DRAFT INTERNATIONAL STANDARD
ISO/DIS 19349

ISO/TC **123**/SC **3** Secretariat: **DIN**

Voting begins on: **2015-08-17** Voting terminates on: **2015-11-17**

Plain bearings — Lubrication and control

Titre manque

ICS: 21.100.10

Reference number
ISO/DIS 19349:2015(E)

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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 19349 was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 3, *Dimensions, tolerances and construction*.

Introduction

This standard is based on German Standard DIN 31692-1:1996 *Plain bearings – Part 1: Lubrication and lubrication monitoring*.

Plain bearings — Lubrication and lubrication monitoring

1 Scope

This standard specifies requirements for oil-lubricated plain bearings (plain bearing assemblies) as for instance specified in ISO 11687.

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 2909, *Petroleum Products – Calculation of viscosity index from kinematic viscosity*

ISO 3448, *Industrial liquid lubricants – ISO viscosity classification*

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

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

ISO 11687(all parts), *Pedestal plain bearings;*

3 Lubricants

Hydrodynamic plain bearings can be operated with lubricants of different chemical bases. For the guidelines given hereafter, lubrication using oils from a petroleum base (mineral oil) is assumed. Synthetic lubricants might also be used. The bearing manufacturer shall be asked for acceptable classes of lubricants (ISO 6743-99).

Lubricant viscosity grade (ISO 3448) is typically between ISO VG 15 to ISO VG 150 – at a Viscosity Index (ISO 2909) of about 100 (common hydraulic oil) or above (multigrade oils).

Special consideration shall be taken for lubricants that are circulated at low temperatures or with viscosities outside this range.

4 Lubrication

4.1 General

Regular inspection shall be carried out to determine when the lubricant is approaching the end of its service life in order to establish the optimum lubricant replacement interval.

Where plain bearings or the lubrication units are provided with a heater, the capacity per 1 cm^2 heating area shall not exceed 1,5 W in order to prevent local overheating (cracking) and deterioration of the lubricating oil.

4.2 Self-contained bearings

The lubrication of self-contained bearings is ensured by an internal supply mechanism, driven by the main shaft rotation. Typical self-contained bearing lubrication supply mechanisms include ring lubrication and viscosity pump lubrication. The lubrication does not require external energy or equipment.

A means of monitoring the oil level shall be provided.

Depending on the relevant service conditions, it is recommended that the lubricant in self-contained bearing systems be changed every 4 000 to 8 000 service hours or once a year where machinery is not subject to continuous operation (e.g. emergency power supplies).

4.3 Circulation lubrication (forced lubrication)

4.3.1 General

The normal service life for lubricants is in the range of 20’000 service hours, depending on the specific service conditions. Periodic analysis of the lubricant quality will provide more reliable information upon which to base suitable lubricant replacement intervals. This method can help in saving valuable resources and money and therefore shall be preferred.

4.3.2 Oil cleanliness

Due care shall be taken regarding the cleanliness of the lubricant. Contamination with particles shall be minimised by means of oil filtration. Nominal filter mesh sizes are usually below 25 µm.

Depending on the bearing design and application, the requirements for lubricant cleanliness (see ISO 4406) might be different. In cases where the oil supply system is serving different machines the particular demands on cleanliness shall be considered for each machine element with the specifications for the oil supply system (filtration concept).

4.3.3 Oil feed and oil return

It is recommended that the oil supply and return pipes be connected to the bearing housing by flexible connectors.

For electrically insulated plain bearings, isolators shall be used.

If required, oil coolers shall be integral with the bearings or the external oil supply system. Oil mean flow velocity shall not exceed 2m/s in the supply lines.

Oil return lines shall have a slope of at least 5 %. The return flow shall be driven by gravity.

The flow velocity in the lubricant return line (referred to the pipe cross section) shall not exceed 0,17 m/s. Thus, only 70 % of the cross section is filled under the most unfavourable operating conditions, so any oil mist present can be routed back to the oil reservoir along the oil return line.

