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Lubricants, industrial oils and related products (Class L) — Family X (Greases) — Specification

Lubrifiants, huiles industrielles et produits connexes (classe L) — Famille X (Graisses) — Spécifications

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Foreword

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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 12924 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, Subcommittee SC 4, *Classifications and specifications*.

Lubricants, industrial oils and related products (Class L) — Family X (Greases) — Specification

1 Scope

This International Standard specifies the requirements of greases used for the lubrication of equipment, components of machines, vehicles, etc. The purpose of this International Standard is to provide guidance to suppliers and end users of greases and to equipment manufacturers of grease-lubricated equipment.

This International Standard is written in a general form so that its application can accommodate various climatic conditions throughout the world. It also stipulates the requirements for the lubricating grease at the time of the delivery.

The classification of family X (greases), which belongs to class L (lubricants, industrial oils and related products), is specified in ISO 6743-9. In this classification, a grease cannot have more than one symbol. This symbol is expected to correspond to the most severe conditions of temperature, water contamination and load in which the grease can be used.

NOTE Greases having the same classification according to ISO 6743-9 and the same specification according this International Standard are not necessarily compatible with each other. Blending of non-compatible greases can lead to equipment failure. Before changing from one grease to another in an equipment, it is preferable to consult the grease suppliers.

It is intended that this International Standard be read in conjunction with ISO 6743-9.

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 2137:2007, *Petroleum products and lubricants — Determination of cone penetration of lubricating greases and petrolatum*

ISO 2176:1995/C1:2001, *Petroleum products — Lubricating grease — Determination of dropping point*

ISO 6299:1998, *Petroleum products — Determination of dropping point of lubricating greases (wide temperature range)*

ISO 6743-9:2003, *Lubricants, industrial oils and related products (class L) — Classification — Part 9: Family X (Greases)*

ISO 6743-99:2002, *Lubricants, industrial oils and related products (class L) — Classification — Part 99: General*

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

ISO 11007:1997, *Petroleum products and lubricants — Determination of rust-prevention characteristics of lubricating greases*

ISO 11009:2000, *Petroleum products and lubricants — Determination of water washout characteristics of lubricating greases*

ISO 13737:2004, *Petroleum products and lubricants — Determination of low-temperature cone penetration of lubricating greases*

ASTM D1478-07, *Standard Test Method for Low-Temperature Torque of Ball Bearing Grease*

ASTM D2596-97(2008), *Standard Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)*

ASTM D4057-06, *Standard Practice for Manual Sampling of Petroleum and Petroleum Products*

DIN 51805:1974, *Testing of lubricants; determination of flow pressure of lubricating greases, Kesternich method*

DIN 51821-1:1988, *Testing of lubricants; test using the FAG roller bearing grease testing apparatus FE9 , general working principles*

DIN 51821-2:1989, *Testing of lubricants ; test using the FAG roller bearing grease testing apparatus FE9, test method A/1500/6000)*

IP 239/07, *Determination of extreme pressure and antiwear properties of lubricating fluids — Four ball method (European conditions)*

IP 396/09, *Determination of dropping point of lubricating grease — Automatic apparatus method*

NF T60-627:2006, *Petroleum products and lubricants — Dropping point of lubricating greases — Automatic apparatus method*

NF T60-629:2006, *Petroleum products and lubricants — Low-temperature torque of ball bearing greases*

3 Sampling

Unless otherwise specified in commodity specifications, samples of lubricants shall be drawn in accordance with ASTM D4057.

4 Requirements for the greases

Greases are classified in accordance with the system described in ISO 6743-9, where they are designated in the following manner:

ISO - L - X - symbol 1 - symbol 2 - symbol 3 - symbol 4 - NLGI consistency number

where

— symbol 1 is a measurement of the lower operating temperature, symbols A to E;

— symbol 2 is a measurement of the upper operating temperature, symbols A to G;

— symbol 3 is a measurement of the water contamination and anti-rust protection, symbols A to I;

— symbol 4 is a measurement of the ability to lubricate under high loads, symbol A or B;

— the NLGI consistency number is defined in ISO 6743-99 through an evaluation of the penetration in accordance with ISO 2137.

Tables 1 to 5 specify test methods and requirements to establish the compliance with the requirements for each symbol used in the classification system.

To establish the requirements for each symbol, limits have been specified based on the test methods considered most relevant.

Other test methods may be used to evaluate the characteristics of the greases if it can be demonstrated that the alternative methods give comparable results. If grease manufacturers want to verify the compliance of their greases with the limits specified for the various symbols of the classification using other test methods, it is their responsibility to establish the necessary correlations between the specified test methods and the potential alternative methods.

