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ESR-2299

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DIVISION: 03 00 00—CONCRETE
SECTION: 03 21 00—REINFORCING STEEL

REPORT HOLDER:

BARSPLICE PRODUCTS, INC.

4900 WEBSTER STREET
DAYTON, OHIO 45414

EVALUATION SUBJECT:

BPI-GRIP XL, TAPER THREADED GRIP-TWIST AND POSITION TAPER THREADED GRIP-TWIST SYSTEMS FOR CONNECTING STEEL REINFORCING BARS



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DIVISION: 03 00 00—CONCRETE
Section: 03 21 00—Reinforcing Steel**REPORT HOLDER:****BARSPlice PRODUCTS, INC.**
4900 WEBSTER STREET
DAYTON, OHIO 45414
www.barsplice.com
bar@barsplice.com**EVALUATION SUBJECT:****BPI-GRIP XL, TAPER THREADED GRIP-TWIST AND
POSITION TAPER THREADED GRIP-TWIST SYSTEMS
FOR CONNECTING STEEL REINFORCING BARS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)[†]

[†]The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Property evaluated:

Structural

2.0 USES

The BPI-Grip XL, Taper Threaded Grip-Twist and Position Taper Threaded Grip-Twist systems are used to mechanically butt-splice deformed steel reinforcing bars in reinforced concrete construction. The systems comply with Section 12.14.3.2 of ACI 318 (ACI 318 as referenced in Section 1901.2 of the IBC) for use as tension and compression mechanical connections of ASTM A615 Grade 60 or ASTM A706 Grade 60 deformed steel reinforcing bars. The systems also comply with the Type 2 mechanical splice requirements of Section 21.1.6.1 of ACI 318-11 and ACI 318-08 and Section 21.2.6.1 of ACI 318-05, and are for use where Type 1 or Type 2 mechanical splices are specified by the IBC and ACI 318.

3.0 DESCRIPTION**3.1 BPI-Grip XL Systems:**

The BPI-Grip XL system, for splicing equal-diameter steel reinforcing bars inserted into each end of the coupler, is a single-piece, hollow, straight, cylindrical sleeve manufactured from ASTM A519, low carbon steel, seamless tubing complying with additional specifications in the approved quality control documentation. The couplers have uniform inside and outside diameters over the length of the coupler.

The BPI-Grip XL transition couplers for splicing two reinforcing bars of unequal diameters have stepped inside and outside diameters and are manufactured from ASTM A576 low-carbon steel rods complying with additional specifications in the approved quality control documentation.

The inside diameters of both types of BPI-Grip XL couplers are larger than the steel reinforcing bar diameter. See Tables 1 and 2 for the dimensions of couplers, and Figures 1 and 2 for additional details.

3.2 Taper Threaded Grip-Twist System:

The Taper Threaded Grip-Twist System is a two-piece threaded coupler consisting of a taper threaded male coupling device and a taper threaded female coupling device. The end of each coupling device opposite the threaded end is a sleeve for insertion of a steel reinforcing bar. The couplers are manufactured from ASTM A576 steel rods complying with additional specifications in the approved quality control documentation. For use in transition splices of steel reinforcing bars, the coupling device of the larger bar size has a female threaded end to match the male threaded end of the coupling device on the smaller steel reinforcing bar. See Tables 3 and 4 for the dimensions of the coupling devices, and Figures 3 and 4 for additional details.

3.3 Position Taper Threaded Grip-Twist System:

The Position Taper Threaded Grip-Twist System consists of three pieces: one taper threaded female coupling device, one standard threaded female coupling device and one positional stud with tapered threads on one end and standard threads on the opposite end. The end of each coupling device opposite the threaded end is a sleeve for insertion of a steel reinforcing bar. The coupling devices and positional stud are manufactured from ASTM A576 steel rods complying with specifications in the approved quality control documentation. See Table 5 for the dimensions of the coupling devices, and Figure 5.

