TECHNICAL REPORT

ISO TR 6627

First edition
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Internal combustion engines — Piston rings — Expander/segment oil control rings

Moteurs à combustion interne — Segments de piston — Segments racleurs régulateurs d'huile/expandeurs

Reference number
ISO/TR 6627:1992(E)

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 main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 6627, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

This document is being issued in the type 2 Technical Report series of publications (according to subclause G.6.2.2. of part 1 of the IEC/ISO Directives) as a "prospective standard for provisional application" in the field of piston rings because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an "International Standard". It is proposed for provisional application so that information and experi-

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ence of its use in practice may be gathered. Comments on the content of this document should be sent to the ISO Central Secretariat.

A review of this type 2 Technical Report will be carried out not later than two years after its publication with the options of: extension for another two years; conversion into an International Standard; or withdrawal.

Introduction

ISO/TR 6627 is one of a series of International Standards dealing with piston rings for reciprocating internal combustion engines:

ISO 6621-1:1986, *Internal combustion engines — Piston rings — Part 1: Vocabulary*

ISO 6621-2:1984, *Internal combustion engines — Piston rings — Part 2: Inspection measuring principles*

ISO 6621-3:1983, *Internal combustion engines — Piston rings — Part 3: Material specifications*

ISO 6621-4:1988, *Internal combustion engines — Piston rings — Part 4: General specifications*

ISO 6621-5:1988, *Internal combustion engines — Piston rings — Part 5: Quality requirements*

ISO 6622-1:1986, *Internal combustion engines — Piston rings — Part 1: Rectangular rings*

ISO/TR 6622-2:1988, *Internal combustion engines — Piston rings — Part 2: Rectangular rings with narrow ring width*

ISO 6623:1986, *Internal combustion engines — Piston rings — Scraper rings*

ISO 6624-1:1986, *Internal combustion engines — Piston rings — Part 1: Keystone rings*

ISO/TR 6624-2:1988, *Internal combustion engines — Piston rings — Part 2: Half keystone rings*

ISO 6625:1986, *Internal combustion engines — Piston rings — Oil control rings*

ISO 6626:1989, *Internal combustion engines — Piston rings — Coil-spring-loaded oil control rings*

ISO/TR 6627:1992, *Internal combustion engines — Piston rings — Expander/segment oil control rings*

Internal combustion engines — Piston rings — Expander/segment oil control rings

1 Scope

This Technical Report specifies the essential dimensions of expander/segment type oil control rings. Expander design will vary with piston ring manufacturers.

The total circumferential deflection and the piston groove depth should be considered when designing expander/segment oil rings to optimize the fit of the oil ring assembly into the piston groove.

This Technical Report applies to expander/segment oil control rings up to 125 mm inclusive for reciprocating internal combustion engines. It may also be used for piston rings of compressors working under analogous conditions.

The common features and dimensional tables presented in this Technical Report constitute a broad range of variables and the designer, in selecting a particular type, shall bear in mind the conditions under which it will be required to operate.

It is also essential that the designer refers to the specifications and requirements of ISO 6621-3 and ISO 6621-4 before completing his selection.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Technical Report 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 1101:1983, *Technical drawings — Geometrical tolerancing — Tolerances of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 6621-3:1983, *Internal combustion engines — Piston rings — Part 3: Material specifications.*

ISO 6621-4:1988, *Internal combustion engines — Piston rings — Part 4: General specifications.*

3 Symbols

The following symbols are used in this Technical Report:

a_1	segment radial wall thickness
a_6	assembly radial thickness
a_8	spacer radial height
a_9	expander radial height
a_{10}	seating tab height
d_1	nominal ring assembly diameter (= cylinder bore diameter)
h_1	nominal assembly width
h_6	segment width
h_7	spacer width
h_9	expander width
s_1	segment closed gap; stagger gap
θ	nominal seating tab angle
F_t	tangential force

4 Expander/Segment assembly

The expander/segment assembly shall be in accordance with figure 1.

For measuring purposes only, segment gaps shall be in line and expander/spacer ends shall be in the back of the segments; see ISO 6621-2:1984, subclause 3.2.5 b).

When assembled in the engine, the segments and expander shall be positioned as shown in figure 1a).

