



## REMR TECHNICAL NOTE CS-ES-1,5

### SPECIFYING WELDING OR NONDESTRUCTIVE TESTING OF WELDS

PURPOSE: To provide information on sections of the American Welding Society (AWS) Structural Welding Code D1.1 (Ref a) that should be referenced when a welding or inspection project will be performed.

ADVANTAGE: By referencing the AWS Structural Welding Code, most of the difficulties involving delegation of responsibilities on a welding project or preparing a nondestructive testing inspection procedure are eliminated.

WELDING CODE: The AWS Structural Welding Code D1.1 covers prequalified joints, workmanship of the weld, qualification of welders, welding procedure qualifications, inspection, and acceptance/rejection criteria. AWS Code BI.10 (Ref b) covers the descriptions of nondestructive testing methods (NDT) and discusses relating nondestructive methods to the type of joint, the welding process employed, the types of discontinuities characteristic of welding processes, and the capability of a particular inspection method to disclose discontinuities.

FIELD USE: Many specifications for both new steel construction and repair work are vague and do not specifically address welding and nondestructive testing requirements. The use of the AWS Code will eliminate most problems in this area plus make the contractor responsible for doing a good job. For example, paragraph 6.7 in the AWS Code states, "When nondestructive testing other than visual is to be required, it shall be so stated in the information furnished to the bidders. This information shall designate the categories of welds to be examined, the extent of examination of each category, and the method or methods of testing." When radiographic and ultrasonic testings are used, the procedures and techniques are outlined in the Code. The AWS Code has specific acceptance criteria for performance of these NDT methods in addition to visual-inspection acceptance criteria. There is a significant difference between the AWS Code and American Society for Testing and Materials (ASTM) E 164 on ultrasonic testing, especially in the calibration and acceptance criteria used. When dye penetrant or magnetic particle testing is specified, the AWS Code references ASTM E 165 and ASTM E 709 (Ref c and d), respectively.

RESPONSIBILITY OF CONTRACTOR: If the specification writer follows the AWS Code, vague statements, such as, "When necessary to verify the quality of the weld, have it tested," will be eliminated. This statement does not specify how the weld is to be tested or what the acceptance/rejection criteria are; therefore, the statement is useless. On the other hand, if a contract were written with no requirements for inspection, not even visual inspection, it would allow the contractor to do almost anything legally.

Contractors and those responsible for the welding and inspection of welds should have a copy of the AWS Code and be aware of its workmanship requirements. The quality of the workmanship is the responsibility of the contractor; therefore, the contractor should have a copy of the Code in order to perform a welding procedure, certify welders, perform a nondestructive testing of the welds, and determine the accept/reject criteria.

When the engineer or specification writer quotes the AWS Code, the engineer makes the contractor responsible for having a written welding procedure, preparing joints in accordance with a qualified procedure, and welding these joints to a specified procedure. These specifics include groove angle, root opening, effective throat, and welding process. By using the AWS Code, the contractor must have a written qualified joint-procedure specification, welder and welding operator qualification test record, and reports of the nondestructive testing method used.

The - AWS Code also specifies, "All prequalified joint welding procedures to be used shall be prepared by the manufacturer, fabricator, or contractor as written in specifications and shall be available to those authorized to examine them." Most fabricators of steel structures have these written procedures, but many contractors who perform field welding do not. Undoubtedly some have never heard of welding procedures. A government inspector should never be confronted with a situation that has no written welding procedures.

REFERENCES:

- a. American Welding Society. 1986. "Structural Welding Code--Steel," AWS DI.1, Miami, FL.
- b. \_\_\_\_\_. 1986. "Guide for Nondestructive Testing of Welds," AWS BI.10, Miami, FL.
- c. American Society for Testing and Materials. 1983. "Practice for Liquid Penetrant Inspection Method," Designation: E 165, Philadelphia, PA.
- d. \_\_\_\_\_. 1985. "Practice for Magnetic Particle Examination," designation: E 709, Philadelphia, PA.