INTERNATIONAL STANDARD

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Screw and washer assemblies made of steel with plain washers — Washer hardness classes 200 HV and 300 HV

Vis en acier à rondelle plate incorporée — Rondelles de classes de dureté 200 HV et 300 HV

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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.

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 10644 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 10644:1998), which has been technically revised.

Screw and washer assemblies made of steel with plain washers — Washer hardness classes 200 HV and 300 HV

1 Scope

This International Standard specifies the requirements for metric screw and plain washer assemblies made of steel with coarse thread M2 to M12 inclusive, flat seating heads, property classes up to and including 10.9 and washer hardness classes 200 HV or 300 HV.

The plain washers are captive, i.e. prevented from disassembly and free to rotate.

NOTE The manufacturing of screw and washer assemblies takes into consideration material and production procedure of screw blank and washer as well as the assembly process of components, in order to meet specification requirements (see Annex A).

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 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs with specified property classes — Coarse thread and fine pitch thread*

ISO 1207, *Slotted cheese head screws — Product grade A*

ISO 1580, *Slotted pan head screws — Product grade A*

ISO 4014, *Hexagon head bolts — Product grades A and B*

ISO 4015, *Hexagon head bolts — Product grade B — Reduced shank (shank diameter approximately equal to pitch diameter)*

ISO 4017, *Hexagon head screws — Product grades A and B*

ISO 4042, *Fasteners — Electroplated coatings*

ISO 4762, *Hexagon socket head cap screws*

ISO 7045, *Pan head screws with type H or type Z cross recess — Product grade A*

ISO 9717, *Phosphate conversion coatings for metals — Method of specifying requirements*

ISO 10673, *Plain washers for screw and washer assemblies — Small, normal and large series — Product grade A*

ISO 10683, *Fasteners — Non-electrolytically applied zinc flake coatings*

ISO 14579, *Hexalobular socket head cap screws*

ISO 14583, *Hexalobular socket pan head screws*

ISO 15071, *Hexagon bolts with flange — Small series — Product grade A*

ISO 15072, *Hexagon bolts with flange with metric fine pitch thread — Small series — Product grade A*

3 Dimensions

The dimensions of plain washers shall be in accordance with ISO 10673.

The dimensions of the assembled screws shall conform to those of loose parts, i.e. ISO 1207, ISO 1580, ISO 4014, ISO 4015, ISO 4017, ISO 4762, ISO 7045, ISO 14579, ISO 14583, ISO 15071, ISO 15072, with the following exceptions:

— Bolts and screws shall have a reduced shank of such diameter, d_s, that the washer with dimensions in accordance with ISO 10673 is free to rotate.

NOTE $d_s \approx$ pitch diameter.

— The maximum distance from the underside of the head to the commencement of full thread is increased by an amount necessary to accommodate the washer thickness for those products which are approximately threaded to the washer.

For examples of screw and washer assemblies, see Figures 1 and 2.

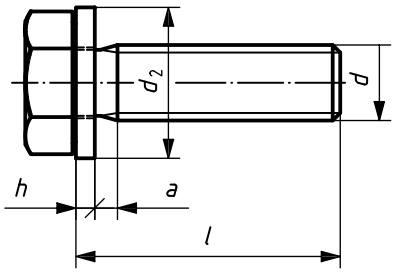


Figure 1 — Screw threaded up to the washer

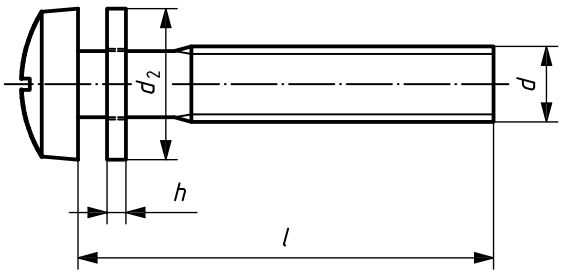


Figure 2 — Screw with shank

— The transition diameter, d_a, as specified in the reference International Standards (see Table 3) shall be reduced by an amount equivalent to the difference between the nominal diameter, d, and pitch diameter to create the transition diameter, d_{a1} (see Figure 3 and Table 1). The curvature under head, as specified in the ISO International Standards for loose parts, shall not be changed.

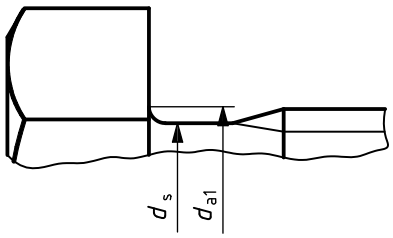


Figure 3 — Transition diameter, d_{a1}, and shank diameter, d_s

Table 1 — Dimensions of transition diameter

Dimensions in millimetres

Thread [a] (Nominal thread diameter) d	a [b] max.	d_{a1} max.	**Dimensions of plain washers** [c] Small series Type S h nom.	d_2 max.	Normal series Type N h nom.	d_2 max.	Large series Type L h nom.	d_2 max.
M2	$2P$ [d]	2,4	0,6	4,5	0,6	5	0,6	6
M2,5		2,8	0,6	5	0,6	6	0,6	8
M3		3,3	0,6	6	0,6	7	0,8	9
(M3,5)		3,7	0,8	7	0,8	8	0,8	11
M4		4,3	0,8	8	0,8	9	1	12
M5		5,2	1	9	1	10	1	15
M6		6,2	1,6	11	1,6	12	1,6	18
M8		8,4	1,6	15	1,6	16	2	24
M10		10,2	2	18	2	20	2,5	30
M12		12,6	2	20	2,5	24	3	37

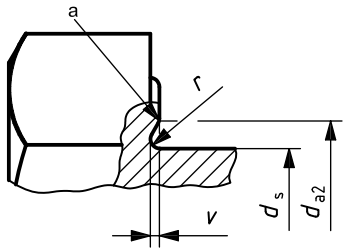
[a] Sizes in parentheses should be avoided.