4.0 INSTALLATION**4.1 General:**

Ends of steel reinforcing bars to be spliced must have square-cut ends. The couplers must be pressed onto the bars by a swaging procedure using a hydraulic press and a series of overlapping pressings in accordance with the Barsplice Products, Inc., published instructions. The BPI-Grip XL installation instructions are entitled "Swaging Instructions (SM02) for No. 3, 4, 5, 6, 7, 8, 9, 10, 11, 14 and 18 Reinforcing Bars - Installation of BPI-Grip Couplers," and are dated August 2003. The installation instructions for the Taper Threaded Grip-Twist and Position Taper Threaded Grip-Twist systems are entitled

“Swaging and Coupler Assembly Instructions (SM 18) for BPI-Taper Threaded Grip-Twist Couplers,” Revision 6, dated August 2004. The couplers must be swaged onto the steel reinforcing bars either at the jobsite or at an approved fabricator’s facility. The published instructions must be available on the jobsite at all times during installation.

4.2 BPI-Grip XL Systems:

For splices of bars with equal diameters, the steel reinforcing bar must be inserted halfway into one end of the coupler, swaging the coupler onto the bar on one end of the coupler. The second bar is then inserted into the other end of the coupler until both bars are butted together, followed by swaging of the coupler onto the second bar. For transition splices, the larger bar must be inserted into the coupler to the insertion depth noted in Table 2.

4.3 Taper Threaded Grip-Twist System:

The steel reinforcing bars must be inserted into the sleeve portion of each of the coupling devices to the insertion depth stated in Table 3, prior to swaging the coupler onto the bar with a die designated by Barsplice Products as a Type 2 die. After both coupling devices are pressed onto the bars, the bars are joined by engaging the threaded ends of each coupling device, in accordance with the manufacturer’s instructions. The threaded ends must be fully engaged, with verification in accordance with the manufacturer’s instructions.

4.4 Position Taper Threaded Grip-Twist System:

The steel reinforcing bars must be inserted into the sleeve portion of each coupling device to the insertion depth noted in Table 4, prior to swaging the coupler onto the bar with a die designated by Barsplice Products as a Type 2 die. Initially, the positional stud must be fully engaged into the swaged sleeve containing standard female threads. To assemble the splice, the bars must be aligned and brought together with the male taper threaded end of the positional stud inside the female taper threaded end of the coupling device. The positional stud must be rotated until the tapered threads of the positional stud are fully engaged in accordance with the manufacturer’s instructions.

4.5 Special Inspection:

Special inspection is required in accordance with Section 1705 of the 2012 IBC (Section 1704 of the 2009 and 2006 IBC). In addition to verifying placement of steel reinforcing bar splices, the special inspector must verify the grade and size of reinforcing bars; coupler identification; field preparation of components; and assembly of the components resulting in spliced bars.

5.0 CONDITIONS OF USE

The BPI-Grip XL, Taper Threaded Grip-Twist and Position Taper Threaded Grip-Twist Systems described in this report comply with, or are suitable alternatives to what is specified in, the codes indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1 The couplers must be identified and installed in accordance with the applicable code, the manufacturer’s instructions and this report. In the event of conflict between this report and the manufacturer’s instructions, this report governs.
- 5.2 Special inspection must be provided in accordance with Section 4.5 of this report.
- 5.3 The minimum concrete cover must be in accordance with the IBC and must be measured from the outer surface of the coupler.
- 5.4 Splice locations must comply with applicable IBC requirements and be noted on plans approved by the code official.

- 5.5 Under the 2012 IBC: For structures regulated by Chapter 21 of ACI 318 (as required by IBC Section 1905.1), to splice reinforcing bars resisting earthquake-induced flexure, axial force, or both, in special moment frames, special structural walls, and all components of special structural walls including coupling beams and wall piers, with the Barsplice mechanical splice systems, mill certificates must be submitted to the code official as evidence that the steel reinforcing bars comply with ACI 318-11 Section 21.1.5.2.

