

Types of Mechanical Splices for Reinforcing Bars

Reported by ACI Committee 439



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Reinforcing bar splices are key components in reinforced concrete construction. Because mechanical splices do not rely on the surrounding concrete to transfer the force between bars, splitting failures are not a concern, and the strength of the splice is not sensitive to the compressive strength of the concrete or the amount of cover. Splices in reinforcing steel are grouped in three categories: lapped bars, mechanical, or welded; the focus of this report is mechanical splices. Strength capacities established in ACI 318 are higher for mechanical splices than for lap splices. Several types of mechanical splices have been qualified to sustain inelastic reinforcing bar strain excursions representative of those that might be brought about by overload due to seismic activity, wind, or blast.

This report provides engineers and contractors with updated information about bar-to-bar mechanical splices and the types of proprietary mechanical splices currently available. There is no attempt to state conditions of acceptance or to endorse or rate one particular mechanical splice over another.

The information on mechanical splices and their installation was provided by mechanical splice manufacturers. Although it was compiled by the committee, none of the information was directly verified by the committee. An attempt was made to include generic descriptions of all

types of mechanical splices generally available and sold in the North American market at the beginning of 2004; however, some mechanical splices new in the market may not be included due to lack of knowledge of their existence or because no information was submitted for inclusion at the time this report was written.

Reasons for using mechanical splices, as well as various engineering considerations that should be made when specifying mechanical splices, are discussed. Mechanical splices are described in terms of seismic type, configuration, installation procedure, clearance requirements, and other characteristics. Illustrations of the various mechanical splices are included.

Keywords: dowel; mechanical connection; mechanical splice; reinforced concrete; sleeve; splice.

CONTENTS

Chapter 1—General, p. 439.3R-2

- 1.1—Introduction
- 1.2—Usage
- 1.3—General considerations

Chapter 2—Design requirements for mechanical splices, p. 439.3R-5

- 2.1—Codes and specifications
- 2.2—Design considerations
- 2.3—Drawings and specifications

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Chapter 3—Mechanical splices and installation, p. 439.3R-7

- 3.1—General
- 3.2—Compression-only mechanical splices
- 3.3—Tension-compression mechanical splices
- 3.4—Dowel bar mechanical splices
- 3.5—Mechanical lap splices

Chapter 4—Summary, p. 439.3R-18

Chapter 5—References, p. 439.3R-19

- 5.1—Referenced standards and reports
- 5.2—Cited references

CHAPTER 1—GENERAL

1.1—Introduction

In reinforced concrete design, the engineer is faced with sizing individual members and establishing reinforcing steel types, placement requirements, and types of splices that will be used throughout the structure. Design drawings or specifications should clearly show or describe all splice locations and the required performance.

The importance and necessity of clearly prescribing splice requirements is evident in ACI 318. Chapter 1 describes specific items to be included on the design drawings, details, and specifications. These items include showing the location and length of lap splices, reinforcement anchorage lengths, and the type and location of mechanical and welded splices. Chapter 12 also addresses this subject, and states: “Splices of reinforcement shall be made only as required or permitted on design drawings, or in specifications, or as authorized by the engineer.”

In beams, columns, walls and slabs, mechanical, welded and lap splices are usually permitted. The merits of each type of splice should always be considered. The selection of the preferred mechanical or welded splice typically must address project- and location-specific problems in addition to cost, installation ease, and other factors.

1.1.1 Report background and scope—This report is a revision of ACI 439.3R-91, and provides updated information about types of proprietary bar-to-bar mechanical splices generally available and sold in the North American market at the beginning of 2004. Those mechanical splice systems that have become obsolete or inactive have been removed from this report. Additionally, references to accessories and devices that connect reinforcing bars to structural steel or to headed end anchorage devices are not included because they are outside the scope of this report.

Usage and design requirements of mechanical splices, as well as size capabilities and features of selected mechanical splices, are described in Chapters 1, 2, and 3 of this report.

