

**PS: 231-1962**

ICS No.

## **PAKISTAN STANDARD**

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## **MILD STEEL BARS FOR STRUCTURAL USES**



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**PAKISTAN STANDARDS AND QUALITY CONTROL AUTHORITY**

**STANDARDS DEVELOPMENT CENTRE**

**(STANDARDIZATION WING),**

**1<sup>st</sup> FLOOR, ST-7-A, BLOCK-3**

**GULISTAN-E-JAUHAR**

**Karachi.**

**PAKISTAN STANDARDS SPECIFICATION**  
**FOR**  
**MILD STEEL BARS FOR STRUCTURAL USES**

**0. FOREWORD:**

- 0.1** This Standard was adopted by Pakistan Standards & Quality Control Authority after recommendations of the Technical Committee for “Structural Steel” (BDC-04) on . The same had been approved and endorsed by the Civil Engineering National Standards Committee (CENSC) on 30-12-1962.
- 0.2** This Standard has been prepared after taking into consideration the views and suggestions of the manufacturers, technologists, suppliers and utilizing agencies.
- 0.3** This Pakistan Standard No.231-1962 was prepared with the help of foreign specifications which has been since revised/modified. Hence to keep up a par with the latest technology, it has been revised accordingly. In preparation of this National Standard the Technical Committee acknowledges with thanks the assistance drawn from the Standard ASTM:A-15-58T, BS:15-1961and BS:785-1938.
- 0.4.** This Standard is subject to periodical review in order to keep pace with development in industry. Any suggestion for improvement will be recorded and placed before the committee in due course.

## SCOPE

This Pakistan Standard applies to Mild Steel bars, round and square sections, for buildings, bridges, concrete reinforcement and general structural purposes and specifies a minimum yield stress.

### 1 Steel Making Process

All bars under this specification shall be rolled from Mild Steel which shall be made by the open hearth process (Acid or Basic) the Acid Bessemer process, the electric process or any of the oxygen processes; unless one of these processes is specially required or ordered. The steel shall not show on analysis more than 0.06% of sulphur or of phosphorous. In the case of oxygen process the nitrogen contents shall not exceed 0.008%.

### 2 Quality of Finished Steel

2.1 All bars shall be well and cleanly rolled and shall subject to the provisions of Clause 3, conform to the dimensions specified or required. They shall be sound and free from cracks, surface flaws, laminations rough, jagged and imperfect edges and all other defects, and shall in all respects comply with the tests and requirements herein mentioned or specified.

### 3 Margin over and under dimensions and weights

3.1(a) The permissible variations in dimensions and weights of bars shall not exceed the limits prescribed in the table given below:

Description of Material	Permissible variation			
	Weight	Total Rolling Margin	Diameter or thickness	Length
Bars up to and including 9.5mm(3/8") diameter or thickness	±5%	10%	±0.5mm	±2"
Over 9.5mm (3/8") diameter or thickness and upto 25mm (excluding 1")	±3.5%	7%	±0.5mm	±2"
Over 25mm (including 1") and above	±3.5%	7%	±0.75mm	±2"

b) When a minimum weight is specified, the rolling margin shall be wholly above such a specified weight and when a maximum weight is specified, the rolling margin shall be wholly below such specified weight. In both cases the rolling margin shall be equal to the total rolling margin given in the foregoing table for the appropriate description or diameter of the bar.

3.2(a) When bars are specified to be cut to certain lengths, they shall be cut within a margin of 2 inches under or 2 inches over the specified length but if the Maker is required to take his cutting margin over and not under the specified lengths, then the margin shall be within 4 inches over.

(b) When exact lengths are specified, the bars shall be cold sawn or machined with a margin of 3/8 inches over or under the length specified.

#### 4 Calculation of weights

4.1 The weight of bars shall be calculated on the basis that steel weights 3.4 Ibs per square inch of sectional area per foot run, equivalent to 0.785 Kg/Sq cm/meter run.

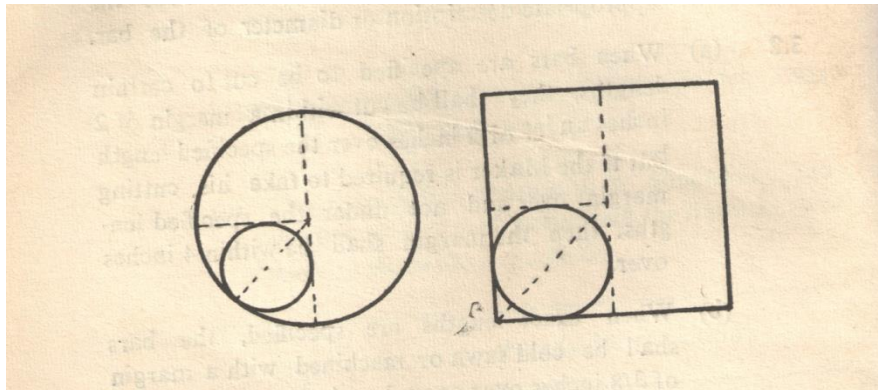
#### 5 Tensile Test Pieces

5.1 The tensile strength and elongation of all steel shall be determined from Pakistan Standard test pieces cut length wise.

