

DETAILED PROCEDURE
FOR
TEST PROGRAM TO EVALUATE
WELDS OF ANCHOR RODS AND STUDS
TO EMBEDDED PLATES

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1.0 Purpose of the Test Program

This program is authorized by Union Electric Company to evaluate the performance of weldments which secure anchor rods and studs onto embedded plates. These tests will supplement Union Electric's report of the Acceptability of Embedded Plates dated March 10, 1978 (ULNRC-238) and its findings. Although the referenced report established that the welds on both the manually welded anchor rods and the machine welded studs installed in concrete prior to June 9, 1977 were a "completely acceptable" product, physical tests on a random sample of those embeds manufactured during that period were requested by the NRC. The test program is directed only at the evaluation of the welds between the studs and anchor rods to the plates.

The bend tests as identified herein are being conducted for information only. Tests of this nature are not required by the governing codes or specifications, nor does such testing reflect loads imposed on the welded assembly by design intent. Therefore, failure of a weld during the bend test cannot of itself constitute a determination that the weld was not suitable for the purpose intended by the design.

2.0 Description of the Test Program

The following tests will be conducted:

2.1 Manually welded embeds

From the 48 embeds segregated and stored at the Callaway jobsite twelve plates have been selected for testing. Six rods on six separate plates have been selected for bend tests. The specific rods have been designated and their direction of bend specified by the NRC. Six additional rods on six other plates were selected by Union Electric for tension testing. The selections included rods having welds with most apparent visual deviations. These selections will be available for NRC review before the test. Bend and tension testing will be done at Lehigh University.

2.2 Machine welded plates

Six plates, embedded in concrete prior to June 9, 1977 shall be identified at the jobsite and tested in place to a load not exceeding the design load conditions (plus load tolerances). The plate selections will be reviewed by the NRC prior to testing.

2.3 Results and Reports

The testing will be witnessed at the jobsite and/or the laboratory by the persons specified below or their authorized representatives. A report, based on the tests, will be issued shortly thereafter.

3.0 Organization for the Test Program

The following lists various entities and their affiliated personnel involved in the test program including their primary responsibilities, where applicable.

Union Electric Company

- D. Schnell - Overall responsibility and coordination with NRC
- W. Zvanut - UF coordinator and witness for testing
- K. Kuechenmeister - Field coordinator with DIC
- R. Powers - QA and witness for testing

Nuclear Regulatory Commission

- E. Gallagher - Witness and observer for test program;
Review test program for acceptability to NRC

Bechtel Power Corporation

- P. Divjak - coordinator between UE/NRC.
- E. Thomas/A. Pagano - Technical direction, responsible for the test set-up.
- K. Parikh - Overall coordinator for test program and report.
Witness for the test program.

Daniel International, Inc.

- _____ - Assistance in the field test program.
Furnishing labor, materials and transportation as required for the test program.

- Dr. Fisher and Dr. Slutter - Consultants; advise test set-up and test procedures and for conducting testing at Lehigh University and at the jobsite as well as recording and reporting all test results at both the laboratory and jobsite.

4.0 Detailed Procedures

4.1 Manually welded rods

From the 48 embeds isolated and held in storage at the jobsite, twelve plates designated herein shall be shipped to Dr. Roger Slutter, Lehigh University, Department of Civil Engineering, Fritz Engineering Laboratory #13, Bethlehem, PA 18015. The following plates and anchor rods are to be used for the designated testing method.

<u>Tension Tests</u>			<u>Bend Tests</u>		
FP412	A16-19 Left,	Rod #5	EP611	A31-2	Rod #2
EP711	A7-155	Rod #5	EP511	A32-2	Rod #5
EP511	A11-1	Rod #5	EP511	A11-46	Rod #9
FP412	A16-18 Bot.,	Rod #12	EP511	A11-42	Rod #10
EP412	A16-18 Top,	Rod #10	EP611	D24-1	Rod #5
EP711	A7-223	Rod #6	EP611	A24-2	Rod #1

Upon arrival at the test laboratory, the plates shall be properly stored in a secure place.

The anchor rods which are to be tested shall be visually examined for any damage during the shipment. If the anchor rod or the 3" x 3" plate at the end of the rod is found to be damaged, the overall coordinator shall determine its suitability for the test program.

The welds that are tested shall then be photographed from at least two angles. The welds between the plate and anchor rod shall then be examined by either the magnetic particle or dye penetration method and the results of test shall be recorded.

In the event the non-destructive examinations show defects in the welds (other than undersize or undercut), the overall coordinator and the consultants shall assess impact of these defects prior to testing. Another rod from the furnished plates shall be selected for the test program to replace the one which was rejected. The 3" x 3" plates for the qualified bolts shall be painted red for tension test and green for bend test. At least one additional anchor rod other than those identified previously in each category shall be selected for use in refining the loading procedures. Thus, seven bolts in each category are required for the test program. The selection process described above shall be performed in the presence of a consultant and the overall coordinator. In the event the selection of an anchor rod for the test program has changed, the overall coordinator shall notify Union Electric, before testing proceeds.

