SECT. VIII-1 2017 CHANGES
MAJOR CHANGES

- **TABLE U-3**

  Year- of Acceptable Edition of Referenced Standard of This Division

  Relevant change:
  According to the change of UW-54, the requirements for qualification of NDE personnel has moved on Sect V, Art. 1
MATERIAL

UG-4 GENERAL

(h) When the rules of this Division require the use of material physical properties, these properties shall be taken from the applicable tables in Section II, Part D, Subpart 2. If the applicable tables in Section II, Part D, Subpart 2 do not contain these properties for a permitted material or do not list them within the required temperature range, the Manufacturer may use other authoritative sources for the needed information. The Manufacturer’s Data Report shall note under “Remarks” the property values obtained and their source.

NOTE: If material physical properties are not listed, the Manufacturer is encouraged to bring the information to the attention of the ASME Committee on Materials (BPV Section II) so that the data can be added in Section II, Part D, Subpart 2.
MATERIAL

Testo

UG-10

MATERIAL IDENTIFIED WITH OR PRODUCED TO A SPECIFICATION NOT PERMITTED BY THIS DIVISION, AND MATERIAL NOT FULLY IDENTIFIED

Rewording and simplification
DESIGN

UG-16 GENERAL

(c) Plate Undertolerance. (before Mill Undertolerance)

(1) Plate material shall not be ordered with a nominal thickness
(2) Plate material with an actual thickness less than the design thickness shall not be used unless the difference in thicknesses is less than the smaller of 0.01 in. (0.3 mm) or 6% of the design thickness [see UG-90(b)(6)].
(3) If plate material is ordered to a specification that allows with an undertolerance greater than the smaller of 0.01 in. (0.3 mm) or 6% of the nominal thickness, the thickness of the plate ordered shall be increased, if required, so that the plate material will meet the requirement of (2) when used.
UG-35.2 Quick-Actuating (Quick-Opening) Closures

(a) Definitions

(1) Quick-actuating closures are closures that are operated by an action that releases all holding elements. *(simplified definition)*

(7) When a quick-actuating closure is provided as a part, it shall be provided with Partial Data Report as meeting the applicable requirements of this Division. – NO REFERENCE TO WELDINGS!!

(8) Nonmandatory Appendix FF provides supplementary information for the Manufacturer of the pressure vessel and provides guidance on installation, operation, and maintenance for the owner and user.
DESIGN

(c) Specific Design Requirements

(5) If clamps used in the design of quick-actuating closures meet the scope of Mandatory Appendix 24, then the requirements of Mandatory Appendix 24 shall also be met.

(6) The Manufacturer of a pressure vessel with a quick-actuating closure shall supply the user with an installation, operation, and maintenance manual that shall address the maintenance and operation of the closure. The manual should address the topics discussed in Nonmandatory Appendix FF. The intent is for this manual to stay with the owner or operator of the pressure vessel.
UG-35.3 Quick-Opening Closures

(a) Definitions

(1) Quick-opening closures are closures other than bolted flange joints as described in UG-44, 1-6, and Mandatory Appendix 2, and quick-actuating closures as described in UG-35.2. Closures utilizing a clamp design that meets the requirements of Mandatory Appendix 24 are exempt from the rules for quick-opening closures. Closures with multiple swing bolts are not considered quick-opening closures.

(2) Holding elements are parts of the closure used to hold the closure to the vessel, and/or to provide the load required to seal the closure. Hinge pins or bolts may be used as holding elements.
DESIGN
(b) General
(1) Quick-opening closures shall be designed such that the failure of a single holding element while the vessel is pressurized (or contains a static head of liquid acting at the closure) will not
   (-a) cause or allow the closure to be opened or leak; or
   (-b) increase the stress in any other holding element by more than 50% above the allowable stress of the element

(2) Quick-opening closures shall be designed and installed such that it can be determined by visual external observation that the holding elements are in satisfactory condition.
(3) All vessels having quick-opening closures shall have a pressure release device (e.g., vent valve, threaded plug) installed on the vessel that will relieve the pressure inside the vessel prior to opening the closure. Alternatively, if release of the product in the vessel could be dangerous to personnel or the environment, or could cause other safety issues, the provisions for pressure release need not be furnished when operating procedures are such that they can ensure there is no pressure in the vessel prior to opening the closure.