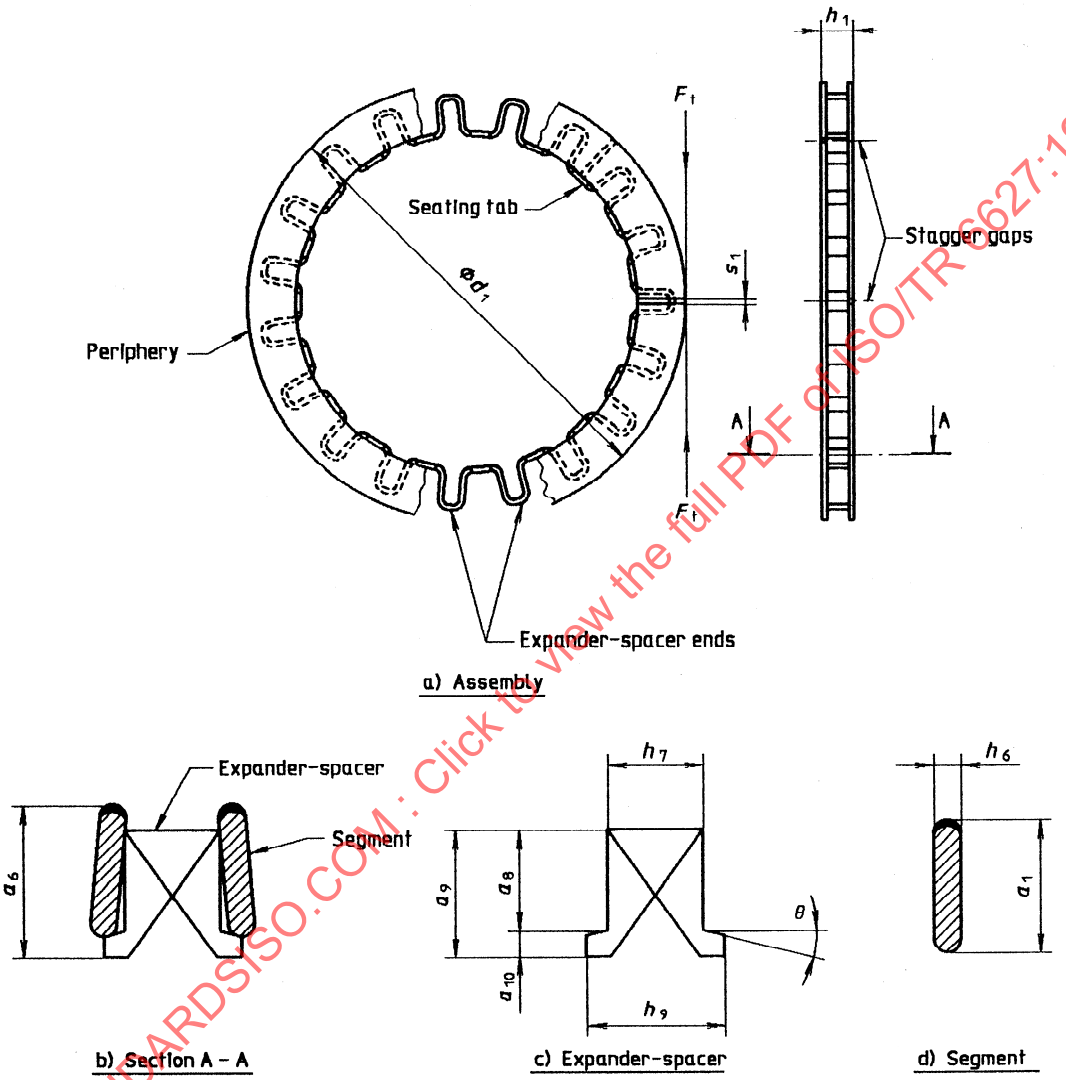
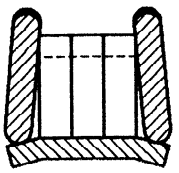
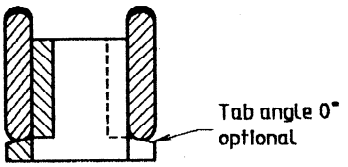
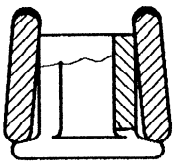
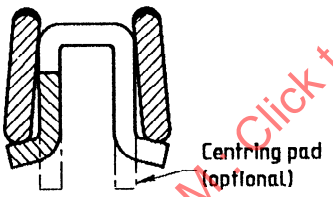
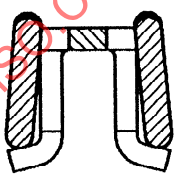


Figure 1 — Expander/segment assembly

5 Ring types

There are any number of possible oil ring expander designs. The more common designs in use today are designated below.

No.	Type	Illustration
5.1	ES-1	
5.2	ES-2	
5.3	ES-3	
5.4	ES-4	
5.5	ES-5	

6 Common features

6.1 Expander seating tab angle

The expander may be designed with the seating tabs at a slight angle resulting in side sealing between the segment and the side of the piston groove. See figure 2.

The nominal seating angle, θ, shown in figure 2 will depend on design: the tolerance is $\pm$ 5°.

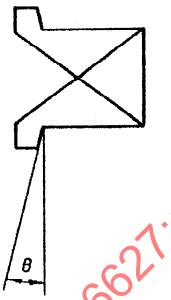


Figure 2 — Expander seating tab angle

6.2 Segment chromium thickness

The common feature of the segment is a chrome-plated periphery, as shown in figure 3, with the thickness specified in table 1.

