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HRC® 555 SERIES, HRC® 670 and HRC® 670L SERIES T-HEAD HEADED ENDS OF CONCRETE REINFORCEMENT

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

1.0 RECOGNITION

The HRC® 555 Series headed reinforcing bars are headed deformed steel reinforcing bars for concrete reinforcement. The HRC® 670 and HRC® 670L are attachable heads for deformed steel reinforcing bars for concrete reinforcement. The structural performance properties of both products comply with the intent of the provisions of the following codes and regulations as alternative solutions:

- CSA A23.1:24, Concrete Materials and Methods Of Concrete Construction
- CSA A23.3:24, Design of Concrete Structures
- CSA S6:25, Canadian Highway Bridge Design Code

2.0 LIMITATIONS

The HRC® 555 headed bars and HRC® 670 field-installed heads 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:

2.1 The headed bars and heads 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.

2.2 Anchorage system calculations and installation details shall be designed in conformance with CSA A23.3 or CSA S6 by the designer and approved by the owner.

2.3 Inspections shall be provided in accordance with Section 3.4 of this report.

2.4 Minimum concrete cover shall be in accordance with the requirements of CSA A23.3 Clause 12.4.2.1, or CSA S6 Clause 8.15.8.2.1, as applicable, unless special conditions dictate otherwise. In all cases, concrete cover shall be indicated on the drawings and shall be measured from the outer surface of the HRC® 555 or HRC® 670 reinforcing bar's head, as applicable.

2.5 Fabricators and fabrication facilities of the HRC® 555 Series shall be qualified by HRC.

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

2.7 The HRC headed bars and heads recognized in this report are produced by or under the supervision of Headed Reinforcement Corp.

3.0 PRODUCT USE

3.1 General: The HRC® 555 Series headed reinforcing bars are Class HA headed deformed steel reinforcing bars for concrete reinforcement. The HRC® 670 and HRC® 670L Series are attachable heads for deformed steel reinforcing bars for concrete reinforcement. All products comply with:

- Clauses 7.1.4, 12.4.2, 12.6.1, and 12.6.2 of CSA A23.3 and with ASTM A970 Class HA head requirements for use in developing deformed bars in tension as Headed $5A_b$ Bars and as an alternative to standard hooks or development lengths of straight deformed reinforcing bars.
- Clauses 8.14.1.5.1, 8.15.1.1, 8.15.3.5.3, 8.15.8.1, and 8.15.8.2 of CSA S6 and with ASTM A970 Class HA head requirements for use in developing deformed bars in tension as $5A_b$ Anchor Heads and as an alternative to standard hooks or development lengths of straight deformed reinforcing bars.

All products develop the specified minimum tensile strength of the reinforcing bar.

3.2 Design:

3.2.1 Use: Use of the headed bars and heads to develop a deformed bar in tension is subject to the conditions in:

- Clause 12.4.2 of CSA A23.3
- Clause 8.15.8.2 of CSA S6

3.2.2 Development Length in Tension for Headed $5A_b$ Bars: Development lengths shall be determined in accordance with:

- Clauses 12.4.2.2 through 12.4.2.6 of CSA A23.3 for Headed $5A_b$ Bars.
- Clauses 8.15.8.2.2 through 8.15.8.2.6 of CSA S6 for $5A_b$ Anchor Heads.

When utilizing the equation in Clause 12.4.2.3 of CSA A23.3 or Clause 8.15.8.2.3 of CSA S6 to calculate development length in tension, the designer shall verify that the proposed heads conform to ASTM A970 Class HA.

The development length in tension, ℓ_{dt}, (including modification factors) shall not be less than the larger of $8d_b$ or 150 mm (6 inches).

Headed deformed bars and heads terminating in a joint shall conform to the provisions of Clause 12.4.4 of CSA A23.3 or Clause 8.15.8.4 of CSA S6.

