

Unofficial Translation

In the event of any doubt or misunderstanding arising from this translation, the standard in Thai will be held to be authoritative

**TIS 20-2543(2000)**  
**Thai Industrial Standard**  
**for**  
**Steel Bars for Reinforced Concrete : Round Bars**

**1. Scope**

- 1.1 This standard specifies grades, sizes, mass and tolerances, materials, requirements, marking and labelling, sampling and criteria for conformity and testing for steel bars for reinforced concrete : round bars which shall be referred to as round bars.
- 1.2 Round bars shall be manufactured, by hot rolling, directly from billet-, bloom- or ingot - steel made by the open hearth, basic oxygen or electric arc furnace process.
- 1.3 This standard covers steel bars of circular cross-section and a length of 3.40 m and greater which may be used as reinforcement in concrete for general construction purposes; it does not cover steel bars of circular cross-section the standards for which are separately promulgated.

**2. Definitions**

For the purpose of this standard, the following definitions apply:

- 2.1 BAR : A rod of steel of circular cross-section.
- 2.2 BUNDLE : Two or more round bars properly bound together.
- 2.3 COIL : One continuous round bar in the form of a coil.
- 2.4 NOMINAL SIZE : The diameter and the cross-sectional area as specified in Table 1.
- 2.5 NOMINAL MASS : Mass per one metre of round bars which having the size equal to the nominal size as specified in table 1.
- 2.6 MASS PER M : Actual mass per one metre of round bars.

**3. Grade**

- 3.1 Round bars in this standard are of one grade denoted by the symbol SR 24.

**4. Sizes, mass and tolerances**

- 4.1 Size designation, nominal sizes and mass per metre of round bars are as given in Table 1.

**Table 1**  
**Size designation, nominal sizes and mass per metre of round bars**  
 (clauses 2.4, 2.5 and 4.2)

Size designation	Nominal size		Mass per m kg/m
	Nominal diameter mm	Nominal cross-sectional area mm <sup>2</sup>	
RB 6	6	28.3	0.222
RB 8	8	50.3	0.395
RB 9	9	63.6	0.499
RB 10	10	78.5	0.616
RB 12	12	113.1	0.888
RB 15	15	176.7	1.387
RB 19	19	283.5	2.226
RB 22	22	380.1	2.984
RB 25	25	490.9	3.853
RB 28	28	615.8	4.834
RB 34	34	907.9	7.127

#### 4.2 The mass per m of round bars

- Note** 1. Nominal cross-sectional area, mm<sup>2</sup> =  $\frac{3.1416 (\text{Nominal diameter, mm})^2}{4}$
2. Nominal mass, kg/m = 0.00785 (Nominal cross-sectional area, mm<sup>2</sup>)

4.2.1 Mass per m of each round bar shall not exceed the nominal mass values as specified in column 3 of Table 2.

4.2.2 The average of mass per m shall not exceed the nominal mass values as specified in column 4 of the Table 2.

Compliance is checked in accordance with clause 9.1.

**Table 2 Tolerances on mass per metre**  
 (clause 4.2)

Size designation	Nominal mass kg/m	Tolerances	
		Individual	Average
RB 6	0.222	± 10.0	± 5.0
RB 8	0.395	± 6.0	± 3.5
RB 9	0.499		
RB 10	0.616		
RB 12	0.888		
RB 15	1.387		
RB 19	2.226		
RB 22	2.984		
RB 25	3.853		
RB 28	4.834		
RB 34	7.127		

- 4.3 The length of round bars in each bundle shall be of the same length and shall not exceed the values as specified in Table 3.  
 Compliance is checked in accordance with clause 9.2.

**Table 3 Tolerances on length**  
(clause 4.3)

Length	Tolerances
Not exceeding 10 m	+ 55 mm 0
Over 10 m	+ 55 mm and add further 5 mm to plus side tolerance given above for every 1 m in excess of 10 m length, not to exceed a maximum value of 120 mm. 0

## 5. Materials

- 5.1 The chemical composition of round bars when determined by the cast analysis shall comply with Table 4.  
Compliance is checked in accordance with clause 9.3.

