

Specification for

# Piston rings up to 200 mm diameter for reciprocating internal combustion engines —

Part 5: Ring grooves

UDC 621.431.3 – 242.3:62 – 45

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This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the Executive Board on 29 October 1976

- British Cast Iron Research Association
- British Rubber Manufacturers' Association
- Fluid Seal Manufacturers' Association
- Individual experts

## Amendments issued since publication

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## Foreword

This British Standard was prepared under the authority of the Mechanical Engineering Standards Committee and specifies, in metric units, the data for a complete range of rationalized sizes for standard types of piston rings for reciprocating internal combustion engines.

It has been prepared primarily to provide a basis for rationalization of sizes, materials and other characteristics of piston rings and incorporates current good practice used within the internal combustion engines industry. This standard supersedes BS 3627 “*Dimensions of compression and oil control rings and piston ring grooves for i.c. engines*” (in imperial units) which, however, will be retained until such time as it is no longer required by industry.

In the preparation of this standard, consideration was given to the equivalent German DIN Standards for piston rings for automotive engineering.

The standard is prepared in five Parts. Other Parts of the standard are:

- *Part 1: Designs, dimensions, materials and designations for single piece rings;*
- *Part 2: Designs, dimensions, materials and designations for multi-piece oil control rings<sup>1)</sup>;*
- *Part 3: Quality requirements;*
- *Part 4: Measuring and testing procedures.*

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, 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.

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<sup>1)</sup> In course of preparation.

## Section 1. General

### 1 Scope

This Part of BS 5341 specifies ring groove dimensions, limits and methods of measuring for all piston ring grooves to suit the rings specified in Parts 1 and 2<sup>2)</sup> of this British Standard and also the formulae for obtaining piston ring groove root diameters, limits and typical piston ring groove root diameter sizes for the range of nominal cylinder bores from 30 mm to 200 mm diameter for both two-stroke and four-stroke cycle spark and compression ignition reciprocating internal combustion engines.

NOTE It is recommended that inspection procedures should be based on BS 6000.

### 2 References

The titles of the publications referred to in this standard are listed on the inside back cover.

## Section 2. Ring groove dimensions and clearances

### 3 Ring groove widths

#### 3.1 Parallel sided grooves

**3.1.1** Parallel sided ring groove widths shall be as specified in Table 5 and Table 6. When compression and oil control rings having the widths specified in Table 5 and Table 6 respectively are assembled in these grooves, the minimum side clearances shall be as specified in Table 1 and Table 2.

**3.1.2** Any deviations of the side clearances required for special applications shall be obtained by altering piston ring groove widths and not by changing the piston ring widths.

**Table 1 — Compression ring minimum side clearance**

All dimensions are in millimetres.

| Nominal cylinder bore $d_1$ |                     | Spark ignition engines |               | Compression ignition engines |               |
|-----------------------------|---------------------|------------------------|---------------|------------------------------|---------------|
| Over                        | Up to and including | Top groove             | Lower grooves | Top groove                   | Lower grooves |
| —                           | 100                 | 0.040                  | 0.040         | 0.065                        | 0.040         |
| 100                         | 174                 | 0.065                  | 0.040         | 0.065                        | 0.040         |
| 174                         | 200                 | —                      | —             | 0.075                        | 0.065         |

**Table 2 — Oil control ring minimum side clearance**

All dimensions are in millimetres.

| Nominal cylinder bore $d_1$ |                     | Spark ignition engines | Compression ignition engines |
|-----------------------------|---------------------|------------------------|------------------------------|
| Over                        | Up to and including |                        |                              |
| —                           | 100                 | 0.040                  | 0.040                        |
| 100                         | 174                 | 0.040                  | 0.040                        |
| 174                         | 200                 | —                      | 0.065                        |

NOTE The scraper ring being a dual purpose ring would normally be fitted with compression ring side clearance.

#### 3.2 Taper sided grooves

**3.2.1** Taper sided ring groove widths shall be as specified in Table 7 and Table 8. When 15° or 6° Keystone (wedge) rings having the widths specified in Table 7 and Table 8 respectively are assembled in these grooves, the minimum side clearances shall be as given in Figure 1 and Table 3 when the piston ring is flush with the piston land immediately above the groove, taken on bottom limit of the minor axis with the measurements taken when the piston and the gauge are at standard temperature.

