International Standard

ISO 11366

First edition
2025-05

# Petroleum and related products — In-servicing of steam, gas and combined cycle turbines lubricating oils — Guidance and requirements

*Produits pétroliers et produits connexes — Suivi en service des huiles lubrifiantes pour turbines à vapeur, à gaz et à cycle combiné — Recommandations et exigences*

Reference number
ISO 11366:2025(en)

© ISO 2025



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

# Contents

Page

**Foreword** ..... **v**
**Introduction** ..... **vi**
**1 Scope** ..... **1**
**2 Normative references** ..... **1**
**3 Terms and definitions** ..... **2**
**4 Description of turbine oils** ..... **2**
**5 Factors affecting the service life** ..... **3**
5.1 General ..... 3
5.2 Oil system design ..... 3
5.3 Conditions of the oil system at start-up ..... 4
5.4 Original oil quality ..... 4
5.5 System operating temperature ..... 4
5.6 Contamination rates and purification provisions ..... 4
5.7 Oil make-up rates ..... 5
**6 Deterioration of turbine oils in service** ..... **5**
6.1 General ..... 5
6.2 Viscosity ..... 5
6.3 Oxidation stability ..... 5
6.4 Solid particles ..... 6
6.5 Sludge ..... 6
6.6 Antirust properties ..... 6
6.7 Water separability ..... 7
6.8 Foaming and air release characteristics ..... 7
6.9 Total acid number ..... 7
6.10 Flash point ..... 7
**7 Recommended tests and interpretation** ..... **8**
7.1 Appearance and odour ..... 8
7.2 Colour ..... 8
7.3 Total acid number ..... 8
7.4 Sludge and deposits ..... 8
7.5 Particle counting ..... 9
7.6 Wear metals ..... 9
7.7 Kinematic viscosity ..... 10
7.8 Remaining oxidation stability ..... 11
7.9 Membrane patch colorimetry (MPC) ..... 11
7.10 Water content ..... 11
7.11 Rust prevention characteristics ..... 11
7.12 Water separability ..... 12
7.13 Foaming characteristics ..... 12
7.14 Air-release value ..... 12
7.15 Flash point ..... 13
**8 Sampling** ..... **13**
8.1 General ..... 13
8.2 Sampling point ..... 13
8.3 Sampling line ..... 13
8.4 Containers ..... 14
8.5 Samples marking ..... 14
**9 Examination of new oil** ..... **15**
9.1 General ..... 15
9.2 Sampling of new oil deliveries ..... 15
9.3 Examination of new oil deliveries ..... 15

© ISO 2025 – All rights reserved

9.4 Testing schedules ... 16
9.4.1 Minimum requirements ... 16
9.4.2 Installation of a new oil charge ... 16

**10 Examination of oils in service ... 17**
10.1 Testing procedures ... 17
10.1.1 General ... 17
10.1.2 Field screening tests ... 17
10.1.3 Laboratory tests ... 18
10.2 Frequency of the testing ... 22

**11 Prolonging an oil in service ... 22**
11.1 General ... 22
11.2 Partial draining and refilling (bleed and feed) ... 23
11.3 Treatment with the oxidation inhibitor package ... 23
11.4 Treatment with the rust inhibitor ... 24
11.5 Treatment with antifoaming agent ... 24
11.6 Clay treatment ... 24
11.7 Conclusion ... 24

**Bibliography ... 26**

© ISO 2025 – All rights reserved

# 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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 first edition of ISO 11366 cancels and replaces ISO/TS 11366:2011, which has been technically revised.

The main changes are as follows:

— addition of Clause 3 “Terms and definitions” and renumbering of the other clauses accordingly;

— addition of subclauses 6.10 “Flash point”, 7.6 “Wear metals” and 7.9 “Membrane patch colorimetry (MPC)", and Clause 11 “Prolonging an oil in service”;

— inclusion of additional tests and update of recommended test results;

— update of the normative references and the Bibliography.

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.

© ISO 2025 – All rights reserved

# Introduction

The in-service monitoring of turbine oils is largely recognized by the power generation industry as necessary to insure long and trouble-free operation of turbines.

