Certification of Companies for Fusion Welding of Steel
Quick Review on Essential Variables

1-Guide (Position)

CSA W47.1, Table 16:
WPDS Qualification, Welding Positions

CJP Groove Weld (Plate or Tubular **), or
Fillet Weld (Plate or Tubular) Qualification Test:

Position Tested	Position Qualified*
1G, 1G (Rotated)	F
2G	F, H
3G	F, V
4G	F, OH
5G	F, V, OH
(2G+5G), 6G	All
1F, 1F (Rotated)	F
2F, 2F (Rotated)	F, H
3F	F, V
4F	F, OH
5F	All

* CJP Groove Qualify CJP, PJP and Fillet Welds
* PJP Groove Qualify any Fillet Weld Size on any thickness
* Fillet Qualify Fillet only
* Vertical uphill to downhill or vice versa is essential variable
* Plug/Slot Welding Qualifies for Only the Positions Tested

** Qualification on plate will qualify only for pipes over 610 mm (24 in OD)

2-Guide (Joint)

CSA W47.1, Table 11:
Soundness Test Essential Variables

-The omission, but not inclusion, of backing or backgouging

See more Essential Variables on CSA W47.1, Table 11

Prequalified Joints (CJP and PJP) are shown in Section 10 of CSA W59-18 (See it all from Sketch Selection).

3-Guide (Thickness/Diameter of Base Metal Range)

CSA W47.1, Table 13:
CJP-Range of Thickness and Diameter Qualification

Test on Plate, CJP Groove Welds:
T: Thickness of Test Coupon Welded

T from 1/8 in. (3 mm) to 3/8 in. (10 mm), incl.:
Qualified Thickness Range: 1/8 in. (3 mm) **Min.**, 2T **Max.**

T above 3/8 in. (10 mm), but less than 1 in. (25 mm):
Qualified Thickness Range: 3/16 in. (5 mm) **Min.**, 2T **Max.**

T from 1 in. (25 mm) and over:
Qualified Thickness Range: 3/16 in. (5 mm) **Min.**, **Unlimited**

T test on ESW and EGW:
Qualified Thickness Range: 0.5T **Min.**, 1.1T **Max.**

Note 2 of CSA W47.1, Table 13: CJP groove weld qualification on any thickness or diameter shall qualify any size of fillet or PJP groove weld for any thickness.

CSA W47.1, Table 14:
PJP-Range of Thickness and Diameter Qualification

Test on Plate (Pipe), PJP Groove Welds:
S: Thickness of Test Groove Depth

S from 1/8 in. (3 mm) to 3/8 in. (10 mm), incl.:
Qualified Thickness Range: 1/8 in. (3 mm) **Min.**, 2S **Max.**

S above 3/8 in. (10 mm) to 1 in. (25 mm), incl.:
Qualified Thickness Range: 3/16 in. (5 mm) **Min.**, **Unlimited**

Note 2 of CSA W47.1, Table 14: Any PJP qualification shall also qualify any fillet weld size on any thickness.

Steel Deck (Arc Spot Welds-Procedure Qualifications):
(See **CSA W47.1, Clause 11.9**).

Fillet Weld WPDS Qualification (Qualify all Plate/Pipe Thickness): Test shall be based on Max. single pass and Min. multiple pass fillet weld size to be used in construction (See **CSA W47.1, Table 15**).

4-Guide (Diameter of Base Metal Range)

Test on Pipe (Tube), CJP Groove Welds:

CSA W47.1, Table 13:
CJP-Range of Thickness and Diameter Qualification

a) Job Size Test Pipes:
Diameter over or less than 24 in. (610 mm OD)

T from 1/8 in. (3 mm) to 3/8 in. (10 mm), incl.:
Qualified Thickness Range: 1/8 in. (3 mm) **Min.**, 2T **Max.**

T over 3/8 in. (10 mm), but less than 3/4 in. (19 mm):
Qualified Thickness Range: 0.5T **Min.**, 2T **Max.**

T from 3/4 in. (19 mm) and over:
Qualified Thickness Range: 3/8 in. (10 mm) **Min.**, **Unlimited**

Qualified Nominal Diameter of Pipe (Tube) Size:
Test diameter and over

b) Standard Test Pipes:
2 in. Sch. 80 (50 mm OD x 6 mm WT) or
3 in. Sch. 40 (75 mm OD x 6 mm WT)
Qualified Thickness Range:
1/8 in. (3 mm) **Min.**, 3/4 in. (19 mm) **Max.**

Qualified Nominal Diameter of Pipe (Tube) Size:
3/4 in. (19 mm OD) through 4 in. (100 mm OD)

6 in. Sch. 120 (150 mm OD x 14 WT) or
8 in. Sch. 80 (200 mm OD x 12 WT)
Qualified Thickness Range:
3/16 in. (5 mm) **Min.**, **Unlimited**

Qualified Nominal Diameter of Pipe (Tube) Size:
4 in. (100 mm OD) and over
Note 2 of CSA W47.1, Table 13: CJP groove weld qualification on any thickness or diameter shall qualify any size of fillet or PJP groove weld for any thickness.

5-Guide (Base Metal Selection)

CSA W47.1, Table 17 Steel Groupings for Procedure Qualification Tests by PQR:
WPDS base metal combinations allowed by PQR

Group letter for soundness tests: A, B, C
Group number for mechanical tests: 1 to 8

CSA W47.1, 11.4.3 A change in the base metal steel group (number) and/or group (letter) as shown in CSA W47.1, Table 17 is essential variable for all process.

For example test on C8 combination groups, qualify all austenitic stainless steels for the same position as allowed in CSA W47.1, Table 16.

6-Guide (Preheat)

The need for and the temperature of preheat are dependent upon a number of factors such as chemical analysis, degree of restraint of the parts being joined, elevated temperature, mechanical properties, and material thicknesses.

When welding two different materials group, the minimum preheat temperature required shall be the higher temperature for the material to be welded. Also, thickness referred to for the minimum preheat is the greater of the nominal thicknesses at the weld of the parts to be joined.

CSA W47.1, Table 11: For materials other than quenched and tempered, a decrease in preheat and interpass temperature of more than 25% is essential variable.

CSA W47.1, Table 11, Note 6: For quenched and tempered grades, an interpass temperature range shall be specified and any deviation from the specified range shall require requalification.

7-Guide (Heat input)

Heat Input Control for Quenched and Tempered Steels:
When quenched and tempered steels are welded, the heat input shall be restricted in conjunction with the maximum preheat and interpass temperatures required. Such considerations shall include the additional heat input produced in simultaneous welding on the two sides of a common member. The preceding limitations shall be in conformance with the producer's recommendations.

CSA W47.1, Table 11, Note 6: For quenched and tempered grades, an interpass temperature range shall be specified and any deviation from the specified range shall require requalification.

The increase may be measured by the following:
Heat input [J /in. (J/mm)] =
(Voltage x Amperage x 60)/ Travel Speed [in./min (mm/min)]

8-Guide (Welding Process)

Essential Variables for SMAW, SAW, GMAW, FCAW, MCAW, GTAW Process:
CSA W47.1, Table 11: Soundness Test Essential Variables

Essential Variables for ESW, EGW Process:
CSA W47.1, Table 12: Soundness Test Essential Variables

Steel Deck (Arc Spot Welds-Procedure Qualifications):
(See **CSA W47.1, Clause 11.9**).