INTERNATIONAL STANDARD

ISO 10438-3

Second edition
2007-12-15

Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries —

Part 3: General-purpose oil systems

Industries du pétrole, de la pétrochimie et du gaz naturel — Systèmes de lubrification, systèmes d'étanchéité, systèmes d'huile de régulation et leurs auxiliaires —

Partie 3: Systèmes d'huile pour applications générales

Reference number
ISO 10438-3:2007(E)

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Published in Switzerland

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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 10438-3 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

This second edition cancels and replaces the first edition (ISO 10438-3:2003), which has been technically revised.

ISO 10438 consists of the following parts, under the general title *Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries*:

— *Part 1: General requirements*

— *Part 2: Special-purpose oil systems*

— *Part 3: General-purpose oil systems*

— *Part 4: Self-acting gas seal support systems*

Introduction

This International Standard was developed jointly with API 614, 5th edition. ISO 10438 is divided into four parts corresponding to the four chapters of API 614.

Users of this part of ISO 10438 should be aware that further or differing requirements might be needed for individual applications. This part of ISO 10438 is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly appropriate where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this part of ISO 10438 and provide details. This part of ISO 10438 is to be used in conjunction with 10438-1.

This part of ISO 10438 requires the purchaser to specify certain details and features.

A bullet (•) at the beginning of a clause or subclause indicates that either a decision is required or further information is to be provided by the purchaser. This information should be indicated on the datasheet(s); otherwise it should be stated in the quotation request or in the order.

In this International Standard, US Customary (USC) units are included in brackets for information.

Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries —

Part 3: General-purpose oil systems

1 Scope

This part of ISO 10438, in conjunction with ISO 10438-1, specifies requirements for oil systems for general-purpose applications. These oil systems can provide lubrication oil, but not seal oil and can serve equipment such as compressors, gears, pumps and drivers.

NOTE The term "general-purpose" is defined in ISO 10438-1.

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 10438-1:2007, *Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries — Part 1: General requirements*

ISO 10438-2:2007, *Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries — Part 2: Special-purpose oil systems*

ISO 13706:2005, *Petroleum, petrochemical and natural gas industries — Air-cooled heat exchangers*

ISO 13709, *Centrifugal pumps for petroleum, petrochemical and natural gas industries*

ISO 15649:2001, *Petroleum and natural gas industries — Piping*

ISO 16889, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element* [1)]

API RP 686, *Machinery Installation and Installation Design*

IEC 60034 (all parts), *Rotating electrical machines*

TEMA, *Standards of the Tubular Exchanger Manufacturers Association*

NEMA MG1, *Motors and Generators*

1) To be published. (Revision of ISO 16889:1999)

3 Terms, abbreviated terms and definitions

For the purposes of this document, the terms, definitions and abbreviated terms given in ISO 10438-1 apply.

4 General

4.1 Basic design

4.1.1 This part of ISO 10438 covers general-purpose oil systems. Typical datasheets for general-purpose oil systems are in Annex A. Typical piping and instrument diagrams for general-purpose oil systems are in Annex B. Typical inspector checklists for general-purpose oil systems are in Annex C. General-purpose (GP) oil systems are divided into classes and are defined by a coding system that defines the major components supplied (see Table 1). The user shall choose the applicable class and code based upon the required minimum reliability targets for the equipment train. Various API standards have supplied minimum recommended systems as indicated in Table 2 for their equipment. Annex D is supplied as a reference to provide guidance on the selection of a system.

Table 1 — General-purpose oil system class types with standard configuration options

Equipment	Class I	Class II	Class III
Pump configuration	Shaft-driven main pump only	Shaft-driven main pump and motor auxiliary pump	Motor main and motor auxiliary pump
Positive displacement	P0	P0	P0
Centrifugal	N/A	N/A	P1
Reservoir part of equipment (i.e. gear case)	R0	R0	R0
External stainless reservoir	R1	R1	R1
Stainless pipe	Default	Default	Default
No reservoir heater included	H0	H0	H0
Reservoir heater	H1	H1	H1
Baseplate part of equipment	BP0	BP0	BP0
Stand-alone console, reservoir mounted (No baseplate)	BP1	BP1	BP1
Stand-alone console with full baseplate	BP2	BP2	BP2
Single cooler and single filter	C1F1	C1F1	C1F1
Single cooler and dual filter	C1F2	C1F2	C1F2
Dual cooler and single filter	C2F1	C2F1	C2F1
Dual cooler and dual filter	C2F2	C2F2	C2F2
Shell-and-tube cooler(s)	C0	C0	C0
Plate-and-frame cooler(s)	C1	C1	C1
Fin/Fan cooler	C2	C2	C2
Combined plv/pcv (not applicable to centrifugal pumps)	PV0	PV0	PV0