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 Clause 12.4.2.1 of CSA A23.3 or Clause 8.15.8.2.1 of CSA S6.

The development length, ℓ_{dt}, shall be measured from the critical section to the inner bearing surface of the head.

In accordance with Clause 12.4.2.7 of CSA A23.3 or Clause 8.15.8.2.7 of CSA S6, headed $5A_b$ bars shall not be considered effective in developing the bar in compression. Development of headed $5A_b$ bars in compression shall be the same as straight bars in accordance with Clause 12.3 of CSA A23.3 or Clause 8.15.5 of CSA S6.

For designs in accordance with CSA A23.3 or CSA S6, the use of 45M (No. 14) and 55M (No. 18) headed $5A_b$ bars for development length is outside the scope of this report. The anchorage of 45M (No. 14) and 55M (No. 18) bars shall be designed in accordance with CSA A23.3 Annex D, CSA S6 Annex A8.2, or otherwise to the satisfaction of the registered design professional and approved by the building official.

3.2.3 Seismic Force-Resisting Systems: Use of the headed bars and heads to develop a deformed bar in tension is subject to the requirements in Clause 21 of CSA A23.3 or Clause 4 of CSA S6. Reinforcement in structural elements that are part of the SRFS shall comply with Clause 21.2.7.1 of CSA A23.3.

3.2.4 Termination of Headed Bars: When designed in accordance with the Clauses of CSA A23.3 or CSA S6 discussed in this report, headed bars shall extend through the full length of beam-column joints and corbels and generally be placed as close to the back face as permitted by cover requirements.

Splices of reinforcement to headed deformed reinforcing bars in tension shall comply with Clauses 12.14 and 12.15 of CSA A23.3 or Clause 8.15.11.3 of CSA S6.

3.2.5 Design for Anchorage to Concrete: Where headed reinforcing bars are used as anchorage to concrete, concrete breakout failure shall be considered, and the design shall be substantiated in accordance with CSA A23.3 Annex D or CSA S6 Annex A8.2.

3.3 Installation: The HRC® 555, HRC® 670, and/or 670L T-Head shall be installed in accordance with HRC's installation instructions, applicable code sections of CSA A23.3 or CSA S6, this Listing report, and the approved plans. The HRC® 555's forged head is fixed and requires no field assembly.

3.3.1 The HRC® 670 and/or 670L 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 ground down. With the bolt removed, the HRC® 670 and/or 670L 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.

3.4 Inspection:

3.4.1 CSA A23.1/A23.3: Inspection of the headed bars or anchorage as shall be provided at the job site as required by Clause 6.6.11 of CSA A23.1. The location and spacing of headed deformed reinforcing bars and anchors shall be inspected prior to concrete placement. Permissible tolerances shall be in accordance with Clauses 6.6.8 and 6.7.3.1, and Figure 3 of CSA A23.1, as applicable.

3.4.2 CSA S6: Inspection of the headed bars as shall be provided at the job site as required by Clause 1.4.4.5 of CSA S6. When used as anchorage, inspection shall be provided at the job site as required by Clause A8.2.10 of CSA S6. The location and spacing of headed deformed reinforcing bars and anchors shall be inspected prior to concrete placement.

4.0 PRODUCT DESCRIPTION

4.1 Product Information

4.1.1 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 10M (No. 4) through 45M (No. 14) 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.

4.1.2 HRC® 670: The HRC® 670 Series are Class HA heads complying with the requirements of ASTM A970 Annex A1. The HRC® 670 Series are field-installed T-Heads used mainly for retrofits and field repairs. The HRC® 670 Series, when connected to the specified reinforcing bars, complies with 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 15M (No. 5) through 55M (No. 18) reinforcing bars.

The net head bearing area, A_{brg}, of the HRC® 670 devices exceeds four times the nominal cross-sectional area, A_b, of the reinforcing bar. The HRC® 670 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 headed reinforcing bars are shown in Table 3 and Figure 2 of this report.