Under the 2009 IBC and 2006 IBC: For structures regulated by Chapter 21 of ACI 318 (as required by IBC Section 1908.1), to splice reinforcing bars resisting earthquake-induced flexural and axial forces in special moment frame members, special structural walls and coupling beams, with the Barsplice mechanical splice systems, mill certificates must be submitted to the code official as evidence that the steel reinforcing bars comply with ACI 318-08 Section 21.1.5.2 under the 2009 IBC (ACI 318-05 Section 21.2.5 under the 2006 IBC [denoted as ACI 318 Section 21.2.5.1 in 2006 IBC Section 1908.1.5]).

- 5.6 Jobsite swaging of couplers: For jobsite swaging of the couplers onto the steel reinforcing bars, the following requirements must be satisfied:
 - a. The couplers must be swaged onto the steel reinforcing bars by fabricators/installers approved by a designated representative of Barsplice Products, Inc.
 - b. The jobsite fabricator must demonstrate the following items to the satisfaction of the special inspector for each coupler model type and steel reinforcing bar size:
 1. The fabricator must assemble the couplers onto the ends of the steel reinforcing bar as required by Barsplice Products, Inc., in a manner consistent with the installation instructions noted in Section 4.1 and with the treatment of the qualifying test specimens.
 2. For Type 2 splices, connections using the fabricator-prepared assemblies of couplers and steel reinforcing bars, tested in static tension, must develop 100 percent of the specified tensile strength of the steel reinforcing bar and 125 percent of the specified yield strength of the reinforcing bar. This may be demonstrated by test reports submitted to the code official. These tests should be conducted prior to commencement, and periodically throughout the duration, of the jobsite assembly of the couplers onto the ends of the steel reinforcing bars. The frequency of the tensile tests must be acceptable to the registered design professional for the building project, and to the code official.
 3. For Type 1 splices, connections using the fabricator-prepared couplers and steel reinforcing bars, tested in static tension, must develop 125 percent of the specified yield strength of the steel reinforcing bar. This may be demonstrated by test reports submitted to the code official. These tests must be conducted prior to commencement, and periodically throughout the duration, of the jobsite assembly of the couplers on the ends of the steel reinforcing bars. The frequency of the tensile tests must be acceptable to the registered design professional for the building project, and to the code official.

- 5.7 Fabricator facility swaging of couplers: For couplers that are swaged onto the steel reinforcing bars at facilities of fabricators other than Barsplice Products, Inc., the following requirements must be satisfied:
- The fabricator must be approved by the code official in accordance with Section 1704.2.5.2 of the 2012 IBC (Section 1704.2.2 of the 2009 IBC).
 - The couplers must be swaged onto the steel reinforcing bars by fabricators/installers approved by a designated representative of Barsplice Products, Inc.
 - The fabricator must assemble the couplers onto the ends of the steel reinforcing bar as required by Barsplice Products, Inc., in a manner consistent with the installation instructions noted in Section 4.1 and with the treatment of the qualifying test specimens.
 - For Type 2 splices, connections using the fabricator-prepared assemblies of couplers and steel reinforcing bars, tested in static tension, must develop 100 percent of the specified tensile strength of the steel reinforcing bar and 125 percent of the specified yield strength of the

reinforcing bar. This may be demonstrated by test reports submitted to the code official.

- For Type 1 splices, connections using the fabricator-prepared assemblies of couplers and steel reinforcing bars, tested in static tension, must develop 125 percent of the specified yield strength of the steel reinforcing bar. This may be demonstrated by test reports submitted to the code official.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Connector Systems for Steel Reinforcing Bars (AC133), dated December 2012.

7.0 IDENTIFICATION

Each carton of couplers, coupler devices and positional studs is labeled with the name and address of Barsplice Products, Inc., product name and size, heat number, and the evaluation report number (ICC-ES ESR-2299). Each coupler and coupler device is labeled with the Barsplice Products, Inc., name, the designation "Type 2" and the evaluation report number.

