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HEADED REINFORCEMENT CORP.

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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:

03 21 00 Reinforcing Steel

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes:

- 2021, 2018, 2015, and 2012 International Building Code® (IBC)
- 2021, 2018, 2015, and 2012 International Residential Code® (IRC)
- 2023 City of Los Angeles Building Code (LABC) – attached supplement
- 2023 City of Los Angeles Residential Code (LARC) – attached supplement

1.2 Evaluated in accordance with:

- IAPMO UES 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 Sections 25.4.4 and 25.4.5 of ACI 318-19 and 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 normalweight 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 exceeds 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, complies 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 bars.

The net head bearing area, A_{brg} , of the HRC® 670 HeadLock™ devices exceeds 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 318-19 or ACI 318-14, or Section 12.6 of ACI 318-11.

The development length, ℓ_{dt} , in inches, (including modification factors) shall not be less than the larger of $8d_b$ or 6-inches.

The concrete cover for the reinforcement shall be at least $2d_b$, and the center-to-center spacing between bars shall be at least $3d_b$, in accordance with Section 25.4.4.1 of ACI 318-19.

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.

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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.

For design in accordance with ACI 318-14 Chapter 17 or ACI 318-11 Appendix D, the use of No. 14, No. 18, Grade 75, and Grade 80 headed deformed 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_{dt} , shall be measured from the critical section as shown in Figure R25.4.4.2a of ACI 318-19 and 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 318-19 and 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 318-19 and 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 318-19 and 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 318-19 and 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 318-19 and 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 318-19 and 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, the HRC® 670 HeadLock™ shall be pushed onto the bar. The bar end shall be against the bolt hole. The bolt is then reinserted and torqued until the bolt head breaks off.

4.3 Special Inspection: Periodic special inspection of the headed bars shall be provided at the job site as required by Sections 1704.2 and 1705.3 of the IBC. The special inspector is responsible for verifying the 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 318-19 and 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.

5.6 For structures regulated by ACI 318-19 and 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 318-19 and ACI 318-14, or Section 21.1.5.2 of ACI 318-11.



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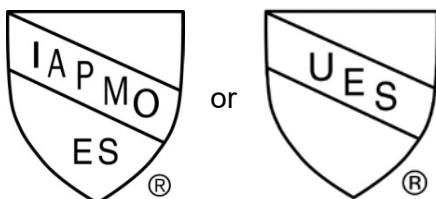
5.7 The use of headed and mechanically anchored deformed reinforcement for lap splices is outside the scope of this report.

6.0 SUBSTANTIATING DATA

Data in accordance with IAPMO UES Evaluation Criteria for Headed and Mechanically Anchored Deformed Reinforcement Bars in Tension (EC 006-2021), approved August 2021. 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 manufacturer'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, and the Uniform Evaluation Report Number (ER-177). Products prepared by officially licensed fabricators may have additional unique identifiers that correspond to the fabricator. Either IAPMO UES Mark of Conformity may also be used as shown below:



IAPMO UES ER-177

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



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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	5 - 11	7 – 18

¹ Note: For compliance with the IBC and either ACI 318-19 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 318-19 and ACI 318-14 or Section D.2.3 of ACI 318-11. See Section 4.1.3 of this report.

² Note: The scope of applicability is described in Section 4.1.1 of this report, which varies with the edition of ACI 318.

