



**MATERIAL SPECIFICATION FOR  
STEEL REINFORCEMENT FOR CONCRETE**

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<b>1440.01</b>	<b>SCOPE</b>

This specification covers the requirements for all steel reinforcement used in concrete work.

**1440.02 REFERENCES**

This specification refers to the following standards, specifications or publications:

**Ontario Provincial Standard Specifications, Construction**

OPSS 905 Steel Reinforcement for Concrete

**Ontario Ministry of Transportation Publications**

Designated Sources for Materials (DSM)

Structural Manual

Laboratory Testing Manual:

LS-448 Method of Test for Determination of Tensile Properties of Welded Wire Reinforcement

## CSA Standards

G30.18-09 (R2019)	Carbon Steel Bars for Concrete Reinforcement
G40.20-13/G40.21-13	General Requirements for Rolled or Welded Structural Quality Steel Structural Quality Steels
S6-19	Canadian Highway Bridge Design Code

## ASTM International

A276 / A276M - 17	Stainless Steel Bars and Shapes
A416 / A416M - 18	Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
A421 / A421M - 15	Stress-Relieved Steel Wire for Prestressed Concrete
A722 / A722M - 18	High-Strength Steel Bars for Prestressed Concrete
A955 / A955M - 20	Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
A1064 / A1064M - 18a	Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

## International Organization for Standardization/International Electrotechnical Commission

ISO/IEC 17025:2005	General Requirements for the Competence of the Testing and Calibration Laboratories
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## Others

Reinforcing Steel Institute of Canada - Reinforcing Steel Manual of Standard Practice - 2004

## 1440.03 DEFINITIONS

For the purpose of this specification the following definitions apply:

**Lot** means a quantity of steel that can be identified. For each size designation of prestressing steel strand, a lot shall be reels or coils produced from one heat. For each nominal diameter of prestressing steel bar and for each size designation of reinforcing steel bar, a lot shall be all the supplied bars from one heat.

**Prestressing Steel** means as defined in OPSS 905.

**Prestressing Steel Bar** means a high strength alloy steel bar having a nominal diameter greater than 9 mm.

**Reinforcing Steel Bars** means as defined in OPSS 905.

**Spacer** means a rolled steel shape punched to form hooks that are bent over the spiral to maintain a specified pitch.

**Spiral** means continuously wound reinforcing steel in the form of a cylindrical helix.

**Splice Bar** means as defined in OPSS 905.

**Stainless Steel Reinforcing Bars** means as defined in OPSS 905.

**Steel Reinforcement** means as defined in OPSS 905.

**Strand** means as defined in OPSS 905.

**1440.04 DESIGN AND SUBMISSION REQUIREMENTS**

**1440.04.01 Submission Requirements**

**1440.04.01.01 Mill Certificates for Reinforcing Steel Bars, Stainless Steel Reinforcing Bars, Steel Welded Wire Reinforcement, Splice Bars, and Stainless Steel Splice Bars**

Two copies of the mill certificates for each lot shall be submitted to the Contract Administrator prior to shipment of reinforcing steel bars, stainless steel reinforcing bars, welded wire reinforcement, splice bars, and stainless steel splice bars. The certificates shall show that the material is as specified in the Contract Documents.

**1440.04.02 Mill Certificates and Stress-Strain Curves for Prestressing Steel**

Two copies of the mill certificates and stress-strain curves for each lot shall be submitted to the Contract Administrator prior to shipment of prestressing steel. The certificates shall show that the material is as specified in the Contract Documents.

When mill test certificates originate from a mill outside Canada or the United States of America, the Contractor shall have the information on the mill test certificate verified by testing by a Canadian laboratory. This laboratory shall be certified by an organization accredited by the Standards Council of Canada to comply with the requirements of ISO/IEC DIS 17025 for the specific tests or type of tests required by the material standard specified on the mill test certificate. The mill test certificates shall be stamped with the name of the Canadian laboratory and appropriate wording stating that the material is in conformance with the specified Contract requirements. The stamp shall include the appropriate material specification number, testing date (i.e., yyyy- mm-dd), and the signature of an authorized officer of the Canadian laboratory.

**1440.05 MATERIALS**

**1440.05.01 Reinforcing Steel Bars, Splice Bars, Tie Bars, Dowel Bars, Spirals, and Spacers**

Reinforcing steel bars shall be according to CSA G30.18.

All reinforcing steel bars shall be Grade 400W according to CSA G30.18.

Deformed steel bars for spirals shall be according to CSA G30.18 type W. Steel spacers according to CSA G40.20/G40.21, Grade 350 G shall be provided with the spirals.

**1440.05.02 Stainless Steel Reinforcing Bars, Stainless Steel Splice Bars, Tie Bars, Dowel Bars, Spirals, Spacers, and Stainless Steel Mechanical Connectors**

Stainless steel reinforcing bars and spirals shall be according to ASTM A276 and ASTM A955, minimum Grade 420.

