HRC 500 Upset Headed Bar Testing

for HRC approved fabricators

V2 7/16/20

TECH NOTE

Introduction:

This document has been prepared to provide brief overview of the testing requirements associated with the fabrication of HRC 500 upset headed bars for use with the HRC 500 Mechanical Splicing System.

Background:

When reinforcing bars are headed at a fabricator's facility, the ICC-ES report requires 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
- ICC-ES ESR-2764
- ICC AC133 defines acceptance criteria for mechanical splice systems
- ASTM A370 defines test methods for mechanical testing of steel products
- ASTM A1034 defines testing mechanical splices for steel reinforcing bars
- HRC QA Manual
- **Please note that in some cases, other project specific specifications and/or requirements may govern.**

IBC Section 1704:

- Requires the code official to approve the fabricator.

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TECH NOTE

ICC-ES ESR-2764

- Section 5.8.1 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 5.8.1 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 5.8.2 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 5.8.3 states “For each coupler model type and steel reinforcing bar size and steel specification, the fabricator must demonstrate the following items to the satisfaction of the code official:
    - The fabricator prepares the ends of the steel reinforcing bar as required by HRC in a manner consistent with the qualifying test specimens.
    - For Type 2 splices, connections of each steel reinforcing bar using the fabricator-prepared steel reinforcing bars, tested in static tension, develop 100 percent of the specified tensile strength of the steel reinforcing bar and 125 percent of the specified yield strength of the reinforcing bar for use under the IBC. This may be demonstrated in test reports submitted to the code official.
    - For Type 1 splices, connections of each steel reinforcing bar using fabricator-prepared steel reinforcing bars, tested in static tension, develop at least 125 percent of the specified yield strength of the steel reinforcing bars. This may be demonstrated in test reports submitted to the code official.
    - You need to have test results proving you are capable of making products meeting HRC and/or the projects standards.

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HRC QA Manual:

1.11 Mechanical Connectors (Couplers)

ICC-ES ESR-2764 describes mechanical splices as a system consisting of coupler parts and steel reinforcing bars with specially prepared ends. The fabricator must be approved by the code official in accordance with IBC Section 1704.2. The fabricator must also demonstrate to the satisfaction of the code official for each coupler model type and steel reinforcing bar size that the ends of the steel reinforcing bar are prepared as defined by HRC, in a manner consistent with the qualifying test specimens.

Please note: Other project specifications / requirements may govern.

4.2.1 Upset Head Testing for Components Prepared at Fabrication Facility or Jobsite

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).

Typical Requirements*:

For Type 2 Splices: Develop 100% Tensile strength and 125% of the yield strength of the bar (IBC), and per UBC the lesser of 95% of the actual ultimate strength or 160% of specified yield strength of the bar. May be demonstrated in test report submitted to the code official.

For Type 1 Splices: Develop 125% of specified yield strength of the bar. May be demonstrated in test reports submitted to the code official.

*Other requirements may govern (e.g. Caltrans Service and Ultimate splices)

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:

The HRC QA manual discusses testing of HRC 500 upset headed bars. 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 and A1034. This type of destructive tensile testing will identify material quality issues will be able to confirm that the upset headed bars and couplers will perform as required, meeting or exceeding the ACI 318 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, upset heads should be checked regularly during fabrication. The critical HRC 500 upset head dimensions are overall diameter and minimum thickness per the HRC QA manual. These dimensions are easy to confirm by using HRC Go/No-Go gauges.