

JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 2401-4 : 2012

(JFPA/JSA)

**O-rings — Part 4: Anti-extrusion rings
(back-up rings)**

ICS 23.100.60:83.140.50

Reference number : JIS B 2401-4 : 2012 (E)

PROTECTED BY COPYRIGHT

B 2401-4 : 2012

Date of Establishment: 2012-03-21

Date of Public Notice in Official Gazette: 2012-03-21

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Machine Elements

JIS B 2401-4 : 2012, First English edition published in 2012-11

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2012

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols	2
5 General	2
6 Types	2
6.1 General types	2
6.2 Spiral	3
6.3 Bias-cut	3
6.4 Endless	3
7 Positioning of back-up rings in housings	3
8 Shapes and dimensions	4
9 Appearance	4
10 Material	4
11 Designation codes of products	5
11.1 General	5
11.2 Back-up rings used for O-rings for dynamic applications (P) and O-rings for static applications (G)	5
11.3 Back-up rings used for ISO O-rings for general industrial applications (F) and ISO O-rings for precision instrument applications (S)	5
12 Inspection	6
13 Marking	7
14 Identification statement (reference to this Standard)	7
Annex JA (normative) Shapes and dimensions of back-up rings used for ISO O-rings for general industrial applications (F) and ISO O-rings for precision instrument applications (S)	13
Annex JB (informative) Comparison table between JIS and the correspond- ing International Standard	17

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Fluid Power Association (JFPA) /Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

Consequently JIS B 2407:1995 has been withdrawn and replaced with this Standard.

This JIS document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public or utility model right. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or the utility model right.

JIS B 2401 series consists of the following 4 parts under the general title “*O-rings*”:

Part 1: O-rings

Part 2: Housing dimensions and sizes

Part 3: Quality acceptance criteria

Part 4: Anti-extrusion rings (back-up rings)

O-rings — Part 4 : Anti-extrusion rings (back-up rings)

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of ISO 3601-4 published in 2008 modifying some of the technical contents so as to be applicable to back-up rings that have been conventionally in use in Japan.

The portions given continuous sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JB. A part of the contents of the corresponding International Standard is moved to Annex JA.

1 Scope

This Standard specifies the back-up rings that are intended for preventing extrusion of O-rings specified in JIS B 2401-1.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 3601-4 : 2008 *Fluid power systems — O-rings — Part 4 : Anti-extrusion rings (back-up rings)* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21-1.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 0142 *Fluid power systems and components — Vocabulary*

NOTE : Corresponding International Standard : ISO 5598 *Fluid power systems and components — Vocabulary* (MOD)

JIS B 2401-1 *O-rings — Part 1 : O-rings*

NOTE : Corresponding International Standard : ISO 3601-1 *Fluid power systems — O-rings — Part 1 : Inside diameters, cross-sections, tolerances and designation codes* (MOD)

JIS B 2401-2 *O-rings — Part 2 : Housing dimensions and sizes*

NOTE : Corresponding International Standard : ISO 3601-2 *Fluid power systems — O-rings — Part 2 : Housing dimensions for general applications* (MOD)

JIS K 6891 *Testing methods for polytetrafluoroethylene molding powder*

JIS K 7215 Testing methods for durometer hardness of plastics

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS B 0142 apply.

4 Symbols

For the purpose of this Standard, the following symbols apply.

- b_1 : width of the O-ring housing (without back-up rings)
- b_2 : width of the O-ring housing (with one back-up ring)
- b_3 : width of the O-ring housing (with two back-up rings)
- b_5 : thickness of bias-cut and endless back-up ring
- b_6 : thickness of spiral back-up ring
- d_2 : cross-section diameter of O-ring (in accordance with JIS B 2401-1)
- d_3 : housing groove diameter (for piston sealing)
- d_4 : cylinder inside diameter
- d_5 : rod diameter
- d_6 : housing groove diameter (for rod sealing)
- d_9 : piston diameter
- d_{10} : rod bore diameter
- d_{14} : inside diameter of back-up ring (only applicable to spiral type)
- d_{15} : outside diameter of back-up ring (only applicable to spiral type)
- d_{16} : inside diameter of back-up ring (only applicable to bias-cut and endless type)
- d_{17} : outside diameter of back-up ring (only applicable to bias-cut and endless type)
- l : gap of spiral [dimension of opening of spiral when mounted on mandrel diameter (d_{14})]
- t : width of back-up ring in the radial direction

5 General

The O-ring housings with which back-up rings are to be used shall be in accordance with the general requirements for O-ring housings. For example, surface condition, roundness of groove bottom, roundness of groove edge, lead-in chamfer, dimensions and tolerances and width of housings shall be as specified in the related clauses in JIS B 2401-2.