(4) When a quick-opening closure is provided as a part, it shall be provided with a Partial Data Report and shall meet the applicable requirements of this Division.
DESIGN

(c) Specific Design Requirements

(1) The design rules of Mandatory Appendix 2 of this Division may not be applicable to the design of quick-opening closures; see 2-1(e).

(2) The design shall consider the effects of cyclic and other loadings (see UG-22) and mechanical wear on the holding elements and the sealing surfaces.

(3) The Manufacturer of a pressure vessel with a quick-opening closure shall supply the user with an installation, operation, and maintenance manual that shall address the maintenance and operation of the closure. The manual should address the topics discussed in Nonmandatory Appendix FF. The intent is for this manual to stay with the owner or operator of the pressure vessel.
DESIGN

OPENINGS AND REINFORCEMENTS

UG-36 OPENINGS IN PRESSURE VESSELS

Deleted alternative rules 1-9 and 1-10 and relevant references in this paragraph
DESIGN

UG-46 INSPECTION OPENING

Included the U-tube and floating tubesheet Heat exchanger and any other condition where it is not possible to be inspect

Inspection openings may be omitted in vessels covered in (b), and in heat exchangers where the construction does not permit access to the shell side, such as of fixed tubesheet heat exchangers or U-tube and floating tubesheet heat exchangers with Configuration a, b, or c as shown in Figure UHX-12.1 or Figure UHX-14.2. Report shall include one of the following notations under “Remarks”:

1. “UG-46(b)” when telltale holes are used in lieu of inspection openings;
2. “UG-46(a)” when inspection openings are omitted in fixed tubesheet heat exchangers or U-tube and floating tubesheet heat exchangers with Configuration a, b, or c as shown in Figure UHX-12.1 or Figure UHX-14.2;
DESIGN

UG-46 INSPECTION OPENING

 Included the U-tube and floating tubesheet Heat exchanger and any other condition where it is not possible to be inspect

Inspection openings may be omitted in vessels covered in (b), and in heat exchangers where the construction does not permit access to the shell side, such as of fixed tubesheet heat exchangers or U-tube and floating tubesheet heat exchangers with Configuration a, b, or c as shown in Figure UHX-12.1 or Figure UHX-14.2. Report shall include one of the following notations under “Remarks”:

(1) “UG-46(b)” when telltale holes are used in lieu of inspection openings;
(2) “UG-46(a)” when inspection openings are omitted in fixed tubesheet heat exchangers or U-tube and floating tubesheet heat exchangers with Configuration a, b, or c as shown in Figure UHX-12.1 or Figure UHX-14.2;
(5) Multiple Process Welding Procedures.

When qualifying a welding procedure with impact testing that employs multiple welding processes, or multiple sets of essential and supplementary essential variables for a welding process, the welding procedure shall be qualified by testing separate sets of impact test specimens removed from the weld metal and heat-affected zone, as follows:

(-a) The requirements of (f) shall be met.
(-b) The requirements of (g) and (3) specifying the location, number, and orientation of test specimen sets to be removed for each welding process or set of variables shall be modified as follows:

(-1) The weld thickness shall be considered the base metal thickness.

(-2) The surface of the last deposited layer of weld metal shall be considered the weld surface.

(-3) The root side of the first deposited layer of weld metal shall be considered the root surface.

(-c) If the weld thickness for a welding process or set of variables is small enough that the maximum obtainable Charpy specimen has a width along the notch less than 0.099 in. (2.5 mm), toughness testing of the weld metal and heat-affected zone is not required for that welding process or set of variables.
UG-93 – INSPECTION OF MATERIALS

or if a Material Test Report is supplied by a materials manufacturer, the materials manufacturer may transcribe data produced by other organizations, provided he accepts responsibility for the accuracy and authenticity of the data.
(c) the official Certification Mark with the PRT Designator shown in Figure UG-116 sketch (c) on parts [see (h)].

(NeW)
(4) A nameplate furnished with the Certification Mark on prefabricated or preformed parts may be removed from the completed pressure vessel if all of the following conditions are satisfied:

(-a) The nameplate interferes with further fabrication or service.

(-b) The Manufacturer of the completed vessel has agreement from the Authorized Inspector to remove the nameplate.

(-c) The removal of the nameplate shall be noted in the “Remarks” section of the vessel Manufacturer's Data Report.

