Table QW-452.6
Fillet Qualification by Groove-Weld Tests

Type of Joint	Thickness of Test Coupon as Welded, in. (mm)	Qualified Range	Type and Number of Tests Required
Any groove	All thicknesses	All base material thicknesses, fillet sizes, and diameters	Fillet welds are qualified when a welder/welding operator qualifies on a groove weld test

(15)

Table QW-453
Procedure/Performance Qualification Thickness Limits and Test Specimens for Hard-Facing (Wear-Resistant) and Corrosion-Resistant Overlays

Thickness of Test Coupon (T)	Corrosion-Resistant Overlay [Note (1)]		Hard-facing Overlay (Wear-Resistant) [Note (2)]	
	Nominal Base Metal Thickness Qualified (T)	Type and Number of Tests Required	Nominal Base Metal Thickness Qualified (T)	Type and Number of Tests Required
Procedure Qualification Testing				
Less than 1 in. (25 mm) T	T qualified to unlimited	Notes [Note (4)], [Note (5)], and [Note (9)]	T qualified up to 1 in. (25 mm)	Notes [Note (3)], [Note (7)], [Note (8)], and [Note (9)]
1 in. (25 mm) and over T	1 in. (25 mm) to unlimited		1 in. (25 mm) to unlimited	
Performance Qualification Testing				
Less than 1 in. (25 mm) T	T qualified to unlimited	[Note (6)]	T qualified to unlimited	Notes [Note (8)] and [Note (10)]
1 in. (25 mm) and over T	1 in. (25 mm) to unlimited		1 in. (25 mm) to unlimited	

NOTES:

(1) The qualification test coupon shall consist of base metal not less than 6 in. (150 mm) × 6 in. (150 mm). The weld overlay cladding shall be a minimum of $1\frac{1}{2}$ in. (38 mm) wide by approximately 6 in. (150 mm) long. For qualification on pipe, the pipe length shall be a minimum of 6 in. (150 mm), and a minimum diameter to allow the required number of test specimens. The weld overlay shall be continuous around the circumference of the test coupon. For processes (performance qualification only) depositing a weld bead width greater than $\frac{1}{2}$ in. (13 mm) wide, the weld overlay shall consist of a minimum of three weld beads in the first layer.

length

(2) The test base metal coupon shall have minimum dimensions of 6 in. (150 mm) wide × approximately 6 in. (150 mm) long with a hard-faced layer a minimum of $1\frac{1}{2}$ in. (38 mm) wide × 6 in. (150 mm) long. The minimum hard-faced thickness shall be as specified in the Welding Procedures Specification. Alternatively, the qualification may be performed on a test base metal coupon that represents the size of the production part. For qualification on pipe, the pipe lenth shall be 6 in. (150 mm) minimum, and of a minimum diameter to allow the required number of test specimens. The weld overlay shall be continuous around the circumference of the test coupon.

(3) The hard-facing surface shall be examined by the liquid penetrant method and shall meet the acceptance standards in QW-195.2 or as specified in the WPS. Surface conditioning prior to liquid penetrant examination is permitted.

(4) The corrosion-resistant surface shall be examined by the liquid penetrant method and shall meet the acceptance standards as specified in QW-195.