5.2 The test pieces shall not be annealed or otherwise subjected to heat treatment; unless the lot from which they are cut is similarly treated, in which case the pieces shall be similarly and simultaneously treated with the lot before testing.

5.3 Any straightening of test pieces which may be required shall be done cold.

5.4 The test pieces for bars having diameters or sides not exceeding 3 inches may be reduced by turning. For bars having diameters or thickness above three inches the test piece may, at the option of the manufacturer, be taken from the position shown in the sketches given below:



#### 6. Tensile Properties

6.1 The materials of bars shall conform to the following requirements as to tensile properties: when determined in accordance with “Pakistan Standard Specification for Tensile Testing of Steel” (under preparation).

**Table 1**

Round and Square Bars Nominal thickness or diameter		Tensile Strength		Minimum Yield Stress		Elongation min	
in	mm	Tons/in <sup>2</sup>	Kg/mm <sup>2</sup>	Tons/in <sup>2</sup>	Kg/mm <sup>2</sup>	Test pieces prop. $4\sqrt{AO}$	Test prece. Pop $5.65\sqrt{AO}$
Below 3/8"	Below 9.53	Bent tests only required					
3/8" upto and including 3/4	upto and including 19.05	24.5 to 33.5	38.6 – 52.7	16,0	25.2	24%	20%
Over 3/4	Over 19.05	24.5 to 33.5	38.6 – 52.7	15.0	23.6	24%	20%

**7 Number of Tensile Tests**

**7.1** For round or square bars, one tensile test shall be made from each cast; unless the quantity of the steel from one cast exceeds five tons, in which case a second tensile test shall be made. When more than one diameter or thickness of bars is specified or required, one additional test shall be made from each diameter or thickness of bar ordered, if desired by the Purchaser or by the Inspecting Officer.

**8 Cold Bend Test Pieces**

**8.1** Bend test pieces shall be sheared or cut lengthwise from round or square bars and when sections permit, shall be not less than 1½ inches wide. In cases where section is less than 1½ inch wide or if the Maker so desires, round and square bars shall be bent in the full section of the bars rolled.

**8.2** In all bend tests the rough edge or arris caused by cutting may be removed by filing or grinding or machining but the test pieces shall receive no other preparation.

**8.3** The test piece shall not be annealed or otherwise subjected to heat treatment; unless the lot from which they are cut is similarly treated, in which case the test piece shall be similarly and simultaneously treated with the lot before testing.

**9 Cold Bend Test**

**9.1** For cold bend tests except in the case of bars 1 inch diameter or thickness and under, the test pieces shall withstand, without fracture, being doubled over, either by pressure or by blows from a hammer until the internal radius is not greater than 1½ times the thickness or diameter of the test piece and the sides are parallel.

**9.2** In the case of bars 1 inch diameter or thickness and under, the internal radius of the bend shall be not greater than the diameter or thickness of the bars.

**10 Number of Cold Bend Tests**

**10.1** For every five tons or a part of five tons of materials presented for inspection, bend test shall be taken from the material from each cast included therein:

From each diameter of round bars and  
From each thickness of square bars } one test piece lengthwise.

**10.2** Except for the first five tons or a part of five tons, one additional test shall be taken from each diameter or thickness of bars.

**11 Test by Chemical Analysis**

**11.1** The purchaser or his authorized representative shall be at liberty to inspect and verify the steel maker's certificate of cast analysis at the premises of the manufacturer or supplier.

**11.2** When the purchaser requires an actual analysis of finished material, this shall be made at a place agreed between the purchaser and the manufacturer or supplier and the cost of material destroyed together with the cost of the analysis shall be borne by the purchaser, provided the material destroyed stands the test.

**12 Retests before Rejection**

**12.1** Should a tensile test piece break outside the middle half of its gauge length, the test may, at the Maker's option be discarded and another test be made of the same bar. In all cases should any test piece first selected, not fulfill the tests applicable to the description of material to be tested, two additional test pieces may be taken. Should either of them fail to fulfill such tests all steel from the cast from which the test pieces have been taken may be rejected. The additional tests shall be carried out, in the same manner in all respects, as the tests herein before required to be made in the first instance.

### 13 Identification of Casts

13.1 The Maker shall make the bars as far as possible in such a way as to enable all finished steel to be traced to the original cast. Every facility for tracing the steel to the original cast shall be given to the purchaser and to the Inspection Officer.

