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**HRC® 555 SERIES AND HRC® 670 SERIES
 T-HEAD (HEADLOCK™) HEADED ENDS
 OF CONCRETE REINFORCEMENT**

CSI DIVISION:

03 CONCRETE

CSI Section:

03210 Reinforcing Steel

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes:

- 2018, 2015 and 2012 International Building Code® (IBC)
- 2018, 2015 and 2012 International Residential Code® (IRC)

1.2 Evaluated in accordance with:

- IAPMO ES EC 006

1.3 Properties assessed:

- Structural

2.0 PRODUCT USE

The HRC® 555 Series headed reinforcing bars are Class HA headed deformed steel reinforcing bars for concrete reinforcement. The HRC® 670 HeadLock™ is an attachable head for deformed steel reinforcing bars for concrete reinforcement. Both products comply with Section 25.4.4 and 25.4.5 of ACI 318-14 and Section 12.6 of ACI 318-11 with Class HA heads for use in developing headed and anchored deformed bars in tension in normal-weight concrete as an alternative to standard hooks or development lengths of straight deformed reinforcing bars.

3.0 PRODUCT DESCRIPTION

3.1 Product information:

3.1.1 HRC® 555: The HRC® 555 Series are Class HA headed deformed bars complying with the requirements of ASTM A970. HRC® 555 Series are integrally factory-forged where the heads are produced by deforming the bar end(s) in a hot forging process. The headed reinforcing steel bars are available in No. 4 (13 mm) through No. 11

(35 mm) sizes. The net head bearing area, A_{brg} , of the HRC® 555 headed devices exceed four times the nominal cross-sectional area, A_b , of the reinforcing bar, in conformance with the Class HA Head requirements in Annex A1 of ASTM A970. The HRC® 555 Series is recognized for use with the material, grade, and reinforcing bar sizes listed in Table 1 of this report. The dimensions of the HRC® 555 headed reinforcing bars are shown in Table 2 and Figure 1 of this report.

3.1.2 HRC® 670: The HRC® 670 HeadLock™ Series are Class HA heads complying with the requirements of ASTM A970 Annex 1A. The HRC® 670 HeadLock™ Series. The HRC® 670 HeadLock™ Series are field installed T-Heads used mainly for retrofits and field repairs. The HRC® 670 HeadLock™ Series, when connected to the specified reinforcing bars, comply as Class HA in accordance with ASTM A970. HRC® 670 uses a wedged grip system with a spring and tension bolt that is installed on the end of a torch cut, sheared, or saw cut reinforcing bar. The product is available in sizes for use with No. 5 (16 mm) through No. 18 (57 mm) reinforcing bar.

The net head bearing area, A_{brg} , of the HRC® 670 HeadLock® devices exceed four times the nominal cross-sectional area, A_b , of the reinforcing bar. The HRC® 670 HeadLock® Series is recognized for use with the material, grade, and reinforcing bar sizes listed in Table 1 of this report. The dimensions of the HRC® 670 HeadLock™ headed reinforcing bars are shown in Table 3 and Figure 2 of this report.

3.2. Material information: HRC® 555 headed ends are manufactured from ASTM A615 or ASTM A706 steel reinforcing bars. HRC® 670 HeadLock™ T-Heads are manufactured from AISI 1141 and AISI 8620 steel and include a steel spring and a rubber O-ring.

4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 Development Length: Development lengths shall be determined in accordance with Section 25.4.4 of ACI 318-14 or Section 12.6 of ACI 318-11 for bar sizes No. 4 through No. 11, ASTM A615 and A706 Grade 60 only.

The development length, ℓ_{dt} , in inches, (including modification factors) shall not be less than the larger of $8d_b$ or 6-inches. The development lengths, in inches, of Class HA headed deformed bars for uncoated ASTM A706 and A615 Grade 60 reinforcing bar are as follows:

The product described in this Uniform Evaluation Service (UES) Report has been evaluated as an alternative material, design or method of construction in order to satisfy and comply with the intent of the provision of the code, as noted in this report, and for at least equivalence to that prescribed in the code in quality, strength, effectiveness, fire resistance, durability and safety, as applicable, in accordance with IBC Section 104.11. This document shall only be reproduced in its entirety.





Bar Size No.	f'c (normal-weight concrete), psi		
	4,000	5,000	6,000
4	7.6	6.8	6.2
5	9.5	8.5	7.7
6	11.4	10.2	9.3
7	13.3	11.9	10.8
8	15.2	13.6	12.4
9	17.1	15.3	14.0
10	19.3	17.2	15.7
11	21.4	19.1	17.5

The concrete cover for the reinforcement shall be at least $2d_b$, and the clear spacing between bars shall be at least $4d_b$, in accordance with Section 25.4.4.1 of ACI 318-14 or Section 12.6 of ACI 318-11.

The use of No. 14, No. 18, Grade 75, and Grade 80 bars for development length is outside the scope of this report. The anchorage of No. 14, No. 18, Grade 75 and Grade 80 bars shall be designed in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, or otherwise to the satisfaction of the registered design professional and approved by the building official.