**Table 4 Chemical composition (cast analysis)**  
(clause 5.1)

Element	% by weight (max)
Carbon	0.280
Sulfur	0.058
Phosphorous	0.058

## 6. Requirements

- 6.1 General requirements
- 6.1.1 Round bars shall have smooth surface (except for the provision of marking), and be free from splits, fractures, rust or other defect that are detrimental to application use.
- 6.1.2 Round bars shall be uniformly round in its cross-section and be free from wings or undulations.  
Compliance is checked by visual inspection.
- 6.2 Mechanical properties
- 6.2.1 Tensile requirements
- 6.2.1.1 The tensile strength shall be not less than 385 MPa.
- 6.2.1.2 The yield strength shall be not less than 235 MPa.
- 6.2.1.3 The elongation shall be not less than 21 %.  
Compliance is checked in accordance with clause 9.4.
- 6.2.2 Bending requirement  
When tested as directed in clause 9.5, the test piece shall show no sign of fractures or splits on the outside of the bent portion.

## 7. Marking and labelling

- 7.1 Marking on round bars
- 7.1.1 The round bar shall bear at least number, letter or mark indicating the following information and legibly embossed on each of round bars
- (1) Name of a manufacturer, factory or a registered trade-mark ;
  - (2) Size designation.
- 7.1.2 The former being spaced at a distance of at least 50 mm from the latter.
- 7.2 Each bundle or coil of round bar shall have a tag, which shall not be easily torn or removed, attached to it and the tag shall bear at least number, letter or mark indicating legibly and clearly the following information:
- (1) The word "Round bar";
  - (2) Grade;
  - (3) Size designation;
  - (4) Length in m (bundle only) or mass in kg (coil only);
  - (5) Cast number, or other equally indicative sign;
  - (6) Name of a manufacturer, factory or a registered trade-mark ;
  - (7) Country of manufacture.
- 7.3 In case foreign language is used, the meaning shall correspond to that in Thai specified above.

## 8. Sampling and criteria for conformity

- 8.1 Lot : Round bars of the same size designation which are manufactured, delivered or purchased at the same time.
- 8.2 Sampling and acceptance shall comply with the sampling plan below or with any other technically equivalent plan.
- 8.2.1 Sampling and acceptance for testing on length (bundle only)
- 8.2.1.1 Sampling shall be taken at random from the same lot as specified in Table 5. For each of which shall give one sample for measurement of length
  - 8.2.1.2 Provided that all samples failing to comply with the requirement of clause 4.3 does not exceed the acceptance number specified in Table 5, that lot shall be deemed to comply with the requirements.
- 8.2.2 Sampling and acceptance for testing general requirements
- 8.2.2.1 From either and of each of the samples passing the test of clause 8.2.1, a test sample of 1.50 m shall be cut from the straight section of each of the round bars, or from either and each of the samples in the form coil shall be taken at random from the same lot as specified in Table 5, a test sample of 1.5 m shall be cut from the section of each coil for testing on general requirements.
  - 8.2.2.2 Provided that all samples failing to comply with the requirement of clause 6.1 does not exceed the acceptance number specified in Table 5, that lot shall be deemed to comply with the requirements.
- 8.2.3 Sampling and acceptance for testing on mass per m
- 8.2.3.1 After the inspection, the samples as of clause 8.2.2 shall be carried out for testing on mass per m.
  - 8.2.3.2 Provided that all samples failing to comply with the requirement of clause 4.2.1 does not exceed the acceptance number specified in Table 5, and provided the samples meet the requirement of clause 4.2.2, that lot shall be deemed to comply with the requirements.

**Table 5 : Sampling plan for testing on the length,  
general requirements and mass per metre**  
(clauses 8.2.1, 8.2.2 and 8.2.3)

Lot size Ton	Sample size Bundle/Coil	Acceptance number
Not exceed 150	5	0
Over 150 but not exceed 500	20	1
Over 500	32	2

