bonnet or nonwelded pump casing), the evaluation of suitability required by IWA-4160 shall include an evaluation of the material for its intended application, including any differences that might affect form, fit, or function.

(e) The receiving plant shall obtain certification for the following:

1. The supplying plant purchased the material in accordance with NA-3700/NCA-3800 and maintained it in accordance with their Quality Assurance Program.
2. Since receipt by the supplying plant, the material was not placed in service, welded, brazed, or subjected to any operation that might affect the mechanical properties of the material (e.g., heat treatment or forming).

**IWA-4140 RESPONSIBILITIES**

**IWA-4141 Owner’s Responsibilities**

It is the responsibility of the Owner to provide or cause to be provided the following:

(a) Repair/Replacement Program and Plans required by IWA-4150;
(b) specification requirements for repair/replacement activities.

**IWA-4142 Repair/Replacement Organization’s Quality Assurance Program**

(a) The organization that performs repair/replacement activities shall establish a Quality Assurance Program for control of their activities in accordance with the Repair/Replacement Program and Plans. The Quality Assurance Program shall comply with either of the following:

1. IWA-1400(o), when the Owner is the Repair/Replacement Organization.
2. When the Repair/Replacement Organization is other than the Owner, the Repair/Replacement Organization’s Quality Assurance Program shall be documented and shall comply with the applicable quality assurance program criteria of 10CFR50 Appendix B supplemented as necessary to be consistent with the Owner’s Quality Assurance Program; NQA-1, Part I; or Article NCA-4000. The Owner shall ensure that the Repair/Replacement Organization’s Quality Assurance Program meets the requirements of this Article for the activities to be performed. The program shall be reviewed and accepted by the Owner.

1. When the performance of repair/replacement activities is split between the Owner and a Repair/Replacement Organization, each organization’s Quality Assurance Program shall comply with (a)(1) or (a)(2) for their respective activities. The Owner shall be responsible for establishing interfaces and for assuring that the requirements of this Article are met by the combination of the two Quality Assurance Programs.

**IWA-4142.1 Alternative Quality Assurance Program Requirements for Owners**

(b) Requirements. For repair/replacement activities identified in (a), the following requirements may be used in lieu of possession of a Certificate of Authorization or Quality System Certificate (Materials), required by IWA-4221(a) and IWA-4221(b).

1. The Owner’s Quality Assurance Program required by IWA-1400(o) shall describe how these activities are controlled.

2. Owners shall use the requirements of NCA-3800 to qualify the Material Organization.

3. When accepting small products, the Owner shall perform the activities required by the Certificate Holder by NB/NC/ND/NE/NF-2610(b). The Quality Assurance Program of IWA-1400(o) may be used in lieu of Article NCA-4000.

4. When utilizing unqualified source material, the Owner shall perform the activities required of the Certificate Holder by NCA-3855(b), or NCA-4255.5(b).

5. When utilizing unqualified source material or accepting small products, use of these alternative requirements shall be recorded on a Certified Material Test Report or a Certificate of Compliance, as applicable.

**IWA-4143 Stamping**

(a) Application of the ASME NPT symbol is neither required nor prohibited for the fabrication of parts, appurtenances, piping subassemblies, and supports to be used by the Owner when performed at the Owner’s facilities by a Repair/Replacement Organization with a quality assurance program that complies with IWA-4142. These provisions may not be used to manufacture complete pumps, valves, vessels, or tanks.

(b) Application of the ASME NA symbol stamp is neither required nor prohibited for installation.
IWA-4150 REPAIR/REPLACEMENT PROGRAM AND PLAN

(a) Repair/replacement activities shall be completed in accordance with the Repair/Replacement Program. The Program is a document or set of documents that defines the managerial and administrative control for completion of repair/replacement activities.

(b) The Edition and Addenda of Section XI used for the Repair/Replacement Program shall correspond with the Edition and Addenda identified in the in-service inspection program applicable to the inspection interval. Alternatively, later Editions and Addenda of Section XI, or specific provisions within an Edition or Addenda later than those specified in the Owner’s Inservice Inspection Program may be used. When provisions of later Editions and Addenda are used, all related requirements shall be met.

