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Legacy report on the 1997 *Uniform Building Code*™, the 2000 *International Building Code*®, and the 2000 *International Residential Code*®

DIVISION: 03—CONCRETE

Section: 03210—Reinforcing Steel

REINFORCING STEEL COUPLERS AND SPLICES

ERICO, INC.
34600 SOLON ROAD
SOLON, OHIO 44139

1.0 SUBJECT

Reinforcing Steel Couplers and Splices.

2.0 DESCRIPTION

2.1 LENTON Couplers:

2.1.1 General: The LENTON system, consisting of the LENTON couplers and rebar, is a tapered threaded splice designed for use in reinforced concrete construction. Devices are available in seven basic styles: Standard (A2), TRANSITION (A2), FORM SAVER (SA or FS), WELDED HALF COUPLER (C3J), INTERLOK (LK), POSITION (P9) and TERMINATOR (D6). LENTON couplers are designed to mechanically butt-splice No. 4 (13) through No. 18 (57) reinforcing steel (rebar) conforming to ASTM A 615 Grade 60 and ASTM A 706 specifications. LENTON Standard devices also are designed to mechanically butt-splice No. 9 (29) through No. 18 (57) rebars conforming to ASTM A 615, Grade 75. Rebar may be galvanized in accordance with ASTM A 767 or epoxy-coated in accordance with ASTM A 775 or ASTM A 934 when utilized with the LENTON Standard (A2), TRANSITION (A2), FORM SAVER (SA or FS), TERMINATOR (D6), WELDED HALF COUPLER (C3J), and POSITION (P). All styles have interior-tapered threads for joining the reinforcing bars.

The couplers are manufactured from steels listed in Figure 1.

The threads on the rebar are right-handed and tapered to match the accompanying coupler. Threading is done at locations approved by ERICO, Inc. Quality control checks are performed at the threading location using gages supplied by ERICO, Inc. The bar-end gage controls the end diameter, which automatically controls the thread length. The profile gage determines the correct profile and depth. Prior to quality control checks, all threads are visually inspected for cleanliness and damage. Damaged threads are removed by saw cutting, and the bar is then remachined using the LENTON bar threader. Prior to shipping from the rebar fabrication shop, the threads are protected to ensure damage-free bar ends at the jobsite.

2.1.2 Design: The LENTON systems comply as tension or compression splices for deformed reinforcing bars as specified in Section 1912.14.3.4 of the 1997 *Uniform Building Code*™ (UBC) and Section 21.2.6.1 of ACI 318-99 [ACI 318-99 is referenced in 2000 *International Building Code*® (IBC) Section 1901 and 2000 *International Residential Code*® (IRC) Section R612]. The splice devices also comply with the Type 1 and Type 2 mechanical splice requirements of Section 1921.2.6.1 of the UBC and Section 21.2.6.1 of ACI 318-99 (IBC and IRC). The Terminator is designed as anchorage in accordance with Section 1913 of the IBC.

2.1.3 Installation:

2.1.3.1 General: The LENTON couplers must be installed in accordance with the applicable code, this evaluation report, and the ERICO installation instructions. The splice locations must be detailed on the plans approved by the building official. All required distances, spacings and coverages described in Sections 1907.6 and 1907.7 and Table 7-A of the UBC or Sections 7.6 and 7.7 of ACI 318-99 and Table 719.11(1) of the IBC must be measured from the outside of the sleeves. When bars act in compression only, the connecting device may project $\frac{1}{2}$ inch (12.7 mm) into the required cover. However, in no case may the cover be less than $\frac{3}{4}$ inch (19.1 mm). As Type 2 splices, the couplers are permitted in any location within a member for all seismic zones or seismic design categories.

2.1.3.2 LENTON Standard Coupler (A2): The LENTON Standard coupler is used to join straight bars where at least one rebar end is free to rotate. For field installation of the Standard coupler, the thread protector is removed from the threaded bar end, which is inspected for cleanliness and damage. In some cases, the coupler is fastened to the bar at the fabrication facility, to protect the threads. A wire brush is used to remove rust and adhered concrete. The coupler is then screwed onto the threaded end of a bar to be spliced, and is tightened by hand. The second bar is inserted into the coupler and is rotated until hand-tight. A LENTON inspection wrench secures the connection to the required setting listed in Figure 2; a “click” in the handle can be felt, as well as heard, when the desired torque has been attained.

