



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

NOV 18 2005

WBN-TS-04-18

10 CFR 50.90

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Gentlemen:

In the Matter of) Docket No. 50-390
Tennessee Valley authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - LICENSE AMENDMENT (WBN-TS-04-18) USE OF BAR LOCK MECHANICAL COUPLERS FOR SPLICING REINFORCING BARS IN THE SHIELD BUILDING RESTORATION - TEST RESULTS (TAC NO. MC5368)

The purpose of this letter is to document the summary of the test results for the Bar-Lock couplers as requested in NRC's letter dated March 7, 2005. The qualification testing was performed on the remaining couplers used at TVA's Sequoyah Nuclear Plant during Shield Building restoration from the steam generator replacement, as well as the newly manufactured couplers. Enclosed are the excerpts from the Engineering Test Report. These test results show that the remaining Sequoyah Nuclear Plant couplers as well as the new Bar-Lock couplers are qualified for use to repair the opening in the dome of the WBN Shield Building.

There are no regulatory commitments associated with this submittal. If you have any questions concerning this matter, please call me at (423) 365-1824.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on this 18 day of November. 2005.

Sincerely,



P. D. Pace
Manager, Site Licensing
and Industry Affairs

Enclosure

cc (Enclosure):

NRC Resident Inspector
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

Mr. D. V. Pickett, Project Manager
U.S. Nuclear Regulatory Commission
MS 08G9a
One White Flint North
11555 Rockville Pike
Rockville, Maryland 20852-2738

U.S. Nuclear Regulatory Commission
Region II
Sam Nunn Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, Georgia 30303

ENCLOSURE

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1
EXCERPTS FROM THE
ENGINEERING TEST REPORT 24900-ETR-001
FOR
BAR-LOCK QUALIFICATION

**ENGINEERING TEST REPORT
FOR
BAR-LOCK QUALIFICATION**

1.0 GENERAL

- 1.1 Watts Bar Nuclear Power Plant is a two-unit power plant located approximately 50 miles northeast of Chattanooga at the Watts Bar Site in Rhea County, Tennessee, which is operated by Tennessee Valley Authority (TVA, hereafter referred to as 'OWNER'). Bechtel (hereafter referred to as the CONTRACTOR) has the overall responsibility for execution of the Unit 1 Steam Generator Replacement (SGR) Project. The SGR project requires that openings be created in the concrete dome of the Shield Building to remove the generators. The Bar-lock couplers are to be used in the repair of these openings.
- 1.2 This test report documents the qualification of the Bar-lock couplers to be used in the repair of the opening in the Unit 1 Shield Building dome made during the steam generator replacement project.
- 1.3 The purpose of these tests is to provide the required documentation for the qualification of the Barlock couplers to the requirements of ASME Section III Division 2 Article CC 4330, "Splicing of Reinforcing Bars" for use in the repair of the construction opening in the concrete Shield Building Dome made during the steam generator replacement project outage.

2.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

2.1 General

The edition of the codes and standards referred to in this report are those noted below.

2.2 American Society for Testing and Materials (ASTM)

- A 370 – 97a Standard Test Methods and Definitions for Mechanical Testing of Steel Products
- A 615 – 96a Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

2.3 American Society of Mechanical Engineers

Boiler and Pressure Vessel Code, 1992, Section III, Division 2

2.4 American National Standards Institute (ANSI)

- N45.2-1977 Quality Assurance Program Requirements for Nuclear Facilities
- ANSI N45.2.2-72 Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants
- ANSI N45.2.5-74 Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants
- N45.2.6-1978 Qualifications of Inspection, Examination, and Testing Personnel for Nuclear Power Plants

2.5 Reference Documents

24900-C-312, "Technical Specification for Installation of Bar-Lock Rebar Splices"

24900-BL, "Bar-Lock Installation Guidelines"

24900-C-602, "Testing of Bar-lock Splices"

Satec Test Machine Operation Manual

3.0 TESTING

3.1 The testing of the couplers (remaining Sequoyah couplers as well as the newly manufactured couplers) was per the requirements of Specification 24900-C-602, "Technical Specification for Qualification Testing of Bar-Lock Mechanical Rebar Splices." The testing occurred during the week of August 29th, 2005. The testing was performed using Bechtel's SATEC machine located at Palo Verde Nuclear Station in Arizona. The calibration data is attached to this report.

3.2 Rebar from the same lot was used in the tests.

3.3 Six 36" long sections of rebar were prepared for static tensile testing for each rebar size (spares were also prepared).

3.4 Eighteen coupler rebar assemblies were manufactured for each rebar size for testing (12 static tensile tests and 6 cyclic tensile tests). Spares were also prepared.

3.5 Static Tensile Test Acceptance Criteria

3.5.1 The average tensile strength of the splices shall not be less than 90% of the actual tensile strength of the unspliced rebar being tested, nor less than 100% of the specified minimum tensile strength of the rebar. For Grade 60 rebar, the minimum specified tensile strength is 90 ksi.

3.5.2 The tensile strength of an individual splice shall not be less than 125% of the specified minimum yield strength of the rebar. For Grade 60 rebar, the minimum specified yield strength is 60 ksi.

3.6 Cyclic Tensile Test Acceptance Criteria

3.6.1 The spliced rebar shall be able to withstand 100 cycles of stress variation from 5% to 90% of the specified minimum yield strength of the rebar. For Grade 60 rebar, 5% minimum specified yield strength is 3 ksi, and 90% minimum specified yield strength is 54 ksi.