Table 1 (*continued*)

Equipment	Class I	Class II	Class III
Separate PCV	PV1	PV1	PV1
No thermostatic valve included	TV0	TV0	TV0
Thermostatic valve	TV1	TV1	TV1
No block-and-bypass valves included	BB0	BB0	BB0
Block-and-bypass valves around PCV	BB1	BB1	BB1

EXAMPLE 1 General-purpose system designations: Class I-P0-R1-H1-BP1-C1F2-C0-PV0-TV0-BB0

Shaft-driven main pump

Positive-displacement pump

External stainless steel reservoir

Reservoir heater included

Stand-alone console reservoir mounted equipment (no baseplate)

Single cooler and dual filters

Shell and tube cooler type

Combined PLV and PCV

No thermostatic valve

No block and bypass valves

EXAMPLE 2 General-purpose system designations: Class III-P0-R1-H1-BP2-C2F2-C0-PV1-TV1-BB1

Motor-driven main and motor-driven auxiliary pump

Positive-displacement pumps

External stainless steel reservoir

Reservoir heater included

Stand-alone console with full baseplate

Dual coolers and dual filters

Shell and tube cooler type

Separate PLV and PCV

Thermostatic valve

Block and bypass valves

Table 2 — Recommendations of minimum GP system class by equipment

Equipment type [a]	P&ID figure	Console class and code
ISO 13709 or API 610	B.1	Class II – P0-R1-H0-BP0-C1F1-C0-PV0-TV0-BB0
API 611	B.1	Class II – P0-R1-H0-BP1-C1F1-C0-PV0-TV0-BB0
ISO 13707 or API 618	B.2	Class II – P0-R0-H1-BP2-C1F2-C0-PV0-TV1-BB0
API 672	B.3	Class II – P0-R0-H1-BP0-C1F2-C0-PV1-TV1-BB0
API 673	B.4	Class III – P0-R1-H1-BP1-C1F1-C0-PV0-TV1-BB0
API 674	B.5	Class I – P0-R0-H0-BP0-C1F1-C0-PV0-TV0-BB0
API 677	B.5	Class I – P0-R0-H0-BP0-C1F1-C0-PV0-TV0-BB0
NOTE 1 This table is presented for guidance in the selection of a lubrication system for the above referenced equipment. NOTE 2 The recommended base systems are based on the individual referenced equipment standard recommendations at the time of publication of this part of ISO 10438.		
[a] The referenced equipment standards may suggest alternative base systems in editions published subsequent to this part of ISO 10438, or the user may select alternative systems based on his experience or a Failure modes and effects analysis (FMEA) as described in Annex D.		

4.1.2 The oil system supplied shall be capable of supplying sufficient quantities of clean, filtered oil at proper temperature and pressure for start-up and all operating conditions of the serviced rotating equipment.

4.2 General

4.2.1 The equipment (including auxiliaries) covered by this part of ISO 10438 shall be designed and constructed for a minimum service life of 20 years.

NOTE It is recognized that this is a design criterion.

- **4.2.2** The purchaser shall specify the design goal for uninterrupted operation (mission time) of the equipment.

NOTE Annex D is available as a guide for system reliability goals.

4.2.3 The oil system shall be suitable for general purpose applications as defined in ISO 10438-1:2007, 3.1.17. The system shall be designed as a separate console or may be designed to be integral with the baseplate of the equipment it serves. If components are spared, the design shall allow for transfer between and shutdown of the main and spared components of the system for maintenance without interrupting the operation of the system or the equipment the system serves. General-purpose systems supply lubricating oil only (i.e. no seal oil) and do not require an accumulator to cover transient conditions.

An accumulator may be specified in accordance with ISO 10438-2, however, it is normally not required on this class of equipment.

- **4.2.4** The purchaser shall specify the equipment's normal operating point and alternate operating points, including transients.

- **4.2.5** Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort of the purchaser and the vendor having unit responsibility. The equipment furnished by the vendor shall conform to the maximum allowable sound pressure level specified. In order to determine compliance, the vendor shall provide both maximum sound pressure and sound power level data per octave band for the equipment.