4.1.3 HRC® 670L: The HRC® 670L Series are Class HA heads complying with the requirements of ASTM A970 Annex A1. The HRC® 670L Series, when connected to the specified reinforcing bars, complies with Class HA in accordance with ASTM A970. HRC® 670L 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 15M (No. 5) through 55M (No. 18) reinforcing bars.

The net head bearing area, A_{brg}, of the HRC® 670L devices, exceeds nine times the nominal cross-sectional area, A_b, of the reinforcing bar. The HRC® 670L 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® 670L headed reinforcing bars are shown in Table 4 and Figure 3 of this report.

4.2. Material Information: HRC® 555 headed ends are manufactured from CSA G30.18 grade 400R, 400W, 500R, and 500W (ASTM A615 or ASTM A706 Grades 60 and 80) steel reinforcing bars. HRC® 670 and HRC® 670L T-Heads are manufactured from AISI 1141 and AISI 8620 steel and include a steel spring and a rubber O-ring.

5.0 IDENTIFICATION

HRC® 555 headed ends are packaged with a label bearing the manufacturer's name (Headed Reinforcement Corporation), model, and size. HRC® 670 and HRC® 670L T-Heads shall include a marking etched on the top of the product that includes the product name, a unique lot number, and the size of the reinforcing bar the head is to be used with. All 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 Service Listing Report Number (UEL-5052). Products prepared by officially licensed fabricators may have additional unique identifiers that correspond to the fabricator. The UES Mark of Conformity may also be used as shown below:

IAPMO UES UEL-5052

6.0 SUBSTANTIATING DATA

6.1 Data in accordance with IAPMO UES Evaluation Criteria for Headed and Mechanically Anchored Deformed Reinforcement Bars in Tension (EC 006-2024), approved September 2024.

6.2 Test reports are from laboratories in compliance with ISO/IEC 17025.

7.0 STATEMENT OF RECOGNITION

This listing report describes the results of research carried out by IAPMO Uniform Evaluation Service on **Headed Reinforcement Corp.** HRC® 555, HRC® 670, and HRC® 670L to assess conformance to the standards shown in Section 1.0 of this report and serves as documentation of the product certification. Products are manufactured as noted in Section 2.7 of this report under a quality control program with periodic inspections under the supervision of IAPMO UES.

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

TABLE 1 – EVALUATED PRODUCTS: SIZE AND MATERIAL GRADE [1]

Reinforcement Material	Compatible Reinforcing Bar Sizes (No.)		
	HRC® 555 Series	HRC® 670 Series	HRC® 670L Series
CSA G30.18 Grade 400R/W (ASTM 706/A615 Grade 60)	10M – 45M[2] (#4 - #14)	15M – 55M[2] (#5 – #18)	15M – 55M (#5 – #18)
CSA G30.18 Grade 500R/W (ASTM 706/A615 Grade 80)[2]	15M – 35M (#5 - #11)	25M – 55M[2] (#8 – #18)	25M – 55M (#8 – #18)

[1] Note: For compliance with the CSA A23.3 Annex D or CSA S6 Annex A8.2 as anchorage, additional data needs to be prepared by the designer. Section 3.2.5 of this report provides additional details.

[2] Note: In accordance with Clause 12.4.2 of CSA A23.3 for headed $5A_b$ bars and Clause 8.15.8 of CSA S6 for $5A_b$ anchor heads, the use of reinforcing bars larger than 35M is outside the scope of this report.