4.1 Symbol 1 — Lower operating temperature

The lower operating temperature shall be determined by the following three criteria; see Table 1:

a) the starting and the running torque, in accordance with ASTM D1478 (NF T60-629);

b) the flow pressure, in accordance with DIN 51805;

c) the low-temperature penetrability, in accordance with ISO 13737.

Following the criterion selected, the symbol “1” is completed by a suffix letter between brackets:

— (L) when using the starting/running torque;

— (F) when using the flow pressure;

— (P) when using the low-temperature penetrability.

Table 1 — Lower operating temperature — Symbol 1

Lower operating temperature °C	**Starting torque** mN·m			**Flow pressure** hPa		**Penetrability** 1/10 mm	
		Running torque mN·m					
	Value	**Symbol 1**	**Value**	**Value**	**Symbol 1**	**Value**	**Symbol 1**
0	⩽ 1 000	A (L)	⩽ 100	⩽ 1 400	A (F)	⩾ 140	A (P)
–20		B (L)			B (F)	⩾ 120	B (P)
–30		C (L)			C (F)	⩾ 120	C (P)
–40		D (L)			D (F)	⩾ 100	D (P)
<–40		E (L)			E (F)	⩾ 100	E (P)
—	Test method: ASTM D1478 or NF T60-629.			Test method: DIN 51805.		Test method: ISO 13737.	

4.2 Symbol 2 — Upper operating temperature

The upper operating temperature shall be determined by the following criteria; see Table 2:

a) dropping point for symbols 2 A and 2 B;

b) DIN 51821 (all parts) for symbols 2 C to 2 G.

For greases with an upper operating temperature above 120 °C, the F_{50} bearing life shall be above 100 h at the considered upper operating temperature.

For some greases with high-viscosity base stocks, the rotating speed of 6 000 rpm is considered too high. The FAG FE 9 machine, as described in DIN 51821-1, allows for an alternative rotating speed of 3 000 rpm. If the latter speed is used to assess the upper operating temperature of a grease, the symbol "2" shall be supplemented by the suffix letter S between brackets: (S).

Table 2 — Upper operating temperature — Symbol 2

Upper operating temperature °C	Symbol 2	Dropping point °C	Bearing life h
60	A	⩾ 90	No requirement
80	B	⩾ 130	
120	C	Report	F_{50} > 100 h at the upper operating temperature
140	D		
160	E		
180	F		
> 180	G		
—	—	Test methods: ISO 2176, ISO 6299, IP 396 or NF T60-627	Test method: DIN 51821-1 and DIN 51821-2; test with the FAG FE 9 grease-testing apparatus, procedure A/1500/6000

4.3 Symbol 3 — Water contamination and anti-rust protection

Symbol 3 is a combination of the level of water resistance, as evaluated by means of the water washout test in accordance with ISO 11009, and protection against corrosion, as evaluated by the rust-prevention test in accordance with ISO 11007; see Table 3.

The water washout losses shall be determined at 38 °C for the greases with a symbol "2" from A to D and at 79 °C for the greases with a symbol "2" from E to G.

Table 3 — Water resistance and anti-rust protection — Symbol 3

Symbol 3	Water washout losses		Rust-prevention requirement rating
	Requirement % (m/m)	Temperature °C	
A	No requirement	38	No requirement
B	No requirement	38	1-1 max., distilled water
C	No requirement	38	2-2 max., salt water ISO 7120
D	< 30	38	No requirement
E	< 30	79	1-1 max., distilled water
F	< 30	79	2-2 max., salt water ISO 7120
G	< 10	79	No requirement
H	< 10	—	1-1 max., distilled water
I	< 10	—	2-2 max., salt water ISO 7120
—	Test method: ISO 11009		Test method: ISO 11007

4.4 Symbol 4 — Ability to lubricate under high loads

The test to evaluate the ability to lubricate under high load conditions shall be the four-ball test, considering only the weld load and assuming that the response of this test is satisfactory in the presence of extreme-pressure additives; see Table 4.

Table 4 — Ability of a grease to lubricate under high load conditions — Symbol 4

Symbol 4	Four-ball weld load requirement kg	Test method
A	None	ASTM D2596 or IP 239
B	⩾ 250	

4.5 NLGI consistency number

The NLGI consistency number shall be evaluated by penetration using 60 strokes at 25 °C in accordance with ISO 2137. Table 5 shows the correspondence between the NLGI consistency number and the penetration.

A gap exists in the penetration numbers between the different NLGI grades. This allows for “unofficial” half grades, e.g. a grease with a penetration of 300 1/10 mm, intermediate between the maximum allowed penetration for the NLGI 2 grade and the minimum allowed penetration for the NLGI 1 grade to be designated as a “1,5 grade”.