B31 Case 181-2 (Approval Date: January 4, 2012)
Use of Alternative Ultrasonic Examination Acceptance Criteria in ASME B31.3

Original Inquiry: Under what conditions and limitations may alternative UT acceptance criteria apply in lieu of those described in para. 344.6.2 of ASME B31.3?

When specified by the owner, the ultrasonic examination acceptance criteria included below may be applied for welds in material greater than or equal to 25mm (1.0 in.) in thickness[1] in accordance with ASME B31.3 provided the following requirements are met:

1) General/Scope:
   a) The examination shall be conducted using automated or semi-automated techniques utilizing computer based data acquisition.
   b) The examination shall be performed in accordance with a written procedure approved by a Level III and conforming to the requirements of ASME Section V, Article 4 Mandatory Appendix VIII and:
      i) For Phased Array – ASME Section V, Article 4, Mandatory Appendix V
      ii) For Time of Flight Diffraction (TOFD) - ASME Section V, Article 4, Mandatory Appendix III
   c) Procedure qualification shall meet the requirements of ASME Section V, Article 4, Mandatory Appendix IX.
2) Equipment
   A mechanical guided scanner capable of maintaining a fixed and consistent search unit position relative to the weld centerline shall be used.
3) Personnel
   a) Set-up and scanning of welds shall be performed by personnel certified as Level II or III (or by Level I personnel under the direct supervision of Level II personnel).
   b) Interpretation and evaluation of data shall be performed by Level II or III personnel.
   c) Examination personnel shall be qualified and certified following a procedure or program as described in ASME BPV Code, Section V, Article 1, T-120 (e), (f), (h) and (i).
   d) Personnel demonstration requirements shall be as stated in ASME Section V, Article 4 Mandatory Appendix VII.
4) Examination
   a) The initial straight beam scan for reflectors that could interfere with the angle beam examination shall be performed (a) manually, (b) as part of a previous manufacturing process, or (c) during the weld examination, provided detection of these reflectors is included in the demonstration as required in 1(c) above.
   b) The examination area shall include the volume of the weld, plus the lesser of 25mm (1.0 in.) or *t* of adjacent base metal. Alternatively, the examination volume may be reduced to include the actual heat affected zone (HAZ) plus 6mm (0.25 in.) of base material beyond the heat affected zone on each side of the weld, provided the extent of the weld HAZ is measured and documented.
   c) Scanning may be peformed at reference level provided the procedure qualification was performed at reference level.
5) Data Recording
   Data shall be recorded in the unprocessed form with no thresholding. The data record shall include the complete examination area as specified in (4)(b) above.

1 For wall thicknesses less than 25mm (1.0 in.), the acceptance criteria stated in paragraph 344.6.2 of B31.3 shall be used.

6) Data Analysis
   a) Reflectors exceeding the limits below shall be investigated to determine whether the indication originates from a flaw or is a geometric indication in accordance with 6(b) below.
      i) For amplitude based techniques, the location, amplitude, and extent of all reflectors that produce a response greater than 20% of the reference level shall be investigated.
      ii) For non-amplitude based techniques, the location and extent of all images that have an indicated length greater than 4.0mm (0.16 in.) shall be investigated.
   b) Ultrasonic indications of geometric and/or metallurgical origin shall be classified as specified in ASME Section V, Article 4 Paragraph T-481.
   c) Alternatively, other techniques or NDE methods may be used to classify an indication as geometric (e.g., alternative beam angles, radiography). The method employed is for information only to classify the indication as geometric, and ASME B31.3 requirements for examination techniques are only required to the extent they are applicable.
7) Flaw Evaluation
   a) The dimension of the flaw(s) shall be determined by the rectangle that fully contains the area of the flaw(s). (Refer to Fig. 1)
      i) The length, ℓ, of the flaw shall be drawn parallel to the inside pressure retaining surface of the component.
      ii) The height, *h*, of the flaw shall be drawn normal to the inside pressure retaining surface of the component.
      iii) The flaw shall be characterized as a surface or subsurface flaw, as shown in Figure 1.
      iv) A subsurface indication shall be considered as a surface flaw if the separation (*S* in Figure 1) of the indication from the nearest surface of the component is equal to or less than half the through wall dimension (*h* in Figure 1, sketch [b]) of the subsurface indication.
   b) Multiple Flaws
      i) Discontinuous flaws that are oriented primarily in parallel planes shall be considered to lie in a single plane if the distance between the adjacent planes is equal to or less than 13mm (0.50 in.) or 0.5t, whichever is less.
      ii) If the space between two flaws aligned along the axis of weld is less than the height of the flaw of greater height, the two flaws shall be considered a single flaw.
      iii) If the space between two flaws aligned in the through-thickness dimension is less than the height of the flaw of greater height, the two flaws shall be considered a single flaw.
8) Flaw Acceptance Criteria
   Flaws shall be evaluated against the applicable acceptance criteria of Table 1 or 2, except that flaw length (*l*) shall not exceed 4t, regardless of flaw height (*h*) or the calculated aspect ratio.

