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Internal combustion engines — Piston rings —

Part 4: General specifications

Moteurs à combustion interne — Segments de piston —

Partie 4: Spécifications 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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 22, *Road vehicles*.

This third edition cancels and replaces the second edition (ISO 6621-4:2003), which has been technically revised.

ISO 6621 consists of the following parts, under the general title *Internal combustion engines — Piston rings*:

— *Part 1: Vocabulary*

— *Part 2: Inspection measuring principles*

— *Part 3: Material specifications*

— *Part 4: General specifications*

— *Part 5: Quality requirements*

Introduction

ISO 6621 is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines. Others are ISO 6622-1, ISO 6622-2, ISO 6623, ISO 6624-1, ISO 6624-2, ISO 6624-3, ISO 6624-4, ISO 6625, ISO 6626-1, ISO 6626-2, ISO 6626-3, and ISO 6627.

Internal combustion engines — Piston rings —

Part 4: General specifications

1 Scope

This part of ISO 6621 specifies the general characteristics of piston rings for reciprocating internal combustion engines for road vehicles and other applications (the individual dimensional criteria for these rings are given in the relevant International Standards). It also provides a system for ring coding, designation, and marking. It is applicable to all such rings of a nominal diameter from 30 mm up to and including 200 mm.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6507-3, *Metallic materials — Vickers hardness test — Part 3: Calibration of reference blocks*

ISO 6621-1, *Internal combustion engines — Piston rings — Part 1: Vocabulary*

ISO 6621-2, *Internal combustion engines — Piston rings — Part 2: Inspection measuring principles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6621-1 apply.

4 Piston ring codes

Codes used for piston rings shall be as given in Table 1, corresponding to their explanatory descriptions.

Table 1 — Codes and descriptions in alphabetical order

Code	Description	Relevant International Standard
B	Barrel-faced rectangular ring	ISO 6622-1, ISO 6622-2
BA	Asymmetrical barrel-faced rectangular ring	ISO 6622-1, ISO 6622-2
CR1E ... CR2E	Peripheral surface chromium plated semi-inlaid design	ISO 6621-4
CR1F ... CR2F	Peripheral surface chromium plated inlaid design	ISO 6621-4
CRF ... CR4	Peripheral surface chromium plated fully faced design	ISO 6621-4
CSN, CSG, CSE	Type of coil spring	ISO 6626-1, ISO 6626-2
D	Bevelled edge oil control ring	ISO 6625
D22	Radial wall thickness for “d1/22”	ISO 6622-1, ISO 6623
[a] Material mark (for alternative materials) at the discretion of the manufacturer.		
[b] Any other additional marking on customer’s request, which shall be quoted clearly in the order, shall be agreed upon between manufacturer and customer.		

Table 1 *(continued)*

Code	Description	Relevant International Standard
DSF	Coil spring loaded bevelled edge oil control ring	ISO 6626-1, ISO 6626-2
DSF-C	Coil spring loaded bevelled edge oil control ring, chromium plated, and profile ground	ISO 6626-1, ISO 6626-2
DSF-CNP	Coil spring loaded bevelled edge oil control ring, chromium plated, not profile ground	ISO 6626-1
DSF-NG	Coil spring loaded bevelled edge oil control ring (face geometry similar type DSF-C or DSF-CNP)	ISO 6626-1
DV	Bevelled edge V-groove oil control ring	ISO 6625
E	Scraper ring (stepped)	ISO 6623
EM1 ... EM4	Scraper ring (stepped), taper-faced	ISO 6623
ES-1 ... ES-4	Expander/segment oil control rings	ISO 6627
FE	Ferro oxided on all sides	ISO 6621-4
G	Double bevelled oil control ring	ISO 6625
GSF	Coil spring loaded double bevelled oil control ring	ISO 6626-1, ISO 6626-2
HK	Straight faced half keystone ring 7°	ISO 6624-2, ISO 6624-4
HKB	Barrel faced half keystone ring 7°	ISO 6624-2, ISO 6624-4
HKBA	Asymmetrical barrel-faced half keystone ring	ISO 6624-2, ISO 6624-4
HOL	Openings in oil rings in form of holes	ISO 6626-2
IF	Internal bevel (top side)	ISO 6622, ISO 6624-1, ISO 6624-3
IFU	Internal bevel (bottom side)	ISO 6622
IFV	Variable internal bevel (top side) for defined twist	ISO 6622-1
IFVU	Variable internal bevel (bottom side) for defined twist	ISO 6622-1
IW	Internal step (top side)	ISO 6622-1, ISO 6624-1
IWU	Internal step (bottom side)	ISO 6622-1
K	Straight-faced keystone ring 15°	ISO 6624-1, ISO 6624-3
KA	Peripheral edges chamfered	ISO 6622
KB	Barrel-faced keystone ring 15°	ISO 6624-1, ISO 6624-3
KBA	Asymmetrical barrel-faced keystone ring 15°	ISO 6624-1, ISO 6624-3
KG	Reduced size of peripheral edges at the gap of chromium plated/spray coated/nitrided/PVD coated rings	ISO 6621-4
KI	Inside edges chamfered	ISO 6622
KM1 ... KM5	Taper-faced keystone ring 15°	ISO 6624-1, ISO 6624-3
KU	Reduced peripheral bottom edge chromium plated fully faced design	ISO 6621-4
LF	Uncoated ring peripheral surface or uncoated land peripheral surface, fully lapped	ISO 6621-4
LM	Taper-faced piston ring with partly cylindrical machined peripheral surface	ISO 6621-4

[a] Material mark (for alternative materials) at the discretion of the manufacturer.