TABLE 1—BPI-GRIP XL DIMENSIONS¹

REINFORCING BAR SIZE	COUPLER INSIDE DIAMETER (inches)	COUPLER OUTSIDE DIAMETER (inches)	COUPLER LENGTH (inches)
4	$\frac{5}{8}$	$\frac{15}{16}$	4
5	$\frac{3}{4}$	$1\frac{1}{8}$	$4\frac{3}{4}$
6	$1\frac{5}{16}$	$1\frac{3}{8}$	$5\frac{1}{2}$
7	$1\frac{1}{16}$	$1\frac{9}{16}$	$6\frac{1}{4}$
8	$1\frac{3}{16}$	$1\frac{3}{4}$	7
9	$1\frac{3}{8}$	$1\frac{15}{16}$	$7\frac{1}{2}$
10	$1\frac{1}{2}$	$2\frac{3}{16}$	$8\frac{1}{4}$
11	$1\frac{11}{16}$	$2\frac{3}{8}$	9
14	$1\frac{15}{16}$	$2\frac{15}{16}$	11
18	$2\frac{5}{8}$	$3\frac{13}{16}$	14

For SI: 1 inch = 25.4 mm.

¹The tabulated coupler outside diameters and lengths are prior to swaging of the coupler onto the steel reinforcing bars.

TABLE 2—BPI-GRIP XL TRANSITION COUPLERS¹

REINFORCING BAR SIZE	COUPLER APPROXIMATE OUTSIDE DIAMETER (inches)		COUPLER APPROXIMATE INSIDE DIAMETER (inches)		NOMINAL INSERTION, LARGER BAR, "i" (inches)	COUPLER LENGTH, "L" (inches)
	Larger Bar	Smaller Bar	Larger Bar	Smaller Bar		
5/4	$1\frac{1}{16}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$1\frac{11}{16}$	$4\frac{1}{4}$
6/5	$1\frac{3}{8}$	$1\frac{1}{16}$	$\frac{15}{16}$	$\frac{3}{4}$	$2\frac{1}{16}$	$5\frac{1}{4}$
7/6	$1\frac{9}{16}$	$1\frac{3}{8}$	$1\frac{1}{16}$	$\frac{15}{16}$	$2\frac{7}{16}$	$5\frac{7}{8}$
8/7	$1\frac{3}{4}$	$1\frac{9}{16}$	$1\frac{3}{16}$	$1\frac{1}{16}$	$2\frac{7}{8}$	$6\frac{1}{2}$
9/8	$1\frac{15}{16}$	$1\frac{3}{4}$	$1\frac{5}{16}$	$1\frac{3}{16}$	$3\frac{1}{4}$	$7\frac{5}{8}$
10/9	$2\frac{3}{16}$	$1\frac{15}{16}$	$1\frac{1}{2}$	$1\frac{5}{16}$	$3\frac{7}{16}$	$8\frac{1}{8}$
11/9	$2\frac{3}{8}$	$1\frac{15}{16}$	$1\frac{5}{8}$	$1\frac{5}{16}$	$3\frac{1}{2}$	$8\frac{1}{2}$
11/10	$2\frac{3}{8}$	$2\frac{3}{16}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$3\frac{1}{2}$	$8\frac{1}{2}$
14/11	$2\frac{7}{8}$	$2\frac{3}{8}$	$1\frac{15}{16}$	$1\frac{5}{8}$	$3\frac{7}{8}$	$10\frac{1}{8}$
18/11	$3\frac{15}{16}$	$2\frac{3}{8}$	$2\frac{5}{8}$	$1\frac{5}{8}$	$4\frac{1}{8}$	$11\frac{9}{16}$
18/14	$3\frac{3}{8}$	3	$2\frac{9}{16}$	2	$4\frac{3}{8}$	$11\frac{9}{16}$

For SI: 1 inch = 25.4 mm.

