L.N. 47 of 1988

QUALITY CONTROL (EXPORTS, IMPORTS AND LOCAL GOODS) ACT, 1971

(ACT NO. XIII OF 1971)

Hot Rolled Steel Bars for the Reinforcement of Concrete Order, 1988 (Order No. M1 of 1988)

IN exercise of the powers conferred by section 3 of the Quality Control (Exports, Imports and Local Goods) Act, 1971, the Malta Board of Standards has made the following order:—

Citation and commencement.

1.1 This order may be cited as the Hot Rolled Steel Bars for the Reinforcement of Concrete Order, 1988, and may be referred to as Order No. M1 of 1988.

1.2 This order shall become operative on a date after the lapse of 20 days from the day on which it is laid on the Table of the House of Representatives which date shall be notified by the Board in the Gazette.

Scope.

2.1 This order applies to steel bars in the hot rolled condition and covers only plain round steel bars in grade 250 and deformed high yield steel bars in grade 460.

Interpretation.

3.1 In this order —

3.1.1 "bar" means a bar of steel as rolled and shall be held to include a rod of steel;

3.1.2 "batch" means any quantity of bars of one size and material type presented for examination and test at any one time;

3.1.3 "deformed bar" means a bar, the surface of which is provided with lugs, protrusions or deformations which inhibit longitudinal movement of the bar relative to the concrete which surrounds it in such construction, such that the bond with concrete is increased by at least 25% over that of plain bars;

3.1.4 "gauge length" means the prescribed part of the cylindrical portion of the test piece on which elongation is measured during the tensile test;

3.1.5 "killed steel" and "balanced steel" shall have the meaning defined in British Standard 2094: Part 2;

3.1.6 "length" means a piece of straight bar, without joint or weld, cut to a specified length;

3.1.7 "load at yield point" means the load measured during the tensile test when total extension of the gauge length is the amount specified in Table V;

3.1.8 "nominal size" means the diameter of a nominally round bar, or, for deformed bars, the diameter of a circle derived from the effective cross-sectional area in accordance with article 5 of this order;

3.1.9 "specified characteristic strength" means the value of the yield stress of the steel below which shall fall not more than 5% of the results of the material complying with this order;

3.1.10 "tensile strength" means the maximum load during the tensile test divided by the original cross-sectional area of the test piece. In the case of deformed bars, the effective cross-sectional area determined as described in article 5 of this order shall be used in lieu of the original cross-sectional area mentioned above;

3.1.11 "yield stress" means the load at yield point divided by the original cross-sectional area of the test piece. In the case of deformed bars, the effective cross-sectional area determined as described in article 5 of this order shall be used in lieu of the original cross-sectional area mentioned above.

Dimensions, weights and tolerances.

4.1 The dimensions, weights and tolerances of the bars shall be as follows:

4.1.1 if bars are specified to be cut to certain lengths, each bar shall be cut within deviations of ±25mm on the specified length, but if minimum lengths are specified the deviations shall be +50mm and −0mm, while if maximum lengths are specified the deviations shall be −50mm +0mm;

4.1.2 the maximum deviation of any dimension from the specified shape of the bar shall not exceed ±8% of the principal nominal dimensions;

4.1.3 the rolling tolerances over and under the nominal mass shall be as laid down in Table II of this order; for bars whose effective cross-sectional area is determined as in article 5 of this order, the nominal rolling mass per metre run shall correspond to the gross mass per metre run.

Effective cross sectional area.

5.1 For bars whose pattern of deformation is such that by visual inspection the cross-sectional area is substantially uniform along the length of the bar, the effective cross-sectional area shall be the gross cross-sectional area determined by weighing and measuring to a precision of ±0.5% a length of not less than 0.5m when:

Gross cross-sectional area in mm^2

$$= \text{Effective cross-sectional area}$$

$$= \frac{m}{0.00785L}$$

where m = mass in kg
and L = length in m.