TABLE 2 - DIMENSIONS OF HRC 555 HEADED REINFORCING BARS

Dimensions	Bar size (US equivalent)	10M	15M (#5)	20M (#6)	25M (#8)	30M	35M (#11)	45M (#14)
Reinforcing bar	Diameter [mm]	11.3	16.0	19.5	25.2	29.9	35.7	43.7
	Area [mm^2]	100	200	300	500	700	1000	1500
Head	*T_{min} [mm]	5.58	7.87	9.65	12.70	14.98	17.78	25.91
	D [mm]	24.89	36.07	42.93	57.15	69.09	81.03	97.03

1mm = 0.03937 inch, 1 mm^2 = 0.00155 sq. in.
* Head thickness should be no larger than bar diameter

FIGURE 1 – HRC® 555 HEADED REINFORCING BARS

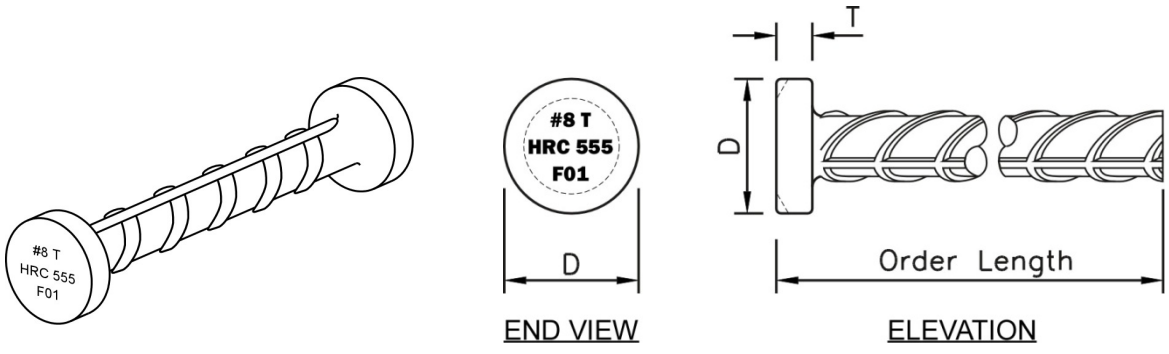

TABLE 3 – DIMENSIONS OF HRC 670 T-HEAD FOR USE WITH REINFORCING BARS

Dimensions	Bar Size (US equivalent)	15M (#5)	20M (#6)	25M (#8)	30M	35M (#11)	45M (#14)	55M (#18)
Reinforcing bar	d_b, Diameter (mm)	16.0	19.5	25.2	29.9	35.7	43.7	56.4
	A_b, Area (mm^2)	200	300	500	700	1000	1500	2500
Head	D_1 (mm)	38.10	44.45	60.32	76.20	88.90	101.60	133.35
	D_2 (mm)	44.45	47.62	63.50	82.55	92.07	101.60	133.35
	L (mm)	56.38	62.99	83.82	93.98	106.68	124.46	158.75
	X (mm)	12.70	12.70	15.87	22.22	25.40	27.17	27.17
	Bolt Socket Size (in)	3/4	3/4	1	1	1 1/2	1 1/2	1 1/2

1mm = 0.03937 inch, 1 mm^2 = 0.00155 sq. in.

