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**Plain washers for screw and washer  
assemblies — Small, normal and large  
series — Product grade A**

*Rondelles plates pour vis à rondelle plate incorporée — Séries étroite,  
normale et large — Grade A*



Reference number  
ISO 10673:2009(E)

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10673 was prepared by Technical Committee ISO/TC 2, *Fasteners*, Subcommittee SC 10, *Product standards for fasteners*.

This second edition cancels and replaces the first edition (ISO 10673:1998), which has been technically revised.



# Plain washers for screw and washer assemblies — Small, normal and large series — Product grade A

## 1 Scope

The International Standard specifies the characteristics of plain steel washers, small, normal and large series, of product grade A for metric screw and washer assemblies in accordance with ISO 10644.

NOTE 1 The product can be manufactured under the conditions defined in Clause 5.

NOTE 2 The manufacturing of screw and washer assemblies takes into consideration material and production procedure of screw and plain washer as well as the assembly process of components, in order to meet specification requirements.

## 2 Normative references

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

ISO 3269, *Fasteners — Acceptance inspection*

ISO 4759-3, *Tolerances for fasteners — Part 3: Plain washers for bolts, screws and nuts — Product grades A and C*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 10644:2009, *Screw and washer assemblies made of steel with plain washers — Washer hardness classes 200 HV and 300 HV*

## 3 Classification

Washers of product grade A for metric screw and washer assemblies are classified into three types:

- type S: small series, preferably for hexagon socket head cap screws and for cheese head screws.
- type N: normal series, preferably for hexagon head screws.
- type L: large series, preferably for hexagon head screws.

## 4 Dimensions

### 4.1 Washers type S

For washers type S (small series), see Figure 1 and Table 1.

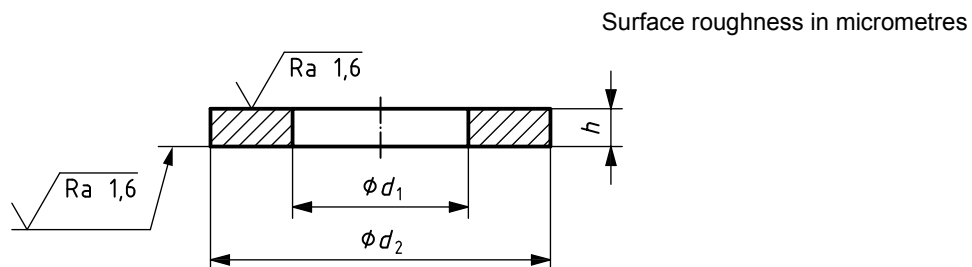


Figure 1 — Washer type S

Table 1 — Dimensions of washer type S

Dimensions in millimetres

| Nominal size<br>(Nominal thread diameter)<br>$d$ | Clearance hole<br>$d_1$ |       | Outside diameter<br>$d_2$ |       | Thickness<br>$h$ |      |      |
|--|-------------------------|-------|---------------------------|-------|------------------|------|------|
|  | nom.<br>(min.)          | max.  | nom.<br>(max.)            | min.  | nom.             | max. | min. |
| 2  | 1,75                    | 1,85  | 4,5                       | 4,2   | 0,6              | 0,65 | 0,55 |
| 2,5  | 2,25                    | 2,35  | 5                         | 4,7   | 0,6              | 0,65 | 0,55 |
| 3  | 2,75                    | 2,85  | 6                         | 5,7   | 0,6              | 0,65 | 0,55 |
| 3,5  | 3,2                     | 3,32  | 7                         | 6,64  | 0,8              | 0,85 | 0,75 |
| 4  | 3,6                     | 3,72  | 8                         | 7,64  | 0,8              | 0,85 | 0,75 |
| 5  | 4,55                    | 4,67  | 9                         | 8,64  | 1                | 1,06 | 0,94 |
| 6  | 5,5                     | 5,62  | 11                        | 10,57 | 1,6              | 1,68 | 1,52 |
| 8  | 7,4                     | 7,55  | 15                        | 14,57 | 1,6              | 1,68 | 1,52 |
| 10   | 9,3                     | 9,52  | 18                        | 17,57 | 2                | 2,09 | 1,91 |
| 12   | 11                      | 11,27 | 20                        | 19,48 | 2                | 2,09 | 1,91 |

## 4.2 Washers type N

For washers type N (normal series), see Figure 2 and Table 2.

