



# Testing of Steel Bars for the Reinforcement of Concrete

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Standards Officer (Materials Laboratory)  
Laboratory Services Division, TTBS

Date: 2020-12-02

# SUMMARY

- ▶ Introduction (LSD, QMS & Accreditation)
- ▶ Tests Identified
- ▶ Descriptions of Testing
- ▶ Questions/Comments

# Introduction



# Laboratory Services Division

TTBS's Laboratory Services Division comprises labs within the following testing activities:

- ▶ Materials Products
- ▶ Electrical Products
- ▶ Fibre Products
- ▶ Chemical Products
- ▶ Energy Efficiency

# Laboratory Services Division

Commonly tested products (Materials Laboratory) includes:

- ▶ Weldments
- ▶ Roofing sheets, purlins and decking pans
- ▶ Reinforced steel bars and wires
- ▶ Structural steel products
- ▶ Coatings

# Quality Management System

TTBS' Labs have established and maintained a  
Quality Management System (QMS)  
that conforms to:

**ISO/IEC 17025:2017, General Requirements for the  
Competence of Testing and Calibration Laboratories**

Mechanical | Textile | Electrical | Chemical

# Benefits of an accredited QMS

- ▶ Guarantees validity of results produced
- ▶ Provides confidence in our activities
- ▶ Ensures results are repeatable and reproducible
- ▶ Improves customer experience





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Location:     
**The Trinidad and Tobago Bureau of Standards - TUNAPUNA, Trinidad and Tobago**

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"Comm Code" Definitions:

- C1 - Available for Commercial Services
- C2 - Conditionally Available for Commercial Services
- C3 - Not Normally Available for Commercial Services
- A - Third Party Inspections (commercially available)
- B - First and Second Party Inspections (not commercially available)
- C - First and Second Party, and also Offering Commercially Available Inspections

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Cert. No.	Organization	Location	Country	Comm. Code	Program
5800.01	The Trinidad and Tobago Bureau of Standards	TUNAPUNA	Trinidad and Tobago	C1	ISO/IEC 17025 : Mechanical
5800.02	The Trinidad and Tobago Bureau of Standards	TUNAPUNA	Trinidad and Tobago	C1	ISO/IEC 17025 : Calibration
5800.03	The Trinidad and Tobago Bureau of Standards	TUNAPUNA	Trinidad and Tobago	C1	ISO/IEC 17025 : Chemical

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## Organization/Accreditation Information

Organization Name: **The Trinidad and Tobago Bureau of Standards**

Web:

Address:  1-2 Century Drive  
Trincity Industrial Estate  
TUNAPUNA, 00000  
Trinidad and Tobago

Contact(s):  **Saira Knox**  
 email: [saira.knox@ttbs.org.tt](mailto:saira.knox@ttbs.org.tt)  
 phone: 1-868-662-8827

### Accreditation(s):



#### **5800.01: Mechanical Field of Testing**

Standard Version(s): **ISO/IEC  
17025:2017**  
Expiration Date: **04/30/2021**

Commercial Code: **Commercially Available  
(C1)**

Download Documents:

 [Accreditation Scope & Certificate](#)



#### **5800.02: Calibration Field**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

TRINIDAD AND TOBAGO BUREAU OF STANDARDS  
1-2 Century Drive, Trincity Industrial Estate  
Macoya, TUNAPUNA, Trinidad and Tobago  
Ms. Saira Knox Phone: 001 868 662 8827

MECHANICAL

Valid To: April 30, 2021

Certificate Number: 5800.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following types of tests on textiles, metals, weldments, electrical insulating gloves, electrical cables:

Test(s):

Test Method(s):

