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Carbon steel bars for concrete reinforcement

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The following revisions have been formally approved and are marked by the symbol delta (Δ) in the margin on the attached replacement pages:

Revised	Clause 10.2
New	None
Deleted	None

- Update your copy by inserting these revised pages.
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9 Tensile and bend test procedures

9.1 Tensile test

Note: *See also Clause 10.2 for bars supplied in coils.*

9.1.1

For bars with a designation number from 10M to 35M, full-section as-rolled bars shall be used for the tensile test.

9.1.2

For bars with a designation number of 45M or 55M, reduced-section as-rolled bars may be used for the tensile test, at the option of the manufacturer. Reduced-section specimens shall have a 200 mm gauge length and be turned down to a diameter of 35.7 mm (1000 mm^2 cross-section) over a length of not less than 225 mm, with fillets at the ends of the turned-down section having a radius of 13 mm. The reduced section may have a gradual taper from the ends toward the middle, with the ends not more than 1% larger in diameter than the middle (controlling) dimension.

9.1.3

Unit stress determinations on full-section specimens shall be based on the nominal cross-sectional areas specified in Table 1. For reduced-section specimens, the yield strength and tensile strength results shall be corrected by the ratio of as-rolled bar mass to nominal bar mass.

9.1.4

Yield strength shall be determined using one of the following methods:

(a) Total elongation under load method: extension under load shall be determined using an autographic diagram method or an extensometer as described in Clause 13 of ASTM A 370. It shall be measured at 0.005 mm/mm of gauge length (0.5%) for Grades 400R and 400W and 0.0035 mm/mm (0.35%) for Grades 500R and 500W. The stress corresponding to the load at these strains shall be recorded as the yield strength.

(b) Halt of the gauge method: where the steel has a sharp-kneed or well-defined type of yield point, the stress corresponding to the load at the halt of the gauge of the testing machine shall be recorded as the yield strength.

9.2 Bend test

9.2.1

Full-section as-rolled bars shall be used for the bend test.

9.2.2

The requirements specified in Table 5 for size of pins and degree of bending shall be observed. When reinforcing bars are furnished in coils, the test specimen shall be straightened before placing it on the bend tester.

9.2.3

The test shall be conducted at ambient temperature, but not less than 16 °C.

9.2.4

The bend shall be made on specimens of sufficient length to ensure free bending and with apparatus that provides

(a) continuous and uniform application of force during bending;

(b) unrestricted movement of the specimen at points of contact with the apparatus while bending around the pin, which shall be free to rotate; and

(c) close wrapping of the specimen around the pin during bending.

9.2.5
More severe methods of bend testing, e.g., placing a specimen across two pins that are free to rotate and applying the bending force with a fixed pin, may be used. When failures occur under more severe methods, retests in accordance with Clause 9.2.4 may be performed.

9.3 Number of tests
For each heat of 50 tonnes or less, one tensile test and one bend test shall be performed for each bar size rolled. For each heat larger than 50 tonnes, two tensile tests and two bend tests shall be performed for each bar size rolled.

10 Tensile test results

10.1 General
Specimens tensile tested in accordance with Clauses 9.1 and 9.3 shall meet the applicable requirements of Table 4.

Δ **10.2 Bars supplied in coils**
When reinforcing bars are supplied in coils, test specimens shall be taken from the end ring of three coils of each size and each heat. The test specimen shall be straightened prior to placing it in the jaws of the tensile machine. The results of the tests shall be a minimum of 25 MPa over the requirements specified in Table 4. If any of the results fall below the 25 MPa requirement, additional test specimens shall be taken from two coils where a sufficient number of rings have been discarded to remove end conditions. These test results for yield strength and tensile strength shall meet the requirements specified in Table 4.
Note: *Straightening should be done carefully to avoid the formation of localized bends and to minimize cold work. Insufficient straightening prior to attaching the extensometer can result in lower-than-actual yield strength readings.*

11 Bend test results
The bend test specimen shall withstand bending around a pin without cracking on the outside of the bent portion.

12 Retests

12.1
If a test specimen develops flaws, it may be discarded and another specimen of the same size bar from the same heat substituted.

12.2
If a test specimen fails for mechanical reasons, e.g., failure of testing equipment or improper specimen preparation, it may be discarded and another specimen of the same bar size from the same heat substituted.

12.3
If a tensile property of a tensile test specimen is less than the applicable value specified in Table 4 and any part of the fracture is outside the middle third of the gauge length, as indicated by scribe scratches marked on the specimen before testing, a retest may be performed on another specimen from the same heat.

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Preface

This is the second edition of CSA G30.18, *Carbon steel bars for concrete reinforcement*. It supersedes the previous edition, published in 1992 under the title *Billet-Steel Bars for Concrete Reinforcement*. The 1992 edition combined the requirements of CSA Standards G30.12-M, *Billet-Steel Bars for Concrete Reinforcement*, and G30.16-M, *Weldable Low Alloy Steel Deformed Bars for Concrete Reinforcement*, and superseded the 1977 editions of these two Standards.

CSA acknowledges that the development of this Standard was made possible, in part, by the financial support of the Reinforcing Steel Institute of Canada.

This Standard was prepared by the Technical Committee on Reinforcing Materials for Concrete, under the jurisdiction of the Strategic Steering Committee on Concrete and Related Products, and has been formally approved by the Technical Committee. It will be submitted to the Standards Council of Canada for approval as a National Standard of Canada.

July 2009

Notes:

(1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

(2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*

(3) *This publication was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.*

(4) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*

(5) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.*

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are published in CSA's periodical* Info Update*, which is available on the CSA Web site at www.csa.ca.*

G30.18-09
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1 Scope

1.1
This Standard specifies requirements for two types of hot-rolled deformed carbon steel bars, designated regular (R) and weldable (W). The designation R is used for specifying, ordering, and communication only and is not rolled onto the bar. The designation W is rolled onto the bar (see Clauses 5 and 15). The two types are distinguished by their chemical composition requirements (see Clause 7). The bars can be in cut lengths or coils. Plain bars (Type R only) are also included in this Standard.

1.2
R grades are intended for general applications. W grades are appropriate for applications where any of the following conditions are desirable:
(a) enhanced weldability;
(b) enhanced ductility;
(c) restricted mechanical properties; or
(d) restricted chemical composition.

1.3
This Standard specifies two minimum yield strength levels, i.e., 400 MPa (designated as Grades 400R and 400W) and 500 MPa (designated as Grades 500R and 500W) (see Table 4).

1.4
Bars produced to this Standard can be welded under appropriate conditions if caution is used.
Note: *See CSA W186 for requirements for welding of reinforcing bars.*

1.5
In CSA Standards, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that which is advised but not required; "may" is used to express an option or that which is permissible within the limits of the standard; and "can" is used to express possibility or capability. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and may be written as requirements. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications
This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

CSA (Canadian Standards Association)
W186-M1990 (R2007)
Welding of reinforcing bars in reinforced concrete construction