- 8.2.4 Sampling and acceptance for testing on the distance between the name of a manufacturer, factory or a registered trade-mark and size designation
- 8.2.4.1 After the inspection as of clause 8.2.3, five samples shall be taken at random for testing on the space at a distance between the name of a manufacturer, factory or a registered trade-mark and size designation.
- 8.2.4.2 Provided that all test pieces meet the requirement of clause 7.1.2, that lot shall be deemed to comply with the requirement.
- 8.2.5 Sampling and acceptance for testing on chemical composition of materials and mechanical properties
- 8.2.5.1 After the inspection as of clause 8.2.3, three samples shall be taken from each lot. However, two sets of samples shall be taken from each lot with a mass exceeding 500 t, and cut each into 2 test pieces, one of which shall be used for determination of chemical composition and the other for bend test.
- 8.2.5.2 One sample shall be taken from the rest samples of clause 8.2.5.1. However, two samples shall be taken from each lot with a mass exceeding 500 t, and cut to make one test piece for testing on bend test.
- 8.2.5.3 Provided that all test pieces shall comply with each of the requirements of clause 5.1, 6.2.1 and 6.2.2, that lot shall be deemed as conforming to the requirements. If the result of the test comply with the followings, retest shall be made on new test pieces or retest, as the case may be;
- (1) If failure to comply with the tensile requirements of clause 6.2.1 results because of alteration in the properties of the test piece due to improper lathing, or because occurs outside the gauge mark at a distance of less than 1/3 of the gauge length from the nearest gauge mark, or because of failure of testing machine, a duplicate test shall be made on new test pieces, the same number of those failing the discarded test, cut from the same test sample.
  - (2) If failure to comply with the tensile requirements of clause 6.2.1 results from other causes than those given in (1), and the tensile strength, or the yield strength falls below the specified values by more than 14 MPa and 7MPa respectively, the tensile requirements shall be deemed as not met and no test shall be required.

- (3) If failure to comply with the tensile requirements of clause 6.2.1 results from other causes than those given in (1), and the tensile strength, or the yield strength falls below the specified limits but by not more than 14 MPa and 7MPa respectively, retest shall be made on new test pieces, the same number of those failing the test, cut from the same test samples.

Provided the results of the all retest samples meet the requirement of clause 6.2.2, that lot of round bars shall be deemed to meet the requirements.

- (4) If the result of the bend test failure to comply with clause 6.2.2, retest shall be made on new test pieces, twice the number of those failing the test, cut from the same test samples.

**Note :** *When tested on tensile properties, no cracking shall be found or not clearly, 0.2% proof stress shall be applied.*

### 8.3 Criteria for conformity

Provided that all bundles or coils of round bars meet the requirements of clauses 7.1.1 and 7.2, and the samples of round bars meet the requirements of clauses 8.2.1.2, 8.2.2.2, 8.2.4.2 and 8.2.5.3, that lot shall be deemed to comply with this standard.

## 9. Tests

### 9.1 Mass per m

#### 9.1.1 Apparatus

9.1.1.1 A weighing device accurate to 1 g.

9.1.1.2 A measuring device accurate to 1 mm.

#### 9.1.2 Procedure

The length and weight of each sample shall be determined to the nearest 1 mm and 1 g respectively, then the mass per m of each sample and the average of samples shall be calculated.

#### 9.1.3 Report

The mass per m of each sample and the average of the samples shall be reported to 4 decimal points.

### 9.2 Length

Measurement shall be made by means of a metal measuring tape having an accuracy of 1 mm and sufficient length to measure the entire length of the bar at one operation.

### 9.3 Chemical composition

Compliance is checked by a general analytical method or other equivalent method and the test report shall include the analysis result of each test piece.

### 9.4 Tensile properties

#### 9.4.1 Apparatus

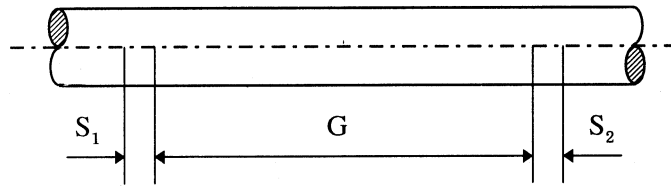
A tensile testing machine capable of applying load uniformly and continuously at specified speed.

#### 9.4.2 Preparation of test piece

9.4.2.1 The condition of the test piece shall be that of finished round bar prepared without any heat treatment. Straightening of a test piece shall be done cold. Overheat test piece shall be discarded.

