



BUILDINGS BULLETIN 2015-036

OTCR

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Purpose: This document establishes acceptance criteria for Grade 100 high-strength steel reinforcing bars (Grade 100 high-strength reinforcing bars) conforming to ASTM A1035/A1035M¹ as an alternative material in the NYC Construction Codes.

Related Code Section(s):

BC 1901.2	BC 1903.5	AC 28-113
BC 1902	BC 1704.4	1 RCNY 101-06

Subject(s): Concrete, reinforcement; Concrete, reinforced concrete; Concrete, reinforcing bars; Reinforcement, concrete; Steel, reinforcement, concrete; Steel, high-strength; Steel, high-strength reinforcing bars

Background: The New York City Building Code references ACI 318², "Building Code Requirements for Structural Concrete" for specific requirements of steel reinforcement. Section 3.5.3.2 of the ACI code states that steel deformed reinforcing bars with a specified yield strength exceeding 60,000 psi shall be permitted provided the yield strength shall be taken as the stress corresponding to a strain of 0.35 percent. Additionally, section 9.4 of the ACI code states that designs shall not be based on a yield strength in excess of 80,000 psi except for prestressing steel. High-strength steel reinforcing bars conforming to ASTM A1035/A1035M have a yield strength in excess of 80,000 psi. This bulletin establishes acceptance criteria for such materials.

Description: Grade 100 high-strength reinforcing bars conforming to ASTM A1035/A1035M have a minimum yield strength of 100,000 psi.

This bulletin does not address Grade 120 high-strength reinforcing bars as referenced in ASTM A1035/A1035M.

Evaluation Scope: NYC Construction Codes

Evaluation Criteria: Pursuant to section AC 28-113, the Office of Technical Certification and Research (OTCR) recognizes Grade 100 high-strength reinforcing bars tested and evaluated in accordance with ICC-ES AC 429³ "Acceptance Criteria for High-Strength Steel Reinforcing Bar".

Acceptable Grade 100 high-strength reinforcing bars shall have an evaluation or code compliance report issued in accordance with AC 429 and shall comply with the conditions of this bulletin. The

agency providing the evaluation or code compliance report shall be accredited to ISO 17065.

Acceptable mechanical connectors shall have an evaluation or code compliance report issued in accordance with AC 429 Section 4.2.18 and shall comply with the conditions of this bulletin. The agency providing the evaluation or code compliance report shall be accredited to ISO 17065.

Uses: Grade 100 high-strength reinforcing bars are steel bars for use as reinforcement in concrete construction.

Conditions of Acceptance: The use of Grade 100 high-strength reinforcing bars shall comply with the NYC Construction Codes and the following:

A. Design

1. Structural design using Grade 100 high-strength reinforcing bars shall be in accordance with ACI 318 as modified by ACI ITG 6R-10⁴, ICC-ES AC 429 and the conditions of this bulletin.
2. The tensile requirements of Grade 100 high-strength reinforcing bars shall be as follows:
 - a. yield strength shall be determined by the offset method (0.2% offset), described in ASTM A370⁵, and
 - b. stress corresponding to a tensile strain of 0.0035 shall be a minimum of 80,000 psi (ASTM A1035/A1035M Section 9.2).
3. Minimum elongation of Grade 100 high-strength reinforcing bars shall not be less than 7% for bar designation numbers 3 through 11 and 6% for bar designation numbers 14 and 18 when tested in accordance with ASTM A1035/A1035M. For computing flexural strength, the yield stress shall not exceed 100,000 psi.
4. For computing compression strength, the yield strength shall not exceed 80,000 psi.
5. For computing shear strength, the yield stress shall not exceed 80,000 psi and shear reinforcement designed for torsion shall not exceed 60,000 psi. Development and lap splice length shall be determined in accordance with ACI 318 Chapter 12 as modified by ICC-ES AC429 Sections 4.2.16 and 4.2.17, and ACI ITG 6R-10 Section 10.2. Mechanical spliced bars shall be designed in accordance with ACI 318 Chapter 12 as modified by ICC-ES AC429 Section 4.2.18 and ACI ITG 6R-10 Section 10.3.
6. Requirements for deformation and measurements of deformation shall be in accordance with ASTM A1035/A1035M Sections 7 and 8.
7. Tension reinforcement in areas of slabs subject to punching shear shall have a maximum yield strength of 60 ksi. This requirement shall not apply if the factored punching shear demand is less than 60% of phi times the nominal punching shear capacity of the concrete.
8. When considering deflection of 2-way slabs the modulus of rupture of concrete shall be in accordance with the following:

$$f_r = 4\lambda\sqrt{f'_c}$$

where $\lambda = 1.0$ for normal weight concrete.

9. Headed mechanical anchorage with high strength steel shall only be used if approved by the commissioner. Proprietary device information must be provided demonstrating that stresses of 140ksi will be developed. Yield stress up to 140 ksi shall be used for calculations for development length of all splices and hooks. ACI 318 Section 12.2.5 shall not be applied to reinforcement complying with this bulletin.
10. Design of Grade 100 high-strength reinforcing bars shall be subject to peer review. The structural peer reviewer shall review structural design calculations, verify that the design engineer of record complied with the structural integrity provisions of the code, and attest to the general completeness of the structural plans and specifications. The reviewing engineer shall submit a report to the borough commissioner stating whether or not the structural design shown on the plans and specifications generally conforms to the structural and foundation requirements of this code.

B. Installation Requirements

1. Installation requirements shall be in accordance with the manufacturer's instructions, the evaluation or code compliance report issued for the installed product, and the conditions of this bulletin.
2. Grade 100 high-strength reinforcing bars shall be marked as per ASTM A1035/A1035M Section 20. All shipments and deliveries of materials shall be accompanied by a mill certificate and label certifying that the materials shipped or delivered are equivalent to those tested and approved.

C. Inspection

1. Pursuant to section BC 1704.4, the installation of Grade 100 high-strength reinforcing bars shall be subject to special inspection requirements of BC Chapter 17 and 1 RCNY section 101-06. Special inspectors shall perform duties in accordance with AC 429 Section 5.7. Additionally, the special inspector shall verify proper installation of approved mechanical connections in accordance with the evaluation or code compliance report including the application of adequate torque. Installer and special inspector shall be trained by the coupler manufacturer on installation requirements.

D. Restrictions

1. Specified yield strengths for design of members using Grade 100 high-strength reinforcing bars shall comply with AC 429 Table 1.
2. Grade 100 high-strength reinforcing bars shall not be used as longitudinal reinforcement in special moment frame members, special structural wall boundary elements, and coupling beams.
3. Use of Grade 100 reinforcing bars as longitudinal reinforcement in a structural member that is part of the seismic-force-resisting system of a building assigned to SDC D, E or F is prohibited.
4. Grade 100 high-strength reinforcing bars shall not be welded.

- Referenced Standards:**
1. ASTM A1035/A1035M-15 "*Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement*"
 2. ACI 318-11 "*Building Code Requirements for Structural Concrete*"
 3. ICC ES AC429 "*Acceptance Criteria for High-Strength Steel Reinforcing Bars*"
 4. ACI ITG 6R-10 "*Design Guide for the Use of ASTM A1035/A1035M Grade 100 high-strength (690) Steel Bars for Structural Concrete*"
 5. ASTM A370-97 "*Standard Test Method and Definition for Mechanical Testing of Steel Products*"