

# HRC 555 Headed Bar Testing

## for HRC approved fabricators

V3 2/25/21



TECH NOTE

### Introduction:

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

### Background:

When reinforcing bars are headed at a fabricator's facility, the ICC-ES and IAPMO-ES reports require the fabricator to be approved by HRC and to follow the XT-2 Operating Manual. As an approved HRC fabricator, you will have a Certificate of Compliance for your shop and Training Certificates for each trained operator on file to prove completion of training and testing. Part of this process is to provide HRC with sample bars from each trained operator for QC inspection and tensile testing. The Certificate of Compliance for your shop is valid for a period of one year from the date of issue.

### Testing Requirements:

Several documents define testing and/or testing related requirements:

- IBC section 1704
- IAPMO-ES ER-177
- ICC-ES ESR-2935
- ASTM A970 defines mechanical testing and performance requirements.
- HRC QA Manual
- **Please note that in some cases, other project specific specifications and/or requirements may govern.**
- **California-based customers need to pay special attention to Caltrans and/or DSA requirements. Please contact HRC for more information and/or assistance.**

#### **IBC Section 1704:**

- Requires the code official to approve the fabricator.

#### **IAPMO-ES ER-177**

- Section 5.5 states "Fabricators and fabrication facilities of the HRC 555 Series shall be qualified by HRC and approved by the building official."
  - As an approved HRC fabricator, you will have a Certificate of Compliance for your shop and Training Certificates for each trained operator on file to prove completion of training and testing.

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### ICC-ES ESR-2935

- Section 5.5.1 states “The fabricator must be approved by the code official in accordance with IBC Section 1704.2.”
  - Link to IBC Section 1704.2 is:  
<https://codes.iccsafe.org/public/document/IBC2018/chapter-17-special-inspections-and-tests>
  - Simply put, you must be a licensed contractor and approved to work on the project.
- Section 5.5.2 states “The fabricator must be approved by the report holder, HRC.”
  - As an approved HRC fabricator, you will have a Certificate of Compliance for your shop and Training Certificates for each trained operator on file to prove completion of training and testing.
- Section 5.5.3 states “The fabricator must demonstrate, to the satisfaction of the code official, compliance with the XT-2 Operating Manual, as defined by HRC.”
  - If the inspector stops by to see your work, he may ask to see the XT-2 Operating Manual. Your team should be ready and able to discuss the manual with him.
- Section 5.5.4 states “For each HRC 555 headed steel reinforcing bar size, the fabricator must demonstrate to the satisfaction of the code official that the headed steel reinforcing bars are consistent with the qualifying test specimens. This may be demonstrated in test reports submitted to the code official.”
  - You need to have test results for each combination of rebar grade and bar size you are fabricating to prove you are capable of making products meeting HRC and/or the projects standards.

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## Testing Requirements from ASTM A970:

ASTM A970 is the Standard Specification for Headed Steel Bars for Concrete Reinforcement. Section 6 covers mechanical testing and performance requirements & section 7 covers frequency of testing:

### 6. Mechanical Test and Performance Requirements

6.1 Headed bars shall be subjected to mechanical tests to verify production method and product quality prior to manufacture. Mechanical testing also shall be performed at intervals during production of the assembly.

#### 6.2 Tensile Tests:

6.2.1 Tensile testing of the headed bar assembly shall be performed in accordance with the requirements described in Test Methods and Definitions A370. The failure mode shall be reported as partial or total fracture of the bar, the head, or the head-to-bar connection.

#### 6.3 Tensile Requirements:

6.3.1 Tensile Properties—The tensile properties of the test specimen shall conform to one of the following classes:

6.3.1.1 Class A—Develop the minimum specified tensile strength of the reinforcing bar.

6.3.1.2 Class B—Develop the minimum specified tensile strength and the minimum specified elongation of the reinforcing bar.

### A1.1 Replacement Requirements for 5.3

A1.1.1.3 The net bearing area of a bar without an obstruction meeting the requirements of this annex is the gross area of the head minus the area of the deformed reinforcing bar and shall not be less than four times the nominal cross-sectional area of the bar.

### A1.2 Replacement Requirements for 6.3.1.1

A1.2.1 Class HA—Develop the minimum specified tensile strength of the reinforcing bar.

## 7. Frequency of Testing

### 7.1 Number of Tests:

7.1.1 Pre-Production—Prior to production, a testing program shall be undertaken that includes two bend tests for welded headed bars and two tensile tests for all headed bars. The tests shall be repeated for each combination of head and bar material specification, grade or type, or head attachment method.

7.1.2 Production Sampling and Testing of Headed Bars—It shall be permissible to use either the tensile test prescribed in 6.3, or the bend test prescribed in 6.4 to verify the production method and product quality of headed bar. A minimum of two specimens shall be sampled and tested for each production shift or period. One test of a headed bar at the start and one test at the end of each 8-h production period or less than 8-h production period or at random intervals during the production period shall be conducted. Sampling shall be conducted at the location where the head is permanently attached to the reinforcing bar in its final form, unless otherwise agreed to by the purchaser and the manufacturer at the time of purchase.

**KEY POINT:** Requires testing before production begins and at regular intervals

**KEY POINT:** Requires tensile testing in accordance with ASTM A370

**KEY POINT:** ACI 318 requires class HA heads which is referred to in Annex A1 – this is a combination of tensile properties (matches class A) and head bearing area ( $\geq 4A_b$ )

**KEY POINT:** 2 tensile test samples for all headed bars are required prior to production. This needs to be repeated for all combinations of rebar type / rebar grade / heat / bar size.

**KEY POINT:** A minimum of 2 specimens shall be sampled and tested for each production shift or period. One test of a headed bar at the start and one test at the end of each production period or at random intervals during the production period shall be conducted. This needs to be repeated for all combinations of rebar type / rebar grade / heat / bar size.

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### HRC QA Manual:

#### 1.12 Headed Ends of Concrete Reinforcement (Headed Bars)

When steel reinforcing bars are headed at a fabricator's facility, ICC-ES ESR-2935 and IAPMO-ES ER-0177 requires the fabricator to be approved by HRC and follow the XT-2 Operating Manual. IBC section 1704 requires the code official to approve the fabricator. ICC-Es also requires the fabricator to demonstrate their fabrication of headed bars for each bars size with test reports (to the satisfaction of the code official). Refer to Section 4.0 for additional testing information. For HRC 555 Series T-Heads, fabricators shall ensure bars are marked with unique identifier as defined by the evaluation reports.

Please note: Other project specifications / requirements may govern.

#### 4.2.2 HRC 555 Series Testing for Components Prepared at Fabricator's Facility

Fabricators are required to test completed assemblies prior to the commencement of work and will be subjected to periodic testing as requested by HRC, the project design official, or the special inspector (as defined by IBC Sec. 1704).

#### 4.3 Test Results

Test results shall be documented and evaluated by a responsible authority to assure that test requirements have been satisfied. Records of all tests shall be kept and logged in a register for inspection and audit purposes.

### Summary and Recommendations:

ASTM A970 defines requirements for headed bar testing and the HRC QA manual discusses this as well. [This 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. Some projects implement testing requirements above and beyond these, so be sure to check the project specifications.](#) 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. [HRC offers tensile testing services and recommends that approved HRC fabricators submit samples regularly to ensure quality. At a minimum, HRC strongly recommends completing tensile testing \(2 bars of each rebar type / rebar grade / bar size combination\) at the start of all significant projects.](#)

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.](#)