2 Straight (non-aqueous) fluids

a) The group of letters "MH" forms a code which indicates a straight (neat) fluid;

b) the numerical group which appears after each code corresponds to the average kinematic viscosity of the oil expressed according to ISO 3448.

3.3 Water-miscible fluids

a) the group of letters "MA" forms a code which indicates a concentrate to be mixed with water by the end user to form an aqueous fluid;

b) the mention of the viscosity grade of the concentrate is not necessary.

4 Specifications guide

4.1 Introduction

Generally, specifications are made of sets of characteristics

a) identification characteristics;

b) performance characteristics.

4.2 Straight (non-aqueous) fluids

4.2.1 Identification characteristics

These characteristics are commonly used in the characterization of petroleum products, for example: viscosity, specified gravity, flash point, pour point, colour, appearance. See table 1.

4.2.2 Performance characteristics

These characteristics are among the most difficult to define because they must be representative of the properties required in numerous, various and specific applications. Unfortunately, there is a lack of standardized and recognized methods to evaluate performances of products.

Some standardized methods exist but are not representative of actual industrial applications.

Among the critical performance characteristics the following may be mentioned, for example:

— extreme pressure (EP);

— anti-wear;

— friction reduction;

— anti-rust;

— anti-mist;

— filterability;

— compatibility with paints and synthetic materials.

See table 1.

Table 1 — Guidelines for establishing specifications of straight (non-aqueous) metalworking fluids

No.	Identification characteristics	Units	ISO L [a]								ISO standards	Other standards or methods
			MHA	MHB	MHC	MHD	MHE	MHF	MHG	MHH		
1.1	Appearance	rating	a	a	a	a	a	a				Visual
1.2	Colour	rating	a	a	a	a	a	a			ISO 2049	
1.3	Odour	rating	a	a	a	a	a	a				Olfactory
1.4	Density	kg/m^3	a	a	a	a	a	a			ISO 3675	
1.5	Viscosity	mm^2/s [b]	a	a	a	a	a	a			ISO 3104	
1.6	Flash point										c	
	. open cup	° C	a	a	a	a	a	a			ISO 2592	
	. closed up	° C	a	a	a	a	a	a			ISO 2719	
1.7	Pour point	° C	a	a	a	a	a	a			ISO 3016	
1.8	Saponification number	mg KOH/g	d	d	d	d	d	d	d	d	ISO 6293	
1.9	Total sulfur content	% mass	e	e	e	e	e	e	e	e	e	
1.10	Copper strip corrosion	rating	a	a	a	a	a	a			ISO 2160	
1.11	Chlorine content	% mass	f	f	f	f	f	f	f	f	f	
1.12	Elements content	% mass	g	g	g	g	g	g	g	g	g	
2.1	Foaming	ml/ml	a	a	a	a	a	a	a	a	ISO 6247	
2.2	Extreme pressure properties		h	h	h	h	h	h	h	h	h	
2.3	Filterability		i	i	i	i	i	i	i	i	i	
2.4	Anti-rust properties	rating	a	a	a	a	a	a	a	a	ISO 7120 A	
2.5	Anti-mist properties	% mass	j	j	j	j	j	j	j	j		NF T 60-196
2.6	Friction-reduction properties	rating	-	a	-	-	a	a			k	
2.7	Storage stability	rating	a	a	a	a	a	a			l	NF T 60-197
2.8	Machining performance	rating	m	m	m	m	m	m	m	m	m	

[a] This characteristic applies to the type of product.

[b] Indicate the temperature.

[c] Select the most relevant method according to the product type and flash-point value.

[d] The determination of this characteristic may be affected by the presence of some chemical compounds, for example : chlorinated paraffins, sulfurized esters.

[e] Precise the method used, for example : X Ray, combustion. The sulfur content coming from the additives may be indicated by the supplier if necessary (added sulfur, total sulfur, sulfur of base stocks).

