

CODE

12.14 — Splices of reinforcement — General

12.14.1 — Splices of reinforcement shall be made only as required or permitted on design drawings, or in specifications, or as authorized by the licensed design professional.

12.14.2 — Lap splices

12.14.2.1 — Lap splices shall not be used for bars larger than No. 36 except as provided in **12.16.2** and **15.8.2.3**.

12.14.2.2 — Lap splices of bars in a bundle shall be based on the lap splice length required for individual bars within the bundle, increased in accordance with **12.4**. Individual bar splices within a bundle shall not overlap. Entire bundles shall not be lap spliced.

12.14.2.3 — Bars spliced by noncontact lap splices in flexural members shall not be spaced transversely farther apart than the smaller of one-fifth the required lap splice length, and 150 mm.

12.14.3 — Mechanical and welded splices

12.14.3.1 — Mechanical and welded splices shall be permitted.

12.14.3.2 — A full mechanical splice shall develop in tension or compression, as required, at least $1.25f_y$ of the bar.

12.14.3.3 — Except as provided in this Code, all welding shall conform to “Structural Welding Code—Reinforcing Steel” (AWS D1.4).

12.14.3.4 — A full welded splice shall develop at least $1.25f_y$ of the bar.

COMMENTARY

R12.14 — Splices of reinforcement — General

Splices should, if possible, be located away from points of maximum tensile stress. The lap splice requirements of **12.15** encourage this practice.

R12.14.2 — Lap splices

R12.14.2.1 — Because of lack of adequate experimental data on lap splices of No. 43 and No. 57 bars in compression and in tension, lap splicing of these bar sizes is prohibited except as permitted in **12.16.2** and **15.8.2.3** for compression lap splices of No. 43 and No. 57 bars with smaller bars.

R12.14.2.2 — The increased length of lap required for bars in bundles is based on the reduction in the exposed perimeter of the bars. Only individual bars are lap spliced along the bundle.

R12.14.2.3 — If individual bars in noncontact lap splices are too widely spaced, an unreinforced section is created. Forcing a potential crack to follow a zigzag line (5-to-1 slope) is considered a minimum precaution. The 150 mm maximum spacing is added because most research available on the lap splicing of deformed bars was conducted with reinforcement within this spacing.

R12.14.3 — Mechanical and welded splices

R12.14.3.2 — The maximum reinforcement stress used in design under the Code is the specified yield strength. To ensure sufficient strength in splices so that yielding can be achieved in a member and thus brittle failure avoided, the 25 percent increase above the specified yield strength was selected as both an adequate minimum for safety and a practicable maximum for economy.

R12.14.3.3 — See **R3.5.2** for discussion on welding.

R12.14.3.4 — A full welded splice is primarily intended for large bars (No. 19 and larger) in main members. The tensile strength requirement of 125 percent of specified yield strength is intended to provide sound welding that is also adequate for compression. See the discussion on strength in **R12.14.3.2**. The 1995 Code eliminated a requirement that the bars be butted since indirect butt welds are permitted by AWS D1.4, although AWS D1.4 does indicate that wherever practical, direct butt splices are preferable for No. 22 bars and larger.

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CODE**21.1.6 — Mechanical splices in special moment frames and special structural walls**

21.1.6.1 — Mechanical splices shall be classified as either Type 1 or Type 2 mechanical splices, as follows:

(a) Type 1 mechanical splices shall conform to 12.14.3.2;

(b) Type 2 mechanical splices shall conform to 12.14.3.2 and shall develop the specified tensile strength of the spliced bar.

21.1.6.2 — Type 1 mechanical splices shall not be used within a distance equal to twice the member depth from the column or beam face for special moment frames or from sections where yielding of the reinforcement is likely to occur as a result of inelastic lateral displacements. Type 2 mechanical splices shall be permitted to be used at any location.

21.1.7 — Welded splices in special moment frames and special structural walls

21.1.7.1 — Welded splices in reinforcement resisting earthquake-induced forces shall conform to 12.14.3.4 and shall not be used within a distance equal to twice the member depth from the column or beam face for special moment frames or from sections where yielding of the reinforcement is likely to occur as a result of inelastic lateral displacements.

21.1.7.2 — Welding of stirrups, ties, inserts, or other similar elements to longitudinal reinforcement that is required by design shall not be permitted.

21.1.8 — Anchoring to concrete

Anchors resisting earthquake-induced forces in structures assigned to SDC C, D, E, or F shall conform to the requirements of D.3.3.

COMMENTARY**R21.1.6 — Mechanical splices in special moment frames and special structural walls**

In a structure undergoing inelastic deformations during an earthquake, the tensile stresses in reinforcement may approach the tensile strength of the reinforcement. The requirements for Type 2 mechanical splices are intended to avoid a splice failure when the reinforcement is subjected to expected stress levels in yielding regions. Type 1 splices are not required to satisfy the more stringent requirements for Type 2 splices, and may not be capable of resisting the stress levels expected in yielding regions. The locations of Type 1 splices are restricted because tensile stresses in reinforcement in yielding regions can exceed the strength requirements of 12.14.3.2. The restriction on Type 1 splices applies to all reinforcement resisting earthquake effects, including transverse reinforcement.

Recommended detailing practice would preclude the use of splices in regions of potential yield in members resisting earthquake effects. If use of mechanical splices in regions of potential yielding cannot be avoided, there should be documentation on the actual strength characteristics of the bars to be spliced, on the force-deformation characteristics of the spliced bar, and on the ability of the Type 2 splice to be used to meet the specified performance requirements.

R21.1.7 — Welded splices in special moment frames and special structural walls

R21.1.7.1 — Welding of reinforcement should be according to AWS D1.4 as required in Chapter 3. The locations of welded splices are restricted because reinforcement tension stresses in yielding regions can exceed the strength requirements of 12.14.3.4. The restriction on welded splices applies to all reinforcement resisting earthquake effects, including transverse reinforcement.

R21.1.7.2 — Welding of crossing reinforcing bars can lead to local embrittlement of the steel. If welding of crossing bars is used to facilitate fabrication or placement of reinforcement, it should be done only on bars added for such purposes. The prohibition of welding crossing reinforcing bars does not apply to bars that are welded with welding operations under continuous, competent control as in the manufacture of welded wire reinforcement.