shall not be farther from the face than the portion of primary flexural reinforcement closest to the face.

12.13.2.5 In joist construction as defined in 8.11, for No. 4 bar and D20 wire and smaller, a standard hook.

12.13.3 Between anchored ends, each bend in the continuous portion of a simple U-stirrup or multiple U-stirrup shall enclose a longitudinal bar.

12.13.4 Longitudinal bars bent to act as shear reinforcement, if extended into a region of tension, shall be continuous with longitudinal reinforcement and, if extended into a region of compression, shall be anchored beyond mid-depth $d/2$ as specified for development length in 12.2 for that part of f_{yt} required to satisfy Eq. (11-17).

12.13.5 Pairs of U-stirrups or ties so placed as to form a closed unit shall be considered properly spliced when length of laps are $1.3\ell_d$. In members at least 18 in. deep, such splices with $A_b f_{yt}$ not more than 9000 lb per leg shall be considered adequate if stirrup legs extend the full available depth of member.

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 engineer.

12.14.2 *Lap splices*

12.14.2.1 Lap splices shall not be used for bars larger than No. 11 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 1/5 the required lap splice length, and 6 in.

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 the specified tensile strength of the spliced bar in tension and 125% of the specified yield strength f_y of the spliced bar in compression.

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

12.14.3.4 A full welded splice shall develop the specified tensile strength of the spliced bar in tension and compression.

12.14.3.5 Mechanical or welded splices not meeting requirements of 12.14.3.2 or 12.14.3.4 are not permitted.

12.14.3.6 All mechanical and welded splices shall be visually examined by a qualified and experienced inspector to assure that they are properly installed at the place of construction. Where it is deemed necessary, the engineer shall be permitted to require the destructive tests of production splices to assure compliance with 12.14.3.2 and 12.14.3.4.

12.14.3.7 Mechanical splices shall be staggered if the strain measured over the full length of the splice (at 0.9 yield) exceeds that of a bar that is not mechanically spliced by more than 50%. If staggered mechanical splices are required, no more than 1/2 of the bars shall be spliced in one plane normal to the bars, and the mechanical splices shall be staggered at least 30 in.

12.15—Splices of deformed bars and deformed wire in tension

12.15.1 Minimum length of lap for tension lap splices shall be as required for Class A or B splice, but not less than 12 in., where:

Class A splice ..... $1.0\ell_d$

Class B splice ..... $1.3\ell_d$

where ℓ_d is calculated in accordance with 12.2 to develop f_y without the modification factor of 12.2.5.

12.15.2 Lap splices of deformed bars and deformed wire in tension shall be Class B splices except that Class A splices are allowed when:

(a) the area of reinforcement provided is at least twice that required by analysis over the entire length of the splice; and

(b) one-half or less of the total reinforcement is spliced within the required lap length.

12.15.3 Mechanical or welded splices used where area of reinforcement provided is less than twice that required by analysis shall meet requirements of 12.14.3.2 or 12.14.3.4.

12.15.4 Mechanical or welded splices not meeting the requirements of 12.14.3.2 or 12.14.3.4 are not permitted.

12.15.5 Splices in tension tie members shall be made with a full mechanical or full welded splice in accordance with 12.14.3.2 or 12.14.3.4, and splices in adjacent bars shall be staggered at least 30 in.

12.15.6 Mechanical or welded splices shall be used for connecting tension-resisting, but not crack-controlling, reinforcing bars located in a region with membrane tension normal to the mechanical or welded splice. The average strength of these mechanical or welded splices shall be equal to the minimum ultimate strength of the bar.

12.16—Splices of deformed bars in compression

12.16.1 Compression lap splice length shall be $0.0005 f_y d_b$, for f_y of 60,000 psi or less, or $(0.0009 f_y - 24) d_b$ for f_y greater than 60,000 psi, but not less than 12 in. For less than 3000 psi, f'_c length of lap shall be increased by 1/3.

12.16.2 When bars of different size are lap spliced in compression, splice length shall be the larger of ℓ_{dc} of larger bar and splice length of smaller bar. Lap splices of No. 14 and No. 18 bars to No. 11 and smaller bars shall be permitted.

12.16.3 Mechanical or welded splices used in compression shall meet requirements of 12.14.3.2 or 12.14.3.4.

12.16.4 *End-bearing splices*

12.16.4.1 In bars required for compression only, transmission of compressive stress by bearing of square cut ends held in concentric contact by a suitable device shall be permitted.

12.16.4.2 Bar ends shall terminate in flat surfaces within 1.5 degrees of a right angle to the axis of the bars and shall be fitted within 3 degrees of full bearing after assembly.

12.16.4.3 End-bearing splices shall be used only in members containing closed ties, closed stirrups, or spirals.