5.2 For bars whose pattern of deformation is such that by visual inspection the cross-sectional area is not substantially uniform along the length of the bar, a sample not less than 0.5m long shall be weighed (m) and measured to a precision of ±0.5% in the as rolled condition, and after the transverse ribs have been removed it shall be re-weighed (**m'**).

5.3 Where the difference between the two masses (m–**m'**) is less than 3% of **m'** the effective cross-sectional area shall be obtained as in paragraph 5.1 of this order.

5.4 Where the difference is equal to, or greater than, 3% the effective cross-sectional area in square millimetres shall be taken as

$$= \frac{1.03\mathbf{m'}}{0.00785L}$$

where **m'** = mass in kg of the bar with transverse ribs removed,
and L = length in m.

5.5 For routine purposes, a nominal ratio of effective cross-sectional area of bars covered by paragraph 5.4 shall be stated and used by the manufacturer.

Description for ordering purposes.

6.1 When ordering material which falls within the scope of this order, the purchaser shall give his requirements as to bar size, and material grade.

Selection of test samples.

7.1 Test samples of sufficient length for the specified test shall be selected from each batch at a frequency of not less than that specified in Table IV of this order. If a batch comprises bars from more than one cast at least one test sample shall be selected to represent each cast.

Requirements.

8.1 Steel reinforcing rods shall be deemed to comply with this order if they conform to the following requirements:

Process of manufacture.

8.1.1 The bars shall be hot rolled steel made by any process except that the air and mixed air-oxygen, bottom-blown basic converter processes shall not be used. In the case of the oxygen processes (both top and bottom blown) the free nitrogen content as determined in the cast analysis of grade 250 shall not exceed 0.008%.

Chemical composition.

8.1.2 The chemical composition of the steel based on the cast analysis shall meet the requirements given in Table VI, while the carbon equivalent value based on the ladle analysis, and calculated in accordance with paragraph 9.1.1, shall not exceed 0.42% for grade 250 and 0.51% for grade 460.

8.1.2.1 The chemical composition of the steel based on the product analysis may exceed the maximum given in Table VI by:

(a) 0.03% carbon, 0.008% sulphur and 0.008% phosphorus in the case of killed steel;

(b) 0.05% carbon, 0.008% sulphur and 0.008% phosphorus in the case of balanced steel.

8.1.2.2 The carbon equivalent value derived from product analysis, calculated in accordance with paragraph 9.1.1 shall not exceed 0.45% for grade 250 and 0.54% for grade 460;

8.1.2.3 In the case of deviations from the specified maximum, the manufacturer shall be given the opportunity to analyse the same selected bars as the purchaser. If any sample

fails, two additional test samples shall be taken from the same batch and subjected to the test or tests in which the original sample failed. If both additional samples pass the test, the batch from which they were taken shall be deemed to comply with this order. If either of them fails, the batch shall be deemed not to comply with this order. These subsequent analytical checks shall be carried out in accordance with paragraph 9.1 of this order.

Quality of finished steel.

8.1.3 All bars shall be well and cleanly rolled and shall be sound and free from harmful surface defects and pipe.

Tensile strength.

8.1.4 When tested in accordance with the method laid down in paragraph 9.2, the specified characteristic strength and the percentage elongation of the steel shall comply with Table III of this order, provided that, for each type and size of bar, —

8.1.4.1 no more than two test results of yield stress out of the last 40 consecutive results are less than the specified characteristic strength;

8.1.4.2 no results are less than 0.93 of the specified characteristic strength;

8.1.4.3 When tested in accordance with the method laid down in paragraph 9.2 of this order, the tensile strength of any bar shall be at least 15% greater than the actual yield stress measured in the tensile test. For steel of grade 250, the yield stress shall not exceed 460N/mm^2.

Bend test.

8.1.5 The material shall withstand without fracture the test referred to in paragraph 9.3 of this order.

8.1.5.1 If any sample fails, two additional samples from the same batch from which the first sample had been taken shall be tested. If both additional samples pass the test, the batch shall be deemed to comply with this order. If either of them fails, the batch shall be deemed not to comply with this order.

