Structural Welding Code—Reinforcing Steel

1. General Provisions

1.1 Scope

The code shall apply to the welding of:

(1) Reinforcing steel to reinforcing steel, and

(2) Reinforcing steel to carbon or low-alloy structural steel.

When the code is stipulated in contract documents, conformance with all provisions shall be required, except for those provisions that the Engineer or contract documents specifically modifies or exempts.

1.2 Application

1.2.1 This code shall be used in conjunction with the prescribed general building code specifications and is applicable to all welding of reinforcing steel, using the processes listed in 1.4, and performed as a part of reinforced concrete construction. When reinforcing steel is welded to structural steel, the provisions of the latest edition of ANSI/AWS D1.1, *Structural Welding Code—Steel* shall apply to the structural steel component.

1.2.2 The weldments specified in this code shall not be used where impact properties are a requirement of the general specification. Impact testing requirements of welded reinforcing bars are not included in this code.

1.2.3 All references to the need for approval shall be interpreted to mean approval by the *Building Commissioner,* defined as the Building Commissioner or the Engineer. Hereinafter the term *Engineer* will be used, and is to be construed to mean the *Building Commissioner* or the *Engineer.*

1.3 Reinforcing Steel Base Metal

1.3.1 Reinforcing steel base metal in this code shall conform to the requirements of the latest edition of one of the ASTM specifications listed within this paragraph.[1] Combinations of any of these reinforcing steel base metals, when welded, shall use a WPS (welding procedure specification) qualified in conformance with section 6.

(1) ASTM A82, *Specification for Plain Steel Wire for Concrete Reinforcement*

(2) ASTM A184/A184M, *Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement*

(3) ASTM A185, *Specification for Welded Plain Steel Wire Fabric for Concrete Reinforcement*

(4) ASTM A496, *Specification for Deformed Steel Wire for Concrete Reinforcement*

(5) ASTM A497, *Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement*

(6) ASTM A615/A615M, *Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement*

(7) ASTM A616/A616M, *Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement*

(8) ASTM A617/A617M, *Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement*

(9) ASTM A706/A706M, *Specification for Low Alloy Steel Deformed Bars for Concrete Reinforcement*

(10) ASTM A767/A767M, *Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement*

(11) ASTM A775/A775M, *Specification for Epoxy-Coated Reinforcing Steel Bars*

(12) ASTM A934/A934M, *Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars*

1. Available from American Society for Testing and Materials, 100 Barr Harbor Drive, W. Conshohocken, PA 19428.

Manufacturing and testing requirements for mats and fabric are covered by the respective ASTM specification. For joining the mats and fabric to other reinforcing bars or structural steels, the provisions of this code shall apply.

1.3.2 When a reinforcing steel not listed in 1.3.1 is approved under the provisions of the general building code or by the Engineer, its chemical composition and carbon equivalent shall be provided and its weldability established by qualification in accordance with the requirements of 6.2 and all other requirements prescribed by the Engineer.

1.3.3 Base metal, other than those previously listed, shall be one of the structural steels listed in the latest edition of ANSI/AWS D1.1, *Structural Welding Code—Steel,* or any steel stipulated in the contract documents or approved by the Engineer.

1.3.4 The carbon equivalent of reinforcing steel bars shall be calculated as shown in 1.3.4.1 or 1.3.4.2, as applicable.

1.3.4.1 For all steel bars, except those designated as ASTM A706, the carbon equivalent shall be calculated using the chemical composition, as shown in the mill test report, by the following formula:

$$C.E = \%C + \%Mn/6 \qquad \text{(Eq. 1)}$$

1.3.4.2 For steel bars designated ASTM A706, the carbon equivalent shall be calculated using the chemical composition, as shown in the mill test report, by the following formula:

$$C.E. = \%C + \%Mn/6 + \%Cu/40 + \%Ni/20 + \%Cr/10 - \%Mo/50 - \%V/10 \qquad \text{(Eq. 2)}$$

The carbon equivalent shall not exceed 0.55%.

1.3.4.3 If mill test reports are not available, chemical analysis may be made on bars representative of the bars to be welded. If the chemical composition is not known or obtained:

(1) For bars number 6 (19) or less, use a minimum preheat of 300°F (150°C).

(2) For bars number 7 (22) or larger, use a minimum preheat of 500°F (260°C).

(3) For all ASTM A706 bar sizes, use Table 5.2 C.E. values of "over 0.45% to 0.55% inclusive."

1.4 Welding Processes

1.4.1 Welding shall be performed with shielded metal arc welding (SMAW), gas metal arc welding (GMAW), or flux cored arc welding (FCAW).

1.4.2 Other welding processes may be used when approved by the Engineer, provided that any special qualification test requirements not covered here are met to ensure that welds satisfactory for the intended application will be obtained.

1.5 Definitions

The welding terms used in this code shall be interpreted in accordance with the definitions given in the latest edition of ANSI/AWS A3.0, *Standard Welding Terms and Definitions*.

1.6 Welding Symbols

Welding symbols shall be those designated to the latest edition of ANSI/AWS A2.4, *Standard Symbols for Welding, Brazing, and Nondestructive Examination.* Special conditions shall be fully explained by additional notes or details.

1.7 Safety Precautions

Safety precautions shall conform to the latest edition of ANSI/ASC Z49.1, *Safety in Welding, Cutting, and Allied Processes*, published by the American Welding Society.

See Annex D for additional information relating to the basic elements of safety general to arc welding processes.

Note: Fabrication performed in conformance with this code may involve hazardous materials, operations, and equipment. The code does not purport to address all of the safety problems associated with its use. It is the responsibility of the user to establish appropriate safety and health practices. The user should determine the applicability of any regulatory limitations prior to use.

1.8 Standard Units of Measurement

The numerical values in this code are in U.S. customary units, with the corresponding SI units in parentheses. Both units are to be regarded as code standards. These unit systems shall be used independently of the other, since the values stated in each system are not necessarily exact equivalents. Combining values from the two systems may result in nonconformance with this specification. Nominal dimensions of standard reinforcing bars are given in Annex B.