

Chemical Requirements of Typical Alloys



**DESIGN ACCORDING
TO ACI 318-19 CODE**

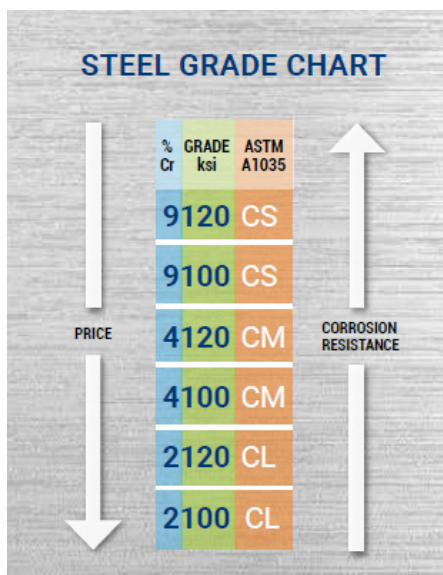
Composition Max, %*

ChromX®	ASTM	Carbon	Chromium	Manganese	Nitrogen	Phosphorus	Sulfur	Silicon
2000	A1035 CL	0.30	2.0 - 3.9	1.5	0.05	0.035	0.045	0.5
4000	A1035 CM	0.20	4.0 - 7.9	1.5	0.05	0.035	0.045	0.5
9000	A1035 CS	0.15	8.0 - 10.9	1.5	0.05	0.035	0.045	0.5

*Maximum unless range is indicated percentages refer to weight percentages.

Tensile Property Requirements

Type	A1035 CL		A1035 CM		A1035 CS	
Grade	Grade 100 [690]	Grade 120 [830]	Grade 100 [690]	Grade 120 [830]	Grade 100 [690]	Grade 120 [830]
Tensile Strength, min, psi [MPa]	150,000 [1030]	150,000 [1030]	150,000 [1030]	150,000 [1030]	150,000 [1030]	150,000 [1030]
Yield Strength (0.2% offset), min, psi [MPa]	100,000 [690]	120,000 [830]	100,000 [690]	120,000 [830]	100,000 [690]	120,000 [830]
Elongation in 8 in. [200 mm], min						
Bar Designation No. 3 through 11, [10 through 36] 14, 18, 20 [43, 57, 64]	7 6	7 6	7 6	7 6	7 6	7 6



ChromX® 9000 (ASTM A1035 CS Grade 100 or 120). This chromium alloy steel provides high corrosion protection for severe corrosive environments caused by seawater, aggressive soils and deicing salts. Designers can meet or exceed 100-year service life requirements called for on many infrastructure projects by specifying ChromX® 9000.

ChromX® 4000 (ASTM A1035 CM Grade 100 or 120). This chromium alloy steel offers the same high-strength as ChromX® 9000 and it is an economical choice for difficult rebar related construction challenges in areas with moderate corrosion concerns, as a direct substitute for epoxy or galvanized rebar.

ChromX® 2000 (ASTM A1035 CL Grade 100 or 120). This chromium alloy steel provides designers/owners all the high strength steel benefits with about twice the service life of black bar at an economic price.

