DSA Project Level Testing Requirements for HRC 555 Headed Bars

V2 3/12/21

TECH NOTE

Introduction:

This document has been prepared to provide brief overview of DSA project level testing requirements associated with the fabrication of HRC 555 headed bars.

DSA Project Level Testing Requirements:

The Division of the State Architect (DSA) does not have a standard Interpretation of Regulations (IR) document specifically for headed bars, but does have one for reinforcing bars. IR 17-10 can be found HERE. IR 17-10 is based on the California Building Code (CBC) which requires sampling and testing of reinforcing bars used in concrete.

Unless the project specifications provide specific information and/or requirements on the sampling and testing of headed bars, it is HRC's interpretation that the only other testing that should be required for HRC 555 headed bars is evaluation against the requirements defined in ACI 318 Code and ASTM A970 Standard Specification. ACI 318 Code requires Class HA Heads as defined in ASTM A970. Class HA heads are required to:

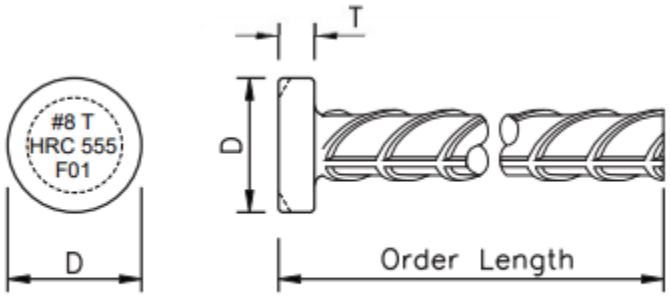
1. Provide a net bearing area of at least 4 times the area of the bar ($A_{brg} \geq 4A_b$).
    a. Net bearing area equals the area of the head minus the area of the bar.
2. Develop the minimum specified tensile strength of the bar.

HRC 555 headed bars are designed to be capable of meeting both ACI 318 and ASTM A970 Class HA requirements for grade 60, grade 75 and grade 80 rebar and are able to develop the minimum tensile strength of the bar material (100 ksi for A706-80) by developing the bar forces (in air).

From a QC/Inspection/Testing perspective, head geometry and headed bar tensile strength need to be considered.

Head Geometry / Critical Dimensions:

There are 2 critical HRC 555 head dimensions that need to be considered for inspection and acceptance per ICC-ES ESR-2935 and IAPMO-ES ESR-0177.



DIMENSIONS OF HRC 555 SERIES T-HEADS

HRC 555	Bar Size	#4	#5	#6	#7	#8	#9	#10	#11	#14
Head	$^{*}T_{min}$ [in]	0.25	0.31	0.38	0.44	0.50	0.56	0.64	0.70	1.02
	D[in]	1.14	1.42	1.69	1.97	2.25	2.56	2.87	3.19	3.82
	A_{brg} [sq.in]	0.82	1.27	1.80	2.45	3.18	4.14	5.20	6.43	9.20

1. Overall Head Diameter *"D"* (to satisfy Code bearing area requirements)

- Heads are formed to the diameter shown in the table above.
- Small variations in diameter (<10%) are acceptable.

2. Overall Head Thickness *"T"*

- Minimum thickness per table above. Maximum head thickness is equal to 1db.
- Excessive head thickness over 1 bar diameter is not recommended due to interference with concrete cover when the heads are hooked around crossing bars.

Tensile Strength Requirements:

The tensile strength requirement for Class HA heads is defined in ASTM A970. Class HA headed bars must develop the specified tensile strength of the bar.

Sampling and Tensile Testing:

Destructive tensile testing (in air & in accordance with ASTM A370 and ASTM A970) of representative samples will be required to confirm building code compliance (ACI 318 and ASTM A970 Class HA). The samples don't have to be cut out of work on-site if you can provide representative samples, but otherwise need to be of comparable material and quality.

Ultimately, the length of HRC 555 headed bars for testing should be discussed with the Laboratory of Record (LOR) prior to sampling to ensure lengths are optimized for their test equipment. If specific direction is not provided, HRC recommends that sample bars are at least 4'-0" long.

Ultimately, the quantity of HRC 555 headed for testing should be discussed with the Laboratory of Record (LOR), but HRC recommends using ASTM A970, which requires 2 samples for any combination of rebar type / grade / heat / bar size that is being fabricated as a guideline.

Summary and Recommendations:

This document provides an overview and key points to consider when supplying HRC 555 headed bars to DSA projects.

Production testing is something that approved HRC fabricators should be doing on a regular basis through HRC or others (mill with tensile testing capabilities, outside lab, etc.) to ensure consistency in both quality and performance.

Tensile testing is done in accordance with ASTM A370. This type of destructive tensile testing will identify material quality issues will be able to confirm that the headed bars will perform as required, meeting or exceeding the ACI 318 and ASTM A970 requirements. Test reports should document the testing with results and pictures. To ensure compliance to ASTM A970 and ACI 318 Class HA bearing area requirements, heads should be checked regularly during fabrication. The critical HRC 555 head dimensions are overall diameter and minimum thickness per ICC-Es ESR-2935. These dimensions are easy to confirm by using HRC Go/No-Go gauges.

HRC offers tensile testing services and recommends that approved HRC fabricators submit samples regularly to ensure quality.

For more information, additional questions or technical support, please contact an HRC representative. Engineer@HRC-USA.com