2.1.3.3 LENTON TRANSITION Couplers (A2): LENTON TRANSITION couplers are similar to the Standard coupler, except the coupler is designed to accommodate bars of different sizes. Installation procedures are the same as those for the LENTON Standard couplers described in Section 2.1.3.2. The connection is then tightened to the appropriate setting listed in Figure 2.

2.1.3.4 LENTON POSITION Couplers (P9): LENTON POSITION couplers are used to join curved or bent bars that must be held in a predetermined position during the joining process. The couplers can also be used where neither bar is free to rotate. All POSITION couplers are manufactured to allow only the coupler to rotate. Installation differs from that of all other LENTON couplers. Figure 5 shows installation procedures.

2.1.3.5 LENTON TERMINATOR (D6): LENTON TERMINATORS are embedment-style coupler devices used as an alternative to bent sections of reinforcing steel in reinforced concrete construction. The device is machined with a LENTON tapered thread. The bearing cross-sectional area is at least four times the nominal area of the reinforcement bars. Installation of the device to the rebar is done using a LENTON Inspection wrench. The connection is tightened to the appropriate setting listed in Figure 3.

2.1.3.6 LENTON FORM SAVER (SA or FS): The LENTON FORM SAVER SA or FS has a factory-installed mounting plate swaged to the LENTON coupler. Also, an internal thread protector is installed to protect the LENTON threads. The FORM SAVER FS style assemblies are produced by a friction forging process, whereby the reinforcing steel is attached to the one end of the coupler by forcing the components together while the coupler is revolving at a specific rate. The other end of FORM SAVER FS accepts rebar with LENTON tapered threads. The friction weld quality is verified by statistical sampling of assemblies. The FORM SAVER SA style couplers accept rebar with LENTON tapered threads at each end. To install the FORM SAVER (SA or FS) assembly, the mounting plate may be used to position the coupler against the form. Upon removal of the framework, the protectors are removed from both the rebar and the coupler. The threaded rebar is screwed into the exposed end of the FORM SAVER SA. The connection is then tightened to the appropriate setting listed in Figure 2.

2.1.3.7 Welded HALF COUPLER (C3J): A LENTON HALF COUPLER provides a mechanical means of connecting reinforcing rebars to structural steel plates and shapes. One end of the coupler is machined to have LENTON standard internal taper threads. The opposite side is prepared for welding. Refer to the current AWS D1.1 Welding Code for required welding procedures. The connection is then tightened to the appropriate setting listed in Figure 3.

2.1.3.8 LENTON INTERLOK (LK): The LENTON INTERLOK system is designed to splice No. 6 through No. 14 rebars. The sleeves are cast from ductile iron complying with ASTM A 536. The sleeves are straight cylinders with one end threaded to receive threaded rebar and the opposite end having internal annular ridges spaced approximately 1 inch (25.4 mm) on center. A typical splicing system is shown in Figure 4. The LENTON INTERLOK splicing system must be installed in accordance with the applicable code, the evaluation report, and the ERICO installation instructions. The system consists of a splice sleeve and ERICO HY10L grout, which is a non-shrink, cementitious mixture. The threaded end of the sleeve has LENTON tapered threads. The coupler is screwed onto the threaded end of a rebar, and is tightened by hand. A wrench is used to complete the LENTON threaded connection. The connection is then tightened to the appropriate setting listed in Figure 3.

The opposite end of the sleeve is open to receive the reinforcing steel of the adjoining precast structural member or projecting dowel from the foundation. The connection is subsequently completed by pouring or pumping HY10L grout into the interior of the sleeve. Batches of ERICO HY10L grout are mixed in accordance with the ERICO installation instructions. The grout is packaged in 50-pound (23 kg) bags.

