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PAKISTAN STANDARD FOR:

Carbon Structural Steel

**PSQCA Complex, Standardization Wing, 1st Floor, Plot-ST-7/A, Block-3,
Scheme No.36, Gulistan-e-Jauher, Karachi**

Pakistan Standard Specification For
Carbon Structural Steel

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C O N T E N T S

Pakistan Standard Specification For
Carbon Structural Steel

0. FOREWORD

0.1 This Pakistan Standard was adopted by the Authority of Pakistan Standards and Quality Control Authority, (National Standard Body of Islamic Republic of Pakistan), after draft prepared by the Mechanical Technical Committee (MTC-5) for "Metal Alloys and Testing, which is duly approved and endorsed by the National Standard Committee on Mechanical on 28.02.2017

02. This Pakistan Standard was first prepared in 2002 based on ASTM-A36/A36M-OOa. In CL: 1 of PS: 4798/2002 merely the word "Sections" between word "Carbon Steel" and "Shapes" was inserted.

0.3 As ASTM has revised the based Standard (A 36/A 36M-ooa), therefore in order to keep pace with the latest development and for the sake of harmonization, it has been felt imperative to revise the version 2002 of PS: 4798 accordingly.

In revision of PS: 4798/2002 assistance have also been derived from the following documents which are acknowledged with thanks.

i- ASTM A6/A6M-14¬¬Standards Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

ii- ISO 6929: Steel Products____ Vocabulary

iv ISO 4948/1___ Classification of steel into unalloyed and alloy steels based on chemical composition

0.4 This Pakistan Standard No.4798 – Carbon Structural Steel is based on ASTM-A36/A36M-14 which is acknowledged with thanks.

0.5 This Standard has been adopted after taking into consideration, the views and the suggestions of the manufacturers, specialists, technologists and utilizing agencies well in line with the technical barriers to trade agreement (WTO/TBT).

0.6 This Standard is subject to periodical review in order to keep with development in technology. Any suggestion for improvement will be recorded and placed before the revising committee in due course.

1. Scope

1.1 This specification covers carbon steel shapes, plates, sections and bars of structural quality for use in riveted, bolted, or welded construction of bridges and buildings, and for general structural purposes.

1.2 Supplementary requirements are provided for use where additional testing or additional restrictions are required by the purchaser. Such requirements apply only when specified in the purchase order.

1.3 When the steel is to be welded, welding procedure suitable for the grade of steel and intended use of service is to be utilized. See Appendix X3 of Specification A6/A6M for information on weldability.

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system is to be used independently of the other, without combining values in any way.

1.5 The text of this specification contains notes or footnotes, or both, that provide explanatory material. Such notes and footnotes, excluding those in tables and figures, do not contain any mandatory requirements.

1.6 For structural products produced from coil and furnished without heat treatment or with stress relieving only, the additional requirements, including additional test results, of A6/A6M apply.

2. Reference Documents

2.1 ASTM Standards

A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling.

A27/A27M Specification for Steel Castings, Carbon, for General Application.

A307 Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.

A325 Specification for Structural Bolts, Steel, Heat, Heat Treated, 120/105 ksi Minimum Tensile Strength.

A325M Specification for Structural Bolts, Steel, and Heat Treated 830 MP_a Minimum Tensile Strength (Metric).

A500 Specification for Cold –Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501 Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

A502 Specification for Rivets, Steel, Structural.

A563 Specification for Carbon and Alloy Steel Nuts.

A563M Specification for Carbon and Alloy Steel Nuts (Metric).

A668/A668M Specification for Steel Forgings, Carbon and alloy, for General Industrial Use.

A1011/A1011M Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved with Formability, and Ultra-High Strength.

A1018/A1018M Specification for Steel, Sheet and Strip, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low Alloy with Improved Formability, and Ultra-High Strength.

F568M Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners (Metric) Withdrawn 2012)[4]

F1554 specification for anchor Bolts. Steel, 36, 55, and 105-ksi Yield Strength.

3. **Appurtenant Materials**

3.1 When components of a steel structure are identified with this ASTM designation but the product form is not listed in the scope of this specification, the material shall conform to one of the standards listed in Table 1 unless otherwise specified by the purchaser.

TABLE- 1: Appurtenant Material Specifications

NOTE 1 – The specifier should be satisfied of the suitability of these materials for the intended application Chemical composition or mechanical properties, or both, may be different than specified in A36/A36M.

Material	ASTM Designation
Bolts	A502, Grade 1
Steel rivets	A307, Grade A or F568M, Class 4.6
High-strength bolts	A325 or A325M
Steel nuts	A563 or A563M
Cast steel	A27/A27M, Grade 65–35 [450–240]
Forgings (carbon steel)	A668/A668M, Class D
Hot-rolled sheets and strip	A1011/A1011M, SS Grade 36 [250] Type 1 or Type 2 or A1018/A1018M, SS Grade 36 [250]
Cold-formed tubing	A500, Grade B
Hot-formed tubing	A501
Anchor bolts	F1554, Grade 36

4. General Requirements for Delivery

4.1 Structural products furnished under this specification shall conform to the requirements of the current edition of Specification A6/A6M, for the specific structural product ordered, unless a conflict exists in which case this specification shall prevail.

