perform or supervise the work. These visual examinations are not required to be performed by personnel and procedures qualified to NB-5500 and NB-5100, respectively, unless so specified.

**NB-4225 Testing of Welding and Brazing Material**

All welding and brazing material shall meet the requirements of NB-2400.

**NB-4130 REPAIR OF MATERIAL**

**NB-4131 Elimination and Repair of Defects**

Material originally accepted on delivery in which defects exceeding the limits of NB-2500 are known or discovered during the process of fabrication or installation is unacceptable. The material may be used provided the condition is corrected in accordance with the requirements of NB-2500 for the applicable product form, except:

(a) the limitation on the depth of the weld repair does not apply;
(b) the time of examination of the weld repairs to weld edge preparations shall be in accordance with NB-5130;
(c) radiographic examination is not required for weld repairs to seal membrane material when the material thickness is 3/4 in. (6 mm) or less.

**NB-4132 Documentation of Repair Welds of Base Material**

The Certificate Holder who makes a repair weld exceeding in depth the lesser of 3/8 in. (10 mm) or 10% of the section thickness, shall prepare a report that shall include a chart that shows the location and size of the prepared cavity, the welding material identification, the welding procedure, the heat treatment, and the examination results of repair welds.

**NB-4200 FORMING, FITTING, AND ALIGNING**

**NB-4210 CUTTING, FORMING, AND BENDING**

**NB-4211 Cutting**

Materials may be cut to shape and size by mechanical means, such as machining, shearing, chipping, or grinding, or by thermal cutting.

**NB-4211.1 Preheating Before Thermal Cutting.** When thermal cutting is performed to prepare weld joints or edges, to remove attachments or defective material, or for any other purpose, consideration shall be given to preheating the material, using preheat schedules such as suggested in Section III Appendices, Nonmandatory Appendix D.

**NB-4212 Forming and Bending Processes**

Any process may be used to hot or cold form or bend pressure-retaining material (NB-4223), including weld metal, provided the required dimensions are attained (see NB-4214 and NB-4220), and provided the impact properties of the material, when required, are not reduced below the minimum specified values, or they are effectively restored by heat treatment following the forming operation. Hot forming is defined as forming with the material temperature higher than 100°F (56°C) below the lower transformation temperature of the material. When required, the process shall be qualified for impact properties as outlined in NB-4213. When required, the process shall be qualified to meet thickness properties, as required for the material in the component. These specimens shall be subjected to the equivalent forming or bending process and heat treatment as the material in the component. Applicable tests shall be conducted to determine that the required impact properties of NB-2300 are met after straining.

**NB-4213 Exemptions.** Procedure qualification tests are not required for materials listed in (a) through (f) below:

(a) hot formed material, such as forgings, in which the hot forming is completed by the Material Organization prior to removal of the impact test specimens;
(b) hot formed material represented by test coupons that have been subjected to heat treatment representing the hot forming procedure and the heat treatments to be applied to the parts;
(c) material that does not require impact tests in accordance with NB-2300;
(d) material that has a final strain less than 0.5%;
(e) material where the final strain is less than that of a previously qualified procedure for that material;
(f) material from which the impact testing is required by NB-2300 is performed on each heat and lot, as applicable, after forming.

**NB-4213.2 Procedure Qualification Test.** The procedure qualification test shall be performed in the manner stipulated in (a) through (f) below.

(a) The tests shall be performed on three different heats of material both before straining and after straining and heat treatment to establish the effects of the forming and subsequent heat treatment operations.
**NCD-4122.1 Marking Materials.** Material shall be marked in accordance with NCD-2150.

**NCD-4123 Examinations**

Visual examination activities that are not referenced for examination by other specific Code paragraphs, and are performed solely to verify compliance with requirements of Article NCD-4000, may be performed by the persons who perform or supervise the work. These visual examinations are not required to be performed by personnel and procedures qualified to NCD-5100 and NCD-5500 respectively, unless so specified.

**NCD-4125 Testing of Welding and Brazing Materials**

All welding and brazing materials shall meet the requirements of NCD-2400.