TABLE 1
Acceptance Criteria for Surface Flaws

Aspect Ratio, h/ℓ	**Weld Thickness**	
	25mm to 64mm (1.0 in. to 2.5 in.)	*100mm to 300mm (3.9 in. to 11.8 in.)*
	h/t	***h/t***
0.00	≤ 0.031	≤ 0.019
0.05	≤ 0.033	≤ 0.020
0.10	≤ 0.036	≤ 0.022
0.15	≤ 0.041	≤ 0.025
0.20	≤ 0.047	≤ 0.028
0.25	≤ 0.055	≤ 0.033
0.30	≤ 0.064	≤ 0.038
0.35	≤ 0.074	≤ 0.044
0.40	≤ 0.083	≤ 0.050
0.45	≤ 0.085	≤ 0.051
0.50	≤ 0.087	≤ 0.052

General Notes:

(a) t = thickness of the weld excluding any allowable reinforcement. For a butt joint joining two members having different thickness at the joint, t is the thinner of the two thicknesses joined. If a full penetration weld includes a fillet weld, the effective throat dimension of the fillet weld shall be included in t.

(b) Aspect Ratio (h/ℓ) used may be determined by rounding the calculated h/ℓ down to the nearest 0.05 increment value within the column, or by linear interpolation.

(c) For intermediate thickness t (weld thicknesses between 64mm and 100mm [2.5 in. and 3.9 in.]) linear interpolation is required to obtain h/t values.

TABLE 2
Acceptance Criteria for Subsurface Flaws

Aspect Ratio, h/ℓ	**Weld Thickness**	
	25mm to 64mm (1.0 in. to 2.5 in.)	*100mm to 300mm (3.9 in. to 11.8 in.)*
	h/t	***h/t***
0.00	≤ 0.068	≤ 0.040
0.10	≤ 0.076	≤ 0.044
0.20	≤ 0.086	≤ 0.050
0.30	≤ 0.098	≤ 0.058
0.40	≤ 0.114	≤ 0.066
0.50	≤ 0.132	≤ 0.076
0.60	≤ 0.156	≤ 0.088
0.70	≤ 0.180	≤ 0.102
0.80	≤ 0.210	≤ 0.116
0.90	≤ 0.246	≤ 0.134
1.00	≤ 0.286	≤ 0.152

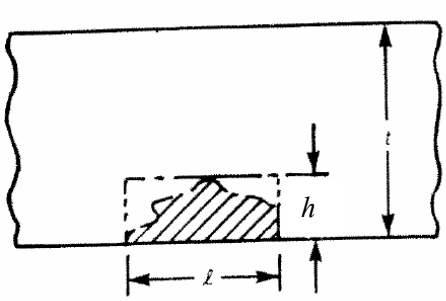
General Notes:

(a) t = thickness of the weld excluding any allowable reinforcement. For a butt joint joining two members having different thickness at the joint, t is the thinner of the two thicknesses joined. If a full penetration weld

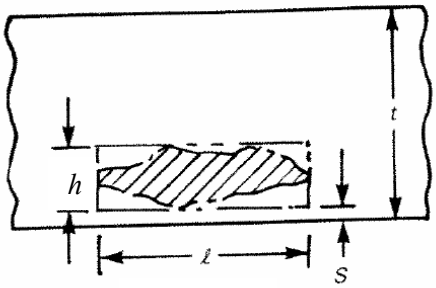
includes a fillet weld, the effective throat dimension of the fillet weld shall be included in t.

(b) Aspect Ratio (h/ℓ) used may be determined by rounding the calculated h/ℓ down to the nearest 0.05 increment value within the column, or by linear interpolation.

(c) For intermediate thickness t (weld thicknesses between 64mm and 100mm [2.5 in. and 3.9 in.]) linear interpolation is required to obtain h/t values.

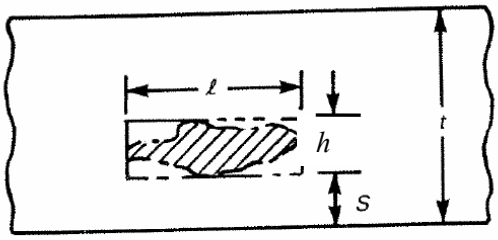


(a) Surface Flaw



$S \leq 0.5h$

(b) Surface Flaw



$S > 0.5h$

(c) Subsurface Flaw

Figure 1: Surface and Subsurface Indications