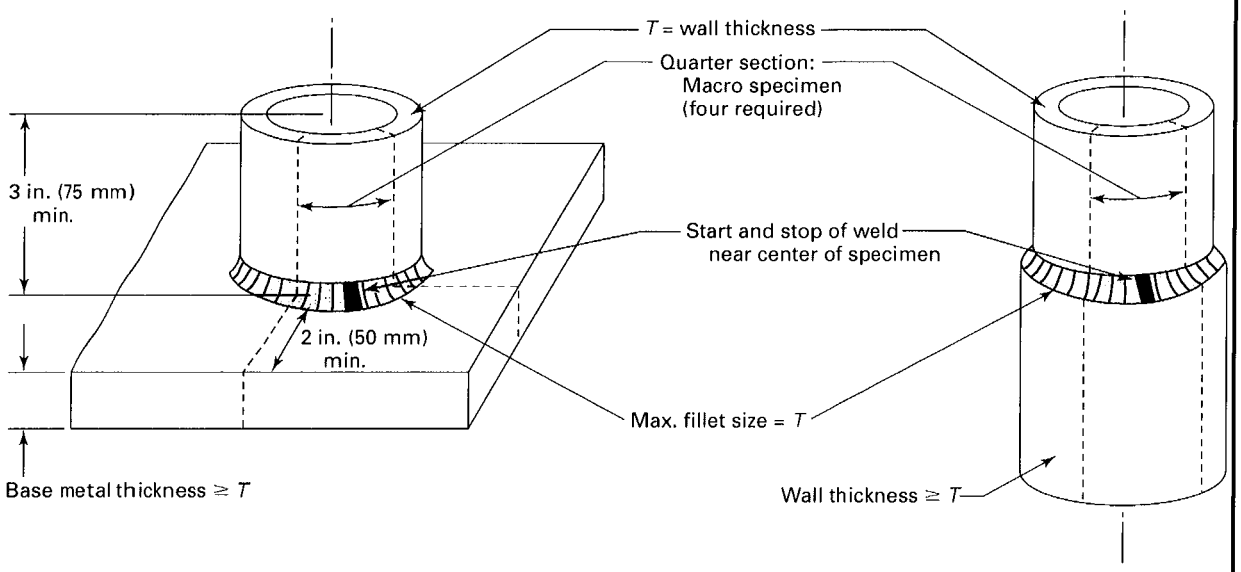
(5) Following the liquid penetrant examination, four guided side-bend tests shall be made from the test coupon in accordance with QW-161. The test specimens shall be cut so that there are either two specimens parallel and two specimens perpendicular to the direction of the welding, or four specimens perpendicular to the direction of the welding. For coupons that are less than $\frac{3}{8}$ in. (10 mm) thick, the width of the side-bend specimens may be reduced to the thickness of the test coupon. The side-bend specimens shall be removed from locations specified in Figure QW-462.5(c) or Figure QW-462.5(d).

(6) The test coupon shall be sectioned to make side-bend test specimens perpendicular to the direction of the welding in accordance with QW-161. Test specimens shall be removed at locations specified in Figure QW-462.5(c) or Figure QW-462.5(d).

(7) After surface conditioning to the minimum thickness specified in the WPS, a minimum of three hardness readings shall be made on each of the specimens from the locations shown in Figure QW-462.5(b) or Figure QW-462.5(e). All readings shall meet the requirements of the WPS.

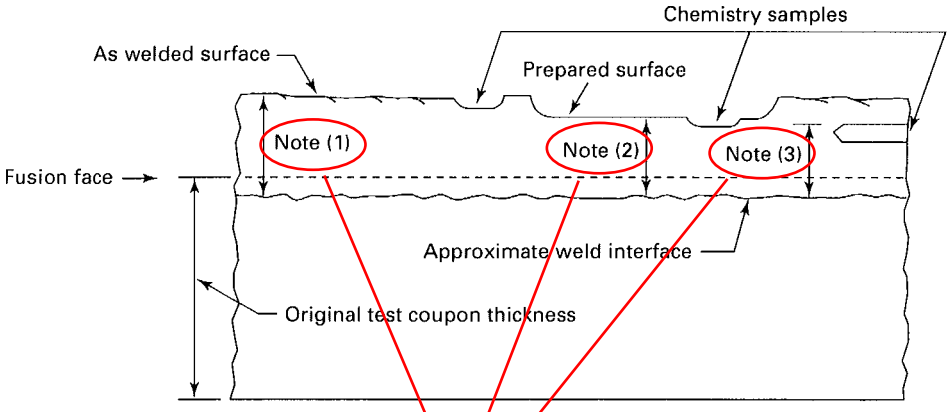
(8) The base metal shall be sectioned transversely to the direction of the hard-facing overlay. The two faces of the hard-facing exposed by sectioning shall be polished and etched with a suitable etchant and shall be visually examined with × 5 magnification for cracks in the base metal or the heat-affected zone, lack of fusion, or other linear defects. The overlay and the base metal shall meet the requirements specified in the WPS. All exposed faces shall be examined. See Figure QW-462.5(b) for pipe and Figure QW-462.5(e) for plate.

Figure QW-462.4(d)
Fillet Welds in Pipe — Procedure



GENERAL NOTES:
(a) Either pipe-to-plate or pipe-to-pipe may be used as shown.
(b) Macro test:
(1) The fillet shall show fusion at the root of the weld but not necessarily beyond the root.
(2) The weld metal and the heat-affected zone shall be free of cracks.