(c) A Repair/Replacement Plan shall be prepared in accordance with the Repair/Replacement Program whenever a repair/replacement activity is to be performed. Repair/Replacement Plans shall include the essential requirements for completion of the repair/replacement activities. Repair/Replacement Plans are not required for the design phase of a repair/replacement activity. However, a Repair/Replacement Plan shall be prepared for rating activities, other than for supports, as defined in IWA-4331(d), whether or not there is accompanying physical work. A Repair/Replacement Plan shall identify the following:

1. applicable Code Edition, Addenda, and Cases of Section XI
2. Construction Code Edition, Addenda, Cases, and Owner’s Requirements used for the following:
   - construction of the item to be affected by the repair/replacement activity
   - construction of the item to be installed by the repair/replacement activity
   - performance of the repair/replacement activities
3. The following items, when applicable to the specific repair/replacement activity, shall be documented.
   - a description of any defects and nondestructive examination methods used to detect the defects
   - the defect removal method, the method of measurement of the cavity created by removing a defect, and, when required by IWA-2600, requirements for reference points
   - the applicable welding or brazing procedure, heat treatment, nondestructive examination, tests, and material requirements
   - the applicable examination, test, and acceptance criteria to be used to verify acceptability
4. description of the repair/replacement activities to be performed

(5) expected life of the item after completion of the repair/replacement activity, when less than the remainder of the previous intended life (design life when specified by the Design Specification) of the item;

(6) whether application of the ASME Code Symbol Stamp is required in accordance with IWA-4143;

(7) documentation in accordance with Article IWA-6000.

IWA-4160 VERIFICATION OF ACCEPTABILITY

(a) If an item does not satisfy the requirements of this Division, the Owner shall determine the cause of unacceptable. Prior to returning the item to service the Owner shall evaluate the suitability of the item subjected to the repair/replacement activity. If the requirements for the original item are determined to be deficient, appropriate corrective provisions shall be included in the Owner’s Requirements and Design Specification, as applicable.

(b) Whether or not the repair/replacement activity results from a failure to satisfy the requirements of this Division, the following requirements shall be met. If the expected life of the item after completion of the repair/replacement activity is less than the remainder of the previous intended life [IWA-4150(c)(5)], the Owner shall initiate actions that will result in a plan for additional examinations and evaluations to verify the acceptability of the item for continued service or schedule subsequent repair/replacement activities prior to the end of the expected life of the item.

IWA-4170 INSPECTION

The services of an Authorized Inspection Agency shall be used. The Owner shall notify the Authorized Inspection Agency prior to starting a repair/replacement activity and keep the Inspector informed of progress so that necessary inspections may be performed.

IWA-4180 DOCUMENTATION

(a) The reports and records required by Article IWA-6000 shall be completed for all repair/replacement activities.

(b) Documents shall be retained in accordance with IWA-6300.

(c) The following records shall be maintained current with respect to the item’s design and configuration:

1. Design Specifications
2. Design Report or analysis that demonstrates compliance with the Construction Code or the Owner’s Requirements
3. Overpressure Protection Reports
4. Revisions or updates to existing reports, records, specifications, and evaluations, as required by (c) or IWA-4311, shall be traceable to and from the original record or report to provide a record of the current status of the item. The review and certification requirements for
technical revisions or updates shall be in accordance with the Owner’s Requirements and the Construction Code [see IWA-4222(a)(1)].

IWA-4190  APPLICATION OF SECTION XI CODE CASES

(a) Cases shall be applicable, as indicated in the Applicability Index for Section XI Cases found in the Code Cases: Nuclear Components book, to the Edition and Addenda specified for the repair/replacement activity.

(b) The use of any Case and revisions to previously approved Cases are subject to acceptance by the regulatory and enforcement authorities having jurisdiction at the plant site.

(c) Cases shall be in effect at the time of the repair/replacement activity except as provided in (d).

(d) Cases that are superseded at the time of the repair/replacement activity, but acceptable to the regulatory and enforcement authorities having jurisdiction at the plant site, may be used.

IWA-4200  ITEMS FOR REPAIR/REPLACEMENT ACTIVITIES

IWA-4210  GENERAL REQUIREMENTS

In the course of preparation.