Mechanical

Mechanical Products Laboratory

Base Metal Thickness	LABP08-005*
Bend, Hardness, Tensile	ASME BVPC IX:2017; ASTM A370-18; AWS D1.1/D1.1 M:2015; API 1104 (21 <sup>st</sup> Edition)
Coating Mass	ASTM A90/A90M-13 (2018); LABP08-004*
Tensile	
Ferrous and Non-Ferrous Metals and Alloys	ASTM A370-18, ASTM E8/E8M-16a
Steel Reinforcing Bar	ASTM A615/615M-18e1, ASTM A706/A706M-16
Steel Round Wire Products	ASTM A370-18 (Annex A4), ASTM E8/E8M-16a
Unpainted Roofing Sheets	ASTM A370-18
Vickers (HV 10)	ASTM E92-17



## Accredited Laboratory

A2LA has accredited

### THE TRINIDAD AND TOBAGO BUREAU OF STANDARDS

*Macoya, TUNAPUNA, Trinidad and Tobago*

for technical competence in the field of

### Mechanical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 18<sup>th</sup> day of March 2020.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 5800.01  
Valid to April 30, 2021

*For the tests to which this accreditation applies, please refer to the laboratory's Mechanical Scope of Accreditation.*

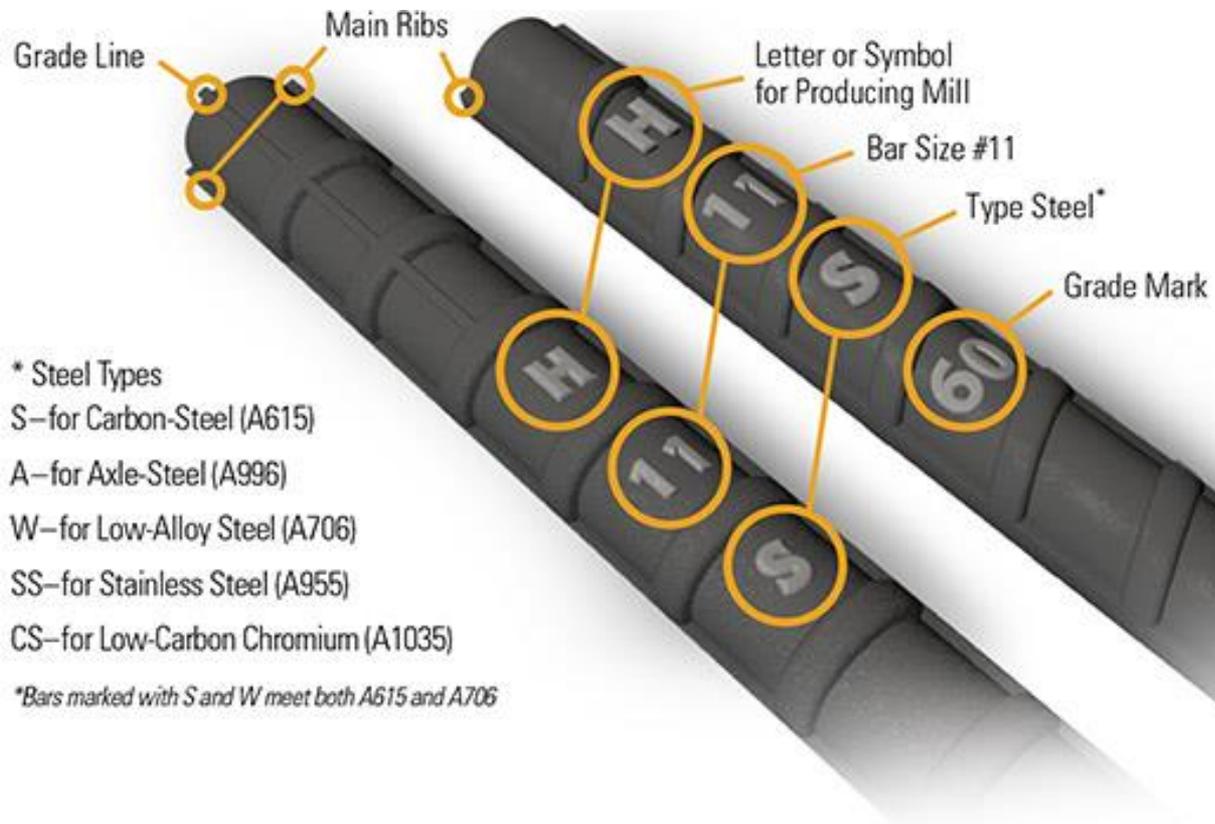
Tests Identified



# Mandatory Tests Identified

Property	Test	Specific details
Markings	<b>Visual Inspection</b>	Point of origin, size designation, type of steel and minimum yield strength
Size	<b>Product Size</b> <b>Mass per Length</b>	Diameter within stated tolerance Mass per length above the minimum requirements
Deformations	<b>Deformation Analysis</b>	Rib spacing, height, gap and angle
Mechanical	<b>Tensile Test</b> <b>Bend Test</b>	Ultimate Tensile Strength, Yield Strength, Elongation Suitable ductility level
Chemical Analysis	<b>Chemical Analysis</b>	Chemical elements are within prescribed limits
Finish	<b>Visual Inspection</b>	Laps, seams, scabs, silvers, casting marks, mill or guide marks, poor epoxy coating that are considered detrimental (i.e. when the bar fails to meet the mechanical requirements)