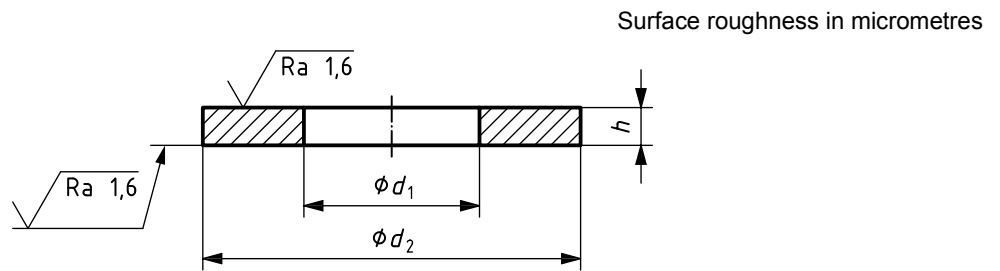


Figure 2 — Washer type N

Table 2 — Dimensions of washer type N

Dimensions in millimetres

| Nominal size<br>(Nominal thread diameter)<br>$d$ | Clearance hole<br>$d_1$ |       | Outside diameter<br>$d_2$ |       | Thickness<br>$h$ |      |      |
|--|-------------------------|-------|---------------------------|-------|------------------|------|------|
|  | nom.<br>(min.)          | max.  | nom.<br>(max.)            | min.  | nom.             | max. | min. |
| 2  | 1,75                    | 1,85  | 5                         | 4,7   | 0,6              | 0,65 | 0,55 |
| 2,5  | 2,25                    | 2,35  | 6                         | 5,7   | 0,6              | 0,65 | 0,55 |
| 3  | 2,75                    | 2,85  | 7                         | 6,64  | 0,6              | 0,65 | 0,55 |
| 3,5  | 3,2                     | 3,32  | 8                         | 7,64  | 0,8              | 0,85 | 0,75 |
| 4  | 3,6                     | 3,72  | 9                         | 8,64  | 0,8              | 0,85 | 0,75 |
| 5  | 4,55                    | 4,67  | 10                        | 9,64  | 1                | 1,06 | 0,94 |
| 6  | 5,5                     | 5,62  | 12                        | 11,57 | 1,6              | 1,68 | 1,52 |
| 8  | 7,4                     | 7,55  | 16                        | 15,57 | 1,6              | 1,68 | 1,52 |
| 10   | 9,3                     | 9,52  | 20                        | 19,48 | 2                | 2,09 | 1,91 |
| 12   | 11                      | 11,27 | 24                        | 23,48 | 2,5              | 2,6  | 2,4  |

### 4.3 Washers type L

For washers type L (large series), see Figure 3 and Table 3.

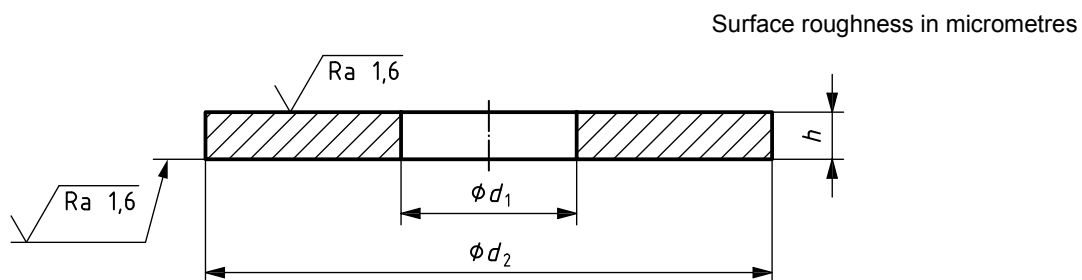


Figure 3 — Washer type L

Table 3 — Dimensions of washer type L

Dimensions in millimetres

| Nominal size<br>(Nominal thread diameter)<br>$d$ | Clearance hole<br>$d_1$ |       | Outside diameter<br>$d_2$ |       | Thickness<br>$h$ |      |      |
|--|-------------------------|-------|---------------------------|-------|------------------|------|------|
|  | nom.<br>(min.)          | max.  | nom.<br>(max.)            | min.  | nom.             | max. | min. |
| 2  | 1,75                    | 1,85  | 6                         | 5,7   | 0,6              | 0,65 | 0,55 |
| 2,5  | 2,25                    | 2,35  | 8                         | 7,64  | 0,6              | 0,65 | 0,55 |
| 3  | 2,75                    | 2,85  | 9                         | 8,64  | 0,8              | 0,85 | 0,75 |
| 3,5  | 3,2                     | 3,32  | 11                        | 10,57 | 0,8              | 0,85 | 0,75 |
| 4  | 3,6                     | 3,72  | 12                        | 11,57 | 1                | 1,06 | 0,94 |
| 5  | 4,55                    | 4,67  | 15                        | 14,57 | 1                | 1,06 | 0,94 |
| 6  | 5,5                     | 5,62  | 18                        | 17,57 | 1,6              | 1,68 | 1,52 |
| 8  | 7,4                     | 7,55  | 24                        | 23,48 | 2                | 2,09 | 1,91 |
| 10   | 9,3                     | 9,52  | 30                        | 29,48 | 2,5              | 2,6  | 2,4  |
| 12   | 11                      | 11,27 | 37                        | 36,38 | 3                | 3,11 | 2,89 |