1.1.2 Reinforcing bar designations and grades—In accordance with the current practice of ASTM International, reinforcing bar sizes shown in this report are stated as number designations with inch-pound sizes shown first and SI sizes shown in parentheses. Likewise, grades of reinforcing bars, unless otherwise described, are referred to in terms of minimum yield strength; Grade 40 (280) has a specified yield strength of 40,000 psi (280 MPa), Grade 60 (420) has

a specified yield strength of 60,000 psi (420 MPa), and Grade 75 (520) has a specified yield strength of 75,000 psi (520 MPa).

1.1.3 Type 1 and Type 2 mechanical splices—There are two primary classifications of mechanical splices, whose use is dictated by design loads in the constructed structure. Type 1 splices are used in elements where there is little concern for inelastic deformations and elevated tensile stresses from seismic events. Type 2 splices have proven, through accepted industry testing, the ability to develop the specified tensile strength of the spliced bars for resistance to elevated tensile stresses.

In accordance with ACI 318, Chapter 21, Type 2 mechanical splices are required to develop the specified tensile strength of the bars being spliced. Type 2 mechanical splices used with ASTM A 706/A 706M are required to develop 80,000 psi (550 MPa) minimum, and also not less than 1.25 times the actual yield strength of the bar. Type 2 mechanical splices used with ASTM A 615/A 615M Grade 60 (420) are required to develop 90,000 psi (620 MPa) minimum, and Type 2 mechanical splices used with ASTM A 615/A 615M Grade 40 (280) are required to develop 60,000 psi (420 MPa) minimum.

The requirements for Type 2 mechanical splices are intended to avoid a splice failure in locations where the reinforcement is subjected to stress levels that are expected to approach the tensile strength of the reinforcement. Lap splices are not recommended in locations where inelastic yielding could occur because such splices are not reliable under conditions of cyclic loading into the inelastic range. Under such circumstances, the engineer is encouraged to specify Type 2 mechanical splices.

In accordance with ACI 318, Type 1 mechanical splices should develop in tension or compression, as required, a minimum of 125% of the specified yield strength of the bar. Type 1 mechanical splices are not required to satisfy the more stringent requirements for Type 2 splices. As a result, Type 1 mechanical splices may not be capable of resisting the stress and strain demands that can take place in sections where yielding of the reinforcement is likely to occur during a seismic event.

For any mechanical splicing system under consideration for use, the reader should obtain supporting test information directly from the manufacturer pertaining to the particular mechanical splice device.

1.1.4 Categorization of mechanical splices—Four basic categories of mechanical splices are considered in this report. They are:

1. Compression-only mechanical splices, also known as end-bearing mechanical splices;
2. Tension-compression mechanical splices that can resist both tensile and compressive forces;
3. Dowel bar mechanical splices; and
4. Mechanical lap splices.

1.1.5 Definitions—In this report, specific terms are defined as follows.

bar-end check—checking the ends of reinforcing bars to determine whether they fit the devices intended for splicing the bars.

coupler—threaded device for joining reinforcing bars for the purpose of providing transfer of either axial compression, axial tension, or both, from one bar to the other.

position coupler—threaded device for joining reinforcing bars where bars are not rotated. A component is rotated to engage coupler threads or reinforcing bar threads.

coupling sleeve—nonthreaded device fitting over the ends of two reinforcing bars for the purpose of providing transfer of axial compression, axial tension, or both, from one bar to the other.

end-bearing sleeve—device fitting over the abutting ends of two reinforcing bars for the purpose of ensuring transfer of only axial compression from one bar to the other.

mechanical lap splice—complete assembly of a coupling sleeve device and any additional components configured to accomplish positive splicing of overlapping reinforcing bars.

mechanical splice—complete assembly of a coupler, a coupling sleeve, or an end-bearing sleeve, including any additional intervening material or other components required to accomplish the splicing of reinforcing bars. (Note: “mechanical splice” was formerly called “mechanical connection” in ACI 318-95 and earlier editions.)