[b] Any other additional marking on customer's request, which shall be quoted clearly in the order, shall be agreed upon between manufacturer and customer.

Table 1 *(continued)*

Code	Description	Relevant International Standard
LP	Taper-faced piston ring with lapped land over the whole circumference but not over the whole width of the peripheral surface	ISO 6621-4
M1 ...M5	Taper-faced rectangular ring	ISO 6622-1, ISO 6622-2
MC11 ... MC68	Material subclasses	ISO 6621-3
MM	Manufacturer's mark	ISO 6621-4
MR	Reduced ratio $m/(d_1 - a_1)$ for reduced load	ISO 6621-4
MU	Any other additional mark[b]	ISO 6621-4
MX	Material mark[a]	ISO 6621-4
MY	Mark for required ring shape "negative ovality"	ISO 6621-4
MZ	Mark for required ring shape "round"	ISO 6621-4
N	Napier ring (undercut step)	ISO 6623
NB030 ... NB130	Nitrided surface, case depth specified on peripheral surface and bottom side	ISO 6621-4
NE1 ... NE3	Ring joint with lateral stop	ISO 6621-4
NH1 ... NH3	Ring joint with internal stop	ISO 6621-4
NM1 ... NM4	Napier ring (undercut step), taper-faced	ISO 6623
NP030 ... NP130	Nitrided surface, case depth specified on peripheral surface only	ISO 6621-4
NS 010 ... NS 050	Nitrided surface, case depth on segments	ISO 6627
NT030 ... NT130	Nitrided surface, case depth specified on peripheral surface and side faces	ISO 6621-4
NX	Nitrided surface of expanders/spacers	ISO 6627
PC001...PC040	Physical vapour deposition coating (PVD) thickness	ISO 6621-4
PN 10...PN 25	Nominal contact pressure classes	ISO 6626-3
PNE, PNL, PNR, PNM, PNH, PNV	Contact pressure class	ISO 6626-1, ISO 6626-2, ISO 6627
PO	Phosphated on all sides	ISO 6621-4
PR	Phosphated on all sides (for rust protection purposes)	ISO 6621-4
R	Straight-faced rectangular ring	ISO 6622-1, ISO 6622-2
RU	Napier ring with reduced undercut or step	ISO 6623
S	Slotted oil control ring	ISO 6625
S005 ... S100	Closed gap (minimum values)	ISO 6621-4
SC1 ... SC4	Peripheral surface spray coated fully faced design	ISO 6621-4
SC1E ... SC4E	Peripheral surface spray coated semi-inlaid design	ISO 6621-4
SC1F ... SC4F	Peripheral surface spray coated inlaid design	ISO 6621-4
SSF	Coil spring loaded slotted oil control ring	ISO 6626-1, ISO 6626-2
SSF-L	Coil spring loaded slotted oil control ring with 0,6 mm nominal land width	ISO 6626-1, ISO 6626-2

[a] Material mark (for alternative materials) at the discretion of the manufacturer.

[b] Any other additional marking on customer's request, which shall be quoted clearly in the order, shall be agreed upon between manufacturer and customer.

Table 1 *(continued)*

Code	Description	Relevant International Standard
T	Straight-faced keystone ring 6°	ISO 6624-1, ISO 6624-3
TB	Barrel-faced keystone ring 6°	ISO 6624-1, ISO 6624-3
TBA	Asymmetrical barrel-faced keystone ring 6°	ISO 6624-1, ISO 6624-3
TM1 ... TM5	Taper-faced keystone ring 6°	ISO 6624-1, ISO 6624-3
TT	Seating tab angle θ	ISO 6627
WF	Reduced heat set	ISO 6621-5, ISO 6626-1, ISO 6626-2
WK	Reduced slot length	ISO 6626-1, ISO 6626-2
WTL	Radial wall thickness (large)	ISO 6626-3
WTS	Radial wall thickness (small)	ISO 6626-3
Y	Ring shape negative ovality	ISO 6621-4
Z	Ring shape round	ISO 6621-4

[a] Material mark (for alternative materials) at the discretion of the manufacturer.

[b] Any other additional marking on customer's request, which shall be quoted clearly in the order, shall be agreed upon between manufacturer and customer.