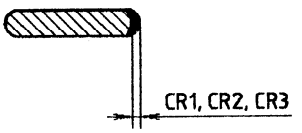


Figure 3 — Chromium thickness of segment

Table 1 — Layer thickness

Chromium	Thickness mm min.
CR1	0,05
CR2	0,1
CR3	0,15

6.3 Segment width

The segment width, h_6, in millimetres, shall be as given in table 3, with the tolerances shown in figure 4.

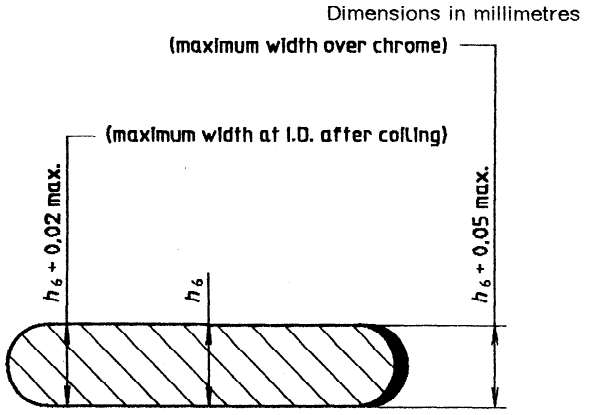


Figure 4 — Segment width

7 Materials

7.1 Expander

The expander shall be of austenitic stainless steel as specified in ISO 6621-3, or of carbon steel, as agreed upon between client and manufacturer.

7.2 Segment

The segment shall be of carbon steel.

8 Force and nominal contact pressure

8.1 Tangential force

The tangential force, F_t, of expander/segment oil control rings is determined by the force of the expander and may be calculated with the following formula:

$$F_t = \frac{1}{2} P_o \times d_1 \times 2h_6$$

where

P_o is the required nominal contact pressure;

d_1 and h_6 are as defined in clause 3.

The force exerted by the segments is negligible.

In table 3, the tangential forces have been tabulated at a unit pressure of P_o ($P_o = 1$ N/mm^2).

8.2 Nominal contact pressure, P_o

The tangential force, F_t, for selected unit pressures is calculated by use of the multiplying factors shown in table 2.

Table 2 — Multiplying factors

Multiplying factor F_t (from table 3)	Unit pressure N/mm^2
1,6[1)]	1,6
1,25	1,25
1	1
0,8	0,8
0,6[2)]	0,6

1) Recommended for repair sizes only.
2) Not recommended for $d_1 < 65$ mm.

9 Dimensions

Dimensions shall be in accordance with table 3.

Table 3 — Dimensions

Dimensions in millimetres

Nominal diameter d_1	Segment width h_6 Column 1	2	3	4	Tolerance	Segment closed gap s_1 Nom.	Tolerance	F_t (P_o = 1 N/mm²) Column 1	2	3	4	Tolerance	Nominal assembly width h_1 (using available h_6) Column 1-3	1-3	1-4	1-4	4
40								16	18	20							
41								16,4	18,4	20,5							
42								16,8	18,9	21							
43								17,2	19,3	21,5							
44								17,6	19,8	22							
45								18	20,2	22,5							
46								18,4	20,7	23							
47								18,8	21,1	23,5							
48								19,2	21,6	24							
49						0,15	$^{+0,50}_{0}$	19,6	22	24,5							
50								20	22,5	25							
51								20,4	22,9	25,5							
52								20,8	23,4	26							
53								21,2	23,8	26,5							
54								21,6	24,3	27							
55								22	24,7	27,5							
56								22,4	25,2	28							
57								22,8	25,6	28,5							
58								23,2	26,1	29							
59								23,6	26,5	29,5			2,5				
60								24	27	30	36						
61								24,4	27,4	30,5	36,6						
62								24,8	27,9	31	37,2						
63								25,2	28,3	31,5	37,8	± 30 % if F_t < 30 N					
64								25,6	28,8	32	38,4						
65	0,4	0,45	0,5	0,6	$^{+0,025}_{0}$			26	29,2	32,5	39	± 20 % if $F_t \geq$ 30 N		3	3,5	4	4,75
66								26,4	29,7	33	39,6						
67						0,2		26,8	30,1	33,5	40,2						
68								27,2	30,6	34	40,8						
69								27,6	31	34,5	41,4						
70								28	31,5	36	42						
71								28,4	31,9	36,5	42,6						
72								28,8	32,4	36	43,2						
73								29,2	32,8	36,5	43,8						
74								29,6	33,3	37	44						
75							$^{+0,75}_{0}$	30	33,7	37,5	45						
76								30,4	34,2	38	45,6						
77								30,8	34,6	38,5	46,2						
78								31,7	35,1	39	46,8						
79								31,6	35,5	39,5	47,4						
80						0,25		32	36	40	48						
81								32,4	36,4	40,5	48,6						
82								32,8	36,9	41	49,2						
83								33,2	37,3	41,5	49,8						
84								33,6	37,8	42	50,4						
85								34	38,2	42,5	51						
86								34,4	38,7	43	51,6						
87								34,8	39,1	43,5	52,2						
88								35,2	39,6	44	52,3						
89								35,6	40	44,5	53,4						