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

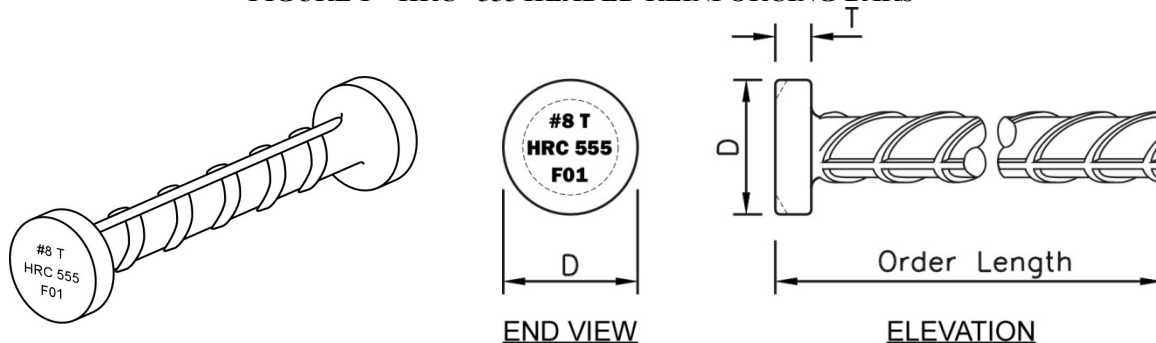


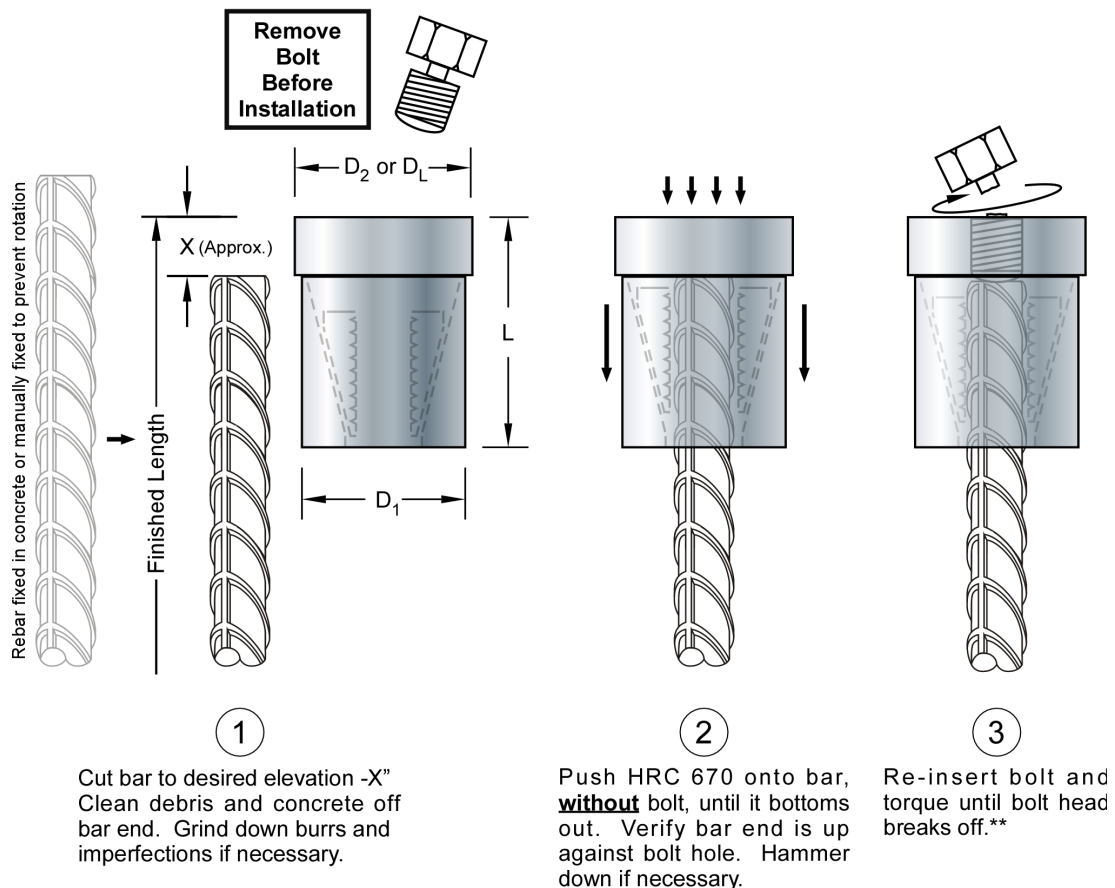
TABLE 3 – DIMENSIONS OF HRC 670 T-HEAD FOR USE WITH REINFORCING BARS

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





CITY OF LOS ANGELES SUPPLEMENT

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

CSI Section:
03 21 00 Reinforced Steel

1.0 RECOGNITION

The HRC® 555 Series headed reinforcing bars and the HRC® 670 HeadLock™ attachable head for deformed steel reinforcing bars, both described in ER-177 and this 2023 LABC and LARC supplemental report, have been evaluated for use as mechanical anchorage in concrete. The HRC® 555 Series headed reinforcing bars and the HRC® 670 HeadLock™ attachable head for deformed steel reinforcing bars have been evaluated for structural performance properties, subject to the requirements in ER-177 and this 2023 LABC and LARC supplemental report. The HRC® 555 Series headed reinforcing bars and the HRC® 670 HeadLock™ attachable head for deformed steel reinforcing bars were evaluated for compliance with the following codes and regulations:

- 2023 City of Los Angeles Building Code (LABC)
- 2023 City of Los Angeles Residential Code (LARC)

2.0 LIMITATIONS

Use of the HRC® 555 Series and the HRC® 670 HeadLock™ recognized in this supplement is subject to the following limitations:

2.1 The design and installation of the HRC® 555 Series and the HRC® 670 HeadLock™ shall be in accordance with the 2021 International Building Code and the 2021 International Residential Code as noted in ER-177.

2.2 Calculations and specifications verifying compliance with this report and the LABC or LARC shall be submitted to the plan check engineer at the time of permit application. The HRC® 555 Series and the HRC® 670 HeadLock™ calculations shall be prepared, stamped, and signed by a California registered design professional.

2.3 Periodic special inspection shall be provided by the Registered Deputy Inspector in accordance with Sections 1704.4 and 1705.3 of the 2023 LABC during installations of the HRC® 555 Series and the HRC® 670 HeadLock™. The special inspector is responsible for verifying the 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.

