

ICC-ES Evaluation Report

ESR-2146

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This report is subject to renewal in one year.

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DIVISION: 03 00 00—CONCRETE
Section: 03 21 00—Reinforcing Steel
REPORT HOLDER:
ERICO INTERNATIONAL CORPORATION
34600 SOLON ROAD
SOLON, OHIO 44139
EVALUATION SUBJECT:
LENTON® STEEL FORTRESS SHEAR REINFORCEMENT
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2009 International Building Code® (2009 IBC)
- 2006 *International Building Code*® (2006 IBC)
- 1997 *Uniform Building Code*™ (UBC)

Property evaluated:

Structural

2.0 USES

The LENTON STEEL FORTRESS is a shear reinforcement system used as an alternative to the multiple-leg stirrups and shearstuds described in Section 11.4 of ACI 318-08 or Section 11.5 of ACI 318-05 (as referenced in Chapter 19 of the IBC) and Section 1911.5.1 of the UBC as shear reinforcement for slabs.

3.0 DESCRIPTION

The LENTON STEEL FORTRESS consists of continuous punched steel strips that are prebent in the manufacturer's plant into a shaped profile as shown in Figure 1, to fit over the top of flexural reinforcement bars in concrete slabs. The LENTON STEEL FORTRESS is manufactured from steel complying with the requirements of ASTM A 505. In addition, the LENTON STEEL FORTRESS material has the following mechanical properties:

Minimum yield strength: 72,500 psi (500 MPa)

Minimum elongation after fracture: 11 percent [over a 2-inch (51 mm) gage length]

The LENTON STEEL FORTRESS is available in the standard sizes indicated in Table 1.

The LENTON STEEL FORTRESS horizontal strip elements have 0.197-inch-diameter (5.0 mm) holes punched along the center of their widths at 0.984 inch (25 mm) on center, to provide for anchorage in concrete. The vertical elements have a curved deformation.

4.0 DESIGN AND INSTALLATION
4.1 DESIGN:

4.1.1 General: General requirements for shear resistance design are presented in Chapter 11 of ACI 318 (IBC) or Section 1911 of the UBC, as applicable. Since the LENTON STEEL FORTRESS is intended to reinforce concrete slabs, special provisions in Section 11.11 of ACI 318-08 or Section 11.12 of ACI 318-05 (IBC) or Section 1911.12 of the UBC, as applicable, must be observed.

4.1.2 Design Considerations: Specific requirements must be as follows, using notations in Chapter 11 of ACI 318 (IBC) or Section 1911 of the UBC, as applicable:

1. Minimum shear span (l_n/d) is 2.
2. For shear spans (l_n/d) exceeding 4, Section 11.2 of ACI 318-08 or Section 11.3 of ACI 318-05 (IBC) or Equations 11-3 or 11-5 in Section 1911.3 of the UBC, and Equation 11-15 in Section 11.4 of ACI 318-08 or Section 11.5 of ACI 318-05 (IBC) or Equation 11-15-1 in Section 1911.5 of the UBC, apply.
3. For shear spans (l_n/d) from 2 to 4, Section 11.7 of ACI 318-08 or Section 11.8 of ACI 318-05 (IBC) or Equations 11-27, 11-28 and 11-29 in Section 1911.8 of the UBC apply.
4. The LENTON STEEL FORTRESS strip net area, described in Table 1, is used to compute effective shear reinforcement, A_v .
5. The LENTON STEEL FORTRESS strip yield strength used for structural design, f_y , is a maximum of 60,000 psi (414 MPa).
6. The concrete compressive strength, f'_c , used for structural design is 3,000 to 5,000 psi (20.7 to 34.5 Mpa).
7. For use of LENTON STEEL FORTRESS in two-way slabs without beams in seismic design category C, D, E or F under the IBC, slab shear reinforcement must comply with Section 21.13.6 of ACI 318-08 or Section 21.11.5 of ACI 318-05.

4.2 Installation:

Installation must comply with ACI 318, as referenced in Chapter 19 of the IBC or Chapter 19 of the UBC, and the plans approved by the code official. A copy of the plans and this report must be available at the jobsite at all times during installation. The LENTON® STEEL FORTRESS is preformed to suit the main flexural reinforcement arrangement, particularly the top reinforcement layer spacing. The vertical legs of the LENTON STEEL FORTRESS must be spaced in accordance with the

structural design and the requirements in the applicable code. The LENTON STEEL FORTRESS must be adequately secured into position with tie wire attaching the horizontal legs of the LENTON STEEL FORTRESS to the top supporting reinforcing bar layer. The minimum concrete cover must be as specified in Section 1907.7 of the IBC or Section 1907.7 of the UBC, but not less than ³/₄ inch (19.1 mm). A typical arrangement of the LENTON STEEL FORTRESS is illustrated in Figure 2. Strip lengths may be cut, spliced and lapped.

