

# Caltrans Project Level Testing Requirements for HRC 555 Headed Bars

V1 7/29/20



TECH NOTE

## **Introduction:**

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

## **Caltrans Project Level Testing Requirements:**

The California Department of Transportation's 2018 Standard Specifications can be found [HERE](#). The requirements for headed bar reinforcement are found in section **52-5**. ***This section is shown in its entirety below along with key points.***

### **52-5 HEADED BAR REINFORCEMENT**

#### **52-5.01 GENERAL**

##### **52-5.01A Summary**

Section 52-5 includes specifications for fabricating headed bar reinforcement.

##### **52-5.01B Definitions**

**lot:** 150 count, or fraction thereof, of headed bar reinforcement for each:

1. Bar size
2. Head size
3. Head type
4. Method of manufacture
5. Heat number of bar material
6. Heat number of head material

**KEY POINT:** Heat number for bar material and head material are the same with HRC 555.

**KEY POINT:** Lot size for bars with HRC 555 on one end = (150 bars). Lot size for bars with HRC 555 on both ends = (75 bars). A single lot is limited to 1 heat of material.

A reinforcing bar with a head on each end is counted as 2 headed reinforcing bars for establishing and testing production lots.

##### **52-5.01C Submittals**

###### **52-5.01C(1) General**

If any part of the head is fabricated in the field, submit a prequalification report as specified under section 52-6.01C(6)(c).

**KEY POINT:** Field fabrication doesn't apply to HRC 555.

###### **52-5.01C(2) Samples**

###### **52-5.01C(2)(a) General**

Reserved

###### **52-5.01C(2)(b) Test Samples**

Submit test samples to METS.

Include copies of the certificates of compliance with the test samples.

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## 52-5.01C(3) Test Reports

Submit a QC test report for each lot.

Each test report must include:

1. Lot number
2. Bar size
3. Type of headed bar reinforcement
4. Physical condition of each test sample
5. Notable defects on any test sample
6. Affected zone limits of each test sample
7. Location of visible necking area on each test sample
8. Ultimate strength of each test sample

## 52-5.01C(4) Certificates

Submit a certificate of compliance for each shipment of headed bar reinforcement. Include with the submittal copies of:

1. Mill test reports for bar reinforcement and head material
2. QC test reports
3. Daily production logs

## 52-5.01D Quality Assurance

### 52-5.01D(1) General

Section 11-3.02 does not apply to headed bar reinforcement.

**KEY POINT:** Field fabrication doesn't apply to HRC 555.

### 52-5.01D(2) Qualifications

If any part of the head is fabricated in the field, the operator and procedure must be prequalified as specified for service and ultimate butt splices under section 52-6.01D(2).

Welding, welder qualifications, and inspection of welding must comply with AWS C6.1.

### 52-5.01D(3) Test Samples

After completing fabrication of a lot of headed bar reinforcement, including preparation for any required epoxy coating, notify the Engineer that the lot is ready for testing.

After receiving notification that lots are ready for QC testing, the Engineer (1) randomly selects department acceptance test samples to be removed from each lot and (2) places tamper-proof markings or seals on the test samples.

Test samples must be 4 feet long for bar reinforcement sizes no. 9 and below and 6 feet long for bar reinforcement sizes no. 10 and above.

Before transporting test samples to an authorized laboratory and METS:

1. Securely bundle and package the 4 test samples for each test in a way that preserves their condition during transportation
2. Identify each test sample by lot number and Contract number using weatherproof markings
3. Attach a completed Sample Identification Card to each bundle

A test sample is rejected if the tamper-proof marking or seal is disturbed before testing.

**KEY POINT:** 4 samples per lot. See description of quantity of bars in lot above.

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# of headed bars required for project	# of lots if bars have head on one end (lot size = 150 bars)	total # of test bars required	# of lots if bars have head on both ends (lot size = 75 bars)	total # of test bars required
150	1	4	2	8
1,500	10	40	20	80
15,000	100	400	200	800

Table 1: HRC Basic Interpretation of Caltrans Lot Size & Test

## 52-5.01D(4) Quality Control

### 52-5.01D(4)(a) General

Maintain a daily production log for the fabrication of headed bar reinforcement for each production lot. The log must include:

1. Production lot numbers
2. Number of bars in each production lot
3. Heats of bar and head material used in each production lot
4. Fabrication records, including tracking and production parameters for welds or forgings

**KEY POINT:** Maintain a daily production log for each project requiring HRC 555 fabrication.

### 52-5.01D(4)(b) Quality Control Testing

A QC test must consist of tensile testing 4 headed bar reinforcement test samples selected from each lot of completed headed bar reinforcement before shipping the lot to the job site or PC plant.