[f] Precise the method used. The absence of this element may be requested from the end user, for disposal or environmental reasons.

[g] For metallurgical compatibility reasons, or any other justified reason, the end user may wish to know the nature and content of specific elements. Disclosure of the limits of nature and content of these elements may be negotiated between the end user and the supplier.

[h] Numerous tests exist to evaluate the extreme pressure properties of fluids, for example : Shell 4-ball, Falex, Reichert, Timken. These are examples of suitable products available commercially. This information is given for the convenience of users of this Technical Specification and does not constitute an endorsement by ISO of these products. The end user may ask to document results in given tests, but the presence of extreme pressure additives does not necessarily mean good machining performance. Moreover, no clear correlation has been established until now, between the laboratory extreme pressure screen tests and the machining performance.

[i] This characteristic represents the ability of the fluid to be filtered by the filtration equipment of the end user, without modification of its physico-chemical characteristics. This characteristic can only be evaluated in actual use.

[j] This characteristic permits the verification of the presence of mist suppressors and their efficiency. English translation is available from AFNOR.

[k] Test method and limits to be negotiated between the end user and the supplier. This characteristic is not necessary or useful in all cases.

[l] Short duration test. Temperature to be negotiated between the end user and the supplier. 0 °C may be too low a temperature for active sulfur-containing oils. English translation is available from AFNOR.

[m] Can only be evaluated in actual machining operations. The criteria to be taken into account are to be negotiated between the end user and the supplier.

4.3 Water-miscible fluids

4.3.1 Identification characteristics

These characteristics are related to the concentrate. In some cases, the presence of water or volatile products does not permit the use of the conventional method intended for the characterization of petroleum products. Among the methods likely to raise problems, the following may be mentioned, for example: viscosity, flash point, pour point, emulsibility, see table 2.

4.3.2 Performance characteristics

These characteristics are evaluated on the fluid after dilution either in a standardized water or in the end-user water at accurately expressed strengths compatible with those required by the industrial applications.

There are few reliable standardized and recognized methods to assess the performance of the products.

Among the critical performance characteristics, the following may be mentioned, for example:

— corrosion protection;

— foaming;

— emulsion stability;

— compatibility with metals, lubricating oils, synthetic materials, seals, paints;

— pH;

— innocuity towards the user;

— gumming tendency (sticking-residue-formation tendency);

— extreme pressure (EP);

— anti-wear.

See table 2.

5 Non-exhaustive lists of characteristics to establish specifications

5.1 Introduction

Two lists are presented in tables for:

a) straight (non-aqueous) fluids (table 1);

b) water-miscible fluids (table 2).

These lists are not closed and must be completed to take into account any other specific criteria.

5.2 List of characteristics for straight (non-aqueous) fluids

Table 1 is divided into two parts:

— identification characteristics;

— performance characteristics.

Table 2 — Guidelines for establishing specifications of water-miscible metalworking fluids