6 Types

6.1 General types Back-up rings are classified according to the material, colour, and shape, as shown in table 1.

Table 1 Types of back-up rings

Type	Material	Colour	Shape
T1	Polytetrafluoroethylene	Milky white	Spiral
T2	Polytetrafluoroethylene	Milky white	Bias-cut
T3	Polytetrafluoroethylene	Milky white	Endless
F1	Polytetrafluoroethylene containing filler	Liver brown	Spiral
F2	Polytetrafluoroethylene containing filler	Liver brown	Bias-cut
F3	Polytetrafluoroethylene containing filler	Liver brown	Endless

6.2 Spiral

6.2.1 The spiral type is typically used with applications in which the system pressure is between 10 MPa and 20 MPa.

6.2.2 At temperature in excess of 100 °C, back-up rings can be necessary when pressures are less than 10 MPa.

6.3 Bias-cut

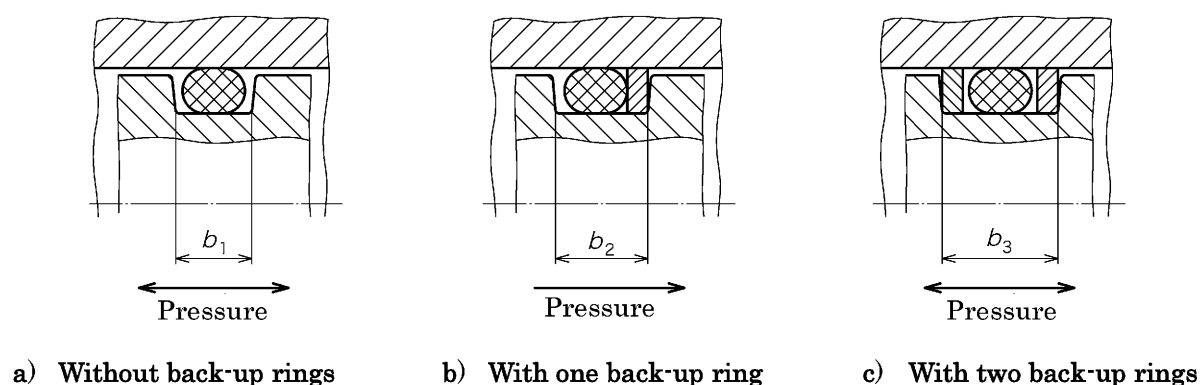
The bias-cut type is the most widely used, mainly because it is easier to install than the endless type, and affords better protection of the O-ring when the system pressure ranges from 15 MPa to greater than 20 MPa.

6.4 Endless

The endless type, while difficult to install in O-ring housings that have single-piece groove or small diameters, affords the ultimate protection of the O-ring at all pressures and temperatures. It is the preferred type for system pressures greater than 25 MPa and temperatures higher than 135 °C.

7 Positioning of back-up rings in housings

Positioning of back-up rings depends on the application and the direction in which pressure acts on the O-ring housing. Back-up rings shall be positioned as shown in figure 1 and figure 2.

**Figure 1 Positioning of back-up ring (piston sealing)**

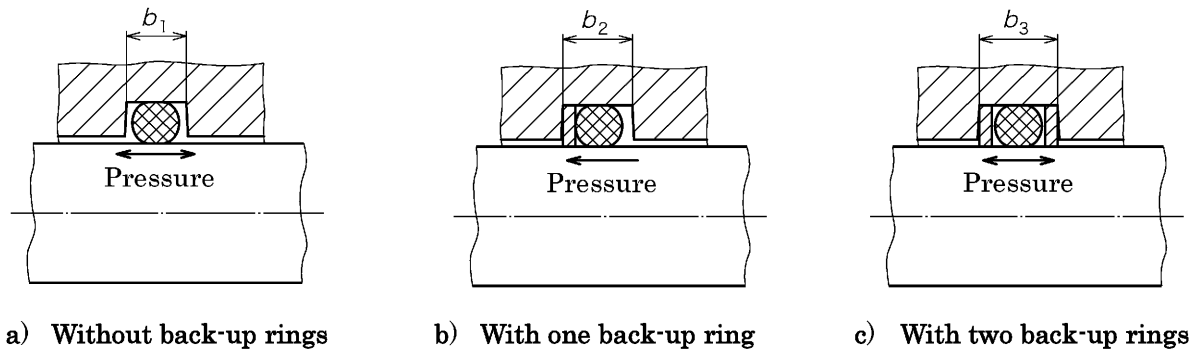


Figure 2 Positioning of back-up ring (rod sealing)

8 Shapes and dimensions

Shapes and dimensions of back-up rings shall be as shown in table 2.

