

Table 4.1
WPS Qualification—Production Welding Positions Qualified by Plate, Pipe, and Box Tube Tests (see 4.3)

Qualification Test		Production Plate Welding Qualified			Production Pipe Welding Qualified			Production Box Tube Welding Qualified		
Weld Type	Positions	Groove	Groove	Fillet ¹	Butt Joint			Butt Joint		
		CJP	PJP	Fillet ¹	CJP	PJP	T-, Y-, K-Connections	CJP	PJP	T-, Y-, K-Connections
CJP Groove ^a	1G	F	F	F	F ^b	F ^b	F	F	F	F
	2G	F, H	F, H	F, H	(F, H) ^b	(F, H) ^b	F, H	F, H	F, H	F, H
	3G	V	V	V	V ^b	V ^b	V	V	V	V
	4G	OH	OH	OH	OH ^b	OH ^b	OH	OH	OH	OH
Fillet ^a	1F			F			F			F
	2F			F, H			F, H			F, H
	3F			V			V			V
	4F			OH			OH			OH
Plug/ Slot										
CJP Groove	1G Rotated	F	F	F	F ^c	F ^c	F	F ^c	F	F
	2G	F, H	F, H	F, H	(F, H) ^c	(F, H) ^c	F, H	(F, H) ^c	F, H	F, H
	5G (2G + 5G)	F, V, OH	F, V, OH	F, V, OH	(F, V, OH) ^c	(F, V, OH) ^c	F, V, OH	(F, V, OH) ^c	F, V, OH	F, V, OH
	6G	All	All	All	All ^e	All ^e	All	All ^e	All	All
	6GR	All	All	All	All ^d	All ^d	All	All ^d	All	All
	1F Rotated			F			F			F
2F Rotated			F, H			F, H			F, H	
4F			F, H			F, H			F, H	
5F			F, H, OH			F, H, OH			F, H, OH	
			All			All			All	All

Qualifies Plug/Slot Welding for Only the Positions Tested

CJP—Complete Joint Penetration
 PJP—Partial Joint Penetration
^a Qualifies for a welding axis with an essentially straight line, including welding along a line parallel to the axis of circular pipe.
^b Qualifies for circumferential welds in pipes equal to or greater than 24 in [600 mm] nominal outer diameter.
^c Production butt joint details without backing or backgouging require qualification testing of the joint detail shown in Figure 4.25(A).
^d Limited to prequalified joint details (see 3.12 or 3.13).
^e For production joints of CJP T-, Y-, and K-connections that conform to either Figure 3.8, 3.9, or 3.10 and Table 3.6, use Figure 4.27 detail for testing. For other production joints, see 4.12.4.1.
^f For production joints of CJP T-, Y-, and K-connections that conform to Figure 3.6, and Table 3.6, use Figures 4.27 and 4.29 detail for testing, or, alternatively, test the Figure 4.27 joint and cut macroetch specimens from the corner locations shown in Figure 4.29. For other production joints, see 4.12.4.1.
^g For production joints of PJP T-, Y-, and K-connections that conform to Figure 3.5, use either the Figure 4.25(A) or Figure 4.25(B) detail for testing.
^h For matched box connections with corner radii less than twice the chord member thickness, see 3.12.4.1.
ⁱ Fillet welds in production T-, Y-, or K-connections shall conform to Figure 3.2. WPS qualification shall conform to 4.11.

Table 4.5 (Continued)
PQR Essential Variable Changes Requiring WPS Requalification for
SMAW, SAW, GMAW, FCAW, and GTAW (see 4.7.1)

Essential Variable Changes to PQR Requiring Requalification	Process				
	SMAW	SAW	GMAW	FCAW	GTAW
Process Parameters (Cont'd)					
18) A change in the travel speed ^c by:		> 15% increase or decrease	> 25% increase or decrease	> 25% increase or decrease	> 50% increase or decrease
Shielding Gas					
19) A change in shielding gas from a single gas to any other single gas or mixture of gas, or in the specified nominal percentage composition of a gas mixture, or to no gas			X	X	X
20) A change in total gas flow rate by:			Increase > 50% Decrease > 20%	Increase > 50% Decrease > 20%	Increase > 50% Decrease > 20%
21) A change to a shielding gas not covered in:			AWS A5.18 or A5.28	AWS A5.20 or A5.29	
SAW Parameters					
22) A change of > 10%, or 1/8 in [3 mm], whichever is greater, in the longitudinal spacing of the arcs		X			
23) A change of > 10%, or 1/8 in [3 mm], whichever is greater, in the lateral spacing of the arcs		X			
24) An increase or decrease of more than 10° in the angular orientation of any parallel electrode		X			
25) For machine or automatic SAW; an increase or decrease of more than 3° in the angle of the electrode		X			
26) For machine or automatic SAW, an increase or decrease of more than 5° normal to the direction of travel		X			
General					
27) A change in position not qualified by Table 4.1	X	X	X	X	X
28) A change in diameter, or thickness, or both, not qualified by Table 4.2	X	X	X	X	X
29) A change in base metal or combination of base metals not listed on the PQR or qualified by Table 4.8	X	X	X	X	X
30) Vertical Welding: For any pass from uphill to downhill or vice versa	X		X	X	X

(Continued)

Table 4.6

PQR Supplementary Essential Variable Changes for CVN Testing Applications Requiring WPS Requalification for SMAW, SAW, GMAW, FCAW, and GTAW

Variable	SMAW	SAW	GMAW	FCAW	GTAW
Base Metal					
1) A change in Group Number	X	X	X	X	X
2) Minimum thickness qualified is T or 5/8 in [16 mm] whichever is less, except if T is less than 1/4 in [6 mm], then the minimum thickness qualified is 1/8 in [3 mm]	X	X	X	X	X
Filler Metal					
3) A change in the AWS A5.X Classification, or to a weld metal or filler metal classification not covered by A5.X specifications	X	X	X	X	X
4) A change in the Flux/Wire classification, or a change in either the electrode or flux trade name when not classified by an AWS specification, or to a crushed slag		X			
5) A change in the manufacturer or the manufacturer's brand name or type of electrode				X	
Position					
6) A change in position to vertical up. A 3G vertical up test qualifies for all positions and vertical down	X		X	X	X
Preheat/Interpass Temperature					
7) An increase of more than 100°F [56°C] in the maximum preheat or interpass temperature qualified	X	X	X	X	X
Post Weld Heat Treatment					
8) A change in the PWHT temperature and/or time ranges. The PQR test shall be subject to 80% of the aggregate times at temperature(s). The PWHT total time(s) at temperature(s) may be applied in one heating cycle	X	X	X	X	X
Electrical Characteristics					