**ARTICLE KT-2
IMPACT TESTING FOR WELDED VESSELS**

**KT-200 IMPACT TESTS**

(a) For vessels of welded construction, the toughness of welds and heat-affected zones of procedure qualification test plates and vessel production test plates shall be determined as required in this Article.

(b) Test plates shall be subjected to heat treatment, including cooling rates and aggregate time at temperature or temperatures, essentially the same as established by the Manufacturer for use in actual manufacture. The total time at temperature shall be at least 80% of the total time at temperature during actual heat treatment of the product and may be performed in a single cycle.

(c) The test temperature for welds and heat-affected zones shall not be higher than for the base materials.

(d) Impact values shall be at least as high as those required for the base materials [see Table KM-234.2(a)].

**KT-210 LOCATION AND ORIENTATION OF SPECIMENS**

Impact tests of welds and heat-affected zones shall be made in accordance with KT-210 for each qualified welding procedure used for pressure retaining welds (i.e. Category A, B, C or D) on each vessel. Base material of test plates representing each welding procedure shall be taken from one of the heats of material used for the vessel production weld joints applying the welding procedure. Base material of production test plates shall be taken from one of the heats of material used for the vessel production of Category A, B, C or D weld joints.

(a) The production test plates shall be welded as an extension to the end of the production weld joint where practical.

(b) Alternatively, the production test plates shall be welded immediately prior to the start of production or welded concurrently with the production weld and following requirements shall be met:

1. Utilize welding materials and procedures which are to be used on the production joint;
2. The welding equipment shall be of the same type as used for production;
3. The location of the test plate welding shall be immediately adjacent to the production welding;
4. In addition, the following requirements shall apply.

**KT-220 IMPACT TESTS FOR WELDING PROCEDURE QUALIFICATIONS**

Impact tests shall be required on weld and heat-affected zones for all welding procedure qualifications.

**KT-221 VARIABLES FOR IMPACT TESTING PROCEDURES**

See Section IX, QW-250.

**KT-222 THICKNESS QUALIFIED WHEN LOWER CRITICAL TEMPERATURE IS EXCEEDED**

For test plates or pipe receiving a postweld heat treatment in which the lower critical temperature is exceeded, the maximum thickness qualified is the thickness of the test plate or pipe.

**KT-230 IMPACT TEST OF PRODUCTION TEST PLATES**

Impact tests of welds and heat-affected zones shall be made in accordance with KT-210 for each qualified welding procedure used on each vessel. Test plates shall be taken from one of the heats of material used for the vessel production welds and shall be welded as an extension to the end of the production weld joint where practical, welded immediately prior to the start of production, or welded concurrently with the production weld, utilizing welding materials and procedures which are to be used on the production joint. If test plates are welded concurrently with the production weld, the welding equipment shall be of the same type as used for production and the location of the test plate welding shall be immediately adjacent to the production welding. In addition, the following requirements shall apply.

(a) If automatic or semiautomatic welding is performed, a test plate shall be made in each position employed in the vessel welding.

(b) If manual welding is to be employed in the horizontal flat position only, a test plate shall be made in the flat position. A vertical test plate with the major portions of the layers of welds deposited in the vertical upward position shall be used to qualify the welding procedure when welds are made in any other position. The vertically welded test plate will qualify the manual welding in all positions.
(c) Impact tests shall be valid only if the thickness of the vessel test plate meets the requirements of Section IX, Table QW-451.1 (including Notes), except that, if the thickness is less than \( \frac{7}{8} \) in. (16 mm), the thickness of the test material shall be the minimum thickness qualified.

**KT-240 BASIS FOR REJECTION**

If the vessel test plate fails to meet the impact requirements, the welds represented by the test plate shall be unacceptable. Reheat treatment in accordance with Part KM and retesting are permitted.
KT-200 IMPACT TESTS

(a) For vessels of welded construction, the toughness of welds and heat-affected zones of procedure qualification test plates and vessel production test plates shall be determined as required in this Article.

(b) Test plates shall be subjected to heat treatment, including cooling rates and aggregate time at temperature or temperatures, essentially the same as established by the Manufacturer for use in actual manufacture. The total time at temperature shall be at least 80% of the total time at temperature during actual heat treatment of the product and may be performed in a single cycle.

(c) The test temperature for welds and heat-affected zones shall not be higher than for the base materials.

(d) Impact values shall be at least as high as those required for the base materials [see Table KM-234.2(a)].

KT-210 LOCATION AND ORIENTATION OF SPECIMENS

All weld impact specimens for both weld procedures and production tests shall comply with the following requirements:

(a) One set of weld metal impact specimens shall be taken across the weld metal material. Each specimen shall be normal to the surface of the weld. The specimen shall be taken from the base material. When test specimens are made on material over 1/2 in. (38 mm) in thickness, two sets of impact specimens shall be taken from the weld, with one set located within 1/16 in. (1.6 mm) of the surface of one side of the material, and one set taken as near as practical midway between the surface and the center of thickness of the opposite side as described above.

(b) One set of heat-affected zone impact specimens shall be taken across the weld metal material. Each specimen shall be located, after etching, the notch in the affected zone. The notch shall be cut approximately normal to the material surface in such a manner as to include as much heat-affected zone material as possible in the resulting fracture.

KT-220 IMPACT TESTS FOR WELDING PROCEDURE QUALIFICATIONS

Impact tests shall be required on welds and heat-affected zones for all welding procedure qualifications.

KT-221 VARIABLES FOR IMPACT TESTING PROCEDURES

See Section IX, QW-250.

KT-222 THICKNESS QUALIFIED WHEN LOWER CRITICAL TEMPERATURE IS EXCEEDED

When the calculated thickness exceeds the minimum thickness for a postweld heat treatment temperature is exceeded, the thickness is the thickness of the test plate or pipe.

KT-230 IMPACT TEST OF PRODUCTION TEST PLATES

Impact tests of welds and heat-affected zones shall be made in accordance with KT-210 for each qualified welding procedure used on each vessel. Test plates shall be taken from one of the heats of material used for the vessel production for Categories A and B weld joints and shall be prepared as an extension to the end of the production weld joint where practical. Welded immediately prior to the start of production, or welded concurrently with the production weld, the welding equipment shall be of the same type as used for production and the location of the test plate welding shall be immediately adjacent to the production welding. In addition, the following requirements shall apply.

(a) If automatic or semiautomatic welding is performed, a test plate shall be made in each position employed in the vessel welding.

(b) If manual welding is to be employed in the horizontal position only, a test plate shall be made in the flat position. A vertical test plate with the major portion of the layers of welds deposited in the vertical upward position shall be used to qualify the welding procedure when tests are made in any other position. The vertically welded test plate will qualify the manual welding in all positions.