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ESR-1163

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Reissued 12/2017
This report is subject to renewal 12/2018.

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

REPORT HOLDER:

SAS STRESSTEEL INC.

100 NEW DUTCH LANE
FAIRFIELD, NEW JERSEY 07004

EVALUATION SUBJECT:

**SAS STRESSTEEL GRADE 97 THREAD BAR STEEL REINFORCING BARS AND
MECHANICAL SPLICE SYSTEMS**

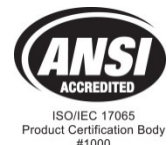


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DIVISION: 03 00 00—CONCRETE
Section: 03 21 00—Reinforcing Steel

REPORT HOLDER:

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EVALUATION SUBJECT:

**SAS STRESSTEEL GRADE 97 THREAD BAR STEEL
REINFORCING BARS AND MECHANICAL SPLICE
SYSTEMS**

1.0 EVALUATION SCOPE

Compliance with the following code:

- 2015[†], 2012 and 2009 *International Building Code*® (IBC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)^{††}

[†]The evaluation report references the appropriate sections of ACI 318 under the 2015 IBC. For applicable sections under other codes, see Table 3.

^{††}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 SAS Stressteel Grade 97 Thread Bars are deformed steel reinforcing bars used as reinforcement in concrete structural members, such as foundations, columns and walls. The bars are an alternative to deformed reinforcement complying with ACI 318. The SAS Stressteel mechanical splice systems are used as tension and compression mechanical splices of the Grade 97 Thread Bar reinforcing bars. Refer to Figure 1 for a typical installed assembly.

3.0 DESCRIPTION

3.1 SAS Stressteel Grade 97 Thread Bars:

SAS Stressteel Grade 97 Thread Bars are steel reinforcing bars with continuous protrusions in a threaded orientation to permit connections with the SAS Stressteel mechanical splice systems. The right-hand oriented protrusions also

permit bar interlock with cast concrete. Available bar sizes and properties are provided in Table 1 of this report. Galvanizing, epoxy coatings, or other coatings are not permitted within the scope of application in this report.

3.2 SAS Stressteel TR 3003 Mechanical Splice Systems:

The SAS Stressteel mechanical splice systems are used as mechanical splices for the SAS Stressteel Grade 97 Thread Bars. The mechanical splice systems are formed from carbon steel and comply with the descriptions and product material specifications in the approved quality documentation. Produced in a hollow cylindrical configuration, the mechanical splice systems receive bars at each end through internal threads in a pattern matching the bars. As an option, each mechanical splice system may have two set screws, one near each end. Mechanical splice system dimensions and available bar sizes are described in Table 1 of this report. The mechanical splice systems comply as Type 1 mechanical splices in accordance with ACI 318.

4.0 DESIGN AND INSTALLATION

4.1 Design: SAS Stressteel Grade 97 Thread Bars:

The bars must be designed as reinforcement for normal-weight concrete in accordance with ACI 318, as amended in Chapter 19 of the IBC, using Table 1. The specified yield strength for design, f_y , used with ACI 318 calculations is 97,000 psi (670 MPa) in lieu of the limits set forth in ACI 318. The following limitations also apply:

1. The high-strength reinforcing bars and mechanical splice systems are limited for use as (a) longitudinal reinforcement for resisting flexure, axial force, and for shrinkage and temperature, in reinforced concrete structures that are not special seismic systems; (b) lateral support of longitudinal bars or for concrete confinement in reinforced concrete structures that are not special seismic systems; (c) shear reinforcement including shear friction in reinforced concrete structures that are not special seismic systems; and (d) torsional reinforcement including longitudinal and transverse reinforcement.
2. The high-strength reinforcing bars and mechanical splice systems shall not be used in beams or slabs.
3. The high-strength reinforcing bars and mechanical splice systems must be used in structures assigned to Seismic Design Category A or B only.

4. Welding of the high-strength reinforcing bars and mechanical splice systems is prohibited.
5. The bending of the high-strength reinforcing bars is limited to No's. 6, 7, 8, 9, 10, 11, and 14 only. Bending procedures must comply with ACI 318.
6. The specified concrete compressive strength must range from 6,000 psi (41.3 MPa) to 12,000 psi (82.7 MPa).
7. For the purpose of providing lateral support of longitudinal steel reinforcing bars and for providing concrete confinement, the yield strength of high-strength steel bars used for design calculations must not exceed 97,000 psi (669 MPa) for spirals, and 80,000 psi (551 MPa) for non-spiral reinforcing bars (or lateral ties) in accordance with Section 20.2.2.4 and Table 20.2.2.4a of ACI 318.
8. For the purpose of providing shear and torsional resistance, the yield strength of high-strength steel bars used for design calculations shall not exceed 60,000 psi (413 MPa) in accordance with Section 20.2.2.4 and Table 20.2.2.4a of ACI 318.