Coating	<b>Epoxy</b> <b>Zinc</b>	

# Testing- Markings



## Grade 60 shown

- Grade 40 – No grade markings
- Grade 60 – 60
- Grade 75 – 75
- Grade 80 – 80
- Grade 100 – 100
- Grade 120 – 120

### \* Steel Types

S–for Carbon-Steel (A615)

A–for Axle-Steel (A996)

W–for Low-Alloy Steel (A706)

SS–for Stainless Steel (A955)

CS–for Low-Carbon Chromium (A1035)

*\*Bars marked with S and W meet both A615 and A706*

# Testing– Bar Size

Bar Designation No.	Nominal Weight, lb/ft [Nominal Mass, kg/m]	Nominal Dimensions <sup>A</sup>		
		Diameter, in. [mm]	Cross-Sectional Area, in. <sup>2</sup> [mm <sup>2</sup> ]	Perimeter, in. [mm]
3 [10]	0.376 [0.560]	0.375 [9.5]	0.11 [71]	1.178 [29.9]
4 [13]	0.668 [0.994]	0.500 [12.7]	0.20 [129]	1.571 [39.9]
5 [16]	1.043 [1.552]	0.625 [15.9]	0.31 [199]	1.963 [49.9]
6 [19]	1.502 [2.235]	0.750 [19.1]	0.44 [284]	2.356 [59.8]
7 [22]	2.044 [3.042]	0.875 [22.2]	0.60 [387]	2.749 [69.8]
8 [25]	2.670 [3.973]	1.000 [25.4]	0.79 [510]	3.142 [79.8]
9 [29]	3.400 [5.060]	1.128 [28.7]	1.00 [645]	3.544 [90.0]
10 [32]	4.303 [6.404]	1.270 [32.3]	1.27 [819]	3.990 [101.3]
11 [36]	5.313 [7.907]	1.410 [35.8]	1.56 [1006]	4.430 [112.5]
14 [43]	7.65 [11.38]	1.693 [43.0]	2.25 [1452]	5.32 [135.1]
18 [57]	13.60 [20.24]	2.257 [57.3]	4.00 [2581]	7.09 [180.1]
20 [64] <sup>B</sup>	16.69 [24.84]	2.500 [63.5]	4.91 [3167]	7.85 [199.5]

# Testing- Mass per Length

The determination of the deviation from nominal mass per length shall be carried out on a test specimen having ends cut square.

The percentage deviation from nominal mass per length of the test specimen shall be within the acceptable tolerance (e.g. at least 94% in ASTM A615/A615M).

In no case shall overweight (excess mass) be the cause for rejection.

The assumed mass of a cubic meter of steel is  $7850 \text{ kg/m}^3$  in accordance with Specification A6/A6M.