IWA-4220  CODE APPLICABILITY

IWA-4221  Construction Code and Owner’s Requirements

(a) An item to be used for repair/replacement activities shall meet the Owner’s Requirements. Owner’s Requirements may be revised, provided they are reconciled in accordance with IWA-4222. Reconciliation documentation shall be prepared.

(b) An item to be used for repair/replacement activities shall meet the Construction Code specified in accordance with (1), (2), or (3) below.

(1) When replacing an existing item, the new item shall meet the Construction Code to which the original item was constructed.

(2) When adding a new component to an existing system, the Owner shall specify a Construction Code that is no earlier than the earliest Construction Code used for construction of the system or of any originally installed component in that system.

(3) When adding a new system, the Owner shall specify a Construction Code that is no earlier than the earliest Construction Code used for other systems that perform a similar function.

(c) As an alternative to (b) above, the item may meet all or portions of the requirements of different Editions and Addenda of the Construction Code, or Section III when the Construction Code was not Section III, provided the requirements of IWA-4222 through IWA-4226, as applicable, are met. Construction Code Cases may also be used. Reconciliations required by this Article shall be documented. All or portions of later different Construction Codes may be used as listed below:

(1) Piping, piping subassemblies, and their supports: B31.1 to B31.7 to Section III.

(2) Pumps, valves, and their supports: from B31.1 to Draft Code for Pumps and Valves for Nuclear Power to Section III.

(3) Vessels and their supports: Section VIII to Section III.

(4) Atmospheric and 0 psig to 15 psig (0 kPa to 100 kPa) storage tanks and their supports: Section VIII, API 620, or API 650 to Section III.

IWA-4222  Reconciliation of Code and Owner’s Requirements

(a) Code Requirements and Owner’s Requirements may be technical or administrative.

(1) Only technical requirements that could affect materials, design, fabrication, or examination, and affect the pressure boundary, or core support or component support function, need to be reconciled.

(2) Administrative requirements, i.e., those that do not affect the pressure boundary or core support or component support function, need not be reconciled. Examples of such requirements include quality assurance, certification, Code Symbol Stamping, Data Reports, and Authorized Inspection.

(b) The administrative requirements of either the Construction Code of the item being replaced or the Construction Code of the item to be used for replacement shall be met.

IWA-4223  Reconciliation of Components

(a) Reconciliation of later Editions or Addenda of the Construction Codes or alternative Codes as permitted by IWA-4221 is not required. The Owner shall evaluate any changes in weight, configuration, or pressure-temperature rating in accordance with IWA-4311.

(b) An earlier Edition and Addenda of the same Construction Code may be used, provided all technical requirements of the earlier Construction Code are reconciled.

IWA-4224  Reconciliation of Material


(a) Materials, including welding and brazing materials, may meet the requirements of later dates of issue of the material specification and later Editions and Addenda of the same Construction Code or Section III when the Construction Code was not Section III, provided the materials are the same specification, grade, type, class, or alloy, and heat-treated condition, as applicable.
ARTICLE IWC-2000
EXAMINATION AND INSPECTION

IWC-2200 PRESERVICE EXAMINATION

(a) All examinations required by this Article (with the exception of Examination Category C-H) for those components initially selected for examination in accordance with the Inspection Program and not exempt from inservice examinations by IWC-1220 shall be completed prior to initial plant startup.

(b) Shop and field examinations may serve in lieu of the on-site preservice examinations, provided

1. In the case of vessels only, the hydrostatic test required by the Construction Code has been completed.

2. Such examinations are conducted under conditions and with equipment and techniques equivalent to those which are expected to be employed for subsequent inservice examinations.

3. Personnel performing the shop and field magnetic particle and liquid penetrant examinations shall be qualified and certified in accordance with NC-5500 or IWA-2300.

4. The shop and field examination records are, or can be, documented and identified in a form consistent with those required in Article IWA-6000.

IWC-2400 INSPECTION SCHEDULE

IWC-2410 INSPECTION PROGRAM

Inspection and system pressure tests may be performed during either system operation or plant outages.

IWC-2411 Inspection Program

(a) The required examinations in each examination category shall be completed during each inspection interval in accordance with Table IWC-2411-1, with the exceptions of Category C-H and of welded attachments examined as a result of component support deformation under Examination Category C-C. If there are less than three items or welds to be examined in an Examination Category, the items or welds may be examined in any two periods, or in any one period if there is only one item or weld, in lieu of the percentage requirements of Table IWC-2411-1.