<sup>2)</sup> Part 2 in course of preparation.

3.2.2 Any deviations of the side clearances required for special applications shall be obtained by altering piston ring groove widths and not by changing the piston ring widths.

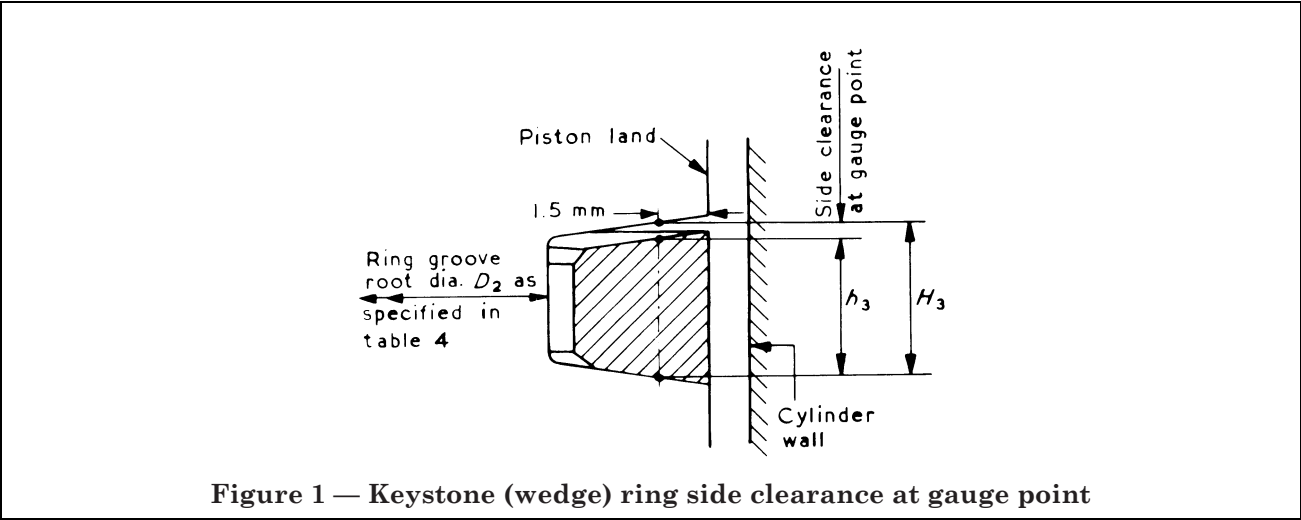


Figure 1 — Keystone (wedge) ring side clearance at gauge point

Table 3 — 15° and 6° Keystone (wedge) ring minimum side clearance

All dimensions are in millimetres.

| Type of ring         | Minimum side clearance at gauge point |
|----------------------|---------------------------------------|
| 6° Keystone (wedge)  | 0.075                                 |
| 15° Keystone (wedge) | 0.040                                 |

4 Ring groove root diameters

Ring groove root diameters shall be as specified in Table 4 and are calculated from the following formulae: compression ring grooves

$$D_2 = d_1 - (2a_1 + 0.006d_1 + 0.50)$$

oil control ring grooves

$$D_2 = d_1 - (2a_1 + 0.006d_1 + 1.50)$$

where

- $D_2$  is the maximum ring groove root diameter<sup>a</sup>;
- $d_1$  is the nominal cylinder bore or ring diameter;
- $a_1$  is the maximum radial thickness given in column 2 of Table 4 (taken from dimensional tables in Part 1 of this standard).

<sup>a</sup> Tolerance on these diameters is 0.250 mm.

NOTE 1 For rings of intermediate sizes and oversizes for reboring, the ring groove root diameters of the next smaller nominal bore are increased by the amount of oversize.  
NOTE 2 The scraper ring being a dual purpose ring would normally be fitted with compression ring groove root diameter.