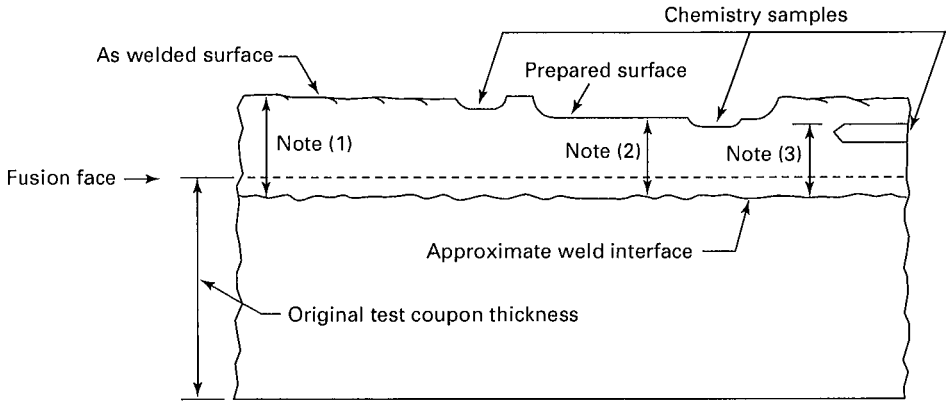
Figure QW-462.5(a)
Chemical Analysis and Hardness Specimen Corrosion-Resistant and Hard-Facing Weld Metal Overlay



The text for these notes are missing. Insert as shown on the next page, from the 2013 Edition.

For Information

Figure QW-462.5(a)
Chemical Analysis and Hardness Specimen Corrosion-Resistant and Hard-Facing Weld Metal Overlay



NOTES:
(1) When a chemical analysis or hardness test is conducted on the as welded surface, the distance from the approximate weld interface to the final as welded surface shall become the minimum qualified overlay thickness. The chemical analysis may be performed directly on the as welded surface or on chips of material taken from the as welded surface.
(2) When a chemical analysis or hardness test is conducted after material has been removed from the as welded surface, the distance from the approximate weld interface to the prepared surface shall become the minimum qualified overlay thickness. The chemical analysis may be made directly on the prepared surface or from chips removed from the prepared surface.
(3) When a chemical analysis test is conducted on material removed by a horizontal drilled sample, the distance from the approximate weld interface to the uppermost side of the drilled cavity shall become the minimum qualified overlay thickness. The chemical analysis shall be performed on chips of material removed from the drilled cavity.

The notes are included in the 2013 Edition, and missing from the 2015 Edition.

This should be spelled "Maximum"

FORM QW-482 (Back)

WPS No. _____ Rev. _____

POSITIONS (QW-405)
Position(s) of Groove _____
Welding Progression: Up _____ Down _____
Position(s) of Fillet _____
Other _____

POSTWELD HEAT TREATMENT (QW-407)
Temperature Range _____
Time Range _____
Other _____

PREHEAT (QW-406)
Preheat Temperature, Minimum _____
Interpass Temperature, Maximim _____
Preheat Maintenance _____
Other _____
(Continuous or special heating, where applicable, should be specified)

GAS (QW-408)

	Percent Composition		
	Gas(es)	(Mixture)	Flow Rate
Shielding			
Trailing			
Backing			
Other			

ELECTRICAL CHARACTERISTICS (QW-409)

Weld Pass(es)	Process	Filler Metal		Current Type and Polarity	Amps (Range)	Wire Feed Speed (Range)	Energy or Power (Range)	Volts (Range)	Travel Speed (Range)	Other (e.g., Remarks, Comments, Hot Wire Addition, Technique, Torch Angle, etc.)
		Classification	Diameter							

Amps and volts, or power or energy range, should be specified for each electrode size, position, and thickness, etc.

Pulsing Current _____ Heat Input (max.) _____
Tungsten Electrode Size and Type _____
(Pure Tungsten, 2% Thoriated, etc.)
Mode of Metal Transfer for GMAW (FCAW) _____
(Spray Arc, Short Circuiting Arc, etc.)
Other _____

TECHNIQUE (QW-410)
String or Weave Bead _____
Orifice, Nozzle, or Gas Cup Size _____
Initial and Interpass Cleaning (Brushing, Grinding, etc.) _____
Method of Back Gouging _____
Oscillation _____
Contact Tube to Work Distance _____
Multiple or Single Pass (Per Side) _____
Multiple or Single Electrodes _____
Electrode Spacing _____
Peening _____
Other _____

(07/15)