(-d) The removed nameplate shall be destroyed.
UG-117 CERTIFICATES OF AUTHORIZATION AND Certification Marks

Application for Certificate of Authorization. Any organization desiring a Certificate of Authorization shall apply to ASME in accordance with the Boiler and Pressure Vessel Committee of the Society, on forms issued by the Society, specifying the certification process of ASME CA-1. Authorization to use Certification Marks maybe granted, renewed, suspended, or withdrawn as specified in ASME CA-1.

(c) Issuance of Authorization. Certificate of Authorization shall be issued in accordance with ASME CA-1 (see Nonmandatory Appendix DD).

(d) Designated Oversight. The Manufacturer shall comply with the requirements of ASME CA-1 for designated oversight by use of an Authorized Inspection Agency or Certified Individual, as applicable.
UG-120 DATA REPORTS

Manufacturers with multiple locations under the operational control of a single organization, each location with its own Certificate of Authorization, may transfer welded or brazed pressure vessel parts, or completely welded pressure vessels that have not been pressure tested or received final inspection, from one location to another without Partial Data Reports, provided the Quality Control System describes the method of identification, transfer, and receipt of the parts. These methods shall include the following requirements:
Note 41

In this usage, organization may be the same company at a single site, a multiplant company with separate Certificates of Authorization, regardless of type, or a multiplant corporation with extended corporate Certificates of Authorization.
(-1) Identification requirements shall include details of the specific marking to be applied. Identification shall be on each part and shall be legible, permanent, and not detrimental to the part.

(-2) The Certificate Holder shall have a transmittal form that is included with each transfer. It shall list all items with corresponding identification number, with indication that the items do not contain the Certification Mark. This form shall be signed by the Certificate Holder.

(-3) The receiving location shall inspect each item upon receipt.

(-4) The Manufacturer of the completed vessel shall retain all transfer forms as part of the vessel records; see Mandatory Appendix 10, 10-13.
(-f) For cases in which a Manufacturer has multiple locations that include both shop and field locations, and the field assembly of a vessel is completed by one Manufacturer’s location that is different from the part Manufacturer’s location(s), the name of the Manufacturer responsible for field assembly shall be shown on Line 1 of the Manufacturer’s Data Report. The Manufacturer responsible for field assembly shall complete and sign both the Shop and Field portions of the Manufacturer’s Data Report.
(2) A Manufacturer with multiple locations, each holding its own Certificate of Authorization, may transfer pressure vessel parts from one of its locations to another without Partial Data Reports, provided the Quality Control System describes the method of identification, transfer, and receipt of the parts. For cases in which a Manufacturer has multiple locations that include both shop and field locations, and the field assembly of the vessel is completed by one Manufacturer’s location that is different from the part Manufacturer’s location(s), the name of the Manufacturer responsible for field assembly shall be shown on Line 1 of the Manufacturer’s Data Report. The Manufacturer responsible for field assembly shall complete and sign both the Shop and Field portions of the Manufacturer’s Data Report.
UG-136 MINIMUM REQUIREMENTS FOR PRESSURE RELIEF VALVES

(g) Set Pressure Change. The set pressure of a valve may be changed after completion of the Form UV-1 but prior to putting the valve in service for overpressure protection, provided all of the following requirements are met:

(1) All parts conversions, valve adjustments, testing, and updating of the existing Form UV-1 or creating a new Form UV-1 shall be performed by the Manufacturer or an Assembler that has been granted permission to apply the Certification Mark with the UV Designator to the specific valve type.
(2) The change to the set pressure shall be validated per (d)(4).

(3) The set pressure and capacity marked on the valve shall be obliterated. The new set pressure and capacity shall be marked in accordance with UG-129. When marking is accomplished by metal nameplate, the original nameplate shall be removed and destroyed, and a new nameplate affixed to the valve.

