

AASHTO/AWS D1.5 (Bridge Welding Code)

Quick Review on Essential Variables

1-Guide (General)

AWS D1.5, 7.7

General Requirements for WPS Qualification:

AWS D1.5, 7.7.1 Except as exempted by 1.3.7 Or 7.11, groove weld WPSs shall be qualified in accordance with 7.12, 7.13 Or 7.14, and fillet weld WPSs shall be qualified in accordance with 7.10. Figure 7.1 shall be used for qualification testing of WPSs under 7.12. Groove WPSs qualified or prequalified by 1.3.7, 7.11, or 7.12 may be used with joint details in Figures 4.4 (CJP) or Figures 4.5 (PJP) without further testing.

7.11 WPSs considered prequalified: Only SMAW WPSs using electrodes listed in Table 6.1 (*except for E100 and E110), and steels listed in 1.2.2, operated within the range recommended by the manufacturers, and conform with this code.

Note: *SMAW E100 and E110 electrodes that are used for Gr. HPS 690W [HPS 100W] in Table 6.1, can NOT be used or listed in prequalified WPSs.

Note: For PJP Groove welds to be qualified based on CJP Groove, Engineer may require the Contractor to provide additional three macroetch test specimens to evaluate weld soundness and to verify that the required weld size is produced. (AWS D1.5, Clause 7.9.1)

Note: Tests required for Fillet welds WPSs are:

- 1) Mechanical Property Test as defined on 7.10.2 [except as exempted by 1.3.7 (Ancillary Product), 7.10.1 (Single Pass Fillet), or 7.11 (Prequalified WPS)], and
- 2) Soundness Test **for each weld size and position**, as per Clause 7.10.3 and Figure 7.8 [if WPS is not considered prequalified by 1.3.7 (Ancillary Product), or 7.11]

Also note:

AWS D1.5, 7.7.2 (Pretest), and 7.7.3 (Verification of PQRs)

AASHTO/AWS D1.5 (Bridge Welding Code)

2-Guide (Position)

AWS D1.5, 7.8:

Each position qualifies WPS for the same position, **except that groove test welds made in flat position shall also qualify for horizontal position.** (Clause 7.8.2)

3-Guide (Thickness of Base Metal Range)

AWS D1.5, 7.6.1 PQR on test plate equal or greater than 1 in. (25 mm) shall be used and it will qualify WPS for all thicknesses covered in this code, **except that:**

(For **EGW** process, WPS qualify range is 0.5T **Min.**, 1.1T **Max.** [T is qualification thickness]), as Table 7.7 and Table 7.6, and for **ESW** process only T [T is qualification weld thickness]), as Table 7.8)

AWS D1.5, Table 7.6: For grade HPS 690W (HPS 100W) material, increase in plate thickness greater than 1/2 in. (12 mm) or decrease of 1 in. (25 mm) or more is essential variables (**except** for **ESW** or **EGW** process).

Note: AWS D1.5, Table 7.6: PQR Essential Variable Changes for WPSs Qualified per 7.12.4 (Table 7.7 for addition essential variable for EGW, and Table 7.8 for ESW)

4-Guide (Heat input)

AWS D1.5, Table 7.6: An increase or decrease above 20% in heat input, over that qualified, is essential variable, and therefore needs re-qualification. For Grade HPS 690W [HPS 100W], increase or decrease shall be limited to 10%

Heat input may be measured by the following:

Heat input [J /in. (J/mm)] =
(Voltage x Amperage x 60)/ Travel Speed [in./min
(mm/min)]

AASHTO/AWS D1.5 (Bridge Welding Code)

5-Guide (Joint)

AWS D1.5, Table 7.6: Essential Variables for Joints:

-For the PQR groove area, an increase or decrease > 25% in the number of passes (SMAW, SAW, GMAW, FCAW, EGW)

-A change from U-groove to V-groove but not vice versa

-A change in the type of groove to a square groove and vice versa (SMAW, SAW, GMAW, FCAW)

-A decrease in the groove angle and root opening, an increase in the root face exceeding the tolerances in the shape of any type of groove 4.12 (CJP-Figures 4.4) or 4.13 (PJP-Figures 4.5) or 5.3.4 (SMAW, SAW, GMAW, FCAW)

-The omission, but not inclusion, of backing or backgouging (SMAW, SAW, GMAW, FCAW)

Note: AWS D1.5, Table 7.6: PQR Essential Variable Changes for WPSs Qualified per 7.12.4 (Table 7.7 for addition essential variable for EGW, and Table 7.8 for ESW)

6-Guide (Filler Metal Selection)

AWS D1.5, Table 7.4, Table 7.6 and Clause 7.5

-Each AWS Classification is essential variable

-Each manufacturer's brand and type of cored electrode (**except** SMAW electrode) is essential variable

AASHTO/AWS D1.5 (Bridge Welding Code)

7-Guide (Base Metal Selection)

AWS D1.5, 7.4.1 Base Metal Qualification Requirements:

Table 7.1 (See 7.4 and C-7.4)

Test on Base Metal Filler Metal Strength MPa [ksi]
"to be listed on WPS"

Test on Gr. 250 (36):

Gr. 36, or 50, or 50W, or HPS 50W 415 [60]

Test on Gr. 50, 50W, or HPS 50W:

Gr. 50, 50W, HPS 50W * 485 [70] or 550 [80]

Test on Gr. 50S:

Gr. 50S ** 485 [70] or 550 [80]

Test on Gr. HPS 70W:

Gr. HPS 70W * 620 [90]

Test on Gr. HPS 100W:

Gr. HPS 100W * 690 [100] or 760 [110]

*Plus, all lower grades (except Gr. 50S**), with matching filler metals strength (including Gr. 50, 50W, HPS 50W but with lower filler metals strength of 415 [60]), as shown above.

**Test on Gr. 50S will qualify only the same grade.

Note: Backing materials shall conform with above (Table 7.1); Equivalent ASTM materials are shown in Table 7.2; Unlisted base metals, when authorized by the Engineer, shall conform with the requirements of Clause 7.4.2