- **4.2.6** Where oil is supplied from a common system to two or more machines (such as a compressor, a gear and a motor), the oil's characteristics shall be specified by the purchaser on the basis of mutual agreement with all vendors supplying equipment served by the common oil system.

- **4.2.7** The system shall be designed to supply oil to all equipment specified.

4.2.8 Recycled oil originating upstream of the filters is preferred and is required when there is a possibility of an explosive mixture in the reservoir.

NOTE This is to minimize the potential for generation of static electricity (or a static charge) that can result when filtered oil bypasses the equipment and is recycled directly to the reservoir.

- **4.2.9** If specified, the arrangement of the equipment, including piping and auxiliaries, shall be developed jointly by the purchaser and the vendor. The arrangement shall provide adequate clearance areas and safe access for operation and maintenance.

NOTE For some pre-engineered general purpose oil systems, purchaser input might be impractical.

- **4.2.10** If specified, minimum defined requirements for clearance around and access to components (especially clearance around and access to coolers, filters and hand valves) shall be incorporated as design requirements.

- **4.2.11** If specified, pumps, filters, strainers, coolers, traps, valves and all other components that retain oil under pressure and are external to the reservoir shall be made of steel.

4.2.12 Unless otherwise specified, pumps may be submerged in the reservoir and these may be made of cast iron.

- **4.2.13** If specified, valved vents, drains and piping shall be furnished to permit draining, cleaning and refilling of idle components while the equipment is in operation.

- **4.2.14** Unless otherwise specified, coolers, filters, overhead oil tanks, drain traps, accumulators and other pressure vessels shall be in accordance with the specified pressure design code. If specified by the purchaser, vessels shall be code stamped.

NOTE 1 Code stamping might not be applicable for pressure design codes other than ASME.

NOTE 2 Local jurisdictions can require a code stamp.

NOTE 3 Code stamping can require additional inspection over the life of the equipment.

- **4.2.15** The vendor shall advise the purchaser of, and both parties shall mutually agree upon, any special provisions that are necessary to ensure that an adequate back-up supply of lube oil is maintained in the event of complete failure of the primary lube-oil supply system. These provisions may include standby pumps, rundown tanks and special arrangements for equipment safety and protection when the equipment decelerates. Provisions shall be adequate for coast-down time and cool-off time, as applicable. The purchaser and the vendor shall mutually agree on the system and its components.

4.2.16 Block valves that interrupt the oil flow to the equipment shall not be installed in oil supply lines downstream of the filters unless the block valves are part of a component block and bypass arrangement.

4.2.17 When components that can require later removal for maintenance are installed using screwed connections, the connecting piping shall be provided with flanges such that the component can be removed without requiring cutting pipe or major disassembly of the unit.

4.3 Baseplates

4.3.1 The major components (pumps, filters, coolers and reservoir) shall be mounted directly on structural steel as a separate console or integrated with the equipment base.

NOTE Reference can be made to the baseplate section of the lubricated equipment specification for baseplate requirements when the console is integrated into the equipment base.

4.3.2 Unless otherwise specified, package baseplates shall be of the drain-gutter type with one or more drain connections at least DN 40 (NPS 1 1/2). Baseplates, mounted components and decking shall be arranged and installed to ensure drainage and avoid the retention of liquid. Sloping of the decking is not required.

- **4.3.3** If specified, sloped decking shall be furnished.

4.3.4 The baseplate shall be provided with lifting lugs for at least a four-point lift or other suitable means. The baseplate shall be designed so that after the components and all piping mounted on it are drained of oil, the package can be lifted without permanently distorting or otherwise damaging either the baseplate or any component mounted on it.

- **4.3.5** If specified, metal decking covering all walk and work areas shall be provided on the top of the baseplate. If furnished, metal decking shall be non-skid.

NOTE Decking might not be required when the grout pour is used to create a walking surface.

- **4.3.6** If specified, baseplates shall be suitable for installation in accordance with API RP 686. Unless otherwise specified, all baseplates shall be provided with at least one opening or hole in each bulkhead section through which grout can be poured and vented. Each opening shall have a clear area of no less than 125 cm^2 (20 in^2) and no dimension less than 100 mm (4 in), and each shall permit filling and venting of the entire cavity with grout under the baseplate without creating air pockets. Each hole into which the grout is poured shall be accessible: no component or piping shall be disturbed and no tripping hazards in walk and work areas shall be created. Vent holes at least 13 mm (1/2 in) in diameter shall be provided for each bulkhead compartment. Each grout hole shall also be provided with steel curbing 13 mm (1/2 in) high to prevent accumulated oil or water from entering the grout. Vent holes shall be provided without curbing.