1.1.6 Welding—With the exception of friction welding, which is a solid-state joint process that is used in some mechanical splice systems, it is beyond the scope of this report to provide comprehensive information about welded splices or other currently available special proprietary splicing systems. Engineers are referred to the most current AWS code for welding reinforcing steel (ANSI/AWS D1.4) and the ASTM specifications for reinforcing bars, such as ASTM A 615/A 615M, A 706/A 706M, and A 996/A 996M. Information about welding of reinforcing bars is also presented in the CRSI *Manual of Standard Practice*.

1.2—Usage

There are numerous situations that dictate the use of mechanical splices or that make their incorporation more practical and cost effective than lap splices. Some of the most common conditions are:

1. Where size No. 14 and 18 (No. 43 and 57) bars are used. This occurs most often in columns, raft mat foundations, and other heavily reinforced concrete structures. ACI 318 does not permit size No. 14 and 18 (No. 43 and 57) bars to be lap spliced. Lap splices are only allowed by ACI 318 in the case of size No. 11 (No. 36) and smaller bars;

2. Where spacing of the reinforcing bars is insufficient to permit lap splicing the bars. This generally occurs in situations requiring large amounts of reinforcement and the use of larger bars, as in heavily loaded columns;

3. When requirements in current codes and specifications for tension lap splices result in long lap splice lengths. This is the case especially for bar sizes such as size No. 9, 10, and 11 (No. 29, 32, and 36) bars in Grade 60 (420) steel or in epoxy-coated reinforcing bars;

4. In tension tie members. Tension lap splices of reinforcing bars in tension tie members are not permitted by the code;

5. When the location of construction joints and provisions for future construction dictate the use of mechanical splices to provide tensile continuity. Mechanical splices are often preferable to having long bar lengths projecting from existing concrete construction. A minimum of a 12 in. (305 mm) bar extension provides sufficient length for application of most mechanical splices without damaging the existing concrete during installation. If mechanical splices must be staggered, the projecting bar extension should be greater to allow for the stagger pattern;

6. To satisfy a steel-concrete ratio of 8% maximum for reinforced concrete columns. This limit is considered in Chapter 10 of ACI 318 to be a practical maximum for reinforcement in terms of economy and requirements for placing. By using mechanical splices instead of lap splices, the amount of longitudinal steel may be significantly reduced in the splice region;

7. When existing reinforced concrete structures are renovated, modified or repaired and new reinforcing bars must be spliced to those already in concrete. Mechanical splicing requires less removal of concrete compared to lap splicing; and

8. When members may be subjected to inelastic deformations due to earthquake. Strength capacities established in ACI 318 are higher for mechanical splices than for lap splices. Lap splices may not be reliable under conditions of cyclic loading into the inelastic range. Type 2 mechanical splices are qualified by tests to sustain inelastic reinforcing bar strain excursions.

1.3—General considerations

All mechanical splices have particular physical features, in the splice components or in the required installation equipment or procedure, that can influence design and construction. Selection of splice type, components and installation requirements, installed cost, and available options should be considered in the design process. The following subsections identify considerations for splice selection.

1.3.1 Spacing and cover requirements—Minimum clear distances between adjacent reinforcing bars are specified in codes and design specifications. For example, Chapter 7 of ACI 318 sets an absolute minimum clear distance between parallel bars in a layer of not less than the nominal diameter of the bar or 1 in. (25 mm), except that for columns, the minimum clear distance is not less than 1-1/2 times the nominal bar diameter or 1-1/2 in. (38 mm). Chapter 7 states that the clear distance limits also apply to adjacent bars in lapped splices, but does not address clearance limits for mechanical splices.