Table 2 Shapes and dimensions of back-up rings

Type of O-ring (symbol indicating the type)	Shapes and dimensions
O-rings for dynamic applications (P)	In accordance with <u>table 4</u> .
O-rings for static applications (G)	In accordance with <u>table 4</u> .
ISO O-rings for general industrial applications (F)	In accordance with Annex JA.
ISO O-rings for precision instrument applications (S)	In accordance with Annex JA.

9 Appearance

The back-up rings shall have a flat and smooth surface, and shall be free from defects such as distortion, flaws, cracks (except in the case of bias-cut type) or stains.

10 Material

The back-up rings shall be manufactured from perfectly baked polytetrafluoroethylene or polytetrafluoroethylene containing filler, which shall have the characteristics as given in table 3.

The material used for back-up rings shall not contaminate oil or the like used in general machinery, be corroded by oil or the like or give any adverse influence on O-rings or metal.

Table 3 Characteristics of materials used for back-up rings

Characteristics	Polytetrafluoroethylene	Polytetrafluoroethylene containing filler	Test method
Specific gravity ^{a)}	2.14 to 2.20	3.00 to 4.00	JIS K 6891
Tensile strength ^{b)} MPa	14.7 min.	12.0 min.	
Elongation ^{b)} (%)	100 min.	100 min.	
Hardness ^{b)} Type D	50 min.	60 min.	JIS K 7215
Dimensional stability ^{c)} (%)	±0.5 max.	±0.5 max.	—
Notes ^{a)} The test piece for specific gravity measurement shall be taken from the product. ^{b)} The test pieces for tensile strength, elongation and hardness measurements shall be taken from the sheet which has been formed under the same conditions as the products. ^{c)} The measurement test piece, a circular disc of 20 mm diameter punched out from the sheet described in Note ^{b)}, shall be heated in the air at 175 °C ± 5 °C for 1 h, and taken out from the thermostatic tank. The test piece shall then be allowed to cool naturally, and the rate of change of diameter shall be obtained when it has cooled down to 25 °C The measurement of dimension shall be performed at 25 °C ± 2 °C.			

11 Designation codes of products

11.1 General

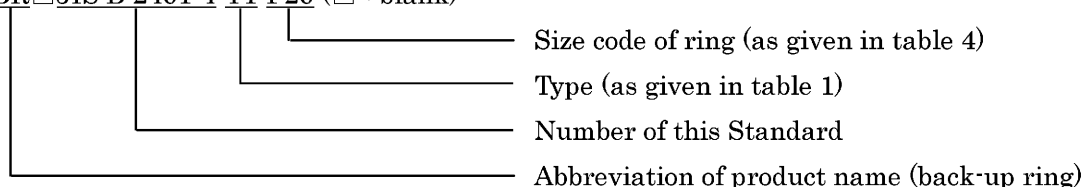
Designation codes of back-up rings shall be in accordance with 11.2 and 11.3.

11.2 Back-up rings used for O-rings for dynamic applications (P) and O-rings for static applications (G)

Back-up rings used for O-rings for dynamic applications (P) and O-rings for static applications (G) shall consist of the abbreviation of the product name, number of this Standard, type and size code of the ring.

Example Spiral, polytetrafluoroethylene, size code of the O-ring P20

BR□JIS B 2401-4-T1-P20 (□ : blank)



11.3 Back-up rings used for ISO O-rings for general industrial applications (F) and ISO O-rings for precision instrument applications (S)

Back-up rings used for ISO O-rings for general industrial applications (F) and ISO O-rings for precision instrument applications (S) shall consist of the abbreviation of product name, number of this Standard, type, cross-section diameter of O-ring, symbol of application type, rod diameter or cylinder inside diameter and housing groove diameter, as shown in the following :