The development length, l_{d_s} , shall be measured from the critical section as shown in Figure R25.4.4.2a of ACI 318-14 or Figure R12.6(a) of ACI 318-11.

Development lengths specified for the development and splices of reinforcement shall not be subject to a strength reduction factor in accordance with Section 25.4.1.3 of ACI 318-14 or Section 9.3.3 of ACI 318-11.

4.1.2 Termination of Headed Bars: When designed in accordance with Section 25.4.4.2 of ACI 318-14 or Section 12.6.2 of ACI 318-11, longitudinal headed deformed bars extending from a beam or a slab terminating at a support member, such as a column, shall extend through the joint to the far face of the confined supporting member in accordance with Figure R25.4.4.2b of ACI 318-14 and Figure R12.6 (b) of ACI 318-11.

Splices of reinforcement to headed deformed reinforcing bars in tension shall comply with Sections 25.5.1 and 25.5.2 of ACI 318-14 or Sections 12.14 and 12.15 of ACI 318-11.

4.1.3 Design for Anchorage to Concrete: Where headed reinforcing bars are used as anchorage to concrete, concrete breakout failure shall be considered. For compliance with Section 1909 of the IBC, ACI 318-14 Chapter 17 and ACI 318-11 Appendix D as anchorage to concrete, additional data needs to be prepared by a registered design professional and approved by the building official to justify how the headed bars are substantiated in accordance with Section 17.1.3 of ACI 318-14 or Section D.2.3 of ACI 318-11 or comply with ANSI/ASME B1.1, B18.2.1 and B18.2.6.

4.2 Installation: The HRC® 555 and HRC® 670 HeadLock™ shall be installed in accordance with HRC’s installation instructions, applicable code sections of ACI 318, this evaluation report, and the approved plans. The HRC® 555’s forged head is fixed and requires no field assembly.

The HRC® 670 HeadLock™ shall be installed by first cutting the reinforcing bar square to the desired length (desired elevation minus the value “X” noted in Table 3) and removing any debris and concrete from the bar end. Any burrs or other imperfections shall be grounded down. With the bolt removed, push the HRC® 670 HeadLock™ onto the bar. The bar end shall be against the bolt hole. Reinsert the bolt and apply a torque until the bolt head breaks off.

4.3 Special Inspection: Special inspection of the headed bars shall be provided at the jobsite as required by Sections 1704.2 and 1705.3 of the IBC. The special inspector is responsible for verifying identification of the headed deformed reinforcing bars, grade and size of reinforcing bars, installation of reinforcing bar splices to the headed deformed reinforcing bars, as well as placement of the headed bars.

5.0 LIMITATIONS

The HRC® 555 and HRC® 670 HeadLock™ headed bars described in this report comply with, or are suitable alternatives to what is specified in, the codes listed in Section 1.0 of this report, subject to the following limitations:

5.1. The headed bars shall be installed in accordance with the applicable code, manufacturer’s installation instructions, and this report. In the event of a conflict, the more restrictive governs.

5.2 Anchorage system calculations and installation details shall be designed in conformance with the IBC and ACI 318 by the registered design professional and approved by the building official.

5.3 Special inspections shall be provided in accordance with Section 4.3 of this report.

5.4 Minimum concrete cover for development shall be in accordance with Sections 20.6 and 25.4.4.1 of ACI 318-14 or Sections 7.7 and 12.6 of ACI 318-11 and shall be measured from the outer surface of the HRC® 555 or HRC® 670 HeadLock™ reinforcing bar’s head, as applicable.

5.5 Fabricators and fabrication facilities of the HRC® 555 Series shall be qualified by HRC and approved by the building official.



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5.6 For structures regulated by ACI 318-14 Chapter 18 (2018 and 2015 IBC), ACI 318-11 Chapter 21 (2012 IBC), where the HRC[®] 555 or HRC[®] 670 HeadLock[™] headed 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, mill certificates shall be submitted to the building official as evidence that the steel reinforcing bars comply with Section 20.2.2.5 of ACI 318-14 or Section 21.1.5.2 of ACI 318-11.

5.7 The use of headed and mechanical anchored deformed reinforcement for lap splices is outside the scope of this criteria.

6.0 SUBSTANTIATING DATA

Data in accordance with IAPMO UES Evaluation Criteria for Headed and Mechanically Anchored Deformed Reinforcement Bars in Tension (EC 006-2018), approved June 2018. Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 IDENTIFICATION

HRC[®] 555 headed ends are packaged with a label bearing the manufacture's name (Headed Reinforcement Corporation), model and size. HRC[®] 670 HeadLock[™] T-Heads shall include a marking etched on the top of the product that includes the product name, lot number, and the size of the reinforcing bar the head is to be used with. Both products shall include the unique heat code identification the letter "H" to indicate that the product has been produced to the ASTM A970 Annex A1 specification one of the IAPMO Uniform ES Mark of Conformities shown below and the Uniform Evaluation Report Number (ER-177). Products prepared by officially licensed fabricators, may have additional unique identifiers that corresponds to the fabricator. Either Mark of Conformity may be used as shown below:



or

IAPMO UES ER-177

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For additional information about this evaluation report please visit www.uniform-es.org or email at info@uniform-es.org



