

*Indian Standard*  
**SPECIFICATION FOR**  
**HARDENED AND TEMPERED WASHERS FOR**  
**HIGH STRENGTH STRUCTURAL BOLTS AND NUTS**

( *First Revision* )

(Incorporating Amendment No. 1)

**1. Scope and Field of Application** — Covers the requirements for through hardened and tempered steel washers intended for assembly with large series hexagon, high strength structural bolts and nuts in the size range M16 to M36.

**2. Types** — These washers shall be of the following types:

Type A — Plain hole circular washers.

Type B — Square taper washers for use with channels (6° taper)

Type C — Square taper washers for use with I-beams (8° taper)

**3. Dimensions and Tolerances** — The dimensions of the plain hole circular washers shall be as given in Table 1 and those for square taper washers shall be as given in Table 2.

**3.1** The washers shall be flat with a maximum deviation not exceeding 0.25 mm from the straightedge laid along a line passing through the centre of the hole.

**3.2** The hole of the washer shall be concentric with the outside dimensions within 0.50 mm.

**3.3** When circular or square taper washers are required to be clipped to provide clearance, the clipped edge shall not be closer to the centre of the washer than 0.9 of the bolt diameter. In case of square taper washers, these may be clipped along the thin edge parallel to the opposite edge.

**4. Grade** — Unless otherwise specified, the washers shall conform to the requirements specified for ordinary washers according to IS : 5369-1975 'General requirements for plain washers and lock washers ( *first revision* )'.

**5. Material** — The washers shall be made from 45C8 steel according to IS : 1570 (Part 2)-1979 'Schedules for wrought steels, Part 2 Carbon steels (unalloyed steels) ( *first revision* )' with the contents of sulphur and phosphorus not exceeding 0.06 percent in the check analysis.

**6. Heat Treatment** — The washers shall be through hardened and tempered. Carburised washers are not suitable.

**7. Hardness** — The washers shall be subjected to a hardness test in accordance with IS : 1586-1968 'Method for Rockwell hardness test (B and C scales) for steel ( *first revision* )' and the hardness shall be between 35 to 45 HRC. The minimum hardness for hot-dip galvanized washers shall be 26 HRC.

**8. Finish** — Unless specified otherwise, the washers shall be supplied in the dull black heat-treated condition with a residual coating of light oil.

**8.1** Where washers are required to be hot-dip galvanized, they shall conform to IS : 4759-1979 'Hot-dip zinc coatings on structural steel and other allied products ( *first revision* )' except that the minimum value of average mass of coating shall be 300 g/m<sup>2</sup>.

**8.1.1** For hot-dip galvanized washers, precautions to avoid hydrogen embrittlement will be necessary and shall be taken as per IS : 6158-1971 'Recommended practice for safeguarding against embrittlement of hot-dip galvanized iron and steel products'.

**9. General Requirements**

**9.1** In regard to requirements not covered in the standard, the washers shall conform to the requirements specified for ordinary washers according to IS : 5369-1975 'General requirements for plain washers and lock washers ( *first revision* )'.

**9.2** The high strength structural bolts to be used with these washers shall conform to the requirements of IS : 3757-1985 'High strength structural bolts ( *second revision* )'.

Adopted 20 March 1985

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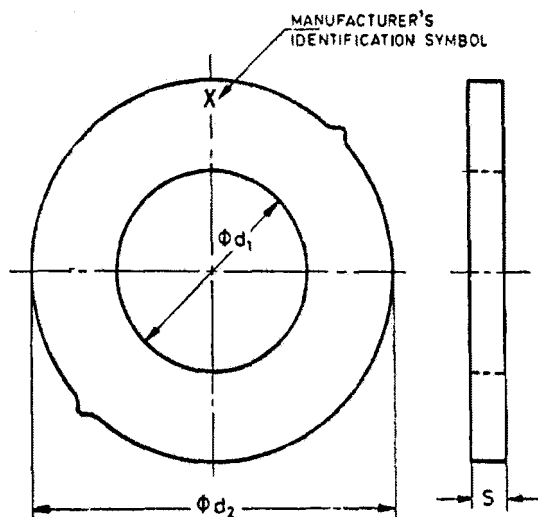
**Price Group 2**

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**TABLE 1 DIMENSIONS FOR PLAIN HOLE CIRCULAR WASHERS (TYPE A)**

( Clause 3 )

All dimensions in millimetres



Nominal size (thread size <i>d</i> of associated bolt)		M16	M20	(M22)*	M24	(M27)*	M30	M36
$d_1$	Min	18	22	24	26	30	33	39
	Max	18.43	22.52	24.52	26.52	30.52	33.62	39.62
$d_2$	Min	32.4	40.4	42.4	48.4	54.1	58.1	70.1
	Max	34	42	44	50	56	60	72
$s$	Min	3.1	3.1	3.4	3.4	3.4	3.4	3.4
	Max	4.6	4.6	4.6	4.6	4.6	4.6	4.6

**Note** — For hot-dip galvanized washers, the above dimensions apply before galvanizing.

\*Sizes shown within brackets are non-preferred.

