

REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 3.28

WELDER QUALIFICATION FOR WELDING IN AREAS OF LIMITED ACCESSIBILITY IN FUEL REPROCESSING PLANTS AND IN PLUTONIUM PROCESSING AND FUEL FABRICATION PLANTS

A. INTRODUCTION

Section 50.34, "Contents of Applications; Technical Information," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires, among other things, that each application for a construction permit or operating license for a fuel reprocessing plant include a discussion of how the applicable requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 will be satisfied. As used in Appendix B, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that safety-related structures, systems, and components will perform satisfactorily in service. Appendix B requires, in part, that measures be established to ensure that special processes, including welding, are controlled and accomplished by qualified personnel using qualified procedures. Paragraph 70.22(f) of 10 CFR Part 70, "Special Nuclear Material," requires that each application for a license to possess and use special nuclear material in a plutonium processing and fuel fabrication plant contain a description of the quality assurance program to be applied to the design, fabrication, construction, testing, and operation of the structures, systems, and components of the plant and that the description include a discussion of how the criteria of Appendix B to Part 50 will be met. Paragraph 70.23(b) of 10 CFR Part 70 provides that the Commission will approve construction of a plutonium processing and fuel fabrication plant when it has determined that the design bases and the quality assurance program provide reasonable assurance of protection against natural phenomena and the consequences of potential accidents, noting that the criteria in Appendix B to 10 CFR Part 50 will be used by the Commission in determining the adequacy of the quality assurance program.

This guide describes a method acceptable to the NRC staff for meeting these requirements with regard to the control of welding of nuclear components for fuel reprocessing plants and for plutonium processing and fuel fabrication plants.

B. DISCUSSION

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code* (ASME Code), Section III, "Nuclear Power Plant Components," and Section VIII, "Pressure Vessels," specify requirements for fabricating components as indicated in the section titles. Many of the requirements of this Code can also be applied to safety-related structures, systems, and components of fuel reprocessing plants and plutonium processing and fuel fabrication plants. Specific portions of the ASME Code and of other applicable codes and standards have been used for fabricating components for such plants. Acceptable practices can differ significantly because there has not been sufficient guidance toward standardization. In the interest of standardization, this guide specifies procedures acceptable to the NRC staff for the qualification of welders for welding in areas of limited accessibility in the plants discussed above. These procedures, which draw on those used for nuclear power plants, will provide a uniform quality level consistent with the function of safety-related structures, systems, and components of fuel reprocessing plants and of plutonium processing and fuel fabrication plants.

*American Society of Mechanical Engineers Boiler and Pressure Vessel Code, 1974 Edition. All references to the ASME Code are to the 1974 edition. Copies may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.

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Performance Qualification

Section III and Section VIII require adherence to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications." One of the requirements is welder qualification for production welds. Review of the requirements of Section IX for performance qualifications indicates the desirability of supplementary requirements to provide better control of welder technique in the production welding of low-alloy and high-alloy steels. Specifically, the assurance of satisfactory welds in locations of restricted direct physical and visual accessibility can be increased significantly by qualifying the welder under conditions simulating the space limitations under which the actual welds must be made.

Experience has shown that a welder qualified to weld components under normal fabricating conditions may not produce acceptable welds if the 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 where other adjacent components or structures prevent the welder from assuming an advantageous position during the welding operation. This disadvantage is particularly important 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-350, specifies conditions for which a welder must requalify, but it lacks specific reference to conditions with limited accessibility and visibility. It is general practice in nuclear shipbuilding to include requirements for welder accessibility to production welds. This practice requires that conditions of restricted welder accessibility to a production weld be simulated when the clearance is less than 30 cm (12 inches) in any direction from the joint. However, requalification would not be required for different restricted accessibility conditions unless other essential elements listed in Section IX are changed.

Section IX, paragraph QW-120, specifies test positions for groove welds. Positions 2G and 5G with a corner structural enclosure that limits access to within 30 to 35 cm (12 to 14 inches) on two sides and overhead would provide acceptable simulation of welder accessibility. Evaluation of tests should be in accordance with Section IX with at least one test specimen representing the least favorable position imposed on the welder.

As an alternative, the structure to be welded, including its actual access limits, may be simulated. From this mockup, one test specimen should be taken from the weld location representing the least favorable position imposed on the welder. The test specimen should be evaluated in accordance with the radiographic requirements of Section IX, paragraphs QW-302.2 and QW-318. In addition, the test section should be sectioned for

macro examination and hardness evaluation of the composite weldment with particular attention to the root fusion and weld toe conditions.

Production Welds

The welding qualification (procedure and performance) by itself does not ensure that the production welds will be made within the specified requirements. To ensure that the welds will be acceptable, the welding process should be audited for correct application of procedure parameters and welder technique.

C. REGULATORY POSITION

Weld fabrication and repair for safety-related structures, systems, and components of wrought low-alloy and high-alloy steels, including nickel base alloys and stainless steels, or other materials such as static and centrifugal castings and bimetallic joints should be performed by qualified welders and procedures in accordance with the requirements of Section IX of the ASME Code supplemented by the following:

1. The performance qualification should require testing of the welder under simulated access conditions when physical conditions restrict the welder's access to a production weld to less than 30 to 35 cm (12 to 14 inches) in any direction from the joint.
2. Requalification is required:
 - a. When significantly different restricted accessibility conditions occur, or
 - b. When any of the essential welding variables listed in Section IX are changed.
3. Production welding should be monitored and adherence to welding qualification requirements should be certified.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for utilizing this regulatory guide.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used in the evaluation of submittals in connection with applications for permits and licenses docketed after October 20, 1975.

If an applicant wishes to use this regulatory guide in developing submittals for applications docketed on or before October 20, 1975, the pertinent portions of the application will be evaluated on the basis of this guide.

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NUCLEAR REGULATORY COMMISSION
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