9.4.2.2 Round bar size RB 15 and under shall be tested in full section. Those in size RB 19 and over may be lathed to a smaller size suitable for the testing machine but by no means to less than 15 mm. Where lathing is performed, the length of the reduced section shall be not less than 5.5 times the diameter of the reduced section.

9.4.2.3 The test piece shall be gripped with the gauge length and the length between grips as in Figure 1.



- When G : Gauge length = 5 D  
 S1 and S2 : Length between grips not less than 0.25 D  
 D : Nominal diameter of full section test piece or diameter of reduced section, as applicable

**Note** : Tolerance for marking of gauge length shall not exceed  $\pm 1\%$

**Figure 1 Test piece**  
 (clause 9.4.2.3)

#### 9.4.3 Procedure

The tensile test shall comply with TIS 244, "Standard methods of test for iron and steel", Part 4, "Tensile testing of steel (general)".

#### 9.4.4 Calculation

##### 9.4.4.1 Tensile strength

- (1) When tested in full section,  
 Tensile strength, MPa

$$= \frac{\text{Maximum tensile load, N}}{\text{Nominal cross-sectional area, mm}^2}$$

- (2) When reduction in cross-section is made,  
 Tensile strength, MPa

$$= k \times \frac{\text{Maximum tensile load, N}}{\text{Calculated cross-sectional area, mm}^2}$$

$$\text{Where } k = \frac{\text{Actual mass of test piece, kg/m}}{\text{Nominal mass of test piece, kg/m}}$$

Calculated cross sectional area, mm<sup>2</sup>

$$= \frac{3.1416 (\text{diameter of reduced section, mm})^2}{4}$$

## 9.4.4.2 Yield strength

- (1) When tested in full section,  
Yield strength, MPa

$$= \frac{\text{Yield load, N}}{\text{Nominal cross-sectional area, mm}^2}$$

- (2) When reduction in cross-section is made,  
Yield strength, MPa

$$= k \times \frac{\text{Yield load, N}}{\text{Calculated cross-sectional area, mm}^2}$$

## 9.4.4.3 Elongation

In either case, elongation, %

$$= \frac{\text{Length increase between gauge marks, mm}}{\text{Original gauge length, mm}} \times 100$$

## 9.4.5 Report

9.4.5.1 The test report shall at least include the following informations:

- (1) Type, serial number and accuracy of testing apparatus;
- (2) Test temperature;
- (3) Length and mass of each test piece prior to lathing;
- (4) Size designation, nominal size and name of a manufacturer, factory or a registered trade-mark
- (5) Where lathing is required, the calculated cross-sectional area and k value
- (6) Gauge length and gripping distance
- (7) Speed of tension
- (8) Yield load and maximum tensile load
- (9) Length between gauge marks determined after the fractured fragments are put together

9.4.5.2 The tensile strength, the yield strength and the elongation obtained on the individual test piece shall be reported to the first decimal point.

## 9.5 Bend test

## 9.5.1 Apparatus

9.5.1.1 A bend testing machine capable of applying load uniformly and continuously throughout the test.

9.5.1.2 The U-shape mandrel of the diameter and the two supports shall be such as to permit unrestricted movement of the test piece to form a U-shape. The mandrel and the supports should form a groove such that when the load is applied the test piece shall bend round the mandrel with its ends paralleling each other.

## 9.5.2 Preparation of test piece

9.5.2.1 The condition of the test piece shall be that of round bar prepared without any heat treatment.

9.5.2.2 The test piece shall be of sufficient length such that when the load is applied its ends shall remain above the supports.

## 9.5.3 Procedure

The load shall be applied by means of the mandrel to the centre of the test piece at a uniform and continuous speed throughout the test piece until the angle of bend 180°. The test piece shall then be inspected.



- 9.5.4 Report  
It shall be reported whether crack or split results on the outside of the bent portion.
  - 9.6 The space at a distance between the name of a manufacturer, factory or a registered trade-mark and size designation.
    - 9.6.1 Apparatus  
A measuring device accurate to 0.1 mm.
    - 9.6.2 Procedure  
The width of the gap between the name of a manufacturer, factory or a registered trade-mark and size designation shall be measured.
    - 9.6.3 Report  
The width of the gap of five test pieces shall be reported to the first decimal point being as the distance between the name of a manufacturer, factory or a registered trade-mark and size designation.
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