4.2 Installation:

4.2.1 SAS Stressteel Grade 97 Thread Bars: The bars and mechanical splice systems must be located in the structure as set forth in the approved plans and specifications. Reinforcement details, including surface conditions, bar placement, clear spacing, offsets, spirals and ties, must comply with the applicable provisions in ACI 318. Bar development and mechanical splice systems must comply with ACI 318, except as modified by Section 4.2.2 of this report.

4.2.2 SAS Stressteel Mechanical Splice Systems: The thread bar ends must be machined flat to within 1.5 degrees of a right angle to the axis of the bars. Each bar end must be marked one-half the mechanical splice system length plus $\frac{1}{2}$ inch (12.7 mm) from the ends. The mechanical splice system must be threaded onto the end of one reinforcing bar. The second bar must be positioned to full end bearing with the first bar, and the mechanical splice system is reverse-threaded until the marks on each bar are exposed. The resulting splice must be tightened with a calibrated torque wrench applied to the second reinforcing bar until the torque in Table 2 of this report is attained. After torquing, the optional screws in the mechanical splice system, when provided, must be set.

4.3 Special Inspection:

Special inspection is required in accordance with Section 1705 of the 2015 IBC and 2012 IBC (Section 1704 of the 2009 IBC). The special inspector must, at a minimum, verify the following:

1. The high-strength steel reinforcing bars are of the type, grade and size specified, and are labeled in accordance with this report.
2. The mechanical splice system identification is in accordance with this report.
3. The installation of high-strength steel reinforcing bars and mechanical splice systems, including field

preparation and assembly of components, field preparation of reinforcing bar ends, bar surface conditions, bending, locations, spacing, protection (cover), embedment, and installation torque, complies with the IBC, ACI 318, approved construction documents and this report.

5.0 CONDITIONS OF USE

The SAS Stressteel Grade 97 Thread Bars and Mechanical Splice Systems described in this report comply with, or are suitable alternatives to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1 The bars and mechanical splice systems must be installed in accordance with the applicable code, the manufacturer's instructions and this report. In case of conflict between the manufacturer's published instructions and this report, the most restrictive governs.
- 5.2 Mechanical splice system locations must comply with applicable code requirements and be noted on plans approved by the code official.
- 5.3 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the building official. 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 For mechanical splice systems, minimum concrete cover must be in accordance with the IBC, and must be measured to the outer surface of the coupler.
- 5.5 The SAS Stressteel Grade 97 Thread Bar Steel Reinforcing Bars and Mechanical Splice Systems are manufactured under a quality control program with inspections by ICC-ES

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Nonprestressed Deformed High-strength Steel Bars for Concrete Reinforcement (AC237), dated February 2017.
- 6.2 Data in accordance with the ICC-ES Acceptance Criteria for Mechanical Splice Systems for Steel Reinforcing Bars (AC133), dated October 2015.

7.0 IDENTIFICATION

Each bar is identified by the thread pattern and the mark "SAS 670." The bar bundles are identified by tags bearing the manufacturer's name (Stahlwerk Annahuetten), the report holder's name (SAS Stressteel, Inc.), the grade, the number of bars in the bundle, the nominal bar diameter, bar length, heat number and the evaluation report number (ESR-1163). The mechanical splice systems are identified by imprinted identification codes shown as "SAS TR XXXX-YY ZZZ" with the product name, report holder's name (SAS Stressteel, Inc.), and the evaluation report number (ESR-1163) on packaging.

TABLE 1—SAS STRESSTEEL GRADE 97 THREAD BAR DIMENSIONS AND PROPERTIES

BAR NUMBER	NOMINAL DIAMETER (in)	SPECIFIED YIELD STRENGTH (psi) ¹	SPECIFIED TENSILE STRENGTH (psi)	CROSS SECTIONAL AREA (in ²)	MINIMUM ELONGATION (percent) ²	WEIGHT (lb/ft)
6	3/4	97,000	116,000	0.39	7	1.34
7	7/8	97,000	116,000	0.59	7	2.00
8	1	97,000	116,000	0.76	7	2.59
9	1 1/8	97,000	116,000	0.95	6	3.25
10	1 1/4	97,000	116,000	1.10	6	3.73
11	1 3/8	97,000	116,000	1.49	6	5.07
14	1 3/4	97,000	116,000	2.25	6	7.66
18	2 1/4	97,000	116,000	4.03	6	13.7
20	2 1/2	97,000	116,000	4.91	6	16.7

For SI: 1 inch = 25.4 mm, 1 psi = 0.006894757 MPa, 1 lb/ft = 14.6 N/m.

¹The specified yield strength may be used for tension or compression reinforcement and is taken as the stress corresponding to a strain of 0.35 percent.

²Elongation measured along an 8-inch length.

