**Approval Date: October 16, 2012**

*Code Cases will remain available for use until annulled by the applicable Standards Committee.*

**Case N-824**
**Ultrasonic Examination of Cast Austenitic Piping Welds From the Outside Surface**
**Section XI, Division 1**

*Inquiry:* What alternative to the requirements of Appendix VIII, VIII-3110(c) may be used when performing ultrasonic examinations of centrifugally-cast and statically-cast austenitic piping welds from the outside surface?

*Reply:* It is the opinion of the Committee that the following requirements may be used in lieu of the requirements of Appendix VIII, VIII-3110(c), when ultrasonically examining cast austenitic piping welds from the outside surface.

## 1 ULTRASONIC EXAMINATION OF CAST AUSTENITIC PIPING WELDS

*(a)* In addition to variations in attenuation, velocity, reflection, and refraction at grain boundaries, the following welds are associated with beam splitting, beam distortion, and beam skewing, due to the coarse-grained and anisotropic nature of the cast austenitic base materials:

*(1)* centrifugally-cast or statically-cast austenitic steel to wrought carbon or low alloy steel

*(2)* statically-cast austenitic steel to centrifugally-cast austenitic steel

*(3)* centrifugally-cast austenitic steel to centrifugally-cast austenitic steel

*(4)* statically-cast austenitic steel to statically-cast austenitic steel

*(5)* statically-cast austenitic steel to wrought austenitic steel

*(b)* Examination of the welds for, which the ultrasonic beam must pass through the wrought carbon, low alloy steel, or wrought austenitic steel materials of the welds in (a) shall meet the requirements of Appendix I, I-2220.

*(c)* The requirements of Appendix III, as supplemented by Table I-2000-1, shall be met for examination of the welds for, which the ultrasonic beam must pass through the cast austenitic base materials listed in 1(a), with the following modifications. Examinations in accordance with this Case shall be performed from the outside surface only.

*(1)* In lieu of the requirements of III-2120, the following requirements shall be met:

*(-a)* All search units shall be dual, transmit-receive, refracted longitudinal wave probes, consisting of monolithic elements (conventional search unit) or multi-element phased arrays (phased-array search unit).

*(-b)* Wedges, whether integral or replaceable, shall allow for no more than a $^{1}/_{32}$ in. (0.8 mm) gap between the search unit and the component surface along the scan length.

*(-c)* Two ranges of inspection frequencies are required.

*(-1)* For piping less than or equal to 1.6 in. (41 mm) thick, up to 1.5 MHz probes shall be used; however, higher frequency probes (up to and including 2 MHz) may be useful for flaw characterization.

*(-2)* For piping greater than 1.6 in. (41 mm) thick, 0.5 MHz to 1.0 MHz probes shall be used.

*(-d)* At least one inside-surface-impingement beam angle (calculated) shall be within the range of 30 deg to 50 deg for examination volume coverage. At least one beam angle greater than or equal to 55 deg is required for detection of deeper flaws.

*(-e)* Search unit size is dependent on frequency, and focal length or sound path. For detection of inner-surface-initiated flaws, the search unit shall have a sufficiently large active aperture to enable appropriate beam focusing within 80% to 110% of the nominal wall thickness of the piping material. The following relationship shall be used to dete[illegible]ppropriate aperture has been chosen:

$$D \sqrt{N 4c/f}$$

**Insert "=" after D

where

$c$ = longitudinal wave velocity in material
$D$ = minimum probe diameter or aperture
$f$ = nominal probe frequency
$N$ = required focal length