[b] Maximum distance from the underside of the washer to the commencement of the first full thread with the washer in contact with the screw bearing face or underhead radius, when measured using a faced-off, i.e. unchamfered, ring gauge, see Figure 1.

[c] Dimensions extracted from ISO 10673 for information only.

[d] P is the pitch of the thread.

— In the case of hexagon head screws, the alternative underhead configuration with undercut (type U) may be used by agreement between the supplier and the purchaser, see Figure 4 and Table 2.



[a] Smooth transition.

Figure 4 — Alternative underhead configuration, type U

Table 2 — Type U dimensions

Dimensions in millimetres

Thread d		M3	M4	M5	M6	M8	M10	M12
d_{a2}	max.	3,6	4,7	5,7	6,8	9,2	11,2	13,7
r	min.	0,1	0,2	0,2	0,25	0,4	0,4	0,6
v	max.	0,20	0,25	0,25	0,30	0,4	0,4	0,5
	min.	0,05	0,05	0,05	0,05	0,1	0,1	0,1
NOTE For other dimensions, see Table 1.								

4 Specifications and reference International Standards

The components of screw and washer assemblies shall satisfy the material and mechanical property requirements specified in the respective product International Standards in the finished condition.

For referee purposes, in case of dispute, testing of the mechanical properties in accordance with ISO 898-1 shall be carried out with the washer component removed.

The hardness classes of the washers used for screw and washer assemblies shall be as follows:

— property class of screw $\leqslant$ 8.8: hardness class of washer 200 HV or 300 HV in accordance with ISO 10673;

— property class of screw 9.8 and 10.9: hardness class of washer 300 HV in accordance with ISO 10673.

NOTE The washer hardness class of the finished products can be obtained with the production methods described in Annex A.

5 Screw and washer combinations

The standardized combinations of screws and washers and the symbols to be used for the components are given in Table 3.

Washers with minimum internal diameter, d_1, assembled with screws with maximum transition diameter, d_{a1}, may cause interference between washer and underhead radius. In that case, contact traces at the underhead radius may appear and the torque/clamp load performance may be affected.

In order to avoid interference and contact traces, the use of screws with head type U or chamfered washers is recommended.

Table 3 — Combinations of screws and washers — Symbols

Screw		Washer [a] Type		
		S	N	L
Reference International Standard	Symbol	Symbol S	Symbol N	Symbol L
ISO 4017	S1	—	x	x
ISO 4014 [b]	S2	—	x	x
ISO 7045	S3	—	x	x
ISO 4762	S4	x	x	x
ISO 1580	S5	—	x	x
ISO 1207	S6	x	x	x
ISO 14579	S10	x	x	x
ISO 14583	S11	—	x	x
ISO 15071	S12	—	x	x
ISO 15072	S13	—	x	x

[a] In accordance with ISO 10673.

[b] Bolts in accordance with ISO 4014 with reduced shank according to Clause 3 will be similar to bolts in accordance with ISO 4015.

6 Coatings

Coatings shall be in accordance with ISO 4042 for electroplated coatings, ISO 10683 for non-electroplated zinc flake coatings and ISO 9717 for phosphate conversion coatings.

Agreement may be made between the manufacturer and the purchaser on other types of coatings.

7 Designation

The designation of a screw and washer assembly shall consist of the following:

— the description of the component;

— reference to this International Standard, i.e. ISO 10644;

— the characteristics of the screw component;

— the screw symbol indicating the type of screw (see Table 3);

— the washer symbol indicating the type of washer (see Table 3);

— the hardness class of the washer.

EXAMPLE 1 A hexagon head screw and washer assembly consisting of a screw M6 × 30-8.8 in accordance with ISO 4017 (symbol S1) and a washer (hardness class 200HV), normal series, in accordance with ISO 10673 (symbol N), is designated as follows:

Screw and washer assembly ISO 10644-M6 × 30-8.8-S1-N 200 HV

EXAMPLE 2 A hexagon head screw and washer assembly of a screw M6 × 30-8.8 in accordance with ISO 4017 (symbol S1) with undercut (type U) and a washer (hardness class 300HV), normal series, in accordance with ISO 10673 (symbol N), is designated as follows:

Screw and washer assembly ISO 10644-M6 × 30-8.8-U-S1-N 300 HV

Annex A
(informative)

Methods for the production of screw and captive washer assemblies

Unless otherwise agreed between the manufacturer and the purchaser, the manufacturer delivers bolt and washer assemblies according to the manufacturing method of his choice.

There are two different methods for the production of screw and captive washer assemblies:

a) **Method 1** utilizes the practice of assembling a screw blank with a washer and then thread rolling the assembly. Subsequent heat treating of the assembly completes the process. The material of both the screw blank and the washer have to be chosen so that all requirements for mechanical properties will be met.

b) **Method 2** utilizes a process in which the fastener blank and the washer component are manufactured independently, then assembled, and threads are rolled in the hardened condition, i.e. after heat treatment.

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