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Lubricants, industrial oils and related products (class L) — Family C (gears) —

Part 1: Specifications for lubricants for enclosed gear systems

Lubrifiants, huiles industrielles et produits connexes (classe L) — Famille C (engrenages) —

Partie 1: Spécifications des lubrifiants pour systèmes d'engrenages sous carter

Reference number
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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 document 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).

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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 12925-1:2018), which has been technically revised. It also incorporates the Amendment ISO 12925-1/Amd1:2020.

The main changes are as follows:

— in Table 6, a specification regarding the protection level against micro-pitting for category CKSMP has been added;

— the environmental requirements for environmentally acceptable products have been updated.

A list of all the parts of ISO 12925 can be found on the ISO website.

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.

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Introduction

Lubricants for gear systems are used in diverse types of gear designs, ranging from simple parallel spur gears to bevel gears (spur, skew or spiral), worm gears and hypoid gears. Industrial gear systems, which are either of open type or enclosed type, vary in size from small enclosed systems used in machine tools to very large systems used in mining, steel mills and cement plants.

Lubricants for these applications vary in composition from refined straight mineral oils to more complex blends, based on mineral oils, synthetic oils (e.g. poly α-olefins, esters, poly-glycols), to vegetable oils and derivatives and friction-modifying additives and/or extreme-pressure. ISO 3448 viscosity grades vary depending on the type of application. They can range from the low viscosity ISO VG 32 to high viscosity ISO VG 1 500. These grades can vary even more for the very low velocities and very high loads. In exceptional cases, viscosity grades may be even higher. Temperature conditions to which the gear systems are exposed also vary considerably, not only due to the ambient conditions of operation, but also depending on the sliding between the gear teeth, on the size of the casings, on the presence on the circulating systems of heat exchangers, on the vicinity of heat sources as in the cement industry or in the steel industry.

Greases may also be used for the splash lubrication of enclosed gears or for the application on open gear teeth.

This document covers the lubricants applied in enclosed gear systems which, at the time of publication, are the most current encountered in the industry. Since the first edition of this document (ISO 12925-1:1996), the requirements for lubricants for enclosed gear systems have largely changed to suit new gear technologies and applications. More demanding requirements have emerged with respect to extreme pressure properties (i.e. resistance to micro-pitting, ability to lubricate low velocity mechanisms, resistance to pitting), foaming and air release characteristics. In addition, there is a greater need for environmentally acceptable products.

This document does not cover the extreme cases of use in terms of gear design, temperature and extreme conditions. For use in exceptional conditions, suppliers and purchasers of lubricants can mutually agree on the testing methods and the acceptability criteria of the products, which is not covered in this document.

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Lubricants, industrial oils and related products (class L) — Family C (gears) —

Part 1: Specifications for lubricants for enclosed gear systems

1 Scope

This document establishes the specifications relative to family C (gears) for lubricants, industrial oils and related products of class L (see ISO 6743-6). This document deals only with lubricants for enclosed gear systems. Lubricants for open gears and greases for gears (enclosed or open) are covered by the other parts of the ISO 12925 series (i.e. ISO 12925-2 and ISO 12925-3).

This document is intended to be read in conjunction with ISO 6743-6. The following categories specified in ISO 6743-6 are covered by this document: CKB, CKC, CKD, CKE, CKSMP, CKTG, CKES, CKPG, CKPR, CSPG, CSPR, CTPG and CTPR.

Detailed information about the different types of gear, and lubricants, and their selection for gearbox design and service conditions can be found in ISO/TR 18792.