The selected anchor rods shall be isolated by cutting a nominal 8" x 8" square plate around each bolt. The initial "rough" cutting of the plate may be done by gas torch; however, the final cutting shall be done by sawing the plate under the supervision of the con-

sultant. Precautions shall be taken to assure that the weld at the juncture of anchor rod and the plate is not affected by the cutting processes.

The individual assemblies obtained shall be sequentially numbered with a waterproof marker such that the marks or tags will be visible during testing. A record referencing the assembly numbers to the original plate numbers shall be maintained by the consultant.

The testing shall take place in the presence of designated personnel. The tension tests and the bend tests shall be done in the 300,000# capacity Baldwin machine. Certified calibration records indicating dates of calibration of the Baldwin machine, strain gages, and associated instrumentation shall be given to the overall coordinator prior to testing. Photographs of each test and a video cassette of test progress shall be recorded and referenced in accordance with the rod numbers.

4.1.1 TENSION TEST - RODS

Tension tests shall be conducted by gradually increasing the load in 10 kip increments until failure of the rod shank or the failure of the weld occurs. The change in the length of the rod shall be recorded for each load increment. Additional intermediate readings may be taken to obtain sufficient data to develop an elastic curve with a well defined yield point. All test data shall be recorded by the consultants and the originals of the recorded data shall be signed by at least one person from each entity represented.

4.1.2 BEND TEST - RODS

A bend test shall first be performed on a selected anchor rod other than those listed above to establish detailed loading procedures. During this first test the relationship of the applied load to deflection angle, the grip at base to hold the assembly, recovery of deflection when the load is released and approximate bend line above the plate shall be noted.

For bend tests on the designated anchor rods a strain gage shall be attached to the shank of the rod where maximum strain is expected, based on results of the initial test. The load shall be applied in 100 lb. increments or less as required to develop data for a load-strain curve. The applied loads and the corresponding strains from the strain gage shall be recorded. The anchor rod shall be bent up to 30 degree angle with tolerances of ± 2 degrees. The welds shall be observed for any sign of cracking during the application of the load. If cracking occurs, the corresponding strain in the rod shall be recorded.

Upon completion of the tests all assemblies shall be packed and shipped to Daniel International Corporation, State Highway CC - 3 miles north of Highway 94, Portland, MO 65057, Attention: K. Kuechenmeister.

4.2 Machine welded studs

The overall coordinator, with the assistance of field personnel, shall select six plates which were embedded in concrete prior to June 9, 1977. The field coordinator shall obtain copies of material certificates for the plates and concrete cylinder test results for the applicable pours and forward them to the overall coordinator. The selection shall be based upon accessibility to the plates and feasibility of mounting a test rig for the plates. The selected plates shall be sequentially numbered and a record of the assigned number to the designated plate number shall be maintained by the field coordinator.

The testing rig, a 30-ton jack and accessories, and two dial gages to measure deflection shall be supplied by the consultants. Certified calibration records indicating the date of calibration for the jack and associated instrumentation shall be given to the overall coordinator prior to testing.

A 1-1/2 inch diameter threaded rod of at least ASTM A-36 quality as shown in Figure 1 shall be welded to each plate near the center of a four stud cluster as defined by the overall coordinator. The weld shall be examined by magnetic particle method prior to testing. The attachment shall be welded 24 hours prior to the actual testing and care shall be exercised to ascertain that the attachment is not loaded by the construction personnel prior to testing. For holding the testing rig in place 4 expansion anchors 1/2 inch diameter and 4" long shall be installed as shown on Figure 1 (See Specification C-103A).

The testing rig shall be mounted on the expansion anchors and firmly secured in place. The jack shall be installed on the threaded attachment to the plate and the hydraulic pump shall be set on a table next to the wall. Dial gages shall be mounted by the consultants on the plate at desirable locations. Load shall be increased gradually on the plate and the deflection readings corresponding to the applied load shall be recorded. The maximum applied load shall be at least the design load but shall not exceed the design load plus 15%. When the maximum load is reached, the final reading for the deflection shall be taken two minutes later and the load shall be released. The test rig shall be moved to the next plate and the same procedure shall be continued.

The originals of the field results shall be signed by the overall coordinator and the consultant. Photographs and a video cassette shall record the test progress.

Note: Minor concrete spalling may occur during plate testing and should not be considered an unusual occurrence.

5.0 Results and Report

The recorded results shall be represented in a tabular and a graphic format in a report. The report shall be prepared by Bechtel with assistance from the consultants. The report shall include conclusions of the test.