Each 50-pound (23 kg) bag of dry grout is slowly blended with approximately 90 ounces (2.7 L) of potable water and thoroughly stirred with a mechanical mixer. The correct amount of water to be added to the grout is predetermined by field-testing the flow of trial batches of grout mixtures with a 2-inch-diameter (51 mm), 4-inch-tall (102 mm) cylinder and a LENTON INTERLOK flow template. The grout must flow to a diameter of no greater than 7 inches (178 mm) on the flow template. Grout mix cannot be retempered. The minimum compressive strength of 2-inch (51 mm) cubes of the grout at 28 days, when tested in accordance with ASTM C 109-02, must be 8,500 psi (58,600 kPa). Compression test specimens must be cured in accordance with ASTM C 109-02. Mixed ERICO HY10L grout can be poured or pumped into the sleeve. All spaces within the sleeve must be fully grouted.

2.2 Special Inspection:

Special inspection is required in accordance with UBC Section 1701 or IBC Section 1704, as applicable. The inspector's duties include sampling of grout compressive strength specimens, and verifying grade and size of reinforcement bars, coupler and sleeve identification, thread quality of bars, position of couplers and sleeves, installation of couplers and sleeves to bars, and welding of the WELDABLE HALF COUPLER.

2.3 Identification:

All devices are packaged with labels bearing the manufacturer's name (ERICO, Inc.) and address, model, size, and evaluation report number (ER-3967). Each LENTON coupler is permanently stamped with the catalog number, size, heat number, Type 2 designation, and the name "LENTON." A shipping tag is attached to each bundle, pallet or skid of each LENTON FORM SAVER shipment, and bears the manufacturer's name (ERICO, Inc.), the part number and the name of the inspection agency. Each LENTON INTERLOK sleeve is identified with the rebar size, part number, Type 2 designation, and manufacturer's name (ERICO, Inc.). Cartons of sleeves are labeled with the manufacturer's name (ERICO, Inc.) and address. Each bag of HY10L grout is imprinted with the manufacturer's name (ERICO, Inc.) and address, product designation, mixing instructions, and evaluation report number (ER-3967).

3.0 EVIDENCE SUBMITTED

Data in accordance with the Acceptance Criteria for Mechanical Connectors for Steel Bar Reinforcement (AC133), dated April 2002, and quality control documentation.

4.0 FINDINGS

That the Reinforcing Steel Couplers and Splices described in this report comply with the 1997 *Uniform Building Code*[™] (UBC), the 2000 *International Building Code*[®] (IBC) and the 2000 *International Residential Code*[®] (IRC), subject to the following conditions:

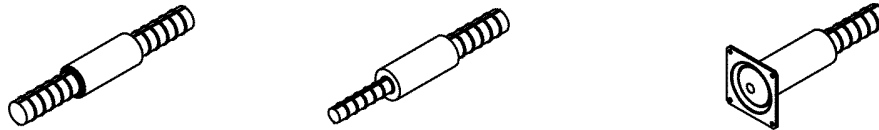
- 4.1 The couplers and splices are installed in accordance with the applicable code, the manufacturer's instructions and this report.**
- 4.2 Splice locations comply with the applicable code and are noted on the plans approved by the building official.**
- 4.3 Special inspection in accordance with Section 2.2 is required.**
- 4.4 The steel reinforcing bar of the FORM SAVER assemblies must be of sufficient length to permit splices of reinforcement in accordance with Section 1912 of the UBC or Section 12 of ACI 318-99.**

This report is subject to re-examination in two years.

FIGURE 1—COUPLERS APPROVED

APPROVED PRODUCTS					
Series	Part Number Suffix	Material Grade	Rebar	Rebar Sizes	TYPE I + 2
STANDARD	A2	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	4 through 18	Yes
			A 615 Grade 75	9 through 18	Yes
			A 706	5 through 18	Yes
TRANSITION	A2	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	4 through 18	Yes
			A 706	4 through 18	Yes
FORM SAVER	SA	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	4 through 11	Yes
			A 706	4 through 11	Yes
	FS	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	4 through 7	Yes
			A 706	4 through 7	Yes
TERMINATOR	D6	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	4 through 18	Yes
			A 706	4 through 18	Yes
WELDED-HALF	C3J	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	—	—
			A706	6 through 14	Yes
INTERLOK	LK	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	6 through 14	Yes
			A706	6 through 14	Yes
POSITION	P9	ASTM A 29 or ASTM A 576 and ASTM A 108	A 615 Grade 60	8 through 18	Yes
			A706	6 through 18	Yes