Nominal dimensions, unit masses, and deformation requirements for metric bar sizes shall be according to CSA G30.18. Stainless spirals shall be provided with stainless spacers in conformance with ASTM A276.

Stainless steel reinforcing bars, stainless steel spirals, stainless steel spiral spacers, and mechanical connectors shall be of a stainless steel type shown in Table 1.

Imperial and soft-converted metric bar size substitutions for metric bar sizes shall be permitted on a one-for-one basis without adjustment as shown in Table 2.

Other Imperial and soft-converted metric stainless steel reinforcing bar sizes may be substituted for metric bar sizes, subject to the following:

- a) The area of substituted steel reinforcement for the concrete component per linear metre or per gross cross-section area, as applicable, shall not be less than that shown for the concrete component on the Contract Drawings; and,
- b) The spacing of substituted steel reinforcement for the concrete component shall be according to CSA-S6 and the Structural Manual, Division 1.

Nominal cross-sectional areas of metric and imperial bar sizes used for determining substitutions shall be according to ASTM A955 and CSA G30.18, respectively.

#### **1440.05.03 Plain and Deformed Steel Wire**

Plain and deformed steel wire shall be according to ASTM A1064.

#### **1440.05.04 Steel Welded Steel Wire Reinforcement**

Welded wire reinforcement shall be according to ASTM A1064 with the following exceptions:

- a) The yield strength shall be calculated according to LS-448 and shall meet or exceed the minimum value specified.
- b) The average minimum elongation of welded wire reinforcement shall be 4% with no individual valid test result less than 3.2% elongation when tested according to LS-448.
- c) The minimum diameter of the wire in welded steel wire reinforcement shall be 3.14 mm.

#### **1440.05.05 Prestressing Steel**

Prestressing steel strand shall be weldless, low relaxation grade according to ASTM A416. Prestressing steel strand shall be certified by its manufacturer to bond to concrete of normal strength and consistency.

Prestressing steel wire shall be according to ASTM A421.

Prestressing steel bars shall be according to ASTM A722. The bars shall not be welded.

### **1440.07 PRODUCTION**

#### **1440.07.01 Manufacture of Reinforcing Steel Bars**

The manufacture of reinforcing steel bars shall be by a manufacturer listed under "Mill" in the Designated Sources for Materials listing for Reinforcing Steel, Uncoated, Fabricators and Mills.

#### **1440.07.02 Manufacture of Stainless Steel Reinforcing Bars**

The manufacture of stainless steel reinforcing bars shall be by a manufacturer listed under "Mills" in the Designated Sources for Materials listing for Reinforcing Steel, Stainless, Mills and Fabricators.

**1440.07.03                      Fabrication of Reinforcing Steel Bar, Stainless Steel Reinforcing Bar, Splice Bar, and Stainless Steel Splice Bars**

Bars shall be cold bent at the fabricator's shop listed under "Fabricators" in the Designated Sources for Materials listings for Reinforcing Steel.

The standard fabricating tolerances for all bars, straight or bent, shall be according to the Reinforcing Steel Manual of Standard Practice of the Reinforcing Steel Institute of Canada.

Fabrication of stainless steel reinforcing bars shall be so that the bar surfaces are not contaminated with deposits of iron or non-stainless steels, and the bar is not damaged by straightening from coil.

**1440.07.04                      Identification**

**1440.07.04.01                  Prestressing Steel**

All steel strand from each manufactured reel used and all high strength alloy bars used shall be assigned an individual lot number and shall be tagged with the lot number.

**1440.07.04.02                  Reinforcing Steel Bars, Stainless Steel Reinforcing Bars, Splice Bars, and Stainless Steel Splice Bars**

All bars shall be shipped in bundles.

Each lot of reinforcing steel bars, stainless steel reinforcing bars, splice bars, and stainless steel splice bars shall be assigned an individual lot number and shall be tagged with the lot number.

In addition, tags for reinforcing steel bars, and stainless steel reinforcing bars shall identify the manufacturer, the stainless steel type and grade or reinforcing steel grade, and bar size.

**1440.08                              QUALITY ASSURANCE**

**1440.08.01                      Inspection and Testing**

The Owner reserves the right to carry out inspections and tests at such times as the Owner may consider necessary to ensure that the materials supplied are according to this specification.

Materials failing to comply with the requirements of this specification shall be rejected.

The Owner's representative shall be permitted free entry to the manufacturing and fabrication plants, as well as the finished product storage and loading areas for inspection purposes.

**TABLE 1  
Type of Stainless Steel**

<b>Common or Trade Name</b>	<b>AISI Type</b>	<b>UNS Designation</b>
Type 316 LN	316 LN	S31653
Type 2205 Duplex	2205	S31803

Note:

A. Condition/Finish: Reinforcing stainless steel bars and shapes shall be hot rolled and pickled, or hot rolled and descaled to the required mechanical properties and dimensions.

**TABLE 2  
Size Conversions**

<b>Metric Bar Size</b>	<b>Imperial Bar Size</b>	<b>Bar Designation No.</b>
15M	# 5	16
25M	# 8	25
35M	# 11	36