



## DRAFT REGULATORY GUIDE

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### DRAFT REGULATORY GUIDE DG-1167

(Proposed Revision 1 of Regulatory Guide 1.71, dated December 1973)

## WELDER QUALIFICATION FOR AREAS OF LIMITED ACCESSIBILITY

### A. INTRODUCTION

This guide describes a method that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for implementing the agency's requirements regarding the control of welding for nuclear components, as they relate to light-water-cooled and gas-cooled reactors. In particular, General Design Criterion 1, "Quality Standards and Records," as specified in Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10, Part 50, of the *Code of Federal Regulations* (10 CFR Part 50), "Domestic Licensing of Production and Utilization Facilities," requires that structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. To augment that requirement, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 requires the establishment of measures to ensure the control of materials and special processes such as welding, as well as proper welder qualification. Moreover, 10 CFR 50.55a, "Codes and Standards," requires, in part, that components of the reactor coolant pressure boundary must be designed, fabricated, erected, and tested in accordance with the standards in Section III, "Nuclear Power Plant Components," of the Boiler and Pressure Vessel Code promulgated by the American Society of Mechanical Engineers (ASME), or equivalent quality standards.

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This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received staff review or approval and does not represent an official NRC staff position.

Public comments are being solicited on this draft guide (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rules and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments may be submitted electronically through the NRC's interactive rulemaking Web page at <http://www.nrc.gov/what-we-do/regulatory/rulemaking.html>. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by **December 10, 2006**.

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This regulatory guide contains information collections that are covered by the requirements of 10 CFR Part 50 which the Office of Management and Budget (OMB) approved under OMB control number 3150-0011. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

## **B. DISCUSSION**

Sections III, "Nuclear Power Plant Components," and VIII, "Pressure Vessels," of the ASME Code specify standards for fabricating Class 1, 2, and 3 components.<sup>1</sup>

### **Performance Qualification**

Sections III of the ASME Code provides for adherence to Section IX, "Welding Qualifications," which, in turn, calls for welder qualification for production welding. In particular, review of the performance qualifications in Section IX indicates the desirability of supplementary requirements to provide improved control of welder technique in the production welding of low-alloy and high-alloy steels. Specifically, the assurance of satisfactory welds in locations with restricted direct physical and visual accessibility can be significantly increased by qualifying the welder under conditions simulating the space limitations under which the actual welds must be made.

Experience has shown that a welder who is qualified to weld components under normal fabricating conditions may not produce acceptable welds if accessibility to the weld area is restricted. Limited accessibility can occur when component parts are joined or repaired in the final assembly or at the plant site if the location and other adjacent components or structures prevent the welder from assuming an advantageous position during the welding operation. Limited accessibility is particularly disadvantageous in the welding of high-alloy steels and nickel-base alloys because welder technique (such as electrode manipulation) is an important variable in the welding procedure.

Section IX, paragraph QW-351, specifies conditions for which a welder must requalify, but it lacks a particular reference to conditions with limited positioning, accessibility, and visibility. It is general practice in nuclear shipbuilding and petrochemical process piping fabrication to include requirements for welder accessibility to production welds. This practice involves simulating the conditions of restricted welder accessibility to a production weld when the clearance is less than 30 centimeters (12 inches) in any direction from the joint. However, requalification would not be required for various restricted accessibility conditions unless essential variables of Section IX are changed.

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<sup>1</sup> Copies of ASME standards discussed herein may be obtained from the American Society of Mechanical Engineers, Three Park Avenue, New York, New York 10016-5990; telephone (800) 843-2763; <http://catalog.asme.org/home.cfm?CATEGORY=CS&TaxonomyItemID=3021>.

Similarly, Section IX, paragraph QW-303, defines limits of qualified positions and diameters, and paragraph QW-461 specifies test positions for groove welds. Positions 2G and 5G, with a corner structural enclosure that limits access to within 30 centimeters (12 inches) on two sides and overhead, may provide an acceptable simulation of welder accessibility for certain cases. These tests should be evaluated in accordance with Section IX, with at least one test specimen representing the least favorable position, access, and visibility imposed on the welder.

