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ESR-3367

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Issued 06/2016

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

REPORT HOLDER:

DYWIDAG-SYSTEMS INTERNATIONAL U.S.A., INC. (DSI)

320 MARMON DRIVE
BOLINGBROOK, ILLINOIS 60440

EVALUATION SUBJECT:

DYWIDAG GRADE 100 THREADBARS® AND COUPLERS



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ICC-ES Evaluation Report**ESR-3367**

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DIVISION: 03 00 00—CONCRETE
Section: 03 21 00—Reinforcing Steel**REPORT HOLDER:****DYWIDAG-SYSTEMS INTERNATIONAL U.S.A., INC. (DSI)**
320 MARMON DRIVE
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(630) 739-1100
dsiamerica@dsiamerica.com
www.dsiamerica.com**EVALUATION SUBJECT:****DYWIDAG GRADE 100 THREADBARS® AND COUPLERS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- 2015, 2012 and 2009 *International Building Code*® (IBC)

Property evaluated:

Structural

2.0 USES

The DYWIDAG Grade 100 Threadbars® are deformed steel reinforcing bars used as longitudinal and transverse reinforcement in reinforced normalweight concrete structural members, such as foundations, columns and walls. The bars are an alternative to deformed reinforcement complying with ACI 318-14 Sections 20.2.1.1 through 20.2.1.3 under the 2015 IBC (ACI 318-11 and -08 Section 3.5.3.2 under the 2012 and 2009 IBC, respectively; ACI 318 is referenced in IBC Section 1901.2). The DYWIDAG Grade 100 couplers are used as tension and compression mechanical splices of the DYWIDAG Grade 100 Threadbars®. The splices comply with ACI 318-14 Section 25.5.7.1 under the 2015 IBC (ACI 318-11 and -08 Section 12.14.3.2 under the 2012 and 2009 IBC, respectively). Refer to Figure 1 for a typical installed assembly.

3.0 DESCRIPTION**3.1 DYWIDAG Grade 100 Threadbars®:**

DYWIDAG Grade 100 Threadbars® are high strength steel reinforcing bars with continuous, uniform, rolled-in pattern of thread-like deformations along the entire length to permit connections with the DYWIDAG Grade 100 couplers. 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 applications permitted in this report. See footnote 1 of Table 1 of this report for yield strength determination.

3.2 DYWIDAG Grade 100 Couplers:

The DYWIDAG Grade 100 Couplers are formed from carbon steel and comply with the product specifications in the approved quality documentation. The couplers are produced in a hollow cylindrical configuration to receive bars at each end through internal threads with a pattern matching the steel reinforcing bars. As an option, each coupler may have up to two set screws, one near each end. The set screws are for securing the coupler to the bar during prefabrication and/or erection. Coupler dimensions and corresponding bar sizes are described in Table 2 of this report. Each coupler and the two mechanically spliced DYWIDAG Grade 100 Threadbars® form a mechanical splice system, which complies with the performance requirements in ACI 318-14 Sections 25.5.7.1 and 18.2.7.1 for Type 1 and Type 2 mechanical splices, respectively, under the 2015 IBC (ACI 318-11 Sections 12.14.3.2 and 21.1.6.1 for Type 1 and Type 2 mechanical splices, respectively, under the 2012 IBC; ACI 318-08 Sections 12.14.3.2 and 21.1.6.1 for Type 1 and Type 2 mechanical splices, respectively, under the 2009 IBC); except that use of the coupler to splice Grade 100 bars under ACI 318-14 Section 18.2.7.1 for the 2015 IBC (under ACI 318-11 and -08 Section 21.1.6.1 for the 2012 and 2009 IBC, respectively) is outside the scope of this evaluation report, since ACI 318-14 Section 20.2.2.5 under the 2015 IBC (ACI 318-11 and -08 Section 21.1.5.2 under the 2012 and 2009 IBC) specifies a maximum steel grade of 60 for reinforcing bars used for high seismic applications.

4.0 DESIGN AND INSTALLATION**4.1 Design: DYWIDAG Grade 100 Threadbars® and Couplers:**

The DYWIDAG Grade 100 Threadbars®, installed with mechanical splices constructed from DYWIDAG Grade 100 couplers, as applicable, are recognized as longitudinal and transverse reinforcement in reinforced concrete structures that are designed and constructed in accordance with IBC and ACI 318, subjected to the following limitations:

1. The high-strength steel reinforcing bars and couplers 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 steel reinforcing bars and couplers must not be used in beams or slabs.
3. The high-strength steel reinforcing bars and couplers must not be used in structures assigned to Seismic Design Category C, D, E, or F. The bars must be used only in structures assigned to Seismic Design Category A or B.
4. Welding of the bars and couplers is prohibited.
5. The bending of the bars is limited to No. 11 bars only, and No. 20 bars must not be bent. Bending procedures must comply with ACI 318-14 Sections 25.3 and 26.6.3 under the 2015 IBC (ACI 318-11 and -08 Sections 7.1 through 7.3, under the 2012 and 2009 IBC, respectively).
6. The specified concrete compressive strength must range from 6,000 psi (41.3 MPa) to 12,000 psi (82.7 MPa).
7. The high strength steel reinforcing bars must be uncoated, installed in normalweight concrete.
8. 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 100,000 psi (689 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 318-14 under the 2015 IBC (Section 9.4 of ACI 318-11 and -08 under the 2012 and 2009 IBC, respectively).
9. 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 318-14 under the 2015 IBC (Sections 11.4.2, 11.5.3.4 and 11.6.6 of ACI 318-11 and -08, under the 2012 and 2009 IBC, respectively).
10. The splice locations must comply with applicable code requirements and must be detailed in the approved construction documents.
11. All required clearance and concrete protection (cover) described in applicable code provisions must be measured from the outside of the couplers.