## 5 Requirements and reference International Standards

See Table 4.

**Table 4 — Requirements and reference International Standards**

| Assembly in relation to screw heat treatment   |                             | Washer to be assembled  |                     |   |                     |
|--|-----------------------------|---|---------------------|---|---------------------|
|  |                             | after heat treatment of the screw<br>(see method 2 in ISO 10644)  |                     | before heat treatment of the screw<br>(see method 1 in ISO 10644)             |                     |
| <b>Material</b> <sup>b</sup>   |                             | Steel   |                     | Heat treatable steel as agreed between screw manufacturer and washer supplier |                     |
| <b>Mechanical properties</b>   | Hardness class              | 200 HV <sup>a</sup>   | 300 HV <sup>a</sup> | 200 HV <sup>c</sup>   | 300 HV <sup>c</sup> |
|  | Hardness range <sup>d</sup> | 200 HV to 300 HV  | 300 HV to 370 HV    | 200 HV to 300 HV  | 300 HV to 370 HV    |
| <b>Tolerances</b>  | Product grade               | A <sup>e</sup>  |                     |   |                     |
|  | International Standard      | ISO 4759-3  |                     |   |                     |
| <b>Finish</b>  |                             | Plain, i.e. washers to be supplied in natural finish or as agreed between screw manufacturer and washer supplier.<br>All tolerances shall apply prior to the application of a plating or coating. |                     |   |                     |
| <b>Workmanship</b>   |                             | Parts shall be uniform in quality and free of irregularities or detrimental defects. No protruding burrs shall appear on the washer.  |                     |   |                     |
| <b>Acceptability</b>   |                             | For the acceptance procedure, see ISO 3269.   |                     |   |                     |
| <p><sup>a</sup> Heat treated (HT) or work hardened (WH) to be defined in the designation. In case of no specification, the washer manufacturer can choose freely.</p> <p><sup>b</sup> Other materials as agreed between screw manufacturer and washer supplier.</p> <p><sup>c</sup> Hardness class after the heat treatment of the screw and washer assembly in accordance with ISO 10644.</p> <p><sup>d</sup> Hardness testing in accordance with ISO 6507-1.<br/>Test force: HV 2 for nominal thicknesses <math>h \leq 0,6</math> mm;<br/>HV 10 for nominal thicknesses <math>0,6 \text{ mm} &lt; h \leq 1,2</math> mm;<br/>HV 30 for nominal thicknesses <math>h &gt; 1,2</math> mm.</p> <p><sup>e</sup> Product grade A does not apply to the tolerances of the clearance hole, <math>d_1</math>, and the thickness, <math>h</math>.</p> |                             |   |                     |   |                     |

## 6 Designation

Plain washers shall be designated in accordance with the following examples.

**EXAMPLE 1** A plain steel washer for screw and washer assemblies, type N (normal series), of nominal size 8 mm, hardness class 200 HV, work hardened (WH), manufactured by method 2 in accordance with ISO 10644:2009, Annex A, is designated as follows:

**Washer ISO 10673-N-8-200 HV WH**

## ISO 10673:2009(E)

EXAMPLE 2 A plain steel washer for screw and washer assemblies, type N (normal series), of nominal size 8 mm, hardness class 200 HV, heat treated (HT), manufactured by method 2 in accordance with ISO 10644:2009, Annex A, is designated as follows:

**Washer ISO 10673-N-8-200 HV HT**

EXAMPLE 3 A plain steel washer for screw and washer assemblies, type N (normal series), of nominal size 8 mm, made of 34CrMo4 steel (for example) and manufactured by method 1 in accordance with ISO 10644:2009, Annex A, is designated as follows:

**Washer ISO 10673-N-8-34CrMo4**

## Bibliography

- [1] ISO 6507-2, *Metallic materials — Vickers hardness test — Part 2: Verification and calibration of testing machines*

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