Clearance limits for mechanical splices may be a factor in the selection and positioning of the appropriate mechanical splice. The outside diameter of the mechanical splice should be known. Up-to-date dimensional data should be obtained from the splice manufacturer. By knowing the diameter of the mechanical splice, the engineer/specifier can decide whether the mechanical splice needs to be staggered on the

basis of the clearance required. For constructibility reasons, mechanical splices are usually best located in the same plane or elevation. There is little justification for staggering mechanical splices solely to prevent undesirable failure modes that are associated with lap splices because, unlike lap splices, the ability of mechanical splices to carry and transfer load from bar-to-bar is not affected by concrete cover or the compressive strength of concrete. Nevertheless, it has been the practice of some designers in the past to stagger mechanical splices as if they were lap splices. Pending any future code revisions, however, the minimum stagger length should be checked and specified by the engineer only when required to be consistent with an applicable code section, such as the provisions in Chapter 12 of ACI 318 related to splices that do not meet Type 1 or 2 requirements.

The size and operation of field equipment, if any, required for the installation of mechanical splices can sometimes dictate a minimum spacing or a stagger pattern. Some information to evaluate these requirements is available in **Chapter 3** of this report.

Some proprietary mechanical splices currently available have outside diameters that are substantially larger than that of the reinforcing bars. Special consideration should be given to the minimum concrete cover of the stirrups, ties, or spirals at these splice locations. In many cases, the stirrup or tie patterns adjacent to the mechanical splices, or the location of the splice itself, can be adjusted to avoid a reduced concrete cover. Codes do not mandate the placing of stirrups and ties over mechanical splices. Where designs involving close spacing of stirrups and ties necessitates their placement over couplers or coupling sleeves, however, it may be necessary to require greater cover over the splices and longitudinal reinforcement so that stirrups or ties encompassing the mechanical splices have adequate cover. Ideally, the dimensions of hoops or stirrups at the splice location should be adjusted to account for the larger diameter of the splice, but that is not generally the case in practice. All structural components of mechanical splices should meet the code-prescribed minimum concrete cover dimension. In the case of dowel bar mechanical splices with flanges, it should be noted that flanges are nonstructural in nature. Therefore, the designer need only consider cover over flanges with respect to durability.

1.3.2 Matching of end alignments, end preparation of deformed bars, use of plain round bars, special bar deformations, and equipment—The engineer/specifier should be aware of any special end preparation of bars required for a particular mechanical splice. For example, for end-bearing splices, Chapter 12 of ACI 318 requires that the ends of the bars be cut to within 1-1/2 degrees of square with respect to the longitudinal axis.

By definition, couplers are threaded, and some require matching threads on the bar ends. One mechanical splice requires reinforcing bars with special thread-like deformations. In most cases, for field assembly purposes, the mechanical splice should be concentrically aligned with the longitudinal bar axis. This is especially important for couplers that require reinforcing bar rotation, so that the bar is not likely

to experience large oscillations when being rotated during field assembly. In the structure, linear alignment from bar to bar can generally be preserved across the splice by using bars with straight ends and securing the continuation bar in place at the time of installation. Splice tolerances for angular misalignment and misinsertion should be obtained from the splice manufacturer. In situations where the axes of the reinforcing bars to be spliced are not concentrically aligned, such as with curved bars, mispositioned dowel bars, and precast-to-precast connections, coupling sleeve systems tolerant to misalignment should be selected.

The reinforcing steel fabricator should be made aware of any special end preparation or threading requirement for the reinforcing bars by design drawings and specifications. Special requirements may entail the use of end-threading machines or special tools and equipment at the construction site. End threading is typically completed in the fabrication shop, although automated threading machines for field use are now becoming available.

Most reinforcing bars are deformed bars with lugs or protrusions that limit longitudinal movement or slip of the bar relative to the surrounding concrete; however, ACI allows limited use of plain reinforcing bars, and ASTM standard specifications exist which define material requirements for such, in sizes up to and including 2 in. (50.8 mm). Several types of mechanical splices rely on mechanical interlock with reinforcing bar deformations and are therefore not suitable for use with plain round bars. The mechanical splice manufacturer can advise accordingly.