4.2 Installation:

4.2.1 General: The steel reinforcing bars and its splice system must be located in the structure as set forth in the approved construction documents. Reinforcement details, such as surface conditions, bar placement, clear spacing, offsets, spirals and ties, must comply with the applicable provisions in IBC and ACI 318. Bar development length and mechanical splices must comply with IBC and ACI 318, except as modified by Section 4.2.2 of this report.

4.2.2 DYWIDAG Grade 100 Couplers: The Threadbar[®] ends must be cut to square within 1.5 degrees of a right angle to the axis of the bars. If the coupler comes with optional set screws, make sure that they are elevated and will not interfere with installation of the bars. The overall length of the coupler is measured. Each of the bar ends, which are to be spliced to the coupler, is marked with an

engagement mark that is located from the bar end with a distance of one-half of the coupler total length. The coupler must be first screwed onto the first bar, and the second bar must be screwed to engage full bearing with the first bar. The coupler is reverse-screwed until the engagement marks on both bars are exposed. The two bar ends must be tightened until the torque in Table 2 of this report is attained. After torquing, the optional set screws in the coupler, when provided, must be set, and movement or rotation of the bar is prohibited.

4.3 Special Inspection:

Special inspection is required in accordance with 2015 and 2012 IBC Section 1705 (2009 IBC Section 1704). 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 installation of high strength steel reinforcing bars and couplers, such as bar surface conditions, bending, locations, spacing, protection (cover), embedment, and installation torque, complies with IBC, ACI 318, approved construction documents and this report.
3. The coupler identification is in accordance with this report.

5.0 CONDITIONS OF USE

The DYWIDAG Grade 100 Threadbars[®] and Couplers 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 bars and couplers 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 requirement governs.
- 5.2 Limitations in Section 4.1 of this report must be observed.
- 5.3 Limitations in Section 3.2 of this report regarding DYWIDAG Grade 100 bars and couplers in high seismic applications must be satisfied.
- 5.4 Prior to installation, calculations and details demonstrating compliance with this report must be submitted to the code 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.
- 5.5 Special inspection must be provided in accordance with Section 4.3 of this report.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Threaded High-strength Steel Bars for Concrete Reinforcement (AC237), dated February 2015, including an analytical assessment in accordance with Annex A of AC237.
- 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 a set of marks rolled onto the surface of one side of the bar to denoting the following:

“GG” – Gerdau mill designation, “U” – St. Paul manufacturing location, a two digit number to signify bar size such as “20” for No. 20 bar, “S” – ASTM A615 steel type, and “100” – for minimum yield strength designation. Each bar bundle is identified with two metal or reinforced fabric tags, with each tag includes the point of origin, batch or heat number, the report holder’s name (DYWIDAG-System International U.S.A., Inc.), the ICC-ES evaluation report (ESR-3367), grade, size, order number and length of Threadbars®. Each coupler is identified with a stamped

“D” to indicate DYWIDAG, and “2” to indicate the coupler is for Type 2 splice connection. Each carton of couplers is identified with a label that includes heat number, “BxxH70751” with “xx” signifying bar size, “100” – for corresponding reinforcing bar grade designation, and ICC-ES evaluation report number (ESR-3367).

TABLE 1—DYWIDAG GRADE 100 THREADBAR® DIMENSIONS AND PROPERTIES

BAR NUMBER	NOMINAL DIAMETER (in)	MINIMUM SPECIFIED YIELD STRENGTH (psi) ¹	MINIMUM SPECIFIED TENSILE STRENGTH (psi)	CROSS SECTIONAL AREA (in ²)	MINIMUM ELONGATION (percent) ²	WEIGHT (lb/ft)
11	1 ³ / ₈	100,000	120,000	1.56	6	5.31
20	2 ¹ / ₂	100,000	120,000	4.91	6	16.70

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

¹Minimum specified yield strength is determined by the offset method, using an offset of 0.2 percent in accordance with ASTM A370 as prescribed in Section 20.2.1.2(a) of ACI 318-14.

²Elongation is measured along an 8-inch length.

TABLE 2—DYWIDAG GRADE 100 COUPLER DIMENSIONS AND TORQUE REQUIREMENTS

BAR NUMBER SIZE	INSIDE DIAMETER (in)	OUTSIDE DIAMETER (in)	LENGTH (in)	TORQUE (ft-lb)
11	1.436	2.375	8.00	200
20	2.511	4.000	12.25	300

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

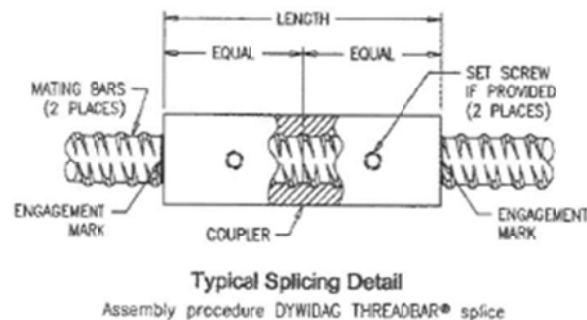


FIGURE 1—ASSEMBLED DYWIDAG GRADE 100 THREADBAR® AND COUPLER