5 Designation of piston rings

5.1 Designation elements and order

5.1.1 General

When designating piston rings complying with the relevant International Standards, the following details shall be provided in the order given, using the codes according to Table 1.

5.1.2 Mandatory elements

The following mandatory elements shall constitute the designation of a piston ring:

— designation (i.e. piston ring);

— number of International Standard;

— type of piston ring (e.g. R);

— hyphen;

— size of piston ring, $d_1 \times h_1$;

— radial wall thickness "regular" without code;

— Code D22 if the selected wall thickness, in accordance with ISO 6622-1 and ISO 6623, is d1/22;

— hyphen;

— material code (e.g. MC11).

5.1.3 Additional elements

The following optional elements may be added to the designation of a piston ring and, if so added, shall be positioned on a second line beneath or separated by a slash (/) from the mandatory elements given in 5.1.2:

— reduced ratio $m/(d_1 - a_1)$, MR;

— ring shape (e.g. Z);

— selected nominal closed gap if it differs from the closed gap specified in the dimension tables (e.g. S05);

— the selected coating (e.g. CR3);

— uncoated rings with fully lapped peripheral surface [e.g. for LF taper faced rings with partly cylindrical peripheral surface, LM (machined), or LP (lapped)];

— selected surface treatment (e.g. PO);

— selected inside edge feature (e.g. KA);

— inside step of bevel (e.g. IWU);

— selected notch to prevent ring rotation (e.g. NH1);

— reduced slot length, if required (e.g. WK);

— coil spring with reduced heat set, if required, (e.g. WF);

— selected type of coil spring, (e.g. CSG);

— selected pressure class (e.g. PNM).

5.1.4 Elements for additional marking

Any additional marking shall be the following with the additional elements of 5.1.3:

— manufacturer's mark, if required (e.g. MM);

— marking of required ring shape (e.g. MZ);

— material, MX (see Table 1, Footnote a);

— code for any other marking, MU (see Table 1, Footnote b).

5.2 Designation examples

5.2.1 Designation example of a piston ring in accordance with ISO 6622-1

For a straight-faced rectangular ring (R) of nominal diameter d_1 = 90 mm (90) and nominal ring width h_1 = 2,5 mm (2,5), made of grey cast iron, non heat treated material subclass 11 (MC11):

Piston ring ISO 6622-1 R - 90 × 2,5 - MC11.

Parameters in parentheses are used in the ISO ring designation.

5.2.2 Designation example of a piston ring in accordance with ISO 6624-1

For a keystone ring 6°, taper faced 60′ (TM3) of nominal diameter d_1 = 105 mm (105) and nominal ring width h_1 = 2,5 mm (2,5) made of spheroidal graphite cast iron, martensitic type, material subclass 51

(MC51), ring shape round (Z) with a selected closed gap of 0,3 mm (S030), inside edges chamfered (KI), and peripheral surface chromium plated, with plating thickness 0,1 mm minimum (CR2):

Piston ring ISO 6624-1 TM3 – 105 × 2,5 – MC51 / Z S030 KI CR2

Parameters in parentheses are used in the ISO ring designation.

5.2.3 Designation example of a piston ring in accordance with ISO 6626-1

For a coil spring loaded, bevelled edge oil control ring, chromium plated and profile ground (DSF-C), with nominal diameter d_1 = 125 mm (125) and nominal ring width h_1 = 5 mm (5) made of grey cast iron, non heat treated, material subclass 11 (MC11) with a selected closed gap of 0,2 mm (S020) having a chromium plating thickness on the lands of 0,15 mm minimum (CR3), phosphated on all cast iron surfaces to a depth of 0,002 mm minimum (PO) with reduced slot length (WK), a coil spring with reduced heat set (WF) having a variable pitch with coil diameter, d_7 ground (CSE), tangential force, F_t, according to the medium nominal contact pressure class (PNM) marked with manufacturer's mark (MM):

Piston ring ISO 6626-1 DSF-C – 125 × 5 – MC11 / S020 CR3 PO WK WF CSE PNM MM

Parameters in parentheses are used in the ISO ring designation.

6 Marking of piston rings

6.1 General

The requirements and recommendations for piston ring marking according to 6.2 and 6.3 apply to piston rings of 1,6 mm radial wall thickness and above. Marking of piston rings of less than 1,6 mm is at the discretion of the manufacturer.

6.2 Mandatory topside identification marking

All rings requiring orientation shall be marked to indicate the top side only (i.e. the side nearest the combustion chamber).

In the absence of any other mark agreed upon between manufacturer and customer, the mark "TOP" should be used.

Marking of the top side applies to *all* the following types of ring:

— taper faced rings;

— asymmetrical barrel-faced rings;

— rings with reduced peripheral bottom edge;

— internally bevelled or stepped rings;

— semi-inlaid rings;

— scraper rings;

— half keystone rings;

— directional oil control rings.

All such rings requiring marking are specified in the relevant International Standards (see Foreword and Bibliography).