¹The tabulated coupler outside diameters and lengths are prior to swaging of the coupler onto the steel reinforcing bars.

TABLE 3—TAPER THREADED GRIP-TWIST DIMENSIONS¹

REINFORCING BAR SIZE	COUPLER LENGTH (inches)		COUPLER APPROXIMATE OUTSIDE DIAMETER (inches)	COUPLER APPROXIMATE INSIDE DIAMETER (inches)	REBAR INSERTION DISTANCE (inches)	
	Male	Female			Male	Female
4	2 ¹³ / ₁₆	2 ¹³ / ₁₆	7/8	5/8	1 ⁵ / ₈	1 ⁵ / ₈
5	3 ⁷ / ₁₆	3 ⁷ / ₁₆	1 ¹ / ₈	3/4	2	2 ¹ / ₁₆
6	4 ¹ / ₁₆	4 ¹ / ₁₆	1 ³ / ₈	1 ⁵ / ₁₆	2 ³ / ₈	2 ¹ / ₂
7	4 ³ / ₄	4 ³ / ₄	1 ⁹ / ₁₆	1 ¹ / ₁₆	2 ³ / ₄	2 ⁷ / ₈
8	5 ³ / ₈	5 ³ / ₈	1 ³ / ₄	1 ³ / ₁₆	3 ³ / ₁₆	3 ¹ / ₄
9	6 ¹ / ₈	6 ¹ / ₈	1 ¹⁵ / ₁₆	1 ⁵ / ₁₆	3 ⁹ / ₁₆	3 ¹¹ / ₁₆
10	6 ⁷ / ₈	6 ⁷ / ₈	2 ³ / ₁₆	1 ¹ / ₂	4	4 ¹ / ₈
11	7 ¹ / ₄	7 ¹ / ₄	2 ³ / ₈	1 ⁵ / ₈	4 ⁷ / ₁₆	4 ¹ / ₂
14	8 ⁷ / ₈	8 ⁷ / ₈	2 ⁷ / ₈	1 ¹⁵ / ₁₆	5 ³ / ₈	5 ⁹ / ₁₆
18	11 ⁹ / ₁₆	11 ⁹ / ₁₆	3 ¹³ / ₁₆	2 ⁵ / ₈	7	7 ¹ / ₄

For SI: 1 inch = 25.4 mm.

¹The tabulated coupler outside diameters and lengths are prior to swaging of the coupler onto the steel reinforcing bars.

