

Specification for

Compatibility between elastomeric materials and hydraulic fluids

[ISO title: Hydraulic fluid power — Compatibility between
elastomeric materials and fluids]

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The preparation of this British Standard was entrusted by the Machinery and Components Standards Committee (MCE/-) to Technical Committee MCE/18, upon which the following bodies were represented:

- Advanced Manufacturing Technology Research Institute
- Association of British Mining Equipment Companies
- British Compressed Air Society
- British Fluid Power Association
- British Hydromechanics Research Association
- British Steel Corporation
- British Telecommunications plc
- Department of Trade and Industry (National Engineering Laboratory)
- Electricity Supply Industry in England and Wales
- Federation of Manufacturers of Construction Equipment and Cranes
- Institution of Mechanical Engineers
- Ministry of Defence

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- Ball and Roller Bearing Manufacturers' Association
- British Railways Board
- British Rubber Manufacturers' Association
- Institute of Petroleum
- Society of British Aerospace Companies Limited

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National foreword

This revision of BS 4832 has been prepared under the direction of the Machinery and Components Standards Committee. It is identical with ISO 6072:1986 “*Hydraulic fluid power — Compatibility between elastomeric materials and fluids*”, published by the International Organization for Standardization (ISO), and supersedes the 1972 edition of BS 4832, which has been withdrawn.

The standard provides a comparative means of assessing the compatibility of various hydraulic fluids with three standardized elastomeric sealing materials. In view of the ever increasing number of operating fluids and sealing materials available to the designer and user of fluid power equipment, it is desirable that a means should be specified to determine the swelling effect of an hydraulic fluid in relation to a standardized elastomer. This standard will assist in the selection of an appropriate elastomer for seals that will be suitable for use with the fluid under consideration. Conversely, for a given sealing material it will be possible to obtain an indication of interchangeability of hydraulic fluids in relation to that material. This will also provide some guidance as to one of the factors which can affect seal life. It should however be borne in mind that there are other factors which affect seal life and performance, such as seal design, surface finish of the surfaces in contact with the seal, as well as contamination from other sources than oil.

Throughout this standard the term “compatibility” is used to indicate that the seal material is not adversely affected by the hydraulic fluid and that they may therefore be used together.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “British Standard”.

In clause 6, the last paragraph should be read as follows.

“Elastomeric material compatibility with fluids determined in accordance with BS 4832, *Specification for compatibility between elastomeric materials and hydraulic fluids*.”

Cross-references

International Standard	Corresponding British Standard
	BS 903 <i>Methods of testing vulcanized rubber</i>
ISO 37:1977	Part A2:1971 <i>Determination of tensile stress-strain properties</i> (Technically equivalent)
ISO 48:1979	Part A26:1969 <i>Determination of hardness</i> (Technically equivalent)
	BS 1673 <i>Methods of testing raw rubber and unvulcanized compounded rubber</i>
ISO 289:1985	Part 3:1969 <i>Methods of physical testing</i> (Technically equivalent)
	BS 903 <i>Methods of testing vulcanized rubber</i>
ISO 815:1972	Part A6:1969 <i>Determination of compression set after constant strain</i> (Technically equivalent)
	BS 3502 <i>Schedule of common names and abbreviations for plastics and rubbers</i>

International Standard	Corresponding British Standard
ISO 1629:1976	Part 3:1978 <i>Rubbers and latices</i> (Identical) BS 903 <i>Methods of testing vulcanized rubber</i>
ISO 1817:1985	Part A16 <i>Determination of the effect of liquids</i> (Identical)
ISO 2393:1973	BS 1674:1976 <i>Specification for equipment and general procedure for mixing and vulcanizing rubber test mixes</i> (Technically equivalent) BS 903 <i>Methods of testing vulcanized rubber</i>
ISO 2781:1981	Part A1:1980 <i>Determination of density</i> (Technically equivalent)

The Technical Committee has reviewed the provisions of ISO 5598 and ASTM D 2934, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

Additional information. With reference to 4.1.2, suitable elastomer test specimens may be obtained in the United Kingdom from Parker Hannifin (UK) Ltd., Seal Group, Maylands Avenue, Hemel Hempstead, Herts HP2 4SJ.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 14, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. Elastomers are used as seals in fluid power systems. Elastomeric materials are any substances having the ability to return to original size and shape after deformation. Hydraulic fluids are water, oil or other fluids which are forced through an orifice or an enclosed circuit. Elastomeric materials and hydraulic fluids are compatible if they are not altered by chemical interaction.

Annex A to this International Standard specifies the percentage volume change of commercial rubbers in mineral-based oils. Annex B describes the rapid method for indicating the effect of mineral-based oils on elastomers by measurement of volume change index (VCI). Annex C provides an information report.

1 Scope and field of application

This International Standard provides formulations, mixing and vulcanization procedures for three types of elastomeric compositions:

- a) acrylonitrile-butadiene rubber (NBR 1);
- b) fluoroelastomers (FPM 1);
- c) ethylene propylene diene rubber (EPDM 1).

These procedures evaluate the effect of mineral-based and fire-resistant hydraulic fluids upon such compositions by measurement, under controlled conditions, of physical properties of standard test pieces of the suitable test elastomer before and after immersion in the fluids.

The elastomeric materials used in these formulations are sensitive to fluid variations and have comparatively high swelling characteristics. Stable cure systems should be used to give adequate storage life.

NOTE This International Standard does not provide formulations of elastomeric materials for actual service.

The changes in volume, hardness, tensile strength and elongation at break [which standard test specimens of the suitable standard test elastomer undergo when immersed in a certain fluid under specified test conditions (see Table 7)] establish an elastomer compatibility index (ECI) for this fluid, which can be expressed in the format given in clause 5.

The ECI (which should be quoted by oil suppliers) allows selection of suitable combinations of fluids and elastomeric materials without prolonged testing. In the case of mineral-based oils, it will be possible to predict the percentage volume change of commercial rubbers (see Annex A).

NOTE The ECI may provide enough information so as to eliminate totally unsuitable elastomer/fluid combinations without having to resort to extensive screening tests.

Representative standard compositions of various types of elastomers permit evaluation of the effect of hydraulic fluids on such compositions and comparison with commercial elastomeric materials for actual service.

They would also assist producers of additives and hydraulic fluids in the development of hydraulic fluids compatible with different elastomer types.

2 References

- ISO 37, *Rubber, vulcanized — Determination of tensile stress-strain properties.*
- ISO 48, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*
- ISO 289, *Rubber, unvulcanized — Determination of Mooney viscosity.*
- ISO 815, *Rubber, vulcanized — Determination of compression set at normal and at high temperatures¹⁾.*
- ISO 1629, *Rubber and latices — Nomenclature.*
- ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids.*
- ISO 2393, *Rubber test mixes — Preparation, mixing and vulcanization — Equipment and procedures.*
- ISO 2781, *Vulcanized rubbers — Determination of density.*
- ISO 5598, *Fluid power systems and components — Vocabulary.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5598 and the following definitions apply.

NOTE For definitions of the types of fluids involved, see Table 7.

3.1 elastomer

a macromolecular, rubber-like material that returns rapidly to approximately its initial dimensions and shape after substantial deformation by a weak stress and release of the stress

¹⁾ At present at the stage of draft. (Revision of ISO 815:1972.)