The contractor and fabricator should coordinate to ensure that proper tooling and equipment exists at the site for installing selected mechanical splices on the specified reinforcing steel within placing tolerance. Related to this, a bar-end check is sometimes advisable before proceeding with certain mechanical splices. The mechanical splice manufacturer can advise accordingly.

1.3.3 Coated reinforcing bars—Reinforcing bars can be epoxy coated to ASTM A 775/A 775M or A 934/A 934M, or zinc coated (galvanized) to ASTM A 767/A 767M as a means of protection from corrosion. Mechanical splices of coated and uncoated reinforcing bars are made in similar ways. To properly install some types of mechanical splices on coated bars, the bar ends should be shielded at the time of coating, or the coating has to be completely removed over the length of the splice device and a short distance, approximately 2 in. (50 mm), beyond the ends of the splice device.

After installation of mechanical splices on coated reinforcing bars, the splice components and any damaged coating on the bars adjacent to the mechanical splices should be touched up with the appropriate compatible patching material. Project specifications should define the requirements for touch-up of the mechanical splices and repair of damaged coatings (refer to Chapter 5 of ACI 301). Flame-cutting of coated bars in any location should be avoided, when possible, because of damage to the coating. Where mechanical splices are used, flame-damaged epoxy coating may be more difficult to remove.

1.3.4 Stainless steel reinforcing bars—Stainless steel bars for concrete reinforcement, such as ASTM A 955/A 955M,

can be mechanically spliced by stainless steel couplers that have chemical composition and corrosion resistance similar to that of the bars. Information on availability should be obtained from the supplier or splice manufacturer. If stainless steel bars are mechanically spliced to dissimilar steels such as carbon steel reinforcing bars, the potential for galvanic corrosion due to dissimilar metals should first be assessed.

1.3.5 Field erection—In many applications, mechanical splices may be staggered for clearance, access, and code requirements. If staggered mechanical splices are used in columns, for example, free-standing erection and assembly of the reinforcement may be required rather than preassembled cages, thus necessitating use of external bracing or formwork to hold bars while completing splices.

There is a considerable difference in the time and equipment required to install different mechanical splices. Therefore, the field erection procedure and schedule should be coordinated with the selection and installation procedure of the mechanical splices. If special equipment is required, particular information regarding its size, weight, operation, and availability should be obtained from the supplier or splice manufacturer.

For some projects, the engineer may find it appropriate to specify the types of mechanical splices to be used. Also, the method of construction may determine the types of mechanical splices that can be most readily used. Any unique requirements of a selected mechanical splice should be considered by all parties before beginning construction. Study of the subsequent descriptions will assist in determining these requirements. The supplier or manufacturer should be able to provide information related to unique requirements, if required.

1.3.6 Inspection and quality assurance—For all of the splices described in Sections 3.3, 3.4, and 3.5, some type of installation inspection or quality assurance is needed to ensure satisfactory performance. Quality system program statements, certificates of compliance, or certified material test reports should be requested from mechanical splice suppliers. Mechanical splice manufacturers can provide installation acceptance criteria for use by engineers and field inspectors. Depending on jurisdiction, special inspection may be required in accordance with a building code or design specification.

Destructive tensile testing of sister splices (also known as companion splices), or a proportion of production pieces, can be specified by the engineer to verify that a particular splice will not prematurely slip or otherwise fail, particularly in critical locations where Type 2 splices are used. The frequency and manner of tensile testing may form part of the project specifications or may be prescribed in building codes. When mechanical splices are used in safety-related structures, such as nuclear containments, it may be mandatory to perform destructive tensile tests on as many as 1-in-50 splices. In some jurisdictions, two or three test specimens may be prepared and tested at the start of the splicing phase. Batch testing (or ongoing testing) is performed by some agencies on 1-in-500 splices or in accordance with instructions issued by the project engineer. ACI 318 makes

no recommendations on the testing frequency of installed splices on a project.