**9.3** The high strength structural nuts to be used with these washers shall conform to the requirements of IS : 6623-1985 'High strength structural nuts ( *first revision* )'.

**10. Designation** — Hardened and tempered washers shall be designated by the word 'washer', nominal size, type and the number of this standard. In case of hot-dip galvanized washers the word 'galvanized' shall be added to the designation.

*Examples :*

A plain hole circular washer of nominal size M24 conforming to this standard and Galvanized shall be designated as :

Washer M24 A IS : 6649 galvanized.

A square taper washer of 6° taper for use with channels, of nominal size M24 conforming to this standard and galvanized shall be designated as :

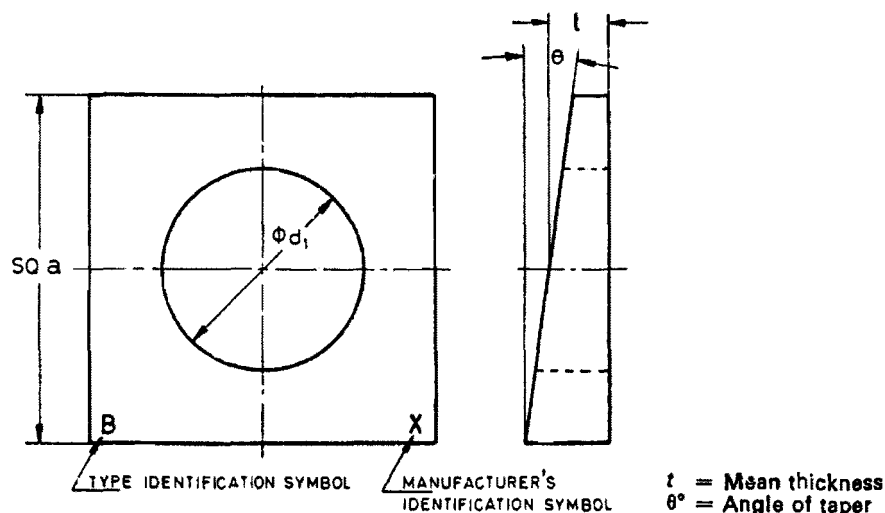
Washer M24 B IS : 6649 galvanized.

**11. Sampling** — Sampling and criteria of acceptance shall be in accordance with IS : 6821-1973 'Methods for sampling non-threaded fasteners'.

**TABLE 2 DIMENSIONS FOR SQUARE TAPER WASHERS (TYPE B AND C)**

( Clause 3 )

All dimensions in millimetres



Nominal size (thread size $d$ of associated bolt)		M16	M20	(M22)*	M24	(M27)*	M30	M36
$d_1$	Min	18	22	24	26	30	33	39
	Max	18.43	22.52	24.52	26.52	30.52	33.62	39.62
$a$	Min	42	42	42	42	55	55	55
	Max	45	45	45	45	58	58	58
$t$	Min	7.5	7.5	7.5	7.5	7.5	7.5	7.5
	Max	8.5	8.5	8.5	8.5	8.5	8.5	8.5
$\theta^\circ$	Type B	6	6	6	6	6	6	6
	Type C	8	8	8	8	8	8	8

**Note 1** — For hot-dip galvanized washers, the above dimensions apply before galvanizing.

\*Sizes shown within brackets are non-preferred.

**12. Marking**

**12.1** Type A plain hole circular washers shall be identified by the provision of two nibs and the manufacturer's identification symbol in indented character as shown in figure under Table 1, the indented symbol being placed as near to the outer edge as possible.

**12.2** Type B and C square taper washers shall be identified by the type identification symbol, B or C, and the manufacturer's identification symbol. All symbols shall be indented and placed as near as possible to the two corners of washer as shown in figure under Table 2.

**13. Mode of Packing** — The washers shall be packed in accordance with the requirements for ordinary washers according to IS : 5369-1975 'General requirements for plain washers and lock washers ( first revision )'.

**14. ISI Certification Marking** — Details available with the Indian Standards Institution.

**EXPLANATORY NOTE**

| IS : 3757 'Specification for high strength friction grip fasteners for structural engineering purposes' was originally published in 1966. The first revision of IS : 3757 catered for 'high' tensile friction grip bolts' only; the corresponding nuts and washers were covered by separate standards. Thus, IS : 6649 'Specification for high tensile friction grip washers' was first published in 1972. In the present revision, in addition to changes in the specification the title has also been changed to 'Hardened and tempered washers for high strength structural bolts and nuts' to be in conformity with the revised versions of the specifications for the associated bolts and nuts.

So far as plain hole circular washers are concerned, the standard is in conformity with ISO/DIS 7415 'Hardened and tempered plain hole circular washers for high strength structural bolts' issued by International Organization for Standardization (ISO).

This edition 2.1 incorporates Amendment No. 1 (October 1988). Side bar indicates modification of the text as the result of incorporation of the amendment.