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8-22

Specification for the Design of Cold-Formed Stainless Steel Structural Members

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PREFACE

This standard provides an update to ASCE 8-02 to align the design of cold-formed stainless steel structures with the latest findings in stainless steel research and practice and, where appropriate, carbon steel research and practice. This version is a significant update from ASCE 8-02 and reflects greater maturity and adoption of cold-formed stainless steel structures worldwide in both applications and standards. Major changes from ASCE 8-02 include adoption of format and provisions aligned with American Iron and Steel Institute standard AISI S100-16 wherever possible; adoption of reliability indices aligned with AISI S100-16; adoption of the use of initial modulus of elasticity, E, and transverse 0.2% offset stress, F_y, wherever possible; and integration of new design methods such as the direct strength method and the continuous strength method.

In the United States, hot-rolled stainless steel structural members that typically have no reductions from cross-section buckling (due to the common use of thicker steel) do not have an approved standard. However, the American Institute of Steel Construction (AISC) provided a prestandard and significant design guidance in AISC Design Guide 27 (2013). As of this writing, AISC is developing a formal standard for structural stainless steel and intends to publish AISC 370 and an updated design guide in the fall of 2021. To the extent possible this standard has been coordinated with AISC 370; however similar to differences between AISI S100-16 and AISC 360 (2016b) for carbon steel, this standard and AISC 370 also invariably have minor differences. Notably, the scope of stainless steel alloys is broader in this standard than the current scope of AISC 370 and the attention given to cross-section buckling and other issues related to the use of thin coil and sheet steel are also given greater attention in this standard than is expected in AISC 370.

Specifying stainless steel is more involved than carbon steel, both in terms of alloy selection and member availability. AISC Design Guide 27 (2013) provides a useful introduction to stainless steel and alloy selection that the user of this standard is encouraged to read. Appendix C of this standard provides a useful summary of stainless steel alloys and properties to which this standard is applicable. Engineers designing in stainless steel are encouraged to contact suppliers early in the process to ensure alloy and member availability. Because stainless steel is often employed for its superior corrosion resistance, special attention must be paid to alloy selection to achieve desired performance, and this standard provides requirements specific to stainless steel structures that greatly exceed those of typical carbon steel applications.

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This standard was prepared through the consensus standards process by balloting in compliance with the procedures of ASCE's Code and Standard Activities Committee. Those individuals who serve on the committee are:

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CHAPTER 1
GENERAL PROVISIONS

This chapter addresses the scope and applicability of this standard; defines the terminology used; summarizes referenced specifications, codes, and standards; and provides requirements for materials.

1.1 SCOPE, APPLICABILITY, AND DEFINITIONS

1.1.1 Scope This standard applies to the design of structural members cold-formed to shape from annealed and cold-rolled austenitic, ferritic, and duplex stainless steel alloys produced to ASTM A240/A240M and A480/A480M and austenitic annealed or cold-worked stainless steels produced to ASTM A666 and A480/A480M in the form of sheet, strip, plate, or flat bar used for load-carrying purposes in (1) buildings and (2) structures other than buildings provided allowances are made for dynamic effects.

1.1.2 Applicability This standard includes design provisions for allowable strength design (ASD) and load and resistance factor design (LRFD). The nominal strength and stiffness of cold-formed stainless steel components such as elements, members, assemblies, connections, and details shall be determined in accordance with the provisions in Chapters 2 through 13, and Appendixes A through C of the standard.

Where the composition or configuration of the components is such that calculation of available strength or stiffness cannot be made in accordance with these provisions (excluding those in Chapter 11), structural performance shall be established from one of the following:

1. Available strength or stiffness by tests only. Specifically, the available strength is determined from tested nominal strength by applying the safety factors or the resistance factors evaluated in accordance with Section 11.2.1.1 Items 1 and 3, and Section 11.2.1.2;
2. Available strength by rational engineering analysis with confirmatory tests. Specifically, the available strength is determined from the calculated nominal strength by applying the safety factors or resistance factors evaluated in accordance with Section 11.2.1.1 Items 2 and 3, and Section 11.2.1.2; or
3. Available strength or stiffness by rational engineering analysis based on appropriate theory and engineering judgment. Specifically, the available strength is determined from the calculated nominal strength by applying the following safety factors or resistance factors:

For members,

$\Omega = 2.00$ (ASD)
$\phi = 0.80$ (LRFD)

For connections,

$\Omega = 3.00$ (ASD)
$\phi = 0.55$ (LRFD)

When rational engineering analysis is used in accordance with Item 2 or 3 of this section to determine the nominal strength for a limit state already provided in this standard, the safety factor shall not be less than the applicable safety factor (Ω), nor shall the resistance factor exceed the applicable resistance factor (ϕ) for the prescribed limit state.

1.1.3 Definitions In this standard, "shall" is used to express a mandatory requirement (i.e., a provision that the user is obliged to satisfy to comply with the standard), and "is permitted" is used to express an option within the limits of the standard.

The following definitions shall apply to terms used in the standard. Terms designated with * are usually qualified by the type of load effect; for example, nominal tensile strength or available compressive strength. Terms designated with ✦ are terms jointly established and coordinated by AISC and AISI standards development.

Stainless Steel Specific Terms

Austenitic Stainless Steel: A stainless steel alloy that is predominantly face-centered cubic in crystalline structure and hardenable only by cold working.

Autopassivating: The ability to form a protective passive film spontaneously on exposure to air or moisture, as long as the surface is free of exogenous surface contamination, without a special passivation treatment.

Duplex (Austenitic-Ferritic) Stainless Steel: A stainless-steel alloy that is a mixture of austenitic and ferritic crystalline structures, with at least one-fourth of the lesser phase, and hardenable only by cold working.

Ferritic Stainless Steel: A stainless steel alloy that is body-centered cubic in crystalline structure (with little, if any, tempered martensite), hardenable only by cold working, and responding to conventional heat treatment by quenching and tempering.

Passivation: Treatment for corrosion-resistant steel to eliminate corrodible surface impurities and provide a protective film.

Passive Film: The protective surface that forms on stainless steel, which protects it against corrosion.

Plastic Moment: Product of the strength at 0.2% offset permanent strain and the plastic section modulus.

Specified Minimum Tensile Strength: Tensile strength specified for a material as defined by ASTM and provided in Appendix C.

Specified Minimum Yield Strength: Yield strength specified for a material as defined by ASTM and provided in Appendix C.