There are three main types of stationary turbines used in power generation plants: steam turbines, gas turbines and combined cycle turbines. The combined cycle turbines consist of two types:

— the first type associates a gas turbine with a steam turbine, with separated lubricating circuits;

— the second type is called a single shaft combined cycle turbine, in which the steam and the gas turbines are on the same shaft and are lubricated with the same oil.

The lubrication requirements of gas turbines and steam turbines are quite similar, but there are some big differences. Gas turbine oils are submitted to localized hot spots and water contamination is less likely.

Gas turbine oils have shorter service life than steam turbine oils, which can range from 10 to 20 years, depending on the top-up level. The lifetime of gas turbine oils can range from five to 10 years, or more.

The values of the various characteristics mentioned in this document are purely indicative. For proper interpretation of the results, many factors should be taken into account, such as the type of equipment, design of the lubricating oil circuit and top-up level.

It is expected that the manufacturer’s instructions are followed.

This document is intended to:

— help power equipment operators evaluate the conditions of the oil in their equipment and maintain oils in-serviceable conditions;

— help users to understand how the oils deteriorate and to carry out a meaningful programme of sampling and testing of oils in use.

© ISO 2025 – All rights reserved

# Petroleum and related products — In-servicing of steam, gas and combined cycle turbines lubricating oils — Guidance and requirements

## 1 Scope

This document provides guidance and requirements for the maintenance in service of mineral oils used as lubricating oils and control fluids used to lubricate steam, gas and combined cycle turbines in service.

This document is applicable to lubricants classified in ISO 6743-5 and specified in ISO 8068, except the grades TSD, TGD and TCD (phosphate esters) for which ISO 11365 is more relevant, and the grades TGCE, THA, THCH, THCE and THE.

This document also gives guidance and requirements with respect to the corrective actions that are taken to maximize service life.

## 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 2049, *Petroleum products — Determination of colour (ASTM scale)*

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

ISO 2719, *Determination of flash point — Pensky-Martens closed cup method*

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

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3722, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods*

ISO 4021, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system*

ISO 4405, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the gravimetric method*

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 4407, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using an optical microscope*

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

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

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 2025 – All rights reserved

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

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

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

ISO 11500, *Hydraulic fluid power — Determination of the particulate contamination level of a liquid sample by automatic particle counting using the light-extinction principle*

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

ASTM D2272, *Standard Test Method for Oxidation Stability of Steam Turbine Oils by Rotating Pressure Vessel*

ASTM D2273, *Standard Test Method for Trace Sediment in Lubricating Oils*

ASTM D5185, *Standard Test Method for Determination of Additive Elements, Wear Metals, and Contaminants in Used Lubricating Oils and Determination of Selected Elements in Base Oils by Inductively Coupled Plasma*

ASTM D6595, *Standard Test Method for Determination of Wear Metals and Contaminants in Used Lubricating Oils or Used Hydraulic Fluids by Rotating Disc Electrode Atomic Emission Spectroscopy*

ASTM D7596, *Standard Test Method for Automatic Particle Counting and Particle Shape Classification of Oils Using a Direct Imaging Integrated Tester*

ASTM D7843, *Standard Test Method for Measurement of Lubricant Generated Insoluble Color Bodies in In-Service Turbine Oils using Membrane Patch Colorimetry*

## 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 Description of turbine oils

Steam- and gas-turbines oils consist of highly refined hydrocarbon-origin base stocks in which additives are added to provide or to improve oxidation stability, as well as rust-protection properties, corrosion-protection properties (mainly for copper and copper containing materials). Additional foam suppressants can be added to limit the foaming tendency. However, care should be taken to avoid adding too much foam suppressant, which can have detrimental effect on air release properties. Demulsifiers can also be used to improve the water-shedding properties, but this should not be a common practice.

To formulate turbines oils, base stocks of API groups I and II are used with success. For special applications, e.g. high-temperature gas turbines, API groups III, III+ and IV base stocks can also be used. In most instances, API group I and group II base stocks are largely sufficient. The refining degree of group I and group II base stocks vary from one producer to another. Hydrogen treatment is essential to get a good response to the antioxidants and to obtain good water-shedding and air-release properties.

Numerous technologies are available to provide the necessary performance in terms of oxidation stability, and rust and corrosion protection. Combination of phenol- and amine-type antioxidants, associated with proper rust inhibitors (either ashless or ash containing) and copper corrosion inhibitors, are commonly used.

© ISO 2025 – All rights reserved