**NCD-4130 REPAIR OF MATERIAL**

Material originally accepted on delivery in which defects exceeding the limits of NCD-2500 are known or discovered during the process of fabrication or installation is unacceptable. The material may be used, provided the condition is corrected in accordance with the requirements of NCD-2500 for the applicable product form, except that:

(a) the limitation on the depth of the weld repair does not apply;

(b) the time of examination of the weld repairs to weld edge preparations shall be in accordance with NCD-5130 for Class 2 or NCD-5120 for Class 3;

(c) radiographic examination is not required for weld repairs to seal membrane material when the material thickness is 1/8 in. (6 mm) or less;

(d) radiographic examination is not required for welded repairs in material used in storage tanks, provided that the welded joints in these materials are not required to be radiographed, the extent of the welded repair does not exceed 10 in.² (6500 mm²) of the surface area, and the magnetic particle or liquid penetrant examination of the repair is made as required by NCD-2539.4.

**NCD-4200 FORMING, CUTTING, AND AlignING**

**NCD-4210 CUTTING, FORMING, AND BENDING**

**NCD-4211 Cutting**

Materials may be cut to shape and size by mechanical means, such as machining, shearing, chipping, or grinding, or by thermal cutting.

**NCD-4211.1 Preheating Before Thermal Cutting.** When thermal cutting is performed to prepare weld joints or edges, to remove attachments or defective material, or for any other purpose, consideration shall be given to preheating the material, using preheat schedules such as suggested in Section III Appendices, Nonmandatory Appendix D.

**NCD-4212 Forming and Bending Processes**

Any process may be used to hot or cold form or bend pressure-retaining materials, including weld metal, provided the required dimensions are attained (see NCD-4214 and NCD-4220), and provided the impact properties of the materials, when required, are not reduced below the minimum specified values, or they are effectively restored by heat treatment following the forming operation. *Hot forming* is defined as forming with the material temperature higher than 100 °F (56°C) below the lower transformation temperature of the material. When required, the process shall be qualified for impact properties as outlined in NCD-4213. When required, the process shall be qualified to meet thickness requirements as outlined in NCD-4223.1.

**NCD-4213 Qualification of Forming Processes for Impact Property Requirements**

When impact testing is required by the Design Specifications, a procedure qualification test shall be conducted using specimenstaken from materialsof the same specification, grade or class, heat treatment, and with similar impact properties, as required for the material in the component. These specimens shall be subjected to the equivalent forming or bending process and heat treatment applicable to the material in the component. Applicable tests shall be conducted to determine that the required impact properties of NCD-2300 are met after straining.

**NCD-4213.1 Exemptions.** Procedure qualification tests are not required for material listed in (a) through (f) below:

(a) hot formed material, such as forgings, in which the hot forming is completed by the Material Organization prior to removal of the impact test specimens;

(b) hot formed materials represented by test coupons required in either NCD-2211 or NCD-4121.2 which have been subjected to heat treatment representing the hot forming procedure and the heat treatments to be applied to the parts;

(c) materials which do not require impacts in accordance with NCD-2300;

(d) materials which have a final strain less than 0.5%;

(e) material where the final strain is less than that of a previously qualified procedure for that material;

(f) material from which the impact testing required by NCD-2300 is performed on each heat and lot, as applicable, after forming.
ARTICLE NF-4000
FABRICATION AND INSTALLATION

NF-4100 GENERAL REQUIREMENTS

NF-4110 INTRODUCTION

NF-4111 Fabrication and Installation

Supports shall be fabricated and installed in accordance with the requirements of this Article and shall be manufactured from material which meets the requirements of Article NF-2000.

NF-4112 Reassembly of Subsection NF Supports

The Certificate Holder may reassemble supports from completed supports that have not been in operating service or from parts and material of disassembled supports that have not been in operating service, provided all required documentation is available and the applicable Code requirements are met.

The program for maintaining identification of material and parts, including material documentation and certification documents (Certificate of Compliance and NS-1 Certificate of Conformance) shall be described in a written procedure.

NF-4120 CERTIFICATION OF MATERIALS AND FABRICATION BY SUPPORT CERTIFICATE HOLDER

(21) NF-4121 Means of Certification

The NS Certificate Holder for a support shall certify Code compliance by the furnishing of an NS-1 Certificate of Conformance [NCA-3211.43(a)] for welded supports or a Certificate of Compliance [NCA-3211.43(b)] for nonwelded supports.

NF-4122 Material Identification

Material for supports shall carry identification markings which will remain distinguishable until the support is fabricated or installed. If the original identification markings are cut off or the material is divided, the marks shall be accurately transferred to the parts or a coded marking shall be used to assure identification of each piece of material during subsequent fabrication or installation, unless otherwise provided by NF-2150. Material supplied with a Certificate of Compliance and welding and brazing material shall be identified and controlled so that they can be traced to each support, or else a control procedure shall be employed which ensures that the specified material is used.