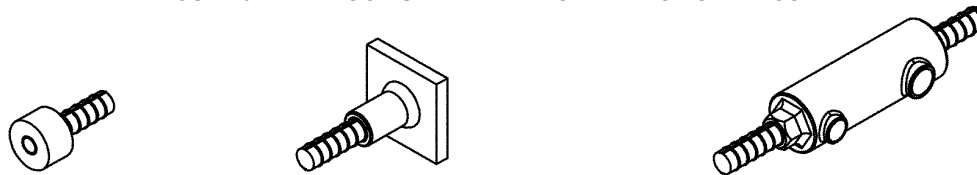
FIGURE 2—CATALOG NUMBER AND INSTALLATION SETTINGS



REBAR ¹ SIZE NO.	STANDARD A2		TRANSITION A2			FORM SAVER SA OR FS		
	Catalog Part No.	Wrench Setting	Catalog Part No.	Rebar Sizes Joined	Wrench Settings	Catalog Part No.		Wrench Setting
						SA Style	FS Style	
4 (13)	EL12A2	30	EL1612A2	4 to 5	30	EL12SA	FS4F	30
5 (16)	EL16A2	90	EL2016A2	5 to 6	90	EL16SA	FS5F	90
6 (19)	EL20A2	130	EL2220A2	6 to 7	130	EL20SA	FS6F	130
7 (22)	EL22A2	160	EL2522A2	7 to 8	160	EL22SA	FS7F	160
8 (25)	EL25A2	200	EL2825A2	8 to 9	200	EL25SA	—	200
9 (29)	EL28A2	200	EL3228A2	9 to 10	200	EL28SA	—	200
10 (32)	EL32A2	200	EL3632A2	10 to 11	200	EL32SA	—	200
11 (36)	EL36A2	200	EL43T36A2	11 to 14	200	EL36SA	—	200
14 (43)	EL43TA2	200	EL57T36A2	11 to 18	200	—	—	—
18 (57)	EL57TA2	200	EL57T43TA2	14 to 18	200	—	—	—

¹Size numbers in parentheses are approximate nominal diameter of bars in millimeters.

FIGURE 3—CATALOG NUMBER AND INSTALLATION SETTINGS



REBAR ¹ SIZE NO.	TERMINATOR D6		WELDED-HALF C3J		INTERLOK LK			
	Catalog Part No.	Wrench Setting	Catalog Part No.	Wrench Setting	Catalog Part No.	Wrench Setting	Max. Angle	Min. Depth
4 (13)	EL12D6	30	—	—	—	—	—	—
5 (16)	EL16D6	90	—	—	—	—	—	—
6 (19)	EL20D6	130	EL20C3J	130	LK6	130	9°	5 1/4
7 (22)	EL22D6	160	EL22C3J	160	LK7	160	9°	5 1/4
8 (25)	EL25D6	200	EL25C3J	200	LK8	200	8°	6
9 (29)	EL28D6	200	EL28C3J	200	LK9	200	7°	6 3/4
10 (32)	EL32D6	200	EL32C3J	200	LK10	200	6°	7 5/8
11 (36)	EL36E6	200	EL36C3J	200	LK11	200	6°	8 1/2
14 (43)	EL43TD6	200	EL43TC3J	200	LKT14	200	5°	11
18 (57)	EL57TD6	200	—	—	—	—	—	—

¹Size numbers in parentheses are approximate nominal diameter of bars in millimeters.

