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Hydraulic fluid power — Sealing devices — Standard test methods to assess the performance of seals used in oil hydraulic reciprocating applications

Transmissions hydrauliques — Dispositifs d'étanchéité — Méthodes d'essai normalisées d'évaluation des performances des joints utilisés dans des applications alternatives à l'huile hydraulique

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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.

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.

International Standard ISO 7986 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 7, *Sealing devices*.

Annexes A, B and C form an integral part of this International Standard. Annex D is for information only.

Introduction

0.1 General

It is widely recognized that the results from reciprocating seal testing can be unpredictable. The background research carried out in support of the preparation of this International Standard has demonstrated that this unpredictability is primarily a function of lack of control of critical variables affecting seal installation and operation. In order to carry out direct comparisons of seal performance, it is necessary to control these variables to closer limits than may be normal in industrial practice. The major variables that can affect seal performance, often even within normal manufacturing tolerance ranges, are listed in subclause 0.3.

0.2 Purpose of the test

The purpose of the test is to provide comparative data on individual reciprocating shaft seal designs and to provide a basis for the preliminary selection of seals based on their relative performance. To achieve this, it is necessary to carry out the tests under strictly defined operating conditions. This International Standard therefore defines standard values of speed, pressure, temperature and surface finish. This will permit comparison of seal test results from sources worldwide.

To make the test results as useful as possible, a range of operating conditions has been provided, so that the most appropriate conditions can be selected as a basis for comparison for initial seal selection.

The pressures are standard working pressures, selected from ISO 2944:1974, 6,3 MPa (63 bar[1]), 16 MPa (160 bar), and 31,5 MPa (315 bar).

The speeds have been selected to include slow speed (where stick-slip and high wear may be problems), medium speed for general purpose hydraulics and a representative high speed.

The constraints on installation and operation in this procedure have been proved by research (primarily carried out at BHR Group in the United Kingdom, under sponsorship from European companies) and international round robin seal tests to be necessary to achieve repeatable results. Any departure from the standard operating conditions and installation criteria cannot be considered a standard test.

1) 1 bar = 0,1 MPa = 10^5 Pa.

0.3 Factors affecting seal performance

Factors affecting seal performance include:

a) installation;

- sealing system, i.e., design of bearing(s), seal(s) and wiper seal;
- installation tolerances, including seal groove, shaft and bearings, extrusion gap;
- shaft material and hardness;
- surface finish of the shaft; variations of surface finish outside the range of Ra 0,08 µm to Ra 0,015 µm, or greater than Rt 1,5 µm, can significantly affect seal performance. Different seal materials also have significantly varying requirements for the optimum surface finish;
- surface finish of the groove surfaces. This must be less than Ra 0,8 µm to avoid static leakage and wear of the seal during pressure cycles;
- bearing material, including its effects on shaft texture and boundary layer.

b) operation;

- fluid, i.e., viscosity, lubricity, compatibility with seal material, including additives and contamination level;
- pressure, including pressure cycle;
- speed, especially speed cycle;
- speed/pressure cycle, i.e., stop-start conditions;
- stroke, especially short strokes (two times the seal contact widths or less), which prevent formation of a lubricant film;
- temperature, i.e., its effect on viscosity and seal material properties;
- external environment.

It is necessary to consider all the above factors and their potential effect on seal performance when comparing potential seal performance in an actual application to results obtained from the standard test.

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1 Scope

This International Standard defines the test conditions and methods for assessing the performance of seals used in oil hydraulic reciprocating applications.

The resulting specified characteristics may be published in manufacturer's literature to enable a direct comparison of seal performance.

The seal under test may be a single seal or a combination seal package.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

ISO 1052:1982, *Steels for general engineering purposes.*

ISO 1629:1995, *Rubber and latices — Nomenclature.*

ISO 2944:1974, *Fluid power systems and components — Nominal pressures.*

ISO 3274:1996, *Geometrical Product Specification (GPS) — Surface texture: Profile method — Nominal characteristics of contact (stylus) instruments.*

ISO 4288:1996, *Geometrical Product Specification (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture.*

ISO 6743-4:1982, *Lubricants, industrial oils and related products (class L) — Classification — Part 4: Family H (Hydraulic systems).*

ISO 10766:1996, *Hydraulic fluid power — Cylinders — Housing dimensions for rectangular-section-cut bearing rings for pistons and rods.*