(4) All other requirements of this Section for the use of the Certification Mark with the UV Designator shall apply, in particular leak testing per (d)(3) and (d)(5), and resealing adjustments per (a)(7).
(2) The centerline of a butt weld attaching a component (flange, pipe, etc.) to a thickened neck nozzle that has a taper transition angle, $\alpha$, less than 71.5 deg shall be located a minimum of 1.5tn from the taper (see Figure UW-9-2), where tn is the nominal thickness of the nozzle wall at the butt weld.
Figure UW-9-2
Butt Welding of Components to Thickened Neck Nozzles

Flange, pipe, cap, or other component

\[ Q \text{ of butt weld} \]

Min. \( 1.5t_n \)

\( t_n \)

Thickened neck

\( \alpha \)
Appendix 28 included in UW13
UW-40 PROCEDURES FOR POSTWELD HEAT TREATMENT

(d) It is recognized that some postweld heat treatments may have detrimental effects on the properties of some materials. When pressure parts of two different P-Numbers Number Groups are joined by welding, engineering judgment shall be applied when selecting the postweld heat treatment temperature and holding time that specified according to produce either UCS-56 or UHA-32, for the material properties suitable for the intended service. Alternatives such as welding with buttering as described in Section IX, QW-283 may be considered. requiring the higher postweld heat treatment temperature
UW-51 RADIOGRAPHIC EXAMINATION OF WELDED JOINTS

Changed the wording using images instead of radigraph to include digital radiograph

UW-54 QUALIFICATION OF NONDESTRUCTIVE EXAMINATION PERSONNEL

Provision for personnel qualification addressed in Sect. V
NONMANDATORY APPENDIX HA UHA-A
SUGGESTIONS ON THE SELECTION AND TREATMENT OF AUSTENITIC CHROMIUM–NICKEL AND FERRITIC AND MARTENSITIC HIGH CHROMIUM STEELS

Introduced

UHA-A-10 RELAXATION CRACKING

Relaxation cracking can occur in P-No. 8 materials not only in cold-formed areas but also in welds where high-level residual tensile stress exists. Unless one or more of the following conditions are satisfied, PWHT at the temperature listed in Table UHA-44 for the specific material grade may be advisable to avoid relaxation cracking: (see the Code)
NONMANDATORY APPENDIX HA UHA-A
SUGGESTIONS ON THE SELECTION AND TREATMENT OF
AUSTENITIC CHROMIUM–NICKEL AND FERRITIC AND
MARTENSITIC HIGH CHROMIUM STEELS

Introduced

UHA-A-10 RELAXATION CRACKING

Relaxation cracking can occur in P-No. 8 materials not only in cold-formed areas but also in welds where high-level residual tensile stress exists. Unless one or more of the following conditions are satisfied, PWHT at the temperature listed in Table UHA-44 for the specific material grade may be advisable to avoid relaxation cracking: (see the Code)
PART UHT
REQUIREMENTS FOR PRESSURE VESSELS CONSTRUCTED OF FERRITIC STEELS WITH TENSILE PROPERTIES ENHANCED BY HEAT TREATMENT

UHT-28 STRUCTURAL ATTACHMENTS AND STIFFENING RINGS

(c) Minor attachments made from material that does not conform to a material specification permitted in this Division may be used and may be welded directly to the pressure part, provided the requirements shown below are satisfied.
Minor attachments are defined as parts of small size, less than or equal to 0.375 in. (10 mm) thick or 5 in.3 (82 cm3) in volume, that carry no load or an insignificant load such that a stress calculation in the designer’s judgment is not required;

*Examples include nameplates, insulation supports, and locating lugs.*

(1) The minimum specified tensile strength of quenched and tempered steels for pressure parts shall be less than or equal to 100 ksi (690 MPa).

(2) The material shall be identified and suitable for welding in accordance with UW-5(b).
(3) The material shall be compatible insofar as welding is concerned with that to which the attachment is to be made.

(4) The specified minimum yield strength of minor attachments shall be within +20% and −60% of that of the material to which they are attached.

(5) If the minor attachment is welded in the area less than from any gross structural discontinuity, where Rm is the mean radius of the shell, and t is the thickness of the shell, the stress evaluation in accordance with Section VIII, Division 2, Part 5 shall be performed.
(6) The effect of differential thermal expansion shall be considered when the thermal expansion coefficient of the minor attachment differs from that of the pressure part to which it is attached.

(7) Welding materials with the equivalent room-temperature tensile strength as that of quenched and tempered steels shall be used.

(8) If the continuous fillet weld is used, the leg dimension of fillet weld shall not be less than 0.25t, where t is the thickness of the minor attachment.