TABLE 2—SAS STRESSTEEL GRADE 97 TR 3003 MECHANICAL SPLICE SYSTEM DIMENSIONS AND TORQUE REQUIREMENTS

BAR NUMBER SIZE	OUTSIDE DIAMETER (in)	LENGTH (in)	TORQUE (ft-lb)
7	1.57	3.94	120
8	1.77	4.72	140
9	1.97	5.51	160
10	2.17	5.91	180
11	2.36	6.69	200
14	3.15	7.87	230
18	4.02	9.84	260
20	4.25	10.24	300

For SI: 1 inch = 25.4 mm, 1 ft-lb = 1.356 N-m.

TABLE 3—APPLICABLE SECTIONS OF ACI 318 UNDER EACH EDITION OF THE IBC

ACI 318-14 (2015 IBC)	ACI 318-11 (2012 IBC)	ACI 318-08 (2009 IBC)
20.2.1.1 – 20.2.1.3	3.5.3.2	3.5.3.2
20.2.2.4 and Table 20.2.2.4a	9.4	9.4
	11.4.2	11.4.2
	11.5.3.4	11.5.3.4
	11.6.6	11.6.6
20.6	7.7	7.7
25.4.2	12.2	12.2
25.5.7	12.14.3	12.14.3
	12.15.4	12.15.4
	12.15.6	12.15.6
	12.16.3	12.16.3

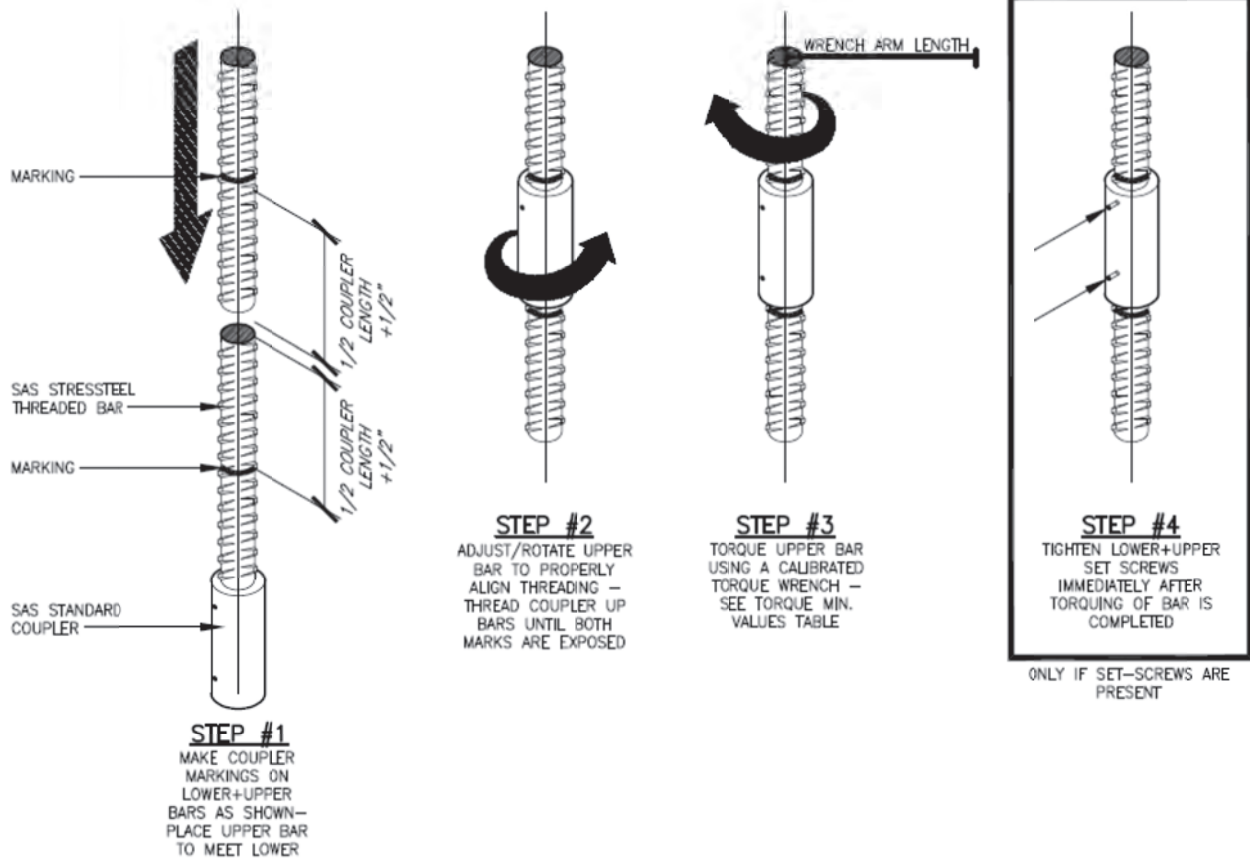


FIGURE 1—ASSEMBLED SAS STRESSTEEL GRADE 97 THREAD BAR AND MECHANICAL SPLICE SYSTEM