FIGURE 2 - HRC® 670 T-HEAD

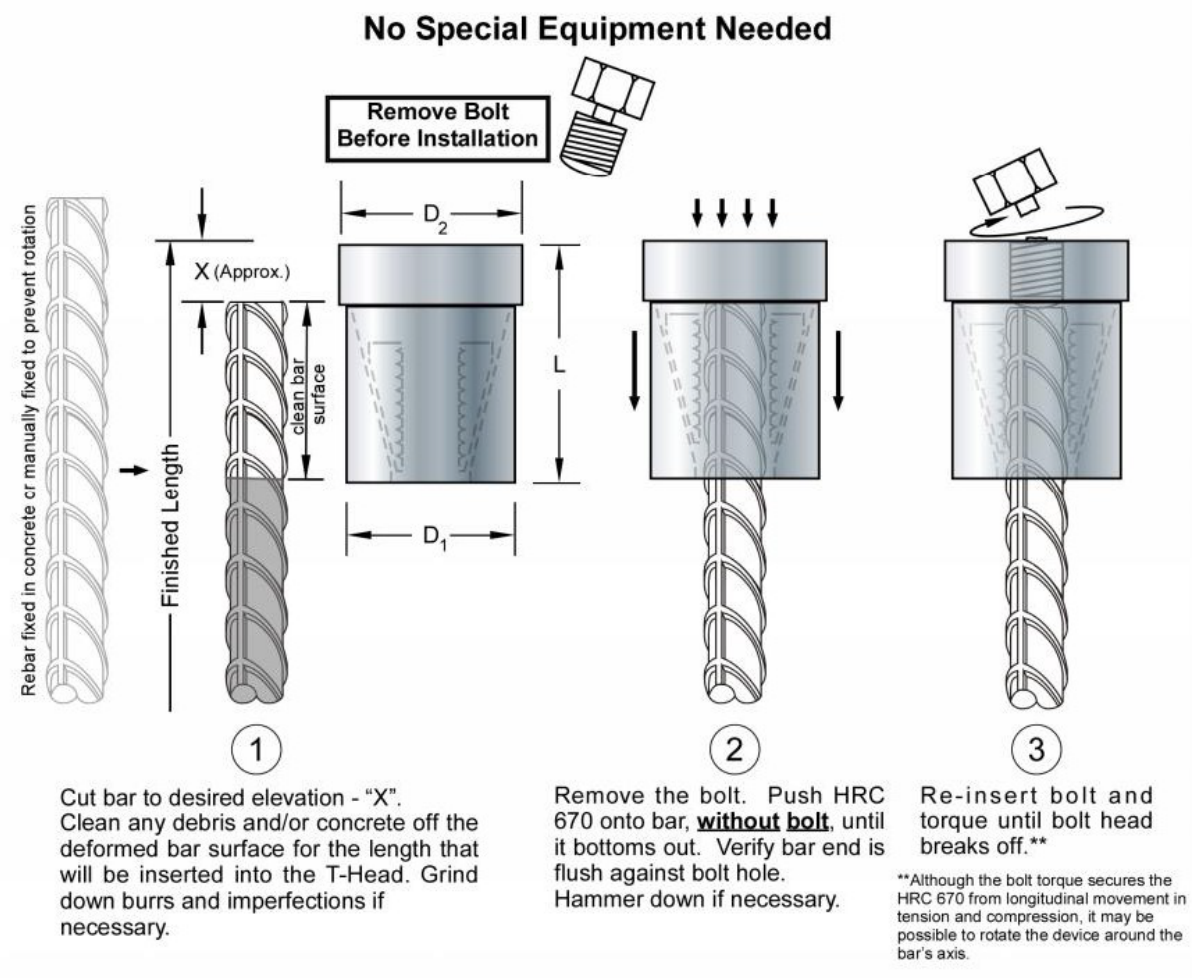

TABLE 4 – DIMENSIONS OF HRC 670L T-HEAD FOR USE WITH REINFORCING BARS

Dimensions	Bar Size (US equivalent)	15M (#5)	20M (#6)	25M (#8)	30M	35M (#11)	45M (#14)	55M (#18)
Reinforcing bar	d_b, Diameter (mm)	16.0	19.5	25.2	29.9	35.7	43.7	56.4
	A_b, Area (mm^2)	200	300	500	700	1000	1500	2500
Head	D_1 (mm)	38.10	44.45	60.32	76.20	88.90	101.60	133.35
	D_L (mm)	50.80	63.50	82.55	101.60	114.30	139.70	184.15
	L (mm)	56.38	62.99	83.82	93.98	106.68	124.46	158.75
	X (mm)	12.70	12.70	15.87	22.22	25.40	27.17	27.17
	Bolt Socket Size (in)	3/4	3/4	1	1	1 1/2	1 1/2	1 1/2

1mm = 0.03937 inch, 1 mm^2 = 0.00155 sq. in.

FIGURE 3 - HRC® 670L T-HEAD