### 14 Inspection

14.1 The Inspecting Officer or the Purchaser shall have free access to the works of the Maker at all reasonable times, he shall be at liberty to inspect the manufacture at any stage and to reject material that does not conform to the terms of this Pakistan Standard.

### 15 Testing Facilities

15.1 The Maker shall supply the material, required for testing, free of charge and shall at his own cost furnished and prepare the necessary test pieces and supply labour and appliances for such testing, as may be carried out at his premises in accordance with this Pakistan Standard. In the absence of facilities at his own works for making the prescribed test the Maker shall bear the cost of carrying out the tests elsewhere.

### 16 Maker's Certificate

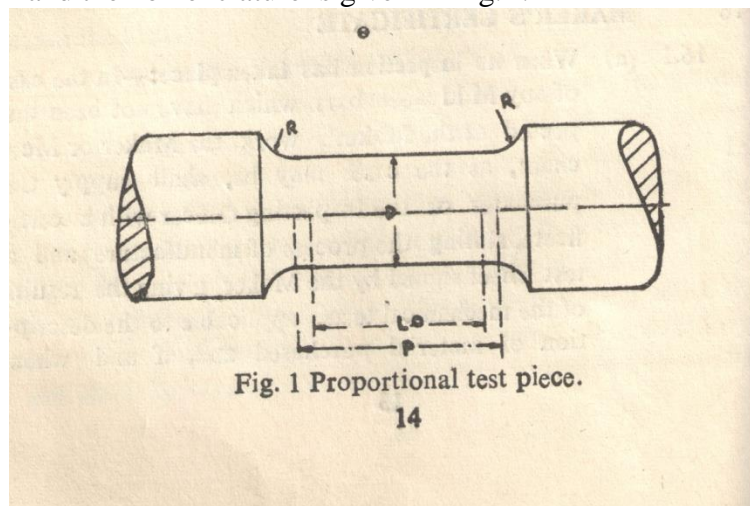
16.1 (a) **When no inspection has taken place:-**In the case of any Mild Steel bars which have not been inspected at the Maker's work, the Maker or Merchant, as the case may be, shall supply the purchaser or the Inspecting Officer with a certificate, stating the process of manufacture and a test sheet signed by the Maker, giving the results of the mechanical tests, applicable to the description of material purchased and, if and when required, a chemical analysis also. Each test sheet shall indicate the numbers of identification marks of the casts, to which it applies, corresponding with the number to be found on the bars.

(b) **When steel is taken from stock:-**When any Mild steel bars are taken from the Merchant's stock, the purchaser or the Inspecting Officer may either (i) have the steel tested at a place appointed by the Purchaser, at his own expense or (ii) the Merchant shall satisfy the Purchaser or the Inspecting Officer by means of number of identification marks on the steel, combines with a Maker's certificate that such steel has been tested and complies with whole of the tests and requirements of this Pakistan Standard, applicable to the description of material, required or specified.

## APPENDIX "A"

### Forms of Pakistan Standard Teisile Test Piece

A-1 **Proportional machined tests piece-**Recommended size of machined round tests pieces are given in Table II and III and the nomenclature is given in Fig. I.



**Table II****Recommended Dimensions for Gauge**

$$\text{length} = 4\sqrt{AO}$$

(see Fig. 1)

<b>Cross Sectional Area Ao in<sup>2</sup></b>	<b>Diameter D inch</b>	<b>Gauge length Lo inch</b>	<b>Minimum parallel length P inch</b>	<b>Minimum radius at shoulder R Inch</b>
1	1.128	4.00	4.60	1.00
¾	0.977	3.45	3.95	0.86
½	0.798	2.85	3.25	0.70
¼	0.564	2.00	2.30	0.50
⅛	0.399	1.40	1.60	0.35

**Table III****Recommended dimensions for gauge**

$$\text{Length} = 5.65\sqrt{AO}$$

(see Fig. 1)

<b>Ao in<sup>2</sup></b>	<b>D inch</b>	<b>Lo inch</b>	<b>P inch</b>	<b>R Inch</b>
1	1.128	5.65	6.25	1.00
¾	0.977	4.90	5.40	0.86
½	0.798	4.00	4.40	0.70
¼	0.564	2.85	3.15	0.50
⅛	0.399	2.00	1.60	0.35

**Note:**

For convenience of marking, the gauge length is given to the nearest 0.05 inch and the minimum parallel length is adjusted accordingly.

**A2 Proportional unmachined test pieces**

For unmachined test pieces of uniform cross section it is recommended that the elongation shall be measured on a gauge length  $4\sqrt{AO}$  or  $5.65\sqrt{AO}$  as for machined, test pieces.