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 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

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

ISO 2592, *Petroleum and related products — Determination of flash and fire points — Cleveland open cup method*

ISO 2909, *Petroleum products — Calculation of viscosity index from kinematic viscosity*

ISO 3016, *Petroleum and related products from natural or synthetic sources — Determination of pour point*

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

ISO 4263-4, *Petroleum and related products — Determination of the ageing behaviour of inhibited oils and fluids — TOST test — Part 4: Procedure for industrial gear oils*

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

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

ISO 6614, *Petroleum products — Determination of water separability of petroleum oils and synthetic fluids*

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 6743-6, *Lubricants, industrial oils and related products (class L) — Classification — Part 6: Family C (Gears)*

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

ISO 7346-2, *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, *Water quality — Test for inhibition of oxygen consumption by activated sludge*

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

ISO 12152, *Lubricants, industrial oils and related products — Determination of the foaming and air release properties of industrial gear oils using a spur gear test rig — Flender foam test procedure*

ISO 12185, *Crude petroleum, petroleum products and related products — Determination of density — Laboratory density meter with an oscillating U-tube sensor*

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

ISO 14593, *Water quality — Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium — Method by analysis of inorganic carbon in sealed vessels (CO2 headspace test)*

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 14669, *Water quality — Determination of acute lethal toxicity to marine copepods (Copepoda, Crustacea)*

ISO 16221, *Water quality — Guidance for determination of biodegradability in the marine environment*

ISO 19291, *Lubricants — Determination of tribological quantities for oils and greases — Tribological test in the translatory oscillation apparatus*

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

EN 16807, *Liquid petroleum products — Bio-lubricants — Criteria and requirements of bio-lubricants and bio-based lubricants*

EN 17181, *Lubricants — Determination of aerobic biological degradation of fully formulated lubricants in an aqueous solution — Test method based on CO_2-production*

ASTM D2711, *Standard Test Method for Demulsibility Characteristics of Lubricating Oils*

ASTM D6081, *Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation*

ASTM D6866, *Standard Test Method for Determining the Biobased Content of Solid, Liquid and Gaseous Samples using Radiocarbon Analysis*

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DIN 3990-16, *Determination of the micro-pitting load carrying capacity of lubricants using FZG-test method GT-C/8,3/90*

DIN 51819-3, *Testing of lubricants — Mechanical-dynamic testing in the roller bearing test apparatus FE8 — Part 3: Test method for lubricating oils, axial cylindrical roller bearing*

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Sampling

Sampling of gear oils for the purpose of this document shall be carried out in accordance with the pertinent procedure described in ISO 3170. The sample shall be evaluated on a representative portion. Any drum, barrel, tanker compartment or any type of container delivered to the end user may be sampled and analysed at the discretion of the purchaser.

5 Environmental requirements for categories CKTG, CKES, CKPG, CKPR

5.1 General

For the purpose of this document, environmentally acceptable gear oils are either triglycerides of mainly vegetable origin, synthetic esters, polyglycols (homo and or co-polymers of ethylene glycol, propylene glycol, butylene glycols), poly α-olefins and related hydrocarbons. The classification of these gear oils shall be in accordance with ISO 6743-6 for categories CKTG, CHES, CKPG, CKPR. The minimum category-defining base oil type content for each category shall be in accordance with the requirements of Table 1.

Table 1 — Minimum category-defining base fluid content for each category

Category	Mass fraction	Category defining base fluid [a] type content of the total fluid formulation	Total base fluid mass fraction of the fluid formulation
CKTG	%	≥ 50	≥ 70
CKES	%	≥ 50	≥ 70
CKPG	%	≥ 50	≥ 70
CKPR	%	≥ 50	≥ 70

[a] Category-defining base fluid is identified as the relevant triglycerides, polyglycols, synthetic esters, poly α-olefins and related hydrocarbon products.

Environmentally acceptable lubricants shall comply with the requirements of EN 16807, as follows: CKTG, CKES, CKPG, and CKPR shall comply with the toxicity requirements. Additionally, CKTG and CKES shall comply with the biodegradability and carbon of biological origin requirements given in Table 2. The requirements published in EN 16807 are intended as baseline requirements for all bio-based lubricants, and represent minimum requirements compared to, for example, the European Ecolabel for Lubricants[8]. With the exception of content of carbon of biological origin, these requirements can also be minimum requirements for other types of environmental standards existing in the world.

In a product line of either of the categories CKTG, CKES, CKPG, CKPR, and for all grades of that line which use the same additive package and the same range of base stocks, toxicity requirements may be tested only on the lightest, medium and heaviest grade of the line.

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