(9) The welds shall be postweld heat treated when required by UHT-56.
PART UHX
RULES FOR SHELL-AND-TUBE HEAT EXCHANGERS

UHX-13.10 Calculation Procedure for Kettle Shell Exchangers With Fixed Tubesheets

UHX-13.10.1 Scope.

This procedure describes how to use the rules of UHX-13.5 when an eccentric cone and small cylinder exist between the large shell side cylinder and the tubesheet on both sides.
PART UHX
RULES FOR SHELL-AND-TUBE HEAT EXCHANGERS

UHX-13.10 Calculation Procedure for Kettle Shell Exchangers With Fixed Tubesheets
UHX-13.10.2 Conditions of Applicability.

(a) The two eccentric cones are identical in geometry and material.
(b) The small shell cylinders adjacent to the tubesheet are identical in geometry and material. They shall meet the length requirements of UHX-13.5.11(a) unless the simply supported rules of UHX-13.9 are applied. The rules of UHX-13.6 shall not be used. The rules of UHX-13.8 may be used only if the length requirements of UHX-13.5.11(a) are met by the small shell cylinders.
(c) This procedure applies only when \( \theta_{ecc} \leq 30 \) deg.
This procedure accounts for the stiffness and loadings in the shell of the eccentric cones used in the design of the tubesheet.

This procedure does not evaluate the acceptability of the shell-to-cone transition. Other requirements in this Division pertaining to shell-to-cone transitions shall be satisfied [e.g., UW-3(b), 1-5, and 1-8].

(d) This procedure applies only when

\[
0.5 \leq \frac{L_{\text{ecc}}}{D_{\text{ecc},S}} \leq 1.5
\]

(e) This procedure applies only when \( D_{\text{ecc},L} \leq 2.17 D_{\text{ecc},S}. \)

\( D_{\text{ecc},L} = \) eccentric cone inside diameter at the large end (see Figure UHX-13.10.3-1)

\( D_{\text{ecc},S} = \) eccentric cone inside diameter at the small end (see Figure UHX-13.10.3-1)
(f) These rules assume that an expansion joint, if present, is located in the small shell cylinder.

(g) For cone-to-cylinder junctions without a transition knuckle, use the following for design cases (pressure-only cases) in 1-5. The cone-to-cylinder junctions do not need to be evaluated for the operating cases (cases including differential thermal expansion).

\[
\begin{align*}
  f_1 &= f_1' + f_1'' \\
  f_2 &= f_2' + f_2''
\end{align*}
\]

where

\[
\begin{align*}
  f_1' &= \sigma_{ccc,L} t_{ecc} \cos(\theta_{ccc}) - \frac{P_s D_{ecc,L}}{4} \\
  f_2' &= \sigma_{ccc,S} t_{ecc} \cos(\theta_{ccc}) - \frac{P_s D_{ecc,S}}{4}
\end{align*}
\]
(h) For cone-to-cylinder junctions without a transition knuckle, use the following for design cases (pressure-only cases) in 1-8. The cone-to-cylinder junctions do not need to be evaluated for the operating cases (cases including differential thermal expansion).

\[ f_1 = f_1' + f_1'' \]
\[ f_2 = f_2' + f_2'' \]

where

\[ f_1' = -\sigma_{ecc,L} t_{ecc} \cos(\theta_{ecc}) + \frac{P_s D_{eccc,L}}{4} \]
\[ f_2' = -\sigma_{ecc,S} t_{ecc} \cos(\theta_{ecc}) + \frac{P_s D_{eccc,S}}{4} \]

**UHX-13.10.3 Additional Nomenclature.**
UHX-16 BELLOWS EXPANSION JOINTS

Bellows expansion joints shall be designed in accordance with Mandatory Appendix 26, as applicable.

The expansion joint shall be designed for the axial displacement range over all load cases from one of the following equations for the axial displacement over the length of the thin-walled bellows element.