TABLE 4—TRANSITION TAPER THREADED GRIP-TWIST DIMENSIONS¹

REINFORCING BAR SIZE	COUPLER LENGTH (inches)		COUPLER APPROXIMATE OUTSIDE DIAMETER (inches)		COUPLER APPROXIMATE INSIDE DIAMETER (inches)		REBAR INSERTION DISTANCE (inches)	
	Male	Female	Male	Female	Male	Female	Male	Female
5/4	2 ¹³ / ₁₆	3 ⁷ / ₁₆	7/8	1 ¹ / ₈	5/8	3/4	1 ⁵ / ₈	2 ¹ / ₁₆
6/5	3 ⁷ / ₁₆	4 ¹ / ₁₆	1 ¹ / ₈	1 ³ / ₈	3/4	1 ⁵ / ₁₆	2	2 ¹ / ₂
7/6	4 ¹ / ₁₆	4 ³ / ₄	1 ³ / ₈	1 ⁹ / ₁₆	1 ⁵ / ₁₆	1 ¹ / ₁₆	2 ³ / ₈	2 ⁷ / ₈
8/7	4 ³ / ₄	5 ³ / ₈	1 ⁹ / ₁₆	1 ³ / ₄	1 ¹ / ₁₆	1 ³ / ₁₆	2 ³ / ₄	3 ¹ / ₄
9/8	5 ³ / ₈	6 ¹ / ₈	1 ³ / ₄	1 ¹⁵ / ₁₆	1 ³ / ₁₆	1 ⁵ / ₁₆	3 ³ / ₁₆	3 ¹¹ / ₁₆
10/9	6 ¹ / ₈	6 ⁷ / ₈	1 ¹⁵ / ₁₆	2 ³ / ₁₆	1 ⁵ / ₁₆	1 ¹ / ₂	3 ⁹ / ₁₆	4 ¹ / ₈
11/9	6 ¹ / ₈	7 ¹ / ₄	1 ¹⁵ / ₁₆	2 ³ / ₈	1 ⁵ / ₁₆	1 ⁵ / ₈	3 ⁹ / ₁₆	4 ¹ / ₂
11/10	6 ⁷ / ₈	7 ¹ / ₄	2 ³ / ₁₆	2 ³ / ₈	1 ¹ / ₂	1 ⁵ / ₈	4	4 ¹ / ₂
14/11	7 ¹ / ₄	6 ³ / ₄	2 ³ / ₈	2 ⁷ / ₈	1 ⁵ / ₈	1 ¹⁵ / ₁₆	4 ⁷ / ₁₆	3 ¹⁵ / ₁₆
18/11	7 ¹ / ₄	8	2 ³ / ₈	3 ¹³ / ₁₆	1 ⁵ / ₈	2 ⁵ / ₈	4 ⁷ / ₁₆	4 ⁵ / ₈
18/14	8 ⁷ / ₈	8	2 ⁷ / ₈	3 ¹³ / ₁₆	1 ¹⁵ / ₁₆	2 ⁵ / ₈	5 ³ / ₈	4 ⁵ / ₈

For SI: 1 inch = 25.4 mm.

¹The tabulated coupler outside diameters and lengths are prior to swaging of the coupler onto the steel reinforcing bars.

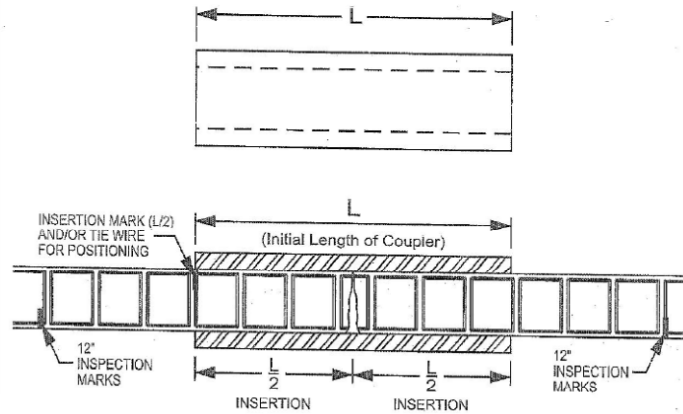
TABLE 5—POSITION TAPER THREADED GRIP-TWIST DIMENSIONS¹

REINFORCING BAR SIZE	COUPLER LENGTH (inches)		COUPLER APPROXIMATE OUTSIDE DIAMETER (inches)	COUPLER APPROXIMATE INSIDE DIAMETER (inches)	REBAR INSERTION DISTANCE (inches)	TAPER MALE INSERTION ² , "H" (inches)	SPACE AFTER ASSEMBLY ² , "S" (inches)
	Taper Threads	Straight Threads					
8	5 ³ / ₈	5 ³ / ₈	1 ³ / ₄	1 ³ / ₁₆	3 ¹ / ₄	1 ¹ / ₂	1 ¹ / ₂
9	6 ¹ / ₈	6 ¹ / ₈	1 ¹⁵ / ₁₆	1 ⁵ / ₁₆	3 ¹¹ / ₁₆	1 ³ / ₄	1 ⁵ / ₈
10	6 ⁷ / ₈	6 ⁷ / ₈	2 ³ / ₁₆	1 ¹ / ₂	4 ¹ / ₈	2	1 ⁷ / ₈
11	7 ¹ / ₄	7 ¹ / ₄	2 ³ / ₈	1 ⁵ / ₈	4 ¹ / ₂	2 ¹ / ₈	1 ³ / ₄
14	8 ⁷ / ₈	8 ⁷ / ₈	2 ⁷ / ₈	1 ¹⁵ / ₁₆	5 ⁹ / ₁₆	2 ¹ / ₂	2 ¹ / ₈
18	11 ⁹ / ₁₆	11 ⁹ / ₁₆	3 ¹³ / ₁₆	2 ⁵ / ₈	7 ¹ / ₄	3 ¹ / ₄	2 ¹ / ₈