TABLE 1 – EVALUATED PRODUCTS: SIZE AND MATERIAL GRADE¹

Reinforcement Material	Compatible Reinforcing bar Sizes (No.)	
	HRC [®] 555 Series	HRC [®] 670 Series HeadLock [™]
ASTM A706/A615 Grade 60	4 - 11	5 - 11
ASTM A615 Grade 75 ²	8 - 11	---
ASTM A706/615 Grade 80 ²	8 - 11	7 - 18

¹ Note: For compliance with the IBC and ACI 318-14 Chapter 17 or ACI 318-11 Appendix D as anchorage, additional data needs to be prepared by the registered design professional and approved by the building official to justify how the headed bars are substantiated in accordance with Section 17.1.3 of ACI 318-14 or Section D.2.3 of ACI 318-11. See Section 4.1.3 of this report.

² Note: In accordance with Section 25.4.4.1 of ACI 318-14 and Section 12.6 of ACI 318-11 the use of Grade 75 and 80 bars for development length is outside the scope of this report.

TABLE 2 - DIMENSIONS OF HRC 555 HEADED REINFORCING BARS

Dimensions	Bar size	#4	#5	#6	#7	#8	#9	#10	#11
Reinforcing bar	Diameter [in]	0.500	0.625	0.750	0.875	1.000	1.128	1.270	1.410
	Area [in ²]	0.20	0.31	0.44	0.60	0.79	1.00	1.27	1.56
Head	*T _{min} [in]	0.25	0.31	0.38	0.44	0.50	0.56	0.64	0.70
	D [in]	1.14	1.42	1.69	1.97	2.25	2.56	2.87	3.19
	A _{brg} [in ²]	0.82	1.27	1.80	2.45	3.18	4.14	5.20	6.43

For SI: 1 inch = 25.4 mm, 1 sq.in. = 645 mm², 1 foot = 305 mm. * Head thickness shall be no larger than bar diameter

FIGURE 1 – HRC[®] 555 HEADED REINFORCING BARS

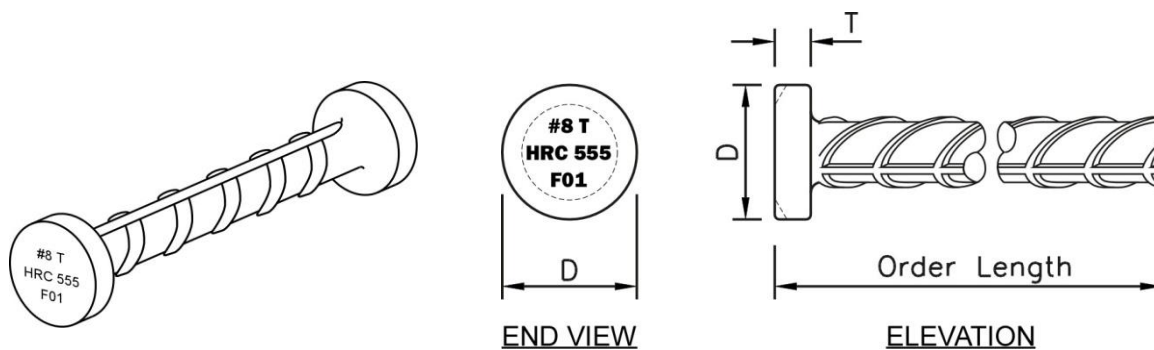




TABLE 3 – DIMENSIONS OF HRC 670 T-HEAD FOR USE WITH REINFORCING BARS

Dimensions	Bar Size	#5	#6	#7	#8	#9	#10	#11	#14	#18
Reinforcing bar	Diameter (in)	0.625	0.75	0.875	1.0	1.128	1.27	1.41	1.69	2.26
	Area (in ²)	0.31	0.44	0.60	0.79	1.00	1.27	1.56	2.25	4.00
Head	D ₁ (in)	1.5	1.75	2.08	2.375	2.625	3.0	3.5	4.0	5.25
	D ₂ (in)	1.75	1.875	2.25	2.5	2.75	3.25	3.625	4.0	5.25
	D _L (in)	2.0	2.5	2.875	3.25	3.625	4.0	4.5	5.5	7.25
	L (in)	2.22	2.48	2.8	3.3	3.35	3.7	4.2	4.9	6.25
	X (in)	0.5	0.5	0.625	0.625	0.75	0.875	1.0	1.07	1.07
	Bolt Socket Size (in)	3/4	3/4	3/4	1	1	1 1/4	1 1/2	1 1/2	1 1/2

For SI: 1 inch = 25.4 mm, 1 sq.in. = 645 mm², 1 foot = 305 mm.

FIGURE 2 - HRC® 670 HeadLock™ T-HEAD

No Special Equipment Needed