Note that these may be used for flanged-and-flued or flanged-only expansion joints when the expansion joint analysis method uses the displacement over the expansion element only [see UHX-17(c)].
UHX-17 FLEXIBLE SHELL ELEMENT EXPANSION JOINTS

(c) Displacements arising from pressure and differential thermal expansion shall be calculated for use in the expansion joint analysis. The length over which the displacement is taken is dependent upon the expansion joint analysis method. If the expansion joint analysis method utilizes displacements over the length of the expansion joint only, use the appropriate equation from UHX-16. If the expansion joint analysis method utilizes displacements over the length between the inner tubesheet faces, L, use the appropriate equation from below. (see Code)
(b) Shipping bars on bellows expansion joints may be required to maintain assembly length during shipment and vessel fabrication. Shipping bars shall not be engaged or otherwise provide any restraint of the expansion joint during vessel pressure testing and operation [see 26-4.1(c) and 26-4.1(d)].
MANDATORY APPENDIX 3
DEFINITIONS

*ASME Designated Organization:* see ASME CA-1

*ASME designee:* see ASME CA-1

*completed pressure vessel:* an assemblage of pressure vessel parts of which no further welding, assembly, or testing is required, and to which a Certification Mark and Designator has been applied and for which a Form U-1 or Form U-1A has been completed.
**pressure vessel part**: an integral piece of the pressure vessel that is required to contain the specified design pressure (internal or external) and/or the hydrostatic or pneumatic test pressure of the contents of the pressure vessel within the allowable stress limits of this Division. If this part were completely removed, the pressure vessel would not be able to contain the design and/or hydrostatic or pneumatic test pressure within the allowable stress limits. Excess thickness and material extensions are included in the pressure part.
MANDATORY APPENDIX 5
FLEXIBLE SHELL ELEMENT
EXPANSION JOINTS

5-4 FABRICATION

(a) The flexible element is the flanged-only head, the flanged-and-flued head, the annular plate, or the flued-only head, as appropriate to the expansion joint configuration per Figure 5-1. The flexible element may be fabricated from a single plate (without welds) or from multiple plates or shapes welded together. When multiple plates or shapes are used to fabricate the flexible element, the following requirements apply:

(see the Code)
(b) The circumferential weld attaching the flexible element to the shell, mating flexible element, or outer shell element, as appropriate to the expansion joint configuration per Figure 5-1, shall be as follows:

1. **Butt joints shall be full penetration welds, Type (1) of Table UW-12.**

2. **Corner joints shall be full penetration welds with a covering fillet and no backing strip.**

The covering fillet shall be located on the inside of the corner and shall have a throat at least equal to 0.7 times the minimum thickness of the elements being joined, or 1/4 in. (6 mm) (note that a fatigue evaluation may require a larger weld). It is permitted for the corner weld to be full penetration through either element being joined.
(c) Nozzles, backing strips, clips, or other attachments shall not be located in highly stressed areas of the expansion joint, i.e., inner torus, annular plate, and outer torus. As an exception, a thin cylindrical liner, having approximately the shell inside diameter, may be attached to an inner torus or an annular plate inner corner. A liner is considered thin when its thickness is no more than t/3; however, it need not be thinner than 1/16 in. (1.6 mm). This liner shall be attached to only one side.
The weld attaching the liner shall have a maximum dimension (groove depth or either fillet leg) no larger than the liner thickness. Nozzles or other attachments located in the outer straight flange or outer shell element shall satisfy the axial spacing requirements of Figure 5-2.

Appendix 3:
lined vessel: a vessel having a corrosion resistant lining attached intermittently to the vessel wall.
(d) The welds within the shell courses adjacent to flexible elements shall be full penetration butt welds, Type (1) of Table UW-12, for a distance of $2.5 \sqrt{Rt}$, where $R$ is $Ra$ or $Rb$, and $t$ is the thickness of the shell or outer shell element, as applicable.
Mandatory Appendix 17
Dimpled or Embossed Assemblies

Added an allowed welding process:

(8) machine or automatic laser beam seam welding without the addition of filler metal.

(f) Dimpled or Embossed Assemblies, which consist of a dimpled or embossed plate welded to another like plate or to a plain plate and for which the welded attachment is made by fillet welds around holes or slots, shall be constructed in accordance with the requirements of UW-19(c). The attachment holes or slots may be completely filled in after fillet welding per the requirements of UW-19(c)(1), provided the plate thickness is greater than 3/16 in. (5 mm) but less than 1/2 in. (12 mm).
The nominal thickness for plate shall not be less than

0.030 in (0.8 mm).
MANDATORY APPENDIX 28
ALTERNATIVE CORNER WELD JOINT DETAIL FOR BOX HEADERS FOR AIR-COOLED HEAT EXCHANGERS

