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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

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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*.

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

ISO 10438 is based on API Std 614, 4th edn., April 1999, divided into four parts as follows:

— *Part 1: General requirements* is based on Chapter 1 of API Std 614;

— *Part 2: Special-purpose oil systems* is based on Chapter 2 of API Std 614;

— *Part 3: General-purpose oil systems* (this part) is based on Chapter 3 of API Std 614;

— *Part 4: Self-acting gas seal support systems* is based on Chapter 4 of API Std 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 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 or decision should be indicated on suitable data sheets; otherwise it should be stated in the quotation request (inquiry) or in the order.

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 specifies requirements for oil systems supplying lubricating oil to machines in general-purpose applications for use in the petroleum, petrochemical and natural gas industries as well as in other industries by agreement. It is intended to be used in conjunction with ISO 10438-1. ISO 10438 in its entirety specifies requirements for lubrication systems, oil-type shaft-sealing systems, self-acting gas seal systems, control-oil systems and other auxiliaries for general- or special-purpose applications. These systems can serve equipment such as compressors, gears, pumps and drivers. General-purpose applications are limited to lubrication systems.

None of the parts of ISO 10438 is applicable to internal combustion engines.

Typical schemas for general-purpose oil systems are provided in Annex A.

NOTE General-purpose systems supply lubricating oil only (i.e. no seal oil) and do not require an accumulator to cover transient conditions.

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 10438-1:2003, *Petroleum, petrochemical and natural gas industries — Lubrication, shaft-sealing and control-oil systems and auxiliaries — Part 1: General requirements*

ISO 14691, *Petroleum and natural gas industries — Flexible couplings for mechanical power transmission — General purpose applications*

IEC 60079 (all parts), *Electrical apparatus for explosive gas atmospheres*

3 Terms, definitions and abbreviated terms

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

4 Minimum components

The bill of material covered below describes the minimum specified system. Manufacturers may substitute alternatives for any of the options covered in this clause as upgrades to the basic system if required or if offered as standard for the equipment serviced. In any event, 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.

The basic oil system shall contain as a minimum the following components:

a) single pump, (cast iron or steel casing) which may be shaft-driven or motor driven;

b) motor driven start-up pump (if required);

c) valves, made of carbon steel with stainless steel trim;

d) oil piping, made of stainless steel with carbon steel slip-on flanges, conforming to the piping system design code (e.g. ASME B31.3), or stainless steel tubing and fittings;

e) reservoir, made of stainless steel with minimum 3 min retention time, or combined with equipment base;

f) single cooler;

g) single filter with 25 µm nominal pore size;

h) single regulator for control of delivered oil pressure;

i) the following instruments:

   1) pressure indicator (PI),

   2) temperature indicator (TI),

   3) visual level indicator (LI),

   4) pressure switch low-low (PSLL).

5 General

5.1 The equipment (including auxiliaries) covered by this part of ISO 10438 shall be designed and constructed for a minimum service life of 20 years. It is recognized that this is a design criterion.

5.2 The oil system shall be suitable for general-purpose applications as defined in ISO 10438-1. 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.

5.3 The vendor shall assume unit responsibility for all equipment and all auxiliary systems included in the scope of the order.

5.4 The materials of construction of all major components shall be clearly stated in the vendor's proposal. Materials shall be identified by reference to applicable international or national standards including the material grade.

5.5 The purchaser shall specify the required oil supply conditions and the heat load.

● **5.6** Control of the sound pressure level (SPL) of all equipment furnished shall be a joint effort of the purchaser and the vendor. The equipment furnished by the vendor shall conform to the maximum allowable sound pressure level specified by the purchaser.

5.7 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 on the data sheets (such as provided in Annex B) on the basis of mutual agreement with all vendors supplying equipment served by the common oil system.

NOTE The usual lubricant employed in a common oil system is a hydrocarbon oil of viscosity grade 32 or 46 as specified in ISO 8068.

5.8 The system shall be designed to supply oil to all equipment specified by the purchaser.

5.9 Oil recycled for control purposes shall originate upstream of the filters.

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.

● **5.10** The purchaser shall specify whether the installation is indoors (heated or unheated) or outdoors (with or without a roof) as well as the weather and environmental conditions in which the equipment will operate (including maximum and minimum temperatures and unusual humidity, dust, or corrosion conditions).

● **5.11** 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.

● **5.12** If applicable, the purchaser shall specify minimum requirements for clearance around and access to components (especially clearance around and access to coolers, filters, and hand valves).

