



MATERIAL SPECIFICATION FOR STEEL REINFORCEMENT FOR CONCRETE

TABLE OF CONTENTS

1440.01	SCOPE
1440.02	REFERENCES
1440.03	DEFINITIONS
1440.04	DESIGN AND SUBMISSION REQUIREMENTS
1440.05	MATERIALS
1440.06	EQUIPMENT - Not Used
1440.07	PRODUCTION
1440.08	QUALITY ASSURANCE
1440.09	OWNER PURCHASE OF MATERIAL - Not Used

1440.01 SCOPE

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):21 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~~ ~~-24a~~ Specification for Stainless Steel Bars and Shapes
A416 ~~/A416M-18~~ ~~-24~~ Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete
A421 ~~/A421M-15~~ ~~-21~~ Specification for Stress-Relieved Steel Wire for Prestressed Concrete
A722 ~~/A722M-18~~ ~~-24~~ Specification for High-Strength Steel Bars for Prestressed Concrete
A955 ~~/A955M-20~~ ~~-20c~~ Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
A1064 ~~/A1064M-18a~~ ~~-24~~ Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
E328-21 Test Methods for Stress Relaxation for Materials and Structures

International Organization for Standardization/International Electrotechnical Commission

ISO/IEC 17025: ~~2005~~ 2017 General Requirements for the Competence of the Testing and Calibration Laboratories

Others

Reinforcing Steel Institute of Canada - Reinforcing Steel Manual of Standard Practice - ~~2004~~ 2020

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, and traced.~~ For each nominal diameter of prestressing steel bar and for each size designation of the reinforcing steel bar, a lot shall be all the supplied bars from one heat. For prestressing strands lot means all the coils of wire of the same nominal wire size contained in an individual shipping release or shipping order.

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. ~~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 bar 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.

Structure means as defined in OPSS 905.

Uncoated Reinforcing Steel Bars 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~~One electronic copy in PDF format 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 for cast-in-place concrete applications and prior to shipment of precast elements to the construction site.~~ 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~~When 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 shall be verified by testing ~~by~~in 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~~Canadian laboratory's test ~~certificates~~certificate shall ~~be stamped with~~clearly identify the laboratory's name ~~of the Canadian laboratory and appropriate wording stating that confirm~~ the material is ~~in conformance with the~~ specified in the Contract ~~requirements~~Documents. The ~~stamp~~certificate 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, and shall be traceable to the original mill test certificate. Samples to be tested in the Canadian laboratory for the purpose of verifying mill test certificates originating from a mill outside of Canada or the United States of America shall be taken from the material once it has arrived in Canada.

1440.04.01.02 Stress-Strain Curves for Prestressing Steel

One electronic copy in PDF format of the mill certificates and stress-strain curves for each lot shall be submitted to the Contract Administrator prior to the shipment of prestressing steel. The certificates shall confirm that the material is as specified in the Contract Documents.

1440.05 MATERIALS

1440.05.01 Uncoated- Reinforcing Steel Bars, Splice Bars, Tie Bars, Dowel Bars, Spirals, ~~and Spacers~~

~~Reinforcing~~Uncoated reinforcing steel bars shall be according to CSA G30.18.

All reinforcing steel bars shall be Grade 400W except for a structure, the grade shall be as specified in the Contract Documents.

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 a minimum Grade 520 according to ASTM A276 and ASTM A955, ~~minimum Grade 520~~.

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- G30.18.~~

Stainless steel reinforcing bars, stainless steel spirals, ~~stainless steel spiral spacers~~, and mechanical connectors shall be of a stainless steel type ~~shown in~~according to 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~~according to Table 2.

Other ~~Imperial~~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~~in the Contract ~~Drawings~~Documents; 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~~Steel 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 steel 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. The maximum relaxation of high-strength bars, as measured according to ASTM E328 on full-scale specimens, shall be 2.5%~~

at 1000 hours when threads are hot-rolled onto the bar, and 4.5% at 1000 hours in other cases. The bars shall not be welded.

1440.07 PRODUCTION

1440.07.01 ~~Manufacture~~ Manufacturer and Fabricator

1440.07.01.01 General

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 steel, and the bar is not damaged by straightening from coil.

1440.07.01.02 ~~Uncoated~~ Reinforcing Steel Bars

The manufacture ~~of and fabricator of uncoated~~ reinforcing steel bars shall be by a manufacturer listed under "Mill" ~~in the Designated Sources for Materials listing for Reinforcing Steel, Uncoated,~~ and a fabricator listed under "Fabricators ~~and Mills,~~" in Ministry's DSM #9.65.80 for the grade specified in the Contract Documents.

~~1440.07.02~~ ~~Manufacture of~~ 01.03 ~~Stainless Steel Reinforcing Bars~~

The ~~manufacture~~ manufacturer and fabricator 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~~ and a fabricator listed under "Fabricators" in Ministry's DSM #9.65.76.

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, for the grade specified in the Contract Documents.

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~~ steel, and the bar is not damaged by straightening from coil.

1440.07.04 Identification

1440.07.04.01 Prestressing Steel

~~All~~ For each size designation of prestressing steel strand, a lot shall be reels or coils produced from each manufactured reel used and one production lot and shall be tagged with the lot number.

~~For each nominal diameter of prestressing steel bar, a lot shall be all high-strength alloy~~ the supplied bars used shall be assigned an individual lot number from one heat, 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.

For each size designation of the reinforcing steel bar, a lot shall be all the supplied bars from one heat. Each lot of uncoated 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~~ as specified in the Contract Documents.

Materials failing to comply with the requirements ~~of this specification~~ specified in the Contract Documents 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

Common or Trade Name	AISI Type	UNS Designation
Type 316 LN	316 LN	S31653
Type 2205 Duplex	2205	S31803
<u>Type 2304 Duplex</u>	<u>2304</u>	<u>S32304</u>

Note:

- A. Condition/Finish: ~~Reinforcing~~ stainless steel reinforcing 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

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