(b) If items or welds are added to the Inspection Program, during the service lifetime of a plant, examination shall be scheduled as follows:

1. When items or welds are added during the first period of an interval, at least 25% of the examinations required by the applicable Examination Category and Item Number for the added items or welds shall be performed during each of the second and third periods of that interval.

2. When items or welds are added during the second period of an interval, at least 25% of the examinations required by the applicable Examination Category and Item Number for the added items or welds shall be performed during the third period of that interval.

3. When items or welds are added during the third period of an interval, examinations shall be scheduled in accordance with (a) for successive intervals.

IWC-2420 SUCCESSIVE INSPECTIONS

(a) The sequence of component examinations which was established during the first inspection interval shall be repeated during each successive inspection interval, to the extent practical. The sequence of component examinations may be modified in a manner that optimizes scaffolding, radiological, insulation removal, or other considerations, provided that the percentage requirements of Table IWC-2411-1 are maintained.

(b) If a component is accepted for continued service in accordance with IWC-3122.3, the areas containing flaws shall be reexamined during the next inspection period listed in the schedule of the Inspection Program of
ARTICLE IWC-3000
ACCEPTANCE STANDARDS

IWC-3100  EVALUATION OF EXAMINATION RESULTS

IWC-3110  PRESERVICE VOLUMETRIC AND SURFACE EXAMINATIONS

IWC-3111  General

(a) The preservice volumetric and surface examinations required by IWC-2200 and performed in accordance with IWA-2200 shall receive an NDE evaluation by comparing the examination results with the acceptance standards specified in IWC-3112.

(b) Acceptance of components for service shall be in accordance with IWC-3112 and IWC-3113.

IWC-3112  Acceptance

(a) A component whose volumetric or surface examination in accordance with IWC-2200 meets (1), (2), or (3) below shall be acceptable for service, provided the verified flaws are recorded in accordance with the requirements of IWA-1400(i) and IWA-2220(b) in terms of location, size, shape, orientation, and distribution within the component.

(1) Volumetric or surface examination confirms the absence of flaws or identifies only flaws that have already been shown to meet the nondestructive examination standards of NC-2500 or NC-5300, as documented in Quality Assurance Records (NCA-4134.17).

(2) Volumetric examination detects flaws that are confirmed by surface or volumetric examination to be nonsurface-connected and that do not exceed the standards of Table IWC-3410-1.

(3) Volumetric examination detects flaws that are confirmed by surface or volumetric examination to be non-surface-connected that are accepted by evaluation in accordance with the provisions of IWC-3132.3 to be acceptable to the end of the service lifetime of the component and reexamined in accordance with the requirements of IBW-2420(b) and IBW-2420(d), in lieu of IWC-2420(b) and IWC-2420(d).

(b) A component whose volumetric or surface examination detects flaws that do not meet the criteria established in (a) shall be unacceptable for service, unless the component is corrected by a repair/replacement activity in accordance with IWC-3113 to the extent necessary to meet the provisions of (a) prior to placement of the component in service.

IWC-3113  Repair/Replacement Activity and Reexamination

The repair/replacement activity and reexamination shall comply with the requirements of Article IWA-4000. Reexamination shall be conducted in accordance with the requirements of IWA-2200. The recorded results shall demonstrate that the area subjected to the repair/replacement activity meets the acceptance standards of Table IWC-3410-1.

IWC-3120  INSERVICE VOLUMETRIC AND SURFACE EXAMINATIONS

IWC-3121  General

(a) The examination results shall be compared with the recorded results of the preservice and prior inservice examinations. Confirmed changes in flaws from prior examinations shall be recorded in accordance with IWA-1400(i) and IWA-2220(b). Acceptance of the component for continued service shall be in accordance with the acceptance alternatives of IWC-3122.

(b) Where a required inservice examination detects flaws that are acceptable under IWC-3112(a), the component shall remain acceptable for service provided the flaws satisfy the acceptance standards of NC-2500 and NC-5300, or the acceptance standards of NCD-2500 (Class 2 only), NCD-5300 (Class 2 only), NC-2500, or NC-5300.