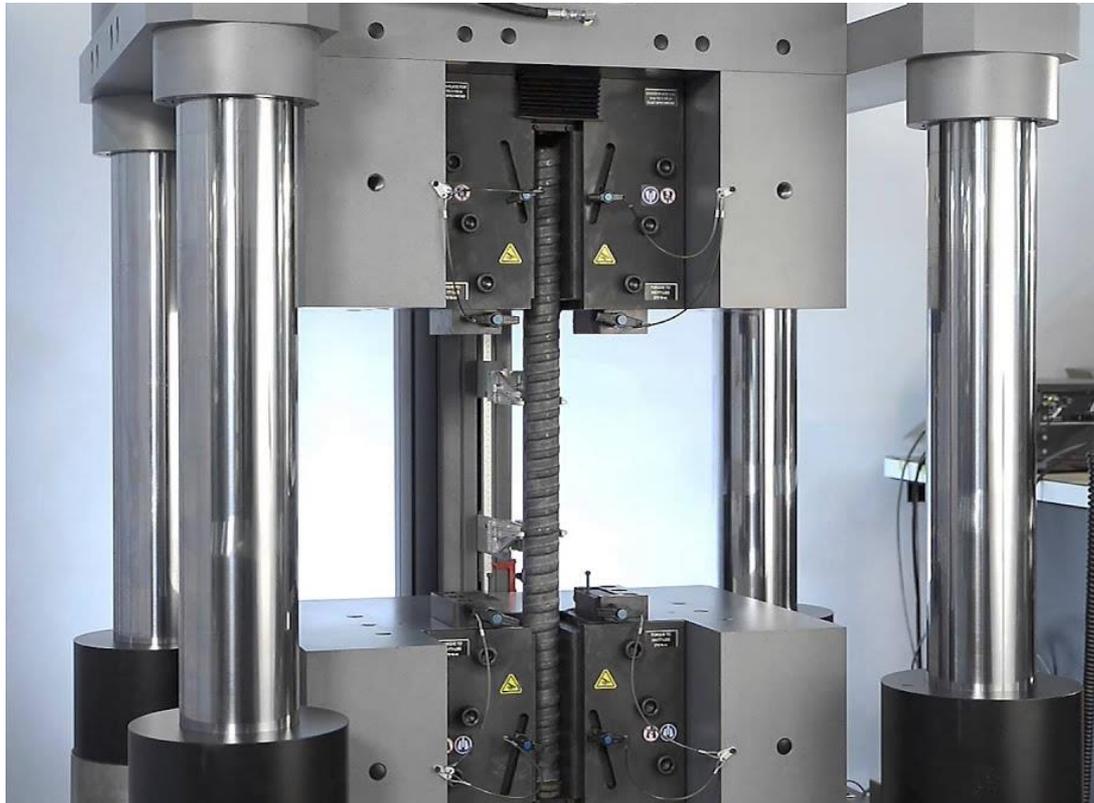
# Testing- Deformation Analysis



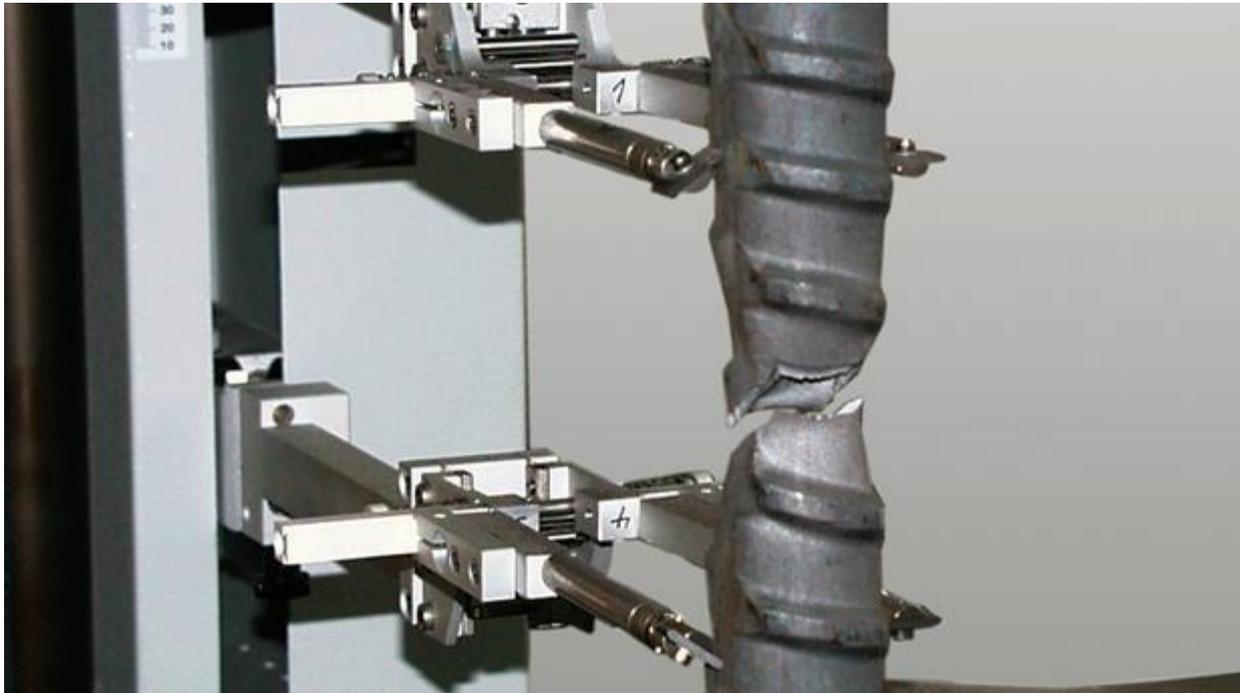
Deformation Requirements, in. [mm]

Maximum Average Spacing	Minimum Average Height	Maximum Gap (Chord of 12.5 % of Nominal Perimeter)
0.262 [6.7]	0.015 [0.38]	0.143 [3.6]
0.350 [8.9]	0.020 [0.51]	0.191 [4.9]
0.437 [11.1]	0.028 [0.71]	0.239 [6.1]
0.525 [13.3]	0.038 [0.97]	0.286 [7.3]
0.612 [15.5]	0.044 [1.12]	0.334 [8.5]
0.700 [17.8]	0.050 [1.27]	0.383 [9.7]
0.790 [20.1]	0.056 [1.42]	0.431 [10.9]
0.889 [22.6]	0.064 [1.63]	0.487 [12.4]
0.987 [25.1]	0.071 [1.80]	0.540 [13.7]
1.185 [30.1]	0.085 [2.16]	0.648 [16.5]
1.58 [40.1]	0.102 [2.59]	0.864 [21.9]
1.75 [44.5]	0.113 [2.86]	0.957 [24.3]

# Testing- Tensile Test



# Testing- Tensile Test



# Testing- Bend Test



# Testing- Chemical Analysis

Element Ranges %		Element Ranges %	
C	0.004–5.0	V	0.005–2.0
S	0.0005–0.1	Ti	0.005–2.5
N <sub>2</sub>	0.0020–0.3	Co	0.005–4.0
MN	0.005–15.0	Sn	0.001–0.20
P	0.001–1.5	W	0.005–3.0
Si	0.005–5.0	Pb	0.002–0.05
Cr	0.01–26.0	B	0.0005–0.05
Ni	0.01–36.0	Ca	0.0002–0.01
Al	0.001–5.5	Mg	0.001–0.01
Mo	0.005–8.0	Ce	0.001–0.2
Cu	0.005–4.0	Zr	0.001–0.1
Cb	0.005–3.0	Ta	0.005–0.5

The percentages of carbon, manganese, phosphorus, sulphur, silicon, copper, nickel, chromium, molybdenum, nitrogen and vanadium shall be determined.



# Question & Answers



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**Website:** <http://gottbs.com/materials-testing-laboratory/#.XEC86VVKjIU>