Tensile test headed bar reinforcement test samples:

1. At a laboratory on the Authorized Laboratories List for testing reinforcing steel splices
2. In the condition received
3. Under ASTM A970/A970M

Do not perform tests on test samples from bundles containing fewer than 4 test samples.

**KEY POINT:** 4 samples per lot. See description of quantity of bars in lot above.

At least 5 business days before performing any testing at the authorized laboratory, notify the Engineer of:

1. Date of the testing
2. Location of the authorized laboratory where the tests will be conducted
3. Number of lots to be tested

At fracture, headed bar reinforcement test samples must comply with the requirements specified in section 52-5.02 as follows:

1. If only 1 test sample complies with the requirements, the Department rejects all headed bar reinforcement in the lot.
2. If only 2 test samples comply with the requirements, perform 1 additional test on the same lot of headed bar reinforcement. This additional test must consist of tensile testing 4 test samples, randomly selected by the Engineer and removed by you from the lot. If any of the 4 test samples from this additional test do not comply with the specified requirements, the Department rejects all headed bar reinforcement in the lot.
3. If 3 or more test samples comply with the requirements, the Department accepts all headed bar reinforcement in the lot.

**KEY POINT:** 3 of 4 samples must comply with requirements to pass. 2 of 4 samples passing requires additional testing, where ALL samples must pass. 1 of 4 samples passing = lot rejection.

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Tag each headed bar in a production lot to be shipped to the job site or PC plant in a way that allows accurate identification at the job site or PC plant.

## 52-5.01D(4)(c) Quality Control Test Report

The quality control test report must be (1) prepared by the laboratory performing the testing and (2) signed by an engineer representing the laboratory. The engineer must be registered as a civil engineer in the State.

## 52-5.01D(5) Department Acceptance

The Department tests headed bar reinforcement as specified for QC testing in section 52-5.01D(4)(b).

The Department will notify you of the Department acceptance test results for each bundle of 4 test samples of splices within 3 business days after METS receives the bundle unless more than 1 bundle is received on the same day, in which case allow 2 additional business days for each additional bundle received.

## 52-5.02 MATERIALS

Headed bar reinforcement must comply with ASTM A970/A970M.

At fracture, headed bar reinforcement must:

1. Comply with the tensile requirements of ASTM A970/A970M, Class A.
2. Show signs of visible necking in the reinforcing bar. The visible necking must be located at least 1 bar diameter away from the affected zone.

Equipment used to perform friction welding must be fitted with an in-process monitoring system to record essential production parameters that describe the process of welding the head onto the reinforcement.

Record the following parameters:

1. Friction welding force
2. Forge force
3. Rotational speed
4. Friction upset distance and time
5. Forge upset distance and time

**KEY POINT:** HRC 555 are 4Ab heads. Full size (9Ab) heads are the Caltrans standard, so be sure to review project plans/specs and determine if HRC 555 are acceptable. Note: If Caltrans plans show heads, and have been “designed in” to the project, the expectation is for you to supply 9Ab heads (HRC 100/200).

Headed bar reinforcement must have full size heads and must be on the Authorized Material List.

**KEY POINT:** If uncertainty exists on whether or not HRC 555 4Ab heads are acceptable, HRC recommends sending a confirming RFI prior to fabrication. Contact HRC if you need assistance.

If headed bar reinforcement is to be epoxy coated:

1. Round edges of heads
2. Remove sharp edges, burrs, and weld flash that would prevent proper coating of the headed bar

**KEY POINT:** If HRC 555 headed bars will be epoxy coated (after fabrication), the heads will need to be cleaned up (grind down rough edges, burrs, etc.)

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Do not use threaded heads if headed bar reinforcement is to be epoxy coated.

## **52-5.03 CONSTRUCTION**

Reserved

## **52-5.04 PAYMENT**

The payment quantity for headed bar reinforcement is the quantity of heads.

Reinforcing bar used for headed bar reinforcement is paid for as bar reinforcing steel. The length of bar used in calculating the weight of reinforcing bar is the entire length of the completed headed bar including the head thickness.

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## **Summary and Recommendations:**

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