2.4 The use of headed and mechanically anchored deformed reinforcement for lap splices is outside the scope of this report.

2.5 The HRC® 555 Series and the HRC® 670 HeadLock™ shall be installed in accordance with the LABC or LARC, the manufacturer's installation instructions, and this supplement. In the event of a conflict, the more restrictive governs. A copy of the manufacturer's installation instructions shall be available on-site for all Registered Deputy Inspectors.

2.6 Headed steel reinforcing bars shall not be used on compression reinforcement and epoxy and other coated bars.

2.7 The design of anchorage to concrete shall comply with Section 4.1.2 of ER-177.

2.8 For use as reinforcement resisting earthquake-induced flexural and axial forces in frame members and boundary elements of special structural walls, the reinforcing bar component of the headed bars shall comply with Section 20.2 of ACI 318-19.

2.9 The HRC® 555 Series and the HRC® 670 HeadLock™ listed in this supplement shall include the unique heat code identification, and the letter "H" to indicate that the product has been produced to the ASTM A970 Annex A1 specification. Products prepared by officially licensed fabricators, may have additional unique identifiers that correspond to the fabricator.

2.10 The fabricator of the steel for the HRC® 555 Series and the HRC® 670 HeadLock™ shall be required to maintain a detailed procedure for material control and suitable procedures and records attesting that the specified material has been furnished. The applicable ASTM designation or coating, as applicable, shall be included in each packaging assembly prior to shipment from the fabricator's plant. The fabricator's identification mark designation shall be established and on record prior to fabrication. Steel that is not identifiable from marking and test records shall be tested to determine conformity to this report. The fabricator shall furnish an affidavit of compliance and test data shall be provided upon request.

2.11 This supplement expires concurrently with ER-177.

For additional information about this evaluation report please visit
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