- **4.3.7** If specified, the baseplate shall be suitable for column mounting (that is, of sufficient rigidity to be supported at specified points) without continuous grouting under structural members. The baseplate design shall be mutually agreed upon by the purchaser and the vendor.

4.3.8 The bottom of the baseplate between structural members shall be open. When the baseplate is installed on a concrete foundation and grouted as specified in 4.3.6, accessibility for grouting under all load-carrying structural members shall be provided.

4.3.9 Levelling screws shall be provided in the proximity of each hold-down bolt.

4.4 Oil reservoirs

4.4.1 General

Reservoirs shall be separate or combined with the equipment baseplate and be rigid enough to prevent sagging and vibration. Components bolted to the reservoir shall be mounted on pads; no bolt holes shall extend into the reservoir.

4.4.2 Protection from dirt and water

Reservoirs shall be sealed to prevent dirt and water from entering. Top-surface openings shall be raised at least 6 mm (1/4 in) and shall have a gasket. When pumps, coolers or filters are mounted on top of the reservoir, the reservoir top may be provided with a drain rim or gutter and one or more drain connections.

NOTE For installations on an existing equipment base, a drain rim or gutter might not be required on the reservoir.

4.4.3 Oil connections and internal piping

4.4.3.1 All oil return flow streams shall be hydraulically located as far away from the pump suction connections as possible.

NOTE The use of the term "hydraulically located as far away" is intended to convey the concept that return flow streams can be directed by internal piping or baffling to avoid disturbing the oil flow at pump inlets. This internal piping or baffling can be used in lieu of external connections physically located such a distance from the pump suctions that they avoid disturbing the oil flow at the pump inlets.

4.4.3.2 All atmospheric oil return connections (including fill connections) shall be located above the maximum operating level and shall transport oil (via open-top stilling tubes or degassing trays) as shown in ISO 10438-2:2007, Figure B.24. Stilling tubes shall have bottom baffles.

4.4.3.3 Pump suction connections shall be located at least 50 mm (2 in) above the reservoir bottom.

4.4.3.4 Reservoir pipe connections 40 mm (1 1/2 in) and larger shall be flanged.

4.4.4 Manways and drains

4.4.4.1 Reservoirs shall be furnished with a valved and blind-flanged or plugged-drain connection.

● **4.4.4.2** If specified, to ensure complete drainage, the bottom of each reservoir shall be sloped to a low point drain.

● **4.4.4.3** If specified, a drain connection (with a valve and a blind flange) at least 50 mm (2 in) in diameter shall be provided.

4.4.4.4 Reservoirs shall be provided with unobstructed access for direct interior visual inspection and cleaning. Manways, if required, shall be at least 600 mm × 600 mm in diameter (24 in × 24 in). If manway-sized access is not required for inspection or cleaning, a minimum 150 mm × 150 mm (6 in × 6 in) port or ports shall be provided.

4.4.5 Features and appendages

The oil reservoir shall have the following features and appendages:

a) capacity to settle moisture and foreign matter adequately and to provide allowance for rundown from the entire system;

b) provisions to eliminate air and minimize migration of foreign matter to each pump suction;

c) reservoir-level indicator, such as a dipstick, level gauge, or bulls eye;

● d) if specified, an oil level glass arranged to cover the span from at least 25 mm (1 in) above the rundown level to 50 mm (2 in) below the pump suction-loss level. The oil level glass shall be located as far away as possible from the oil return lines and be visible from the perimeter of the unit. The maximum and minimum operating levels, rundown level and suction-loss level shall be indicated on the glass. If more than one level glass is provided, they shall be offset. The top glass shall be of the weld pad type;

e) weatherproof, corrosion-resistant filter-breather cap at least 50 mm (2 in) in diameter with filtration rating of 10 µm beta 10 or better shall be provided (this connection may also be used as a fill opening);

● f) if specified, a fill opening at least 50 mm (2 in) in diameter that automatically closes (normally held shut by a spring) and is equipped with a stainless steel fine-mesh strainer basket that has an open area equal to 200 % of the internal pipe area;

g) internal baffles that are not gas-tight;

h) individual, non-pressurized reservoir return lines that shall enter the reservoir above the maximum operating level (see ISO 10438-1:2007, Annex F).