NF-4123 Visual Examinations

Visual examination activities that are not referenced for examination by other specific Code paragraphs, and are performed solely to verify compliance with requirements of Article NF-4000, may be performed by the persons who perform or supervise the work. These visual examinations are not required to be performed by personnel and procedures qualified to NF-5500 and NF-5100, respectively, unless so specified.

NF-4125 Testing of Welding and Brazing Materials

All welding and brazing materials shall meet the requirements of NF-2400.

NF-4130 REPAIR OF MATERIAL

NF-4131 Elimination and Repair of Defects

Material originally accepted on delivery in which defects exceeding the limits of NF-2500 are known or discovered during the process of fabrication or installation is unacceptable. The material may be used provided

Revises to read: All welding material shall meet the requirements of NF-2400.

All brazing material shall meet the requirements of NF-4512.
procedures qualified to WC-5100 and WC-5500, respectively, unless so specified.

WC-4124 Additional Requirements When Strain-Based Acceptance Criteria Have Been Implemented

In order to satisfy the strain-based acceptance criteria of WC-3700 regarding the locations of unique material heats used in containment fabrication, traceability of all unique material heats and their specific location(s) of use shall be established and documented in the final Design Report and the as-built Design Drawings. This requirement is only necessary when strain-based acceptance criteria have been employed in the design of the containment.

WC-4125 Testing of Welding and Brazing Materials

All welding and brazing materials shall meet the requirements of WC-2400.

WC-4130 REPAIR OF MATERIAL

Material originally accepted on delivery in which defects exceeding the limits of WC-2500 are known or discovered during the process of fabrication is unacceptable. The material may be used, provided the condition is corrected in accordance with the requirements of WC-2500 for the applicable product form, except that:

(a) the limitation on the depth of the weld repair does not apply;

(b) the time of examination of the weld repairs to weld edge preparations shall be in accordance with WC-5130;

(c) radiographic examination is not required for weld repairs to seal membrane material when the material thickness is 1/2 in. (6 mm) or less.

(d) When the repair by welding provisions of WC-2539 are used within 1/2 in. (13 mm) on each side of the final closure welds, on canisters that are to be loaded with spent nuclear fuel or high-level radioactive material, progressive examination of each deposited weld layer by the magnetic particle method (WC-2545) or liquid penetrant method (WC-2546), in addition to a final surface examination, may be substituted for the radiographic examination required by WC-2539.4. The thickness of each layer shall not exceed 1/4 in. (6 mm).

WC-4200 FORMING, CUTTING, AND ALIGNING

WC-4210 CUTTING, FORMING, AND BENDING

WC-4211 Cutting

Materials may be cut to shape and size by mechanical means, such as machining, shearing, chipping, or grinding, or by thermal cutting.

WC-4211.1 Preheating Before Thermal Cutting. When thermal cutting is performed to prepare weld joints or edges, to remove attachments or defective material, or for any other purpose, consideration shall be given to preheating the material, using preheat schedules such as suggested in Section III Appendices, Nonmandatory Appendix D.

WC-4212 Forming and Bending Processes

Any process may be used to hot or cold form or bend containment materials, including weld metal, provided the required dimensions are attained (see WC-4214 and WC-4220), and provided the impact properties of the materials, when required, are not reduced below the minimum specified values, or they are effectively restored by heat treatment following the forming operation. Hot forming is defined as forming with the material temperature higher than 100°F (55°C) below the lower transformation temperature of the material. When required, the process shall be qualified for impact properties as outlined in WC-4213.

WC-4213 Qualification of Forming Processes for Impact Property Requirements

When impact testing is required by the Design Specifications, a procedure qualification test shall be conducted on specimens of the same specification, grade or class, heat treated and heat treated to represent the forming and heat treatment conditions. The specimens shall be subjected to the forming process and heat treatment conditions and heat treatments. Impact tests shall be conducted on the formed material to verify the required impact properties of the parts after forming.

WC-4213.1 Exemptions. Procedure qualification tests are not required for material listed in (a) through (f) below:

(a) hot formed material, such as forgings, in which the hot forming is completed by the Material Organization prior to removal of the impact test specimens;

(b) hot formed materials represented by test coupons required in either WC-2211 or WC-4121.2 that have been subjected to the forming procedure and the heat treatments to be applied to the parts;

(c) materials which do not require impacts in accordance with WC-2300;

(d) materials which have a final strain less than 0.5%;

(e) material where the final strain is less than that of a previously qualified procedure for that material;

(f) material from which the impact testing required by WC-2300 is performed on each heat and lot, as applicable, after forming.