IWC-3122  Acceptance

IWC-3122.1  Acceptance by Examination.

(a) A component whose examination confirms the absence of flaws, detects flaws that do not exceed the acceptance standards listed in Table IWC-3410-1, or detects flaws that are acceptable in accordance with IWC-3121(b) shall be acceptable for continued service.

(b) A component whose examination detects flaws that do not meet the acceptance standards of Table IWC-3410-1 shall be unacceptable for continued service, unless the component meets the requirements of IWC-3122.2 or IWC-3122.3.
IWC-3510.5 Material Requirements for Application of Acceptance Standards. The acceptance standards identified in Tables IWC-3510-1, IWC-3510-3, IWC-3511-1, and IWC-3511-2 apply to ferritic steels that satisfy one of the following requirements:

(a) Ferritic steels having specified minimum yield strengths of 50 ksi (350 MPa) or less at room temperature shall meet the requirements of Section III, Subsection NC, NC-2300.

(b) The material shall meet one of the following:

1. SA-508 Grade 2 Class 2 (former designation: SA-508 Class 2a)
2. SA-508 Grade 3 Class 2 (former designation: SA-508 Class 3a)
3. SA-533 Type A Class 2 (former designation: SA-533 Grade A Class 2)
4. SA-533 Type B Class 2 (former designation: SA-533 Grade B Class 2)
5. SA-508 Class 1

(c) Ferritic steels having specified minimum yield strengths greater than 50 ksi (350 MPa) but not exceeding 90 ksi (620 MPa) at room temperature shall meet the requirements of Section III, Subsection NC, NC-2300, and Section III Appendices, Nonmandatory Appendix G, G-2110(b). The acceptance standards may also be applied to materials with dynamic fracture toughness data, $K_{ld}$, that exceed the values of the $K_{ld}$ in Section III Appendices, Nonmandatory Appendix G prior to 1999 addenda, or $K_{lB}$ in Section III Appendices, Nonmandatory Appendix G prior to the 2007 edition.

IWC-3511 Standards for Examination Category C-B, Pressure-Retaining Welds of Nozzles in Vessels

IWC-3511.1 Allowable Planar Flaws.

(a) The size of allowable planar flaws in the nozzle and weld areas within the boundary of the examination volume specified in Figure IWC-2500-4 shall not exceed the following limits:

1. for ferritic steels, those specified in Table IWC-3511-1
2. for austenitic steels, those specified in Table IWC-3514-1

(b) The size of allowable planar flaws in the vessel shell (or head) material adjoining the nozzle and weld areas and within the boundary of the examination volumes specified in Figure IWC-2500-4 shall not exceed the following limits:

1. for ferritic steels, those specified in Table IWC-3511-1
2. for austenitic steels, those specified in Table IWC-3514-1
3. Any two or more coplanar aligned flaws characterized as separate flaws by IWA-3300 are allowable, provided the requirements of IWA-3390 are met.

IWC-3511.2 Allowable Linear Flaws.

(a) The size of allowable linear flaws, as detected by either a surface (PT/MT) or volumetric examination (RT), within the boundary of the examination surfaces and volumes shown in Figures IWC-2500-3 and IWC-2500-4 shall not exceed the following limits:

1. for ferritic steels, those specified in Table IWC-3511-2
2. for austenitic steels, those specified in Table IWB-3514-2

(b) Where a flaw extends beyond the examination boundaries, or separate linear flaws lie both within and beyond the boundaries but are characterized as a single flaw by IWA-3400, the overall flaw size shall not exceed the following limits:

1. for ferritic steels, those specified in Table IWC-3511-2
2. for austenitic steels, those specified in Table IWB-3514-2

IWC-3511.3 Allowable Laminar Flaws.

(a) Laminar flaws in vessel shell or head material within the boundary of the examination volumes specified in Figure IWC-2500-4 shall be governed by the standards of Table IWC-3510-2.

(b) Laminar flaws in the nozzle wall shall be considered as planar flaws and the standards of IWC-3511.1 shall apply.
IWC-3513 Standards for Examination Category C-D, Pressure-Retaining Bolting Greater Than 2 in. (50 mm) in Diameter

IWC-3513.1 Allowable Flaws for Volumetric Examinations of Studs and Bolts.