CHAPTER 2—DESIGN REQUIREMENTS FOR MECHANICAL SPLICES

2.1—Codes and specifications

Design requirements of the applicable code (for example, ACI 318, 349, 350 or 359) or specification (for example, AASHTO *Standard Specifications for Highway Bridges* or AASHTO *LRFD Bridge Design Specifications*) for reinforcing bar mechanical splices are not reproduced or discussed in detail in this report. Codes generally specify a minimum splice strength. For example, ACI 318-05, Chapter 12, requires that a (Type 1) full mechanical splice develop in tension or compression, as required, at least 125% of the specified yield strength f_y of the bar, so some yielding will occur in the reinforcing bar adjacent to the mechanical splice before failure in the splice itself. ACI 318-05, Chapter 21, requires that Type 2 mechanical splices develop the specified tensile strength of the spliced bar. For further background information and some of the considerations made in developing the ACI 318 mechanical splice provisions, the reader is encouraged to review the commentary provided in Chapters 12 and 21 of ACI 318-05.

ASTM A 1034/A 1034M describes the methods for testing mechanical splices, such as monotonic tension tests, monotonic compression tests, and cyclic load tests, but does not quantify the parameters for testing nor acceptance criteria.

Information regarding the claimed qualifications of mechanical splices is limited in this edition of the report to the Type 1 or Type 2 criteria of ACI 318, as summarized in **Table 2.1**. Supporting test results for a particular proprietary mechanical splice should be obtained directly from the splice manufacturer.

Table 2.1 includes a complete listing of tension-compression mechanical splices and shows the performance claimed by the manufacturers as Types 1 and 2 when used in conjunction with Grade 60 (420) deformed reinforcing bars. It should be noted that some manufacturers have more than one version of a specific mechanical splice. For example, there might be a version that is specifically Type 1, and another version that is capable of Type 2 performance. Other splice manufacturers may offer a single version that is rated as both Type 1 and Type 2. Type 2 splices inherently satisfy Type 1 splice performance requirements because the required tensile strength of a Type 2 splice is greater than that of a Type 1 splice.

For repair, renovation, and structural modification, the strength of the mechanical splice is generally dictated by the condition and attributes of the existing reinforcement. For example, if ASTM A 615/A 615M Grade 60 (420) bars are mechanically spliced to 80-year-old structural grade bars that have a characteristic yield strength of 33,000 psi (230 MPa) with an unknown specified tensile strength, it may be unrealistic to specify a particular mechanical splice without first testing the mechanical splice with the old bar. Only certain types of mechanical splices are suitable for these kinds of applications. It is not feasible, for example, to use threaded couplers because of the impracticality of forming

Table 2.1—Tension-compression mechanical splices: availability, applications, and suitability of Types 1 and 2 splices for Grade 60 (420) uncoated deformed reinforcing bars