4.2 Coils are excluded from qualification to this specification until they are processed into a finished structural product. Structural products produced from coil means structural products that have been cut to individual lengths from a coil. The processor directly controls, or is responsible for, the operations involved in the processing of a coil into a finished structural product. Such operations include de-coiling, leveling or straightening, hot-forming or cold-forming (if applicable), cutting to length, testing, inspection, conditioning, heat treatment (if applicable), packaging, marking, loading for shipment, and certification.

NOTE 1—for structural products produced from coil and furnished without heat treatment or with stress relieving only, two test results are to be reported for each qualifying coil. Additional requirements regarding structural products produced from coil are described in Specification A6/A6M.

5. Bearing Plates

5.1 Unless otherwise specified, plates used as bearing plates for bridges shall be subjected to mechanical tests and shall conform to the tensile requirements of Section 8.

5.2 Unless otherwise specified, mechanical tests shall not be required for plates over 1½ in. [40 mm] in thickness used as bearing plates in structures other than bridges, subject to the requirement that they shall contain 0.20 to 0.33 % carbon by heat analysis, that the chemical composition shall conform to the requirements of Table 3 in phosphorus and sulfur content, and that a sufficient discard shall be made to secure sound plates.

6. Materials and Manufacture

6.1 The steel shall be killed

The last approved version of this historical standard is referenced on www.astm.org.

7. Chemical Composition

7.1 The heat analysis shall conform to the requirements prescribed in Table 3, except as specified in 5.2.

7.2 The steel shall conform on product analysis to the requirements prescribed in Table 3, subject to the product analysis tolerances in Specification A6/A6M.

7.3 Unspecified elements shall be applicable as per ISO 4948/1___ Classification of steel into unalloyed and alloy steels based on chemical composition.

8. Tension Test

8.1 The material as represented by the test specimen, except as specified in 5.2 and 8.2, shall conform to the requirements as to the tensile properties prescribed in Table 2.

8.2 Shapes less than 1 in.^{2} [645 mm^2] in cross section and bars, other than flats, less than ½ in. [12.5 mm] in thickness or diameter need not be subjected to tension tests by the manufacturer, provided that the chemical composition used is appropriate for obtaining the tensile properties in Table 2.

8. Keywords

9.1 bars; bolted construction; bridges; buildings; carbon; plates; riveted construction; shapes; steel; structural steel; welded construction

TABLE 2 Tensile Requirements[A]

Plates, Shapes,[B] and Bars:	
Tensile strength, ksi [MPa] [400–550]	58–80
Yield point, min, ksi [MPa]	36 [250][C]
Plates and Bars:[D,E]	
Elongation in 8 in. [200 mm], min, %	20
Elongation in 2 in. [50 mm], min, %	23
Shapes:	
Elongation in 8 in. [200 mm], min, %	20
Elongation in 2 in. [50 mm], min, %	21[B]

[A] See the Orientation subsection in the Tension Tests section of Specification A6/A6M.

[B] For wide flange shapes with flange thickness over 3 in. [75 mm], the 80 ksi [550MPa] maximum tensile strength does not apply and a minimum elongation in 2 in. [50 mm] of 19 % applies.

C *Yield point 32 ksi [220 MPa] for plates over 8 in. [200 mm] in thickness.*

D Elongation not required to be determined for floor plate.

E For plates wider than 24 in. [600 mm], the elongation requirement is reduced two percentage points. See the Elongation Requirement Adjustments subsection under the Tension Tests section of Specification A6/A6M.

TABLE 3 Chemical Requirements

NOTE 1—Where ". . ." appears in this table, there is no requirement. The heat analysis for manganese shall be determined and reported as described in the heat analysis section of Specification A6/A6M.

Product	Shapes[A]	Plates > 15-in. [380 mm] Width[B]					Bars; Plates # 15-in. [380 mm] Width[B]			
Thickness, in. [mm]	All	To ¾ [20], incl	Over ¾ to 1½ [20 to 40], incl	Over 1½ to 2½ [40 to 65], incl	Over 2½ to 4 [65 to 100], incl	Over 4 [100]	To ¾ [20], incl	Over ¾ to 1½ [20 to 40], incl	Over 1½ to 4 [100], incl	Over 4 [100]
Carbon, max, %	0.26	0.25	0.25	0.26	0.27	0.29	0.26	0.27	0.28	0.29
Manganese, %	...	...	0.80–1.20	0.80–1.20	0.85–1.20	0.85–1.20	...	0.60–0.90	0.60–0.90	0.60–0.90
Phosphorus, max, %	0.04	0.030	0.030	0.030	0.030	0.030	0.04	0.04	0.04	0.04
Sulfur, max, %	0.05	0.030	0.030	0.030	0.030	0.030	0.05	0.05	0.05	0.05
Silicon, %	0.40 max	0.40 max	0.40 max	0.15–0.40	0.15–0.40	0.15–0.40	0.40 max	0.40 max	0.40 max	0.40 max
Copper, min, % when cop per steel is specified	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

SUPPLEMENTARY REQUIREMENTS

These requirements shall not apply unless specified in the order.

Standardized supplementary requirements for use at the option of the purchaser are listed in Specification A6/A6M. Those that are considered suitable for use with this specification are listed by title:

S5. Charpy V-Notch Impact Test.

S30. Charpy V-Notch Impact Test for Structural Shapes: Alternate Core Location

S32. Single Heat Bundles

S32.1 Bundles containing shapes or bars shall be from a single heat of steel.

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