(a) The size of allowable nonaxial flaws in pressure-retaining bolting within the boundary of the examination volume shown in Figure IWC-2500-6(a) shall not exceed the limits specified in Table IWC-3513-1.

(b) Any two or more subsurface flaws, at any cross section, which combine to reduce the net area are acceptable provided the combined flaw depths do not exceed the sum of the allowable limits specified in Table IWC-3513-1 for the corresponding flaw aspect ratios, divided by the number of flaws.

(c) Any flaw detected by the volumetric examination shall be investigated by a surface examination. If confirmed to be a surface flaw, the standards of IWC-3513.2 shall apply. If not a surface flaw, the standards of (a) and (b) shall apply.

IWC-3513.2 Allowable Flaws for Surface Examinations of Studs and Bolts. Allowable surface flaws in pressure-retaining bolting shall not exceed the following limits:

(a) nonaxial flaws, 1/4 in. (6 mm) in length
(b) axial flaws, 1 in. (25 mm) in length

Table IWC-3513-1

<table>
<thead>
<tr>
<th>Diameter Range: Nominal Sizes Greater Than 2 in. (50 mm) that meet the requirements of NC-2333 and the specified minimum yield strength between 95 ksi (655 MPa) and 130 ksi (900 MPa) at 100°F (40°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspect Ratio, a/ℓ [Note (1)]</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
<td>0.40</td>
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<tr>
<td>0.50</td>
</tr>
</tbody>
</table>

NOTES:
(1) Dimensions a and ℓ are defined in IWA-3200. For intermediate flaw aspect ratios a/ℓ, linear interpolation is permissible. Refer to IWA-3200(b).
(2) The total depth of an allowable subsurface flaw is twice the listed value.

IWC-3514 Standards for Examination Category C-F-1, Pressure-Retaining Welds in Austenitic Stainless Steel or High Alloy Piping, and C-F-2, Pressure-Retaining Welds in Carbon or Low Alloy Steel Piping

(a) The acceptance standards of IWC-3514 do not apply to planar surface-connected flaws that are in contact with the reactor coolant environment during normal operation and are detected by inservice examination in the following materials:

(1) for PWRs, UNS N06600, N06082, or W86182 surfaces with a normal operating temperature greater than or equal to 525°F (275°C) and in contact with the reactor coolant environment

(2) for BWRs, UNS N06600, W86182, or austenitic stainless steel and associated weld surfaces, in contact with the reactor coolant environment, that are susceptible to stress corrosion cracking and not mitigated

(b) If the acceptance standards are not met or are not applicable, for acceptance by analytical evaluation, the planar surface-connected flaws in (a) shall meet the provisions of IWC-3600.

(c) Susceptible materials and mitigation criteria for BWRs are specified in NUREG 0313 Revision 2, Sections 2.1 and 2.2.

IWC-3514.1 Allowable Planar Flaws.

(a) The size of allowable planar flaws within the boundary of the examination surfaces and volumes delineated in Figures IWC-2500-7 and IWC-2500-9 through IWC-2500-13 shall be in accordance with the standards of IWC-3514.2 and IWC-3514.3, as applicable. In addition, the requirements of IWC-3514.6 shall be satisfied for planar surface-connected flaws that are in contact with the reactor coolant environment during normal operation and are detected by preservice examination in materials that are susceptible to stress corrosion cracking, as defined for PWRs in IWC-3514(a)(1), and for BWRs in IWC-3514(a)(2) and IWC-3514(c).

(b) Where flaws extend beyond the boundaries of the examination surfaces and volumes, or separate flaws are detected that lie both within and beyond the boundaries but are characterized as a single flaw by the rules of IWA-3300, the overall flaw size shall be compared with standards of (a) above.

(c) Any two or more coplanar-aligned flaws that are characterized as separate flaws by IWA-3300 are allowable, provided the requirements of IWA-3390 are met.

(d) Inner surface flaws detected by volumetric examination of piping components with austenitic cladding on the inner surface shall be governed by the following standards:

(1) Surface flaws that do not penetrate through the nominal clad thickness into base metal need not be compared with the standards of (a) above.