**Table 4 — Typical ring groove root diameter sizes in relation to nominal cylinder bore and maximum ring radial thickness**

All dimensions are in millimetres.

| Nominal cylinder bore $d_1$ | Ring maximum radial thickness | Ring groove root diameter $D_2$ |         |             |         |
|-----------------------------|-------------------------------|---------------------------------|---------|-------------|---------|
|                             |                               | Compression                     |         | Oil control |         |
|                             |                               | Maximum                         | Minimum | Maximum     | Minimum |
| 30                          | 1.35                          | 26.620                          | 26.370  | —           | —       |
| 32                          | 1.45                          | 28.408                          | 28.158  | —           | —       |
| 34                          | 1.55                          | 30.196                          | 29.946  | —           | —       |
| 35                          | 1.55                          | 31.190                          | 30.940  | —           | —       |
| 36                          | 1.6                           | 32.084                          | 31.834  | —           | —       |
| 38                          | 1.7                           | 33.872                          | 33.622  | —           | —       |
| 40                          | 1.8                           | 35.660                          | 35.410  | —           | —       |
| 42                          | 1.85                          | 37.548                          | 37.298  | —           | —       |
| 44                          | 1.95                          | 39.336                          | 39.086  | —           | —       |
| 45                          | 2.0                           | 40.230                          | 39.980  | —           | —       |
| 46                          | 2.05                          | 41.124                          | 40.874  | —           | —       |
| 48                          | 2.1                           | 43.012                          | 42.762  | —           | —       |
| 50                          | 2.2                           | 44.800                          | 44.550  | 43.800      | 43.550  |
| 52                          | 2.3                           | 46.588                          | 46.338  | 45.588      | 45.338  |
| 53                          | 2.35                          | 47.482                          | 47.232  | 46.482      | 46.232  |
| 54                          | 2.4                           | 48.376                          | 48.126  | 47.376      | 47.126  |
| 55                          | 2.4                           | 49.370                          | 49.120  | 48.370      | 48.120  |
| 56                          | 2.45                          | 50.264                          | 50.014  | 49.264      | 49.014  |
| 58                          | 2.55                          | 52.052                          | 51.802  | 51.052      | 50.802  |
| 60                          | 2.65                          | 53.840                          | 53.590  | 52.840      | 52.590  |
| 62                          | 2.7                           | 55.728                          | 55.478  | 54.728      | 54.478  |
| 63                          | 2.75                          | 56.622                          | 56.372  | 55.622      | 55.372  |
| 64                          | 2.8                           | 57.516                          | 57.266  | 56.516      | 56.266  |
| 65                          | 2.85                          | 58.410                          | 58.160  | 57.410      | 57.160  |
| 66                          | 2.9                           | 59.304                          | 59.054  | 58.304      | 58.054  |
| 67                          | 2.9                           | 60.298                          | 60.048  | 59.298      | 59.048  |
| 68                          | 2.95                          | 61.192                          | 60.942  | 60.192      | 59.942  |
| 70                          | 3.05                          | 62.980                          | 62.730  | 61.980      | 61.730  |
| 72                          | 3.15                          | 64.768                          | 64.518  | 63.768      | 63.518  |
| 74                          | 3.2                           | 66.656                          | 66.406  | 65.656      | 65.406  |
| 75                          | 3.25                          | 67.550                          | 67.300  | 66.550      | 66.300  |
| 76                          | 3.3                           | 68.444                          | 68.194  | 67.444      | 67.194  |
| 78                          | 3.4                           | 70.232                          | 69.982  | 69.232      | 68.982  |
| 80                          | 3.45                          | 72.120                          | 71.870  | 71.120      | 70.870  |
| 82                          | 3.55                          | 73.908                          | 73.658  | 72.908      | 72.658  |
| 84                          | 3.65                          | 75.696                          | 75.446  | 74.696      | 74.446  |
| 85                          | 3.7                           | 76.590                          | 76.340  | 75.590      | 75.340  |
| 86                          | 3.7                           | 77.584                          | 77.334  | 76.584      | 76.334  |
| 88                          | 3.8                           | 79.372                          | 79.122  | 78.372      | 78.122  |
| 90                          | 3.9                           | 81.160                          | 80.910  | 80.160      | 79.910  |
| 92                          | 4.0                           | 82.948                          | 82.698  | 81.948      | 81.698  |
| 94                          | 4.05                          | 84.836                          | 84.586  | 83.836      | 83.586  |
| 95                          | 4.1                           | 85.730                          | 85.480  | 84.730      | 84.480  |
| 96                          | 4.15                          | 86.624                          | 86.374  | 85.624      | 85.374  |
| 98                          | 4.25                          | 88.412                          | 88.162  | 87.412      | 87.162  |