For SI: 1 inch = 25.4 mm.

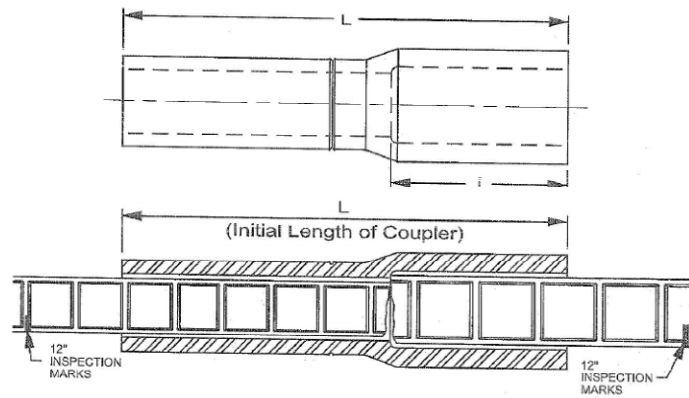
¹The tabulated coupler outside diameters and lengths are prior to swaging of the coupler onto the steel reinforcing bars.

²See Figure 5 for description of dimensions "H" and "S".



For SI: 1 inch = 25.4 mm.

FIGURE 1—BPI-GRIP XL



For SI: 1 inch = 25.4 mm.

FIGURE 2—BPI-GRIP XL TRANSITION

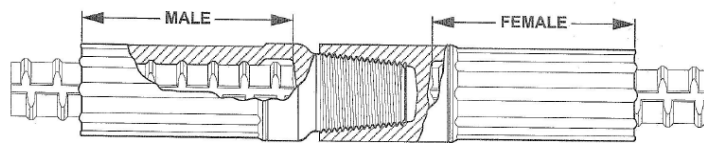


FIGURE 3—TAPER THREADED GRIP-TWIST

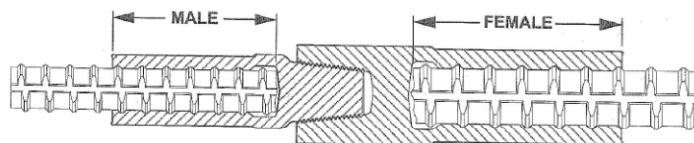


FIGURE 4—TRANSITION TAPER THREADED GRIP-TWIST

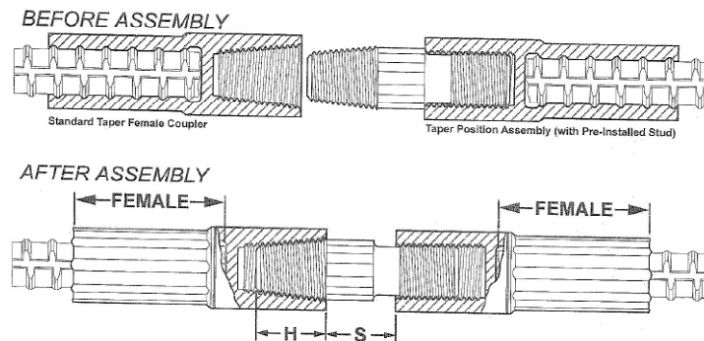


FIGURE 5—POSITION TAPER THREADED GRIP-TWIST