No.	Identification characteristics	Unit	ISO L[a]									ISO Standards	Other standards or methods
			MAA	MAB	MAC	MAD	MAE	MAF	MAG	MAH	MAI		
3.1	Appearance	Rating	a	a	a	a	a	a	a	a			Visual
3.2	Colour	Rating	a	a	a	a	a	a	a	a		ISO 2049	
3.3	Odour	Rating	a	a	a	a	a	a	a	a			Olfactory
3.4	Density	kg/m^3	a	a	a	a	a	a	a	a		ISO 3675	
3.5	Viscosity	mm^2/s [b]	a	a	a	a	a	a	a	a		ISO 3104	
3.6	Flash point											[c]	
	. open cup	° C	a	a	a	a	-	-	-	-		ISO 2592	
	. closed up	° C	a	a	a	a	-	-	-	-		ISO 2719	
3.7	Pour point [d]	° C	a	a	a	a	a	a				ISO 3016	
3.8	Refractive index	-	a	a	a	a	a	a	a	a		ISO 6320	
3.9	Neutralization number	mg KOH/g	a	a	a	a						ISO 6618	
3.10	Base number	mg KOH/g	a	a	a	a	a	a	a	a		ISO 3771	
3.11	Saponification number	mg KOH/g	e	e	e	e	e	e	e	e		ISO 6293	
3.12	Mineral/base oil content	% mass	f	f	f	f	f	f	f	f			
3.13	Copper strip corrosion	Rating	g	g	g	g	g	g	g	g		ISO 2160	
3.14	Storage stability [h]												NF T 60-197
	. short duration	Rating	a	a	a	a	a	a	a	a			
	. long duration	Rating	a	a	a	a	a	a	a	a			
4.1	Appearance	Rating	a	a	a	a	a	a	a	a			Visual
4.2	Product type (opacity) [i]	Optical density	a	a	a	a	a	a	a	a			NF T 60-195
4.3	Emulsibility	Rating	a	a	a	a	a	a	a	a			NF T 60-187 [j]
4.4	Emulsion stability	Rating	a	a	a	a	a	a	a	a			k
4.5	Biological stability	Rating	a	a	a	a	a	a	a	a			l
4.6	Hardness range	Degree	m	m	m	m	m	m	m	m			
4.7	Corrosion protection												
	. ferrous metals	Rating	a	a	a	a	a	a	a	a			n
	. non-ferrous metals	Rating	a	a	a	a	a	a	a	a			See Annex A
4.8	Foaming	Rating	a	a	a	a	a	a	a	a			o
4.9	pH value												p
	. fresh blend	pH Units	a	a	a	a	a	a	a	a			
	. after ageing	pH Units	a	a	a	a	a	a	a	a			
4.10	Sticking/Gumming tendency	Rating	a	a	a	a	a	a	a	a			q

a This characteristic applies to the type of product.

b 20 °C is the recommended temperature. Other temperatures may be negotiated between the end user and the supplier.

c Select the most relevant method according to the flash-point value. The presence of water in the concentrates may affect the determination or render it impossible.

d This characteristic is not necessarily applicable to all types of products.

e The determination of this characteristic may be affected by the presence of some chemical compounds, for example: chlorinated paraffins, sulfurized esters, emulsifiers.

f The oil content may be given by the supplier only if necessary.

g This characteristic is required only if copper alloys are used in the concentrate dispensing/mixing equipment or in the machine coolant system or if machining copper alloys.

h For the short term test, 0 °C and 30 °C are the recommended temperatures. However, other temperatures can be agreed between the end user and the supplier, depending on local climatic conditions. English translation is available from AFNOR.

i In most of the cases, a visual inspection is sufficient to determine product class. However, the French standard NF T 60-195 may be used to classify more precisely the product. English translation is available from AFNOR.

j English translation is available from AFNOR.

k Among the possible methods : NF T 60-187, DIN 51367, IP 263.

l Among the possible methods : that described in Annex C, ASTM D 3946 or any other forthcoming suitable method, resulting from the work of specialized groups (for example IBRG/IP).

m The supplier will precise the range of water hardness in which the product can be applied without creating problems of either foaming or stability.

n Among the possible methods : NF T 60-186, IP 125, IP 287, DIN 51360 parts 1 and 2 and ASTM D 4627.

o Among the possible methods : NF T 60-185, IP 312, ASTM D 3519, ASTM D 3601.

p Laboratory ageing methods agreed between the supplier and the end user could be used to evaluate pH stability. Among the possible methods : NF T 60-193 and DIN 51369.

q Annex B describes four alternative methods which may be used to evaluate this characteristic. Any other method negotiated between the end user and the supplier may be used.

5.3 List of characteristics for water-miscible fluids

Table 2 is divided into two parts:

— characteristics of the products as delivered;

— characteristics and performance of the diluted product.