Methods of test.

9.1 The product analysis checks shall be carried out by sampling in accordance with British Standard 1837 and analysed in accordance with the appropriate method in British Standards Handbook 19.

9.1.1 The carbon equivalent value shall be calculated using the following formula:

$$C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

where C is the percentage of Carbon content,
Mn is the percentage of Manganese content,
Cr is the percentage of Chromium content,
Mo is the percentage of Molybdenum content,
V is the percentage of Vanadium content,
Ni is the percentage of Nickel content,
and Cu is the percentage of Copper content.

9.2 The tensile strength, yield stress and the elongation of the steel shall be determined in accordance with British Standard 18, Part

2, of 1971. The rate of loading when approaching the yield stress shall not exceed 1h bar (10 MN/m²) per second. Samples for this test shall be in accordance with paragraph 9.4 of this order.

9.3 The test pieces shall be bent through 180°, by a continuous and uniform production of bending deformation at every section of the bend around a former having a diameter as specified in sub-paragraph 9.3.2. of this order. Samples for this test shall be in accordance with paragraph 9.4 of this order.

9.3.1 The bend test shall be carried out on —

9.3.1.1 a test piece having a temperature of between 5°C and 20°C;

9.3.1.2 apparatus which ensures close contact between the test piece and the former;

9.3.1.3 a test piece which is adequately supported by plain smooth surfaces or rolls which do not offer resistance to longitudinal movement of the test piece.

9.3.2 The diameter of the former shall be twice the nominal diameter of the material under test in the case of grade 250, and three times the diameter of the material under test in the case of grade 460.

9.4 The tensile and bend tests on deformed bars shall be carried out on straight pieces in the as rolled condition without machining or prior heat treatment. For tensile tests on plain mild steel bars of sizes larger than 40mm, the test samples may be turned concentrically with the bar to 40mm diameter.

Repeal of L.N. 58 of 1976.

10.1 The Hot Rolled Steel Bars for the Reinforcement of Concrete Order, 1976 is hereby repealed.

TABLES

TABLE I

Cross-Sectional Area and Mass

Size (mm)	Cross-Sectional Area (mm²)	Mass per metre run (kg)
6	28.3	0.222
8	50.3	0.395
10	78.5	0.616
12	113.1	0.888
16	201.1	1.579
20	314.2	2.466
25	490.9	3.854
32	804.2	6.313
40	1256.6	9.864
50	1963.5	15.413

TABLE II

Deviations Over and Under Nominal Mass

Nominal Size (mm)	Deviations Over and Under the Nominal Mass per Metre run	
	Batch (%)	Individual Bar (%)
6	+6 −4	−8
8 and 10	+4.5 −3.5	−6
12 and over	±2.5	−4

TABLE III

Tensile Properties

Grade	Nominal Size of Bar (mm)	Specified Characteristic Strength (N/mm^2)	Min. Elongation on $5.65\sqrt{S_0}$*
250	All sizes	250	22
460	All sizes	460	12

* S_0=the original cross-sectional area of the test piece.

TABLE IV

Frequency of Tensile and Bend Tests

Nominal size (mm)	Quantity
Under 10	1 sample from each 25 metric tonnes or part thereof
10 up to and including 16	1 sample from each 35 metric tonnes or part thereof
Over 16 and up to and including 32	1 sample from each 45 metric tonnes or part thereof
Over 32	1 sample from each 55 metric tonnes or part thereof

TABLE V

Percentage Total Strain

Specified Characteristic Strength (N/mm^2)	Percentage Total Strain (%)
250	0.33
460	0.43

TABLE VI

Chemical Composition of Steel Grades

Element	Grade 250 (%max.)	Grade 460 (%max.)
Carbon	0.25	0.30
Sulphur	0.060	0.050
Phosphorus	0.060	0.050

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