4.0 RESULTS

4.1 Static Tensile Tests

4.2 Qualification of #6 Bar-Lock Couplers

4.2.1 The average tensile strength (stress) of the 6 rebar samples is as follows:

4.2.2 Average Ultimate Strength ($F_{u \text{ avg}(\text{bar})}$) of #6 Rebar: 111,901 psi

4.3 Sequoyah Bar-Lock Couplers #6

4.3.1 Average Ultimate Strength ($F_{u \text{ avg}(\#6 \text{ Barlock})}$) of #6 Bar-Lock Coupler (Sequoyah): 104,350 psi

4.3.2 Acceptance Criteria:

- A. $F_{u \text{ avg}(\#6 \text{ Barlock})} > .9 F_{u \text{ avg}(\text{bar})}$ and
- B. $F_{u \text{ avg}(\#6 \text{ Barlock})} > F_{u(\text{specified minimum})}$
- C. $F_u (\text{each splice}) > 1.25 F_y$

4.3.3 Test Result:

- A. $104,350 \text{ psi} > .9(111,901) = 100,712 \text{ psi}$ Therefore, Pass
- B. $104,350 \text{ psi} > 90,000 \text{ psi}$ Therefore, Pass
- C. All individual couplers $F_u > 1.25 (60 \text{ psi}) = 75 \text{ psi}$ (See Appendix C, "Test Checklist Summary") Therefore, Pass

4.4 New Bar-Lock Couplers #6

4.4.1 Average Ultimate Strength ($F_{u \text{ avg}(\#6 \text{ Barlock})}$) of #6 Bar-Lock Coupler (New): 107,730 psi

4.4.2 Acceptance Criteria:

- A. $F_{u \text{ avg}(\#6 \text{ Barlock})} > .9 F_{u \text{ avg}(\text{bar})}$ and
- B. $F_{u \text{ avg}(\#6 \text{ Barlock})} > F_{u(\text{specified minimum})}$
- C. $F_u (\text{each splice}) > 1.25 F_y$

4.4.3 Test Result:

- A. $107,730 > .9(111,901) = 100,712 \text{ psi}$ Therefore, Pass
- B. $107,730 \text{ psi} > 90,000 \text{ psi}$ Therefore, Pass
- C. All individual couplers $F_u > 1.25 (60 \text{ psi}) = 75 \text{ psi}$ (See Appendix C, "Test Checklist Summary") Therefore, Pass

4.5 Qualification of #8 Bar-Lock Couplers

4.5.1 The average tensile strength (stress) of the 6 rebar samples is as follows:

4.5.2 Average Ultimate Strength ($F_{u \text{ avg}(\text{bar})}$) of #8 Rebar: 105,066 psi

4.6 Sequoyah Bar-Lock Couplers #8

4.6.1 Average Ultimate Strength ($F_{u \text{ avg}(\#8 \text{ Barlock})}$) of #8 Bar-Lock Coupler (Sequoyah): 102,306 psi

4.6.2 Acceptance Criteria:

- A. $F_{u \text{ avg}(\#8 \text{ Barlock})} > .9 F_{u \text{ avg}(\text{bar})}$ and
- B. $F_{u \text{ avg}(\#8 \text{ Barlock})} > F_{u(\text{specified minimum})}$
- C. $F_u (\text{each splice}) > 1.25 F_y$

4.6.3 Test Result

- A. $102,306 \text{ psi} > .9(105,066) = 94,560 \text{ psi}$ Therefore, Pass
- B. $102,306 \text{ psi} > 90,000 \text{ psi}$ Therefore, Pass

- C. All individual couplers $F_u > 1.25 (60 \text{ psi}) = 75 \text{ psi}$ (See Appendix C, "Test Checklist Summary") Therefore, Pass

4.7 New Bar-Lock Couplers

- 4.7.1 Average Ultimate Strength ($F_{u \text{ avg}(\#8 \text{ Barlock})}$) of #8 Bar-Lock Coupler (New): 99,951 psi

- 4.7.2 Acceptance Criteria:

- A. $F_{u \text{ avg}(\#8 \text{ Barlock})} > .9 F_{u \text{ avg}(\text{bar})}$ and
- B. $F_{u \text{ avg}(\#8 \text{ Barlock})} > F_{u(\text{specified minimum})}$
- C. $F_u (\text{each splice}) > 1.25 F_y$

- 4.7.3 Test Result:

- A. $99,951 \text{ psi} > .9(105,066) = 94,560 \text{ psi}$ Therefore, Pass
- B. $99,951 \text{ psi} > 90,000 \text{ psi}$ Therefore, Pass
- C. All individual couplers $F_u > 1.25 60 \text{ psi} = 75 \text{ psi}$ (See Appendix C, "Test Checklist Summary") Therefore, Pass

4.8 Cyclic Tensile Tests

- 4.8.1 All #6 and #8 rebar assemblies completed the required number of cycles without failure.

5.0 CONCLUSION

- 5.1 The test results, as shown above and attached to this report, show that the Bar-lock couplers are qualified for use to repair the construction opening in the dome of the Shield Building at Watts Bar Nuclear Plant. This qualification applies to the new couplers manufactured in 2005 as well as the remaining Sequoyah couplers.