Report section and mechanical splice generic name	Bar designation no.		Applications ■ = primary; □ = secondary A = cast-in-place B = precast to precast C = new construction D = in-place renovation/repair				Suitability ■ = primary; □ = secondary E = shop or preinstallation F = field installation G = for deformed bars H = plain round bars			
	Type 1 splice	Type 2 splice	A	B	C	D	E	F	G	H
3.3.1 Cold-swaged steel coupling sleeve	3 to 18 (10 to 57)		■	—	■	■	□	■	■	—
3.3.2 Cold-swaged coupler with taper-threaded ends	3 to 18 (10 to 57)		■	—	■	□	■	□	■	—
3.3.3 Coupler for thread-like deformed reinforcing bars	6 to 18 (19 to 57)		■	—	■	—	□	■	■*	—
3.3.4 Extruded steel coupler with parallel threaded ends	4 to 18 (13 to 57)		■	—	■	—	■	—	■	—
3.3.5 Friction-welded bar coupler with parallel threads	6 to 18 (19 to 57)		■	—	■	—	■	—	■	□
3.3.6 Friction-welded coupler with taper-threaded ends	5 to 18 (16 to 57)		■	—	■	—	■	—	■	□
3.3.7 Grout-filled coupling sleeve	3 to 18 (10 to 57)		□	■	■	□	■	□	■	—
3.3.8 Grout-filled coupling sleeve with parallel thread	4 to 18 (13 to 57)		□	■	■	□	■	□	■	—
3.3.9 Grout-filled coupling sleeve with taper thread	6 to 18 (19 to 57)		□	■	■	□	■	□	■	—
3.3.10 Shear screw and rail coupling sleeve	4 to 18 (13 to 57)	4 to 14 (13 to 43)	■	—	■	■	—	■	■	□
3.3.11 Shear screw and wedge coupling sleeve	4 to 18 (13 to 57)	3 to 14 (10 to 43)	■	—	■	■	—	■	■	□
3.3.12 Steel-filled coupling sleeve	4 to 18 (13 to 57)		■	—	■	■	—	■	■	—
3.3.13 Taper-threaded steel coupler	3 to 18 (10 to 57)		■	—	■	—	■	—	■	□
3.3.14 Threaded coupler with standard national coarse threads	4 to 11 (13 to 36)	4 to 8 (13 to 25)	■	—	■	—	■	—	■	□
3.3.15 Threaded coupler with upsized bar threads, cold-forged	4 to 18 (13 to 57)		■	—	■	—	■	—	■	□
3.3.16 Threaded coupler with upsized bar threads, hot-forged	4 to 11 (13 to 36)		■	—	■	—	■	—	■	□
3.3.17 Upset bar and coupling sleeve with straight threads	5 to 14 (16 to 43)		■	—	■	■	■	■	■	□
3.4.1 Cold-swaged steel flanged coupler with taper-threaded ends	3 to 18 (10 to 57)		■	—	■	—	■	—	■	—
3.4.2 Coupler with standard national coarse threads and flange	4 to 11 (13 to 36)	4 to 8 (13 to 25)	■	—	■	—	■	—	■	□
3.4.3 Coupler with taper threads and mounting plate	3 to 18 (10 to 57)		■	—	■	□	■	□	■	□
3.4.4 Integrally forged coupler with flange	4 to 11 (13 to 36)		■	—	■	—	■	—	■	□

*Coupler must be used with compatible thread-like deformed reinforcing bars.

Notes: **IMPORTANT**—Contact the manufacturer for capabilities in splicing ASTM A 615/A 615M Grade 75 (520) bar. Each splice type classification is based solely on a manufacturer's claimed performance with uncoated ASTM A 615/ASTM A 615M Grade 60 (420) or ASTM A 706/A 706M bar. Splice type classifications may be different for coated bars and other grades or specifications. **Neither ACI, nor the committee, tests or approves any manufacturer's product or process, and consequently do not warrant the splice type classifications.** Splice performance, availability, suitability, limitations, and exclusions should be verified directly with the mechanical splice manufacturer. All information is subject to change.

the required threads on the exposed ends of the reinforcing bars that extend from the concrete. For this reason, Table 2.1 includes some information pertaining to applications and suitability.

2.2—Design considerations

Due to the minimum mechanical splice strength requirement, it is generally assumed in design that the presence of a mechanical splice of two reinforcing bars does not result in a reduction of the anticipated structural strength, the stiffness,

or the ductility of the reinforcing steel. Design codes cover strength requirements for welded and mechanical splices, but generally do not specify how to avoid potential weaknesses that may be directly attributed to the specific details or materials of a mechanical splice.

- In a flexural member, the mechanical splice should not result in a low effective longitudinal stiffness of the reinforcement that violates the strain condition assumed in the member design, and