5.13 Motors, electrical components, and electrical installations shall be suitable for the area classification (class, group, and division or zone) specified on the data sheets and shall meet the requirements of the applicable part(s) of IEC 60079 as well as local codes specified and furnished by the purchaser (see ISO 10438-1).

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

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

● **5.16** 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.

5.17 Coolers, filters, overhead rundown tanks, and other pressure vessels within the scope of the pressure design code shall conform to the requirements of that code.

5.18 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 supply of lube oil is maintained in the event of complete failure of the lube-oil supply system. These provisions may include stand-by 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 upon the system and its components.

5.19 Block valves which 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.

5.20 Welding of piping and pressure-containing parts, as well as any dissimilar-metal welds and weld repairs, shall be performed in accordance with the pressure design code or the piping system design code as applicable.

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

6 Baseplates

6.1 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.

6.2 Unless otherwise specified, console baseplates shall be of the drip-rim type with one or more drain connections at least DN40 (NPS 1 1/2) in size. Baseplates, mounted components, and decking shall be arranged and installed to ensure drainage and avoid the retention of liquid.

6.3 The baseplate shall be provided with lifting lugs for at least a four-point lift. 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.

- **6.4** 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.

- **6.5** If specified, baseplates shall be suitable for grouting.

- **6.6** 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.

- **6.7** If specified, all welding other than that covered by the pressure design code or the piping system design code, such as welding on baseplates, non-pressure ducting, lagging, and control panels, shall be performed in accordance with a structural welding standard (e.g. AWS D1.1).

6.8 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 6.5, accessibility for grouting under all load-carrying structural members shall be provided.

7 Oil reservoirs

7.1 General

Reservoirs shall be separate or combined with the equipment baseplate, and they shall 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.

7.2 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 shall be provided with a drain rim or gutter and one or more drain connections.

7.3 Oil connections and internal piping

7.3.1 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 could 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.

7.3.2 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). Stilling tubes shall have bottom baffles.

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

7.3.4 Reservoir pipe connections DN40 (NPS 1 1/2) and larger shall be flanged.

7.4 Manways and drains

7.4.1 Each reservoir shall be furnished with a valved drain connection.

7.4.2 Manway openings shall be provided which will permit unobstructed access for inspection and cleaning of all interior compartments. Manways shall be located on top of the reservoir and if entry is required for cleaning each manway shall be at least 600 mm × 600 mm (24 in × 24 in). If access is not required for cleaning, a minimum 150 mm (6 in) diameter opening shall be provided.

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

- **7.4.4** If specified, a flanged drain connection (with a valve and a blind flange) at least 50 mm (2 in) in size shall be provided.

7.5 Features and appendages

- **7.5.1** The oil reservoir shall have the following features and appendages:

a) the 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) a reservoir level indicator such as a dipstick, level gauge, or bull’s 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) a weatherproof, corrosion-resistant filter-breather cap at least 50 mm (2 in) in size (this connection may also be used as a fill opening);

f) if specified, a fill opening at least 50 mm (2 in) in size which 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 enter the reservoir above the rundown level (see 7.6.1.1);

i) if specified, a low-level alarm which actuates at the minimum operating.

7.6 Capacity and configurations

7.6.1 Definitions of levels

7.6.1.1 The rundown level (1 in Figure 1) is the highest level that oil in the reservoir may reach when the entire system is shut down.

7.6.1.2 The maximum operating level (2 in Figure 1) is the highest level that oil will reach during normal operation of the equipment.

7.6.1.3 The minimum operating level (3 in Figure 1) is the lowest level that oil will reach during normal operation of the equipment.

7.6.1.4 The suction-loss level (4 in Figure 1) is the level at which the pump begins to lose prime. The pump suction level is defined by the pump suction vortex and net positive suction head requirements.