Junctions and changes in the direction of pipes shall be designed so as not to impair lubricant flow. Sharp bends and downloops shall be avoided. Junctions in return pipes shall be located in the direction of flow. In order to prevent foaming, vertical slopes exceeding 1 m in length shall be avoided.

The circulating oil in the return line shall be unpressurized. No devices impending the flow, such as filters, etc. shall be installed.

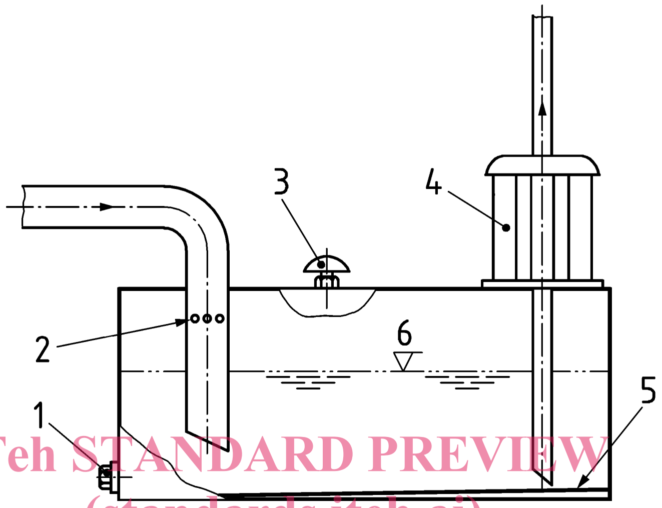
Where more than one device (bearings, and possibly other consumers) is to be supplied with lubrication oil, the design of the oil supply and circulation system should mitigate against the potential harmful interactions in the return lines and oil reservoir caused by differential air pressure conditions.

4.3.4 Oil reservoirs

The capacity of oil reservoirs should be approximately eight times the quantity delivered per minute. The lubricant content in small, very confined systems should not be less than five times this amount. Even small oil reservoirs should have a settling chamber permitting entrained air in the oil to escape. Beside the resting time (before re-use) the reservoir geometrical size at filling level is determining the efficiency of air release from lubrication oil.

Oil reservoirs should be suitably vented to allow entrained air to escape. Where return pipes discharge below the reservoir oil level, vent holes shall be provided above the oil level (permitting the entrained air in the lubricant to escape).

Oil reservoirs shall be equipped with an oil level indicator. The indicator should be positioned a sufficient distance away from the bottom of the reservoir to prevent any deposits entering the device. The bottom of the oil reservoir shall have a slope towards the oil drain.



Key

1 Drain
2 Vent holes located around the pipe circumference
3 Vent
4 Pump
5 Slope
6 Oil level indicator

Figure 1 — Oil reservoir (schematic)

4.4 Hydrostatic lubrication

Hydrostatic shaft lift (“jacking”) using a high pressure oil supply can be used to reduce friction and excessive bearing wear during machine start up, shutdown and periods of prolonged operation at low shaft speed.

The lubricant flowrate depends on the bearing design and conditions. The required jacking pressure and flow rate should be defined by the bearing supplier (designer). As a rule, the steady state hydrostatic lift pressure is 50 to 150 bar. The initial lift pressure (peak value) can be up to twice this value. For bearings of a journal size up to 300 mm, the hydrostatic oil flow rate is typically between 0,5 up to 3 l/min.

A low loss non-return valve should be installed in each high pressure jacking supply line to prevent back flow from the bearing during normal operation.

5 Monitoring

For forced lubricated bearings the oil inlet temperature together with the flow rate are the most relevant parameters for the adjustment (commissioning) and control of forced lubrication systems. These values shall be monitored and connected to the plants control board and alarm system.

NOTE Measuring the oil supply temperature does not substitute a control of the individual bearing temperature.