4.3 Special Inspection:

Continuous special inspection must be provided in accordance with Section 1704.4 and Table 1704.4 of the IBC, or Section 1701.5.1 of the UBC.

A statement of special inspections must be prepared by the registered design professional in charge and submitted to the code official as set forth in IBC Section 1705. The statement must include the inspector’s verification of the identification of the LENTON STEEL FORTRESS and its condition, positioning, clearances, and concrete cover.

5.0 CONDITIONS OF USE

The LENTON STEEL FORTRESS Shear Reinforcement described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The LENTON STEEL FORTRESS is designed and installed as shear reinforcement in accordance with

the IBC or UBC, this report, and the manufacturer’s instructions. In the event of conflict between the manufacturer’s published installation instructions and this report, the most restrictive governs.

5.2 Special inspection is provided in accordance with Section 4.3 of this report.

5.3 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code official for approval. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 Use of the LENTON STEEL FORTRESS in slabs designated as part of a lateral-force-resisting system is beyond the scope of this report.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Shear Reinforcement Systems (AC170), dated August 2010.

7.0 IDENTIFICATION

LENTON STEEL FORTRESS units are identified on packaging with a location code keyed to project plans, part name, part number, dimensions, manufacturer’s name (ERICO International Corporation) and address, and the evaluation report number (ESR-2146).

TABLE 1—STANDARD SIZES OF THE LENTON STEEL FORTRESS

THICKNESS (inch)	WIDTH (inch)	LEG DEPTHS (inches) ¹	LEG SPACING (inches)	NET AREA (square inch)
0.031	0.984	4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5	2.0, 2.25, 2.5, 2.75, 3.0, 3.25, 3.75, 4.0, 4.25, 4.5, 4.75, 5.0, 5.25, 5.5, 5.75, 6.0	0.024
0.047	0.984	4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5	2.0, 2.25, 2.5, 2.75, 3.0, 3.25, 3.75, 4.0, 4.25, 4.5, 4.75, 5.0, 5.25, 5.5, 5.75, 6.0	0.037
0.063	0.984	4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5	2.0, 2.25, 2.5, 2.75, 3.0, 3.25, 3.75, 4.0, 4.25, 4.5, 4.75, 5.0, 5.25, 5.5, 5.75, 6.0	0.050

For **SI**: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

¹Tail anchor length is one half leg depth.

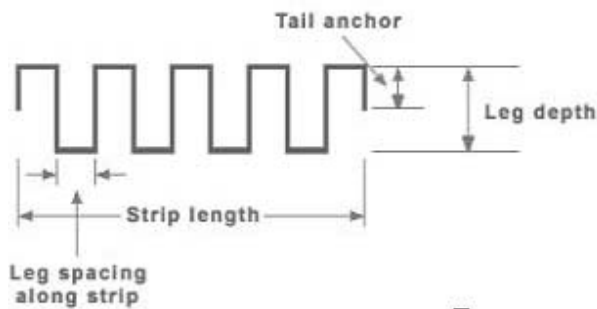


FIGURE 1

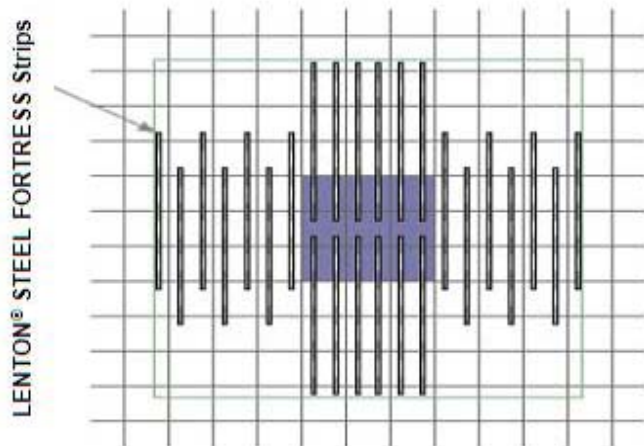


FIGURE 2