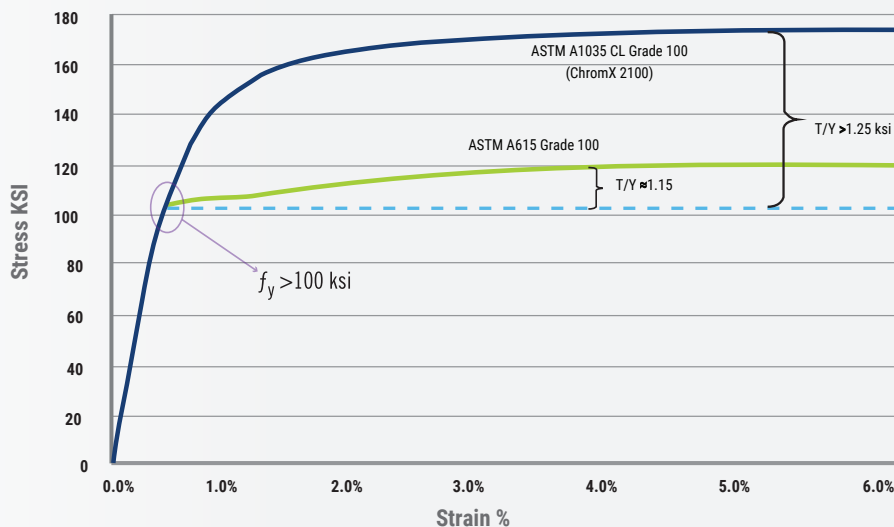
Please note that in recent corrosion testing by the Tourney Consulting Group, the doubling of the service life in concrete can be attained by using Calcium Nitrite as a concrete additive for all three ChromX® grades of steel.

By specifying ASTM A1035 CS, CM or CL, designers can take advantage of the high-strength efficiencies and match the appropriate corrosion resistance for the targeted service life of the structure.

Top 5 Reasons to Specify ASTM A1035 Grade 100

1. ASTM A1035 steels have been produced and sold into the construction market since 2002, and tested by highly-respected, independent third-party organizations.
2. The production process for ChromX[®] A1035 rebar provides consistent mechanical properties from batch to batch and bar to bar that other competing 100 grade products cannot duplicate.
3. ASTM A1035 rebar can be cut and bent on standard fabrication equipment, no special handling is required.
4. Design codes and guides for using ASTM A1035 Grade 100 are available (ACI-ITG6, ACI 439.6R-19, ICC-ES ESR-2107, ICC-ES AC429). These high strength codes and guidelines apply to ASTM A1035 Grade 100 only and do not apply to ASTM A615 Grade 100 rebar. Design according to ACI 318-19 Building Code Requirements includes ChromX[®] bars conforming to ASTM A1035 Grade 100.
5. ASTM A1035 provides a minimum actual tensile/yield (T/Y) ratio of 1.25. ASTM A615 Grade 100 has a minimum T/Y ratio of only 1.15. Due to this low T/Y ratio a cautionary note has been included in the A615 specification warning of the resulting lower margin of safety and reduced warning of failure inherent in A615 Grade 100 rebar. This cautionary note does not apply to ASTM A1035. Etabs Software Models have the ability to design with ASTM A1035 material properties.

Grade 100 Stress-Strain Curves



- ASTM A1035 Yield Strength determined by 0.2% offset method.
- ASTM A1035 with T/Y ratio of a minimum 1.25 offers a greater margin of safety than that offered by A615 Grade 100 with a T/Y ratio of 1.15.



According to ASTM A615 Note 1:

NOTE 1 – Grade 100 [690] reinforcing bars were introduced in this specification in 2015. In contrast to the lower grades, which have ratios of specified tensile strength to specified yield strength that range from 1.31 to 1.5, Grade 100 [690] reinforcing bars have a ratio of specified tensile strength to specified yield strength of 1.15.

Designers should be aware that there will, therefore, be a lower margin of safety and reduced warning of failure following yielding when Grade 100 [690] bars are used in structural members where strength is governed by the tensile strength of the reinforcement, primarily in beams and slabs. If this is of concern, the purchaser has the option of specifying a minimum ratio of tensile strength to actual yield strength.

Consensus design codes and specifications such as “Building Code Requirements for Structural Concrete (ACI 318)” may not recognize Grade 100 [690] reinforcing bars: therefore the 125% of specified yield strength requirements for Type 1 couplers in tension and compression are not applicable.

ASTM A1035 meets the ACI 125% of specified yield requirement for Type 1 couplers per ACI 318-19 and ACI 439-6R-19.



it's what's **inside** that counts

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