7.6.1.5 The charge capacity is the total volume below the rundown level.

7.6.1.6 The normal operating range is any level between the maximum and minimum operating levels.

7.6.1.7 The retention capacity is the total volume below the minimum operating level.

7.6.1.8 Retention time is the time allowed for disengagement of entrained air or gas.

7.6.1.9 The rundown capacity is the volume between the rundown level and the maximum operating level.

7.6.1.10 The working capacity is the volume between the minimum operating level and the suction-loss level.

7.6.2 Criteria for sizing

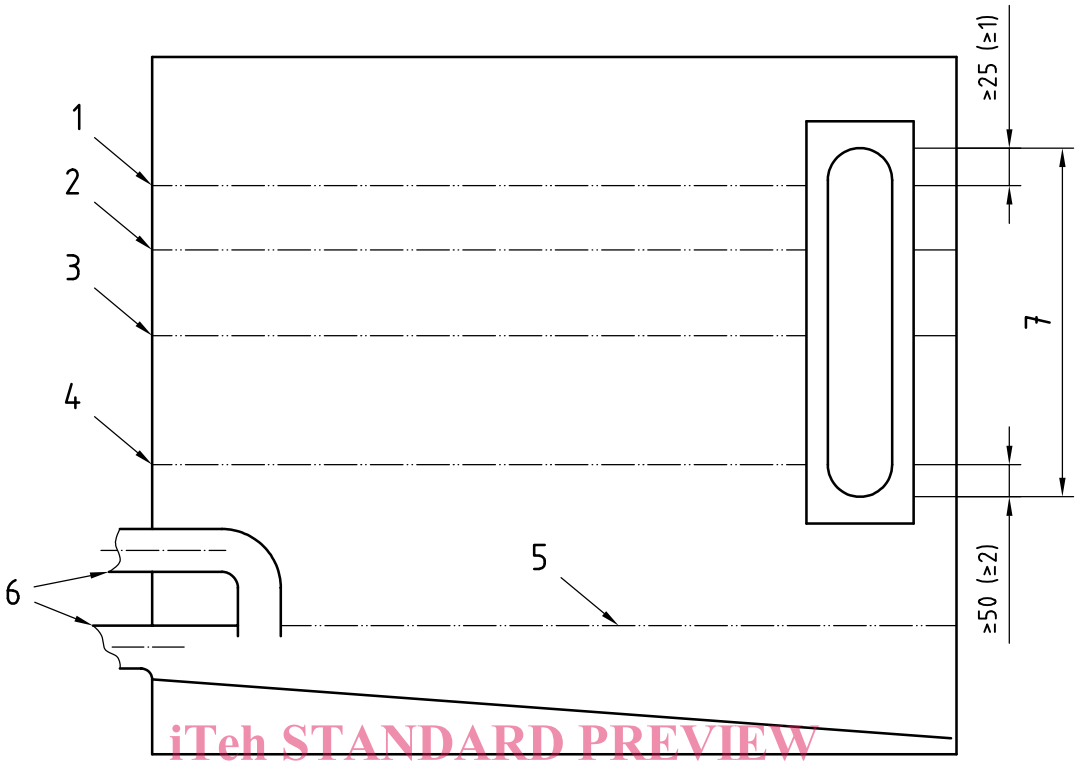
7.6.2.1 The working capacity between the minimum operating level (3 in Figure 1) and the suction-loss level (4 in Figure 1) shall be sufficient for at least 3 min of normal flow.

7.6.2.2 The minimum retention capacity shall be defined as 3 min of normal oil flow.

7.6.2.3 The rundown capacity shall allow for all of the oil contained in all of the components, bearings housings, rundown tanks, control elements, and vendor-furnished piping that drain back to the reservoir. The rundown capacity shall also allow for at least an additional 10 % of these volumes for the purchaser's interconnecting piping.

NOTE Rundown can cause some backup in the drain lines entering the reservoir.

Dimensions in millimetres (inches)



Key

1	rundown level	5	pump suction level
2	maximum operating level	6	alternative pump suction arrangements
3	minimum operating level	7	manufacturer's standard glass length
4	suction-loss level		

A manufacturer's standard gauge glass may be used in this arrangement, with the bottom of the gauge no less than 50 mm below the minimum operating level and with any excess length being above maximum operating level.

Figure 1 — Reservoir levels and oil level glass details

7.7 Heating

● **7.7.1** The purchaser shall specify if an electric heater is required.

7.7.2 When an electric heater is specified, a thermostatically controlled removable electric immersion heating element shall be provided for heating the charge capacity of oil before start-up in cold weather. The device shall have the capacity to heat the oil in the reservoir from the specified minimum site ambient temperature to the manufacturer's required start-up temperature within 12 h. Heater elements in contact with the oil shall be sheathed in austenitic stainless steel; copper or copper-bearing materials shall not contact the oil.

Electric immersion heaters should be interlocked by the purchaser to be de-energized when the oil level drops below the minimum operating level.

7.7.3 When electric heaters are specified, they shall have a maximum surface heat flow density of 2 W/cm^2 (15 W/in^2).

7.7.4 Electric heaters may be in direct contact with the reservoir oil when sized according to 7.7.3.