As a preferred alternative, the structure to be welded (including its actual access limits) may be simulated. Using this mockup, one test specimen should be taken from the weld location representing the least favorable position imposed on the welder, and this specimen should be evaluated in accordance with the radiographic criteria of Section IX, paragraphs QW-191 and QW-302.2. This test specimen should also be sectioned for macro examination (paragraph QW-184) and hardness evaluation of the composite weldment, with particular attention to the root fusion and weld toe conditions.

### **Production Welds**

The qualification (procedure and performance) of welds with limited accessibility, by itself, does not ensure that production welds with limited accessibility will conform to the specified criteria. To better ensure that the welds are acceptable, production welding should be monitored to verify correct application of procedure parameters, welder technique, and limited accessibility qualification criteria.

## **C. REGULATORY POSITION**

Weld fabrication and repair for wrought low-alloy and high-alloy steels, nickel-base alloys, or other materials (such as static and centrifugal castings and bimetallic joints) should comply with the fabrication standards specified in Sections III and IX of the ASME Code, supplemented by the following:

- (1) Performance qualification should provide for testing the welder under simulated position, access, and visibility limitations when any of these physical conditions restrict the welder's access to a production weld to less than 30 centimeters (12 inches) in any direction from the joint, or when visibility of the weld pool is limited or the welder must assume an awkward position.
- (2) Requalification should be necessary when (a) position, access, and visibility conditions for production welding are significantly more limiting than the physical conditions present during qualification, or (b) any of the essential welding variables listed in Section IX change.
- (3) Production welding and adherence to welding qualification criteria should be monitored.

## **D. IMPLEMENTATION**

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this draft regulatory guide. No backfitting is intended or approved in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. Except in those cases in which an applicant or licensee proposes or has previously established an acceptable alternative method for complying with specified portions of the NRC's regulations, the methods to be described in the active guide will reflect public comments and will be used in evaluating (1) submittals in connection with applications for construction permits, standard plant design certifications, operating licenses, early site permits, and combined licenses; and (2) submittals from operating reactor licensees who voluntarily propose to initiate system modifications if there is a clear nexus between the proposed modifications and the subject for which guidance is provided herein.

# REGULATORY ANALYSIS

## 1. Statement of the Problem

The NRC initially issued Regulatory Guide 1.71, “Welder Qualification for Areas of Limited Accessibility,” in December 1973. The guidance does not reflect changes in the ASME Boiler and Pressure Vessel Code formatting since 1973. All of the ASME paragraphs referenced in the December 1973 version of Regulatory Guide 1.71 have changed in designation. For example, “Section IX, paragraph Q-22,” should now read as “Section IX, paragraph QW-351.” Therefore, revision of this regulatory guidance is necessary to include updates in the ASME Code.

## 2. Objective

The objective of this regulatory action is to update the NRC’s guidance for welder qualification for areas of limited accessibility, consistent with changes in the ASME Code since December 1973.

## 3. Alternative Approaches

The NRC staff considered the following alternative approaches to the problem of outdated guidance regarding welder qualification for areas of limited accessibility:

- (1) Do not revise Regulatory Guide 1.71.
- (2) Update Regulatory Guide 1.71.

### 3.1 Alternative 1: Do Not Revise Regulatory Guide 1.71

Under this alternative, the NRC would not revise this guidance, and licensees would continue to use the original version of this regulatory guide. This alternative is considered the baseline or “no action” alternative and, as such, involves no value/impact considerations.

### 3.2 Alternative 2: Update Regulatory Guide 1.71

Under this alternative, the NRC would update Regulatory Guide 1.71 to be consistent with changes in the ASME Code, as they relate to paragraph designation formatting.

This action would clarify the guidance and references to ASME Code for applicants building new nuclear power plants, as well as for licensees.

The costs to the NRC would include the relatively small, one-time cost of issuing the revised regulatory guide.

## 3. Conclusion

Based on this analysis, the staff recommends that the NRC revise Regulatory Guide 1.71. The staff concludes that the proposed action will reduce any unnecessary confusion when referencing the ASME Code.

## **BACKFIT ANALYSIS**

This proposed Revision 1 of Regulatory Guide 1.71 provides licensees and applicants with revised guidance that the NRC staff considers acceptable for welder qualification for areas of limited accessibility. The application of this guide is entirely voluntary. Licensees may continue to use the original version of this regulatory guide if they so choose. Consequently, no backfit, as defined in 10 CFR 50.109, "Backfitting," is either intended or implied.