Information relocated to UW-13.
MANDATORY APPENDIX 32
LOCAL THIN AREAS IN CYLINDRICAL SHELLS AND IN SPHERICAL SEGMENTS OF SHELLS

32-1 SCOPE
The rules of this Appendix permit acceptable local thin areas (LTAs) in cylindrical shells or spherical segments of shells (such as spherical vessel, hemispherical heads, and the spherical portion of torispherical and ellipsoidal heads) under internal pressure be less than the required thickness required by UG-16, UG-27, or UG-32 as applicable. Local thin areas on the inside or outside of cylindrical shells or spherical segments of shells designed for internal pressure are acceptable, provided they meet the requirements in this Appendix.
32-4 ALLOWABLE LOCATIONS FOR LOCAL THIN AREAS

(c) For torispherical and ellipsoidal heads, the edge of an LTA shall not be closer than $2.5 \sqrt{Rt}$ to the cylindrical shell side of the tangent line of the head-to-cylinder junction.

(d) An LTA is not acceptable within the torus portion of a torispherical head or an ellipsoidal head.
(g) A constant-thickness head-to-cylinder junction for a hemispherical head is not considered an area of high stress for LTA rules. The LTA for a hemispherical head is acceptable within the entire head and shell region for a constant-thickness hemispherical head-to-cylinder junction as shown in Figure 32-4-3, sketch (a). The location for an LTA is limited for a non constant thickness hemispherical head-to-cylinder junction as shown in Figure 32-4-3, sketch (b).

For both constant-thickness and nonconstant-thickness hemispherical head-to-cylinder junctions, LTAs are limited by (a), (b), and (h).
Figure 32-4-3
Limits for Hemispherical Head

(a) Constant Thickness Junction

(b) Nonconstant Thickness Junction

No LTA limit

LTA limit

Shell Head

Tangent line

D

D

2.5 \sqrt{Rt}

2.5 \sqrt{Rt}

LTA not permitted in this area
(h) The edge of an LTA shall not be closer than to the centerline of a stiffing ring or structural support.

(i) A junction between two sections of the same thickness within a cylindrical shell, hemispherical head, torispherical head, or ellipsoidal head is not considered an area of high stress for LTA rules and does not limit the allowable location of an LTA.

(j) An LTA is not acceptable within a flat head or a conical head.
MANDATORY APPENDIX 34
REQUIREMENTS FOR USE OF HIGH SILICON STAINLESS STEELS
FOR PRESSURE VESSELS

34-2 HEAT TREATMENT

(b) 14Cr–16Ni–6Si–Cu–Mo

(1) Materials shall be solution annealed at a temperature of 1,950°F (1,065°C) minimum, followed by rapid cooling.

(2) Heat treatment after forming is neither required nor prohibited. If heat treatment is used, it shall be performed at a temperature of 1,950°F (1065°C) minimum, followed by rapid cooling.
43-2 CONSTRUCTION

(2) Subcontracted Parts.

When a vessel Manufacturer subcontracts some of the construction to another Certificate Holder, the part Manufacturer shall construct the part to the Code Edition established for the entire pressure vessel.
(3) Parts Built for Stock.

Parts built for stock shall be constructed to either the Edition that is mandatory at the time of Code certification, or a published Edition issued by ASME prior to Code certification, which is not yet mandatory [refer to 43-1(a)].

(4) Parts Used From Stock.

When a vessel Manufacturer uses a part from stock, the vessel Manufacturer shall ensure that the part fully satisfies all applicable Code requirements of the Code Edition used for construction of the complete vessel.
**45-1 SCOPE**

The rules of this Appendix cover the minimum requirements for design, fabrication, assembly, inspection, testing, and documentation of gasketed, semiwelded, welded, and brazed plate heat exchangers (PHEs). These rules cover the common types of PHEs and their elements but are not intended to limit the configurations or details to those illustrated or otherwise described herein. Designs that differ from those covered in this Appendix, as well as other types of PHEs, shall be in accordance with U-2(g).
Figure 45-3.1-1
Typical Plate Heat Exchanger

Legend:
1 = feet (optional)
2 = heat transfer plates
3 = fixed end plate
4 = movable end plate
5 = support column
6 = frame compression bolts
7 = upper carrying bar
8 = lower guide bar
9 = connections