FIGURE 4—INTERLOK INSTALLATION VIEW

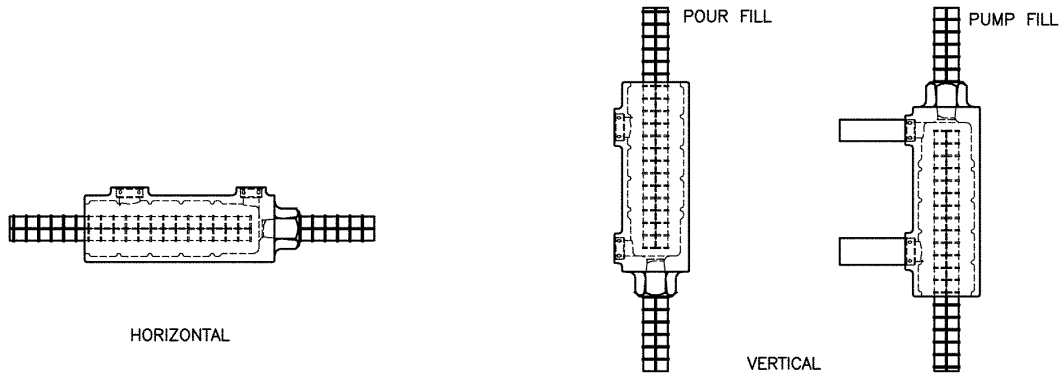
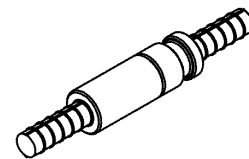


FIGURE 5—CATALOG NUMBER AND INSTALLATION SETTINGS

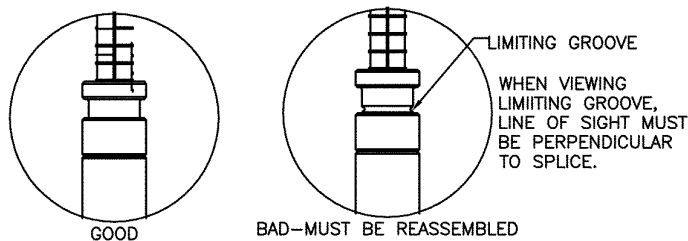
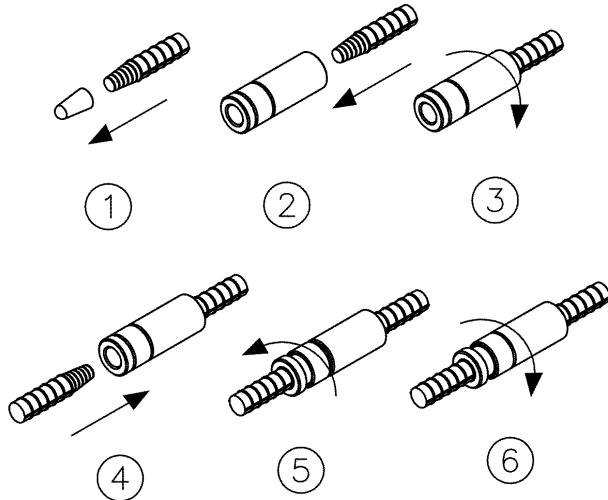
REBAR ¹ SIZE NO.	POSITION P9	
	Catalog Part No.	Wrench Setting
6 (19)	EL20P9	130
7 (22)	EL22P9	160
8 (25)	EL25P9	200
9 (29)	EL28P9	200
10 (32)	EL32P9	200
11 (36)	EL36P9	200
14 (43)	EL43TP9	200
18 (57)	EL57TP9	200

¹Size numbers in parentheses are approximate nominal diameter of bars in millimeters.



POSITION P9 COUPLERS
Installation Instructions

- Step 1 - Remove bar end protector (if present). Visually inspect threaded end, making sure threads are undamaged and free of concrete, rust and other contaminants. Use of a wire brush may be required.
- Step 2 - Check part number on coupler to verify it is the correct size for the bars being spliced (see chart). Insert the coupler onto the bar, and rotate it clockwise until hand-tight. (approximately 4 to 4 1/2 turns).
- Step 3 - Using a standard pipe wrench, securely tighten the coupler to the matching tapered threaded rebar.
- Step 4 - Refer to Step 1 for bar cleanliness. Insert second bar into the coupler.
- Step 5 - While holding the "upper bar," using a standard pipe wrench, rotate the connector end of the coupler in a counter-clockwise direction to tighten the assembly.
- Step 6 - Using a standard pipe wrench, tighten the jam nut against the body.
- Step 7 - Verify that the limiting groove is not visible.



NOTE: LIMITING GROOVE MUST NOT BE VISIBLE AFTER CONNECTOR END HAS BEEN TIGHTENED.