

WELDING PROCEDURE SPECIFICATION (WPS)

FCAW-STEEL

FLUX CORED ARC WELDING (FCAW)

RJV Gasfield Services

4901 Bruce Rd.
Vegreville, AB

Governing codes
and standards: W47.1 - 2009
W59 - 2013
W48-06
AWS 5.29

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Engineer's Seal
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EXPERTS-CONSEILS • CONSULTING INC.



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1 SCOPE

- 1.1** This Welding Procedure Specification (WPS) covers welding and related operations of steel structures, which are fabricated by RJV Gasfield Services in accordance with the terms outlined in:
- CSA Standard W47.1 - 2009
 - CSA Standard W59 - 2013
- 1.2** This Welding Procedure Specification shall be limited to:
- a) Welding of base metal listed in Table 3.1.
 - b) Use of filler metal which conforms to CSA W48 and listed in Table 5.1.
 - c) Base metal thickness from 3 mm (1/8") to unlimited thickness.
 - d) Joints conform to the annex of this WPS: Prequalified Joint Details.
- 1.3** Approved Welding Procedure Data Sheet(s) (WPDS) are required to supplement this Welding Procedure Specification (WPS) when:
- a) Contract documents specify impact/toughness/charpy/CVN values, PWHT or other mechanical property requirements
 - b) A change in any of the variables contained in the succeeding paragraphs or listed in Clause 11.
- 1.4** In case of conflict or discrepancy between an approved Welding Procedure Data Sheet (WPDS) making reference to this specification, the WPDS requirements shall apply.

2 WELDING PROCEDURE

2.1 General

- 2.1.1** Welding shall be done using automatic or semi-automatic FCAW (Flux Cored Arc Welding) gas shielded or self-shielded process in single and multi-pass welds welded using a stringer pass technique.
- 2.1.2** Maximum and minimum electrode diameters shall be as per table 2.1a:
- 2.1.3** Maximum fillet weld made in one pass shall be as per table 2.1b:

TABLE 2.1 a)
Electrode Diameter Criteria

Position	<u>Gas Shielded</u>		<u>Self Shielded</u>	
	Minimum Diameter mm (in)	Maximum Diameter mm (in)	Minimum Diameter mm (in)	Maximum Diameter mm (in)
Flat & Horizontal	0.9 for t < 10 (3/8) 1.2 for t ≥ 10 (3/8)	3.2 (1/8)	1.6 for t < 20 (3/4) 2.0 for t ≥ 20 (3/4)	3.2 (1/8)
Vertical up & Overhead	0.9 for t < 10 (3/8) 1.2 for t ≥ 10 (3/8)	1.6 (1/16)	1.6 for t < 20 (3/4) 2.0 for t ≥ 20 (3/4)	2.0 (5/64)

TABLE 2.1 b)
Maximum single pass fillet size

Position	<u>Gas Shielded</u>		<u>Self Shielded</u>	
	Electrode diameter (mm)	<i>Maximum Single pass fillet size mm (in)</i>	Electrode diameter mm (in)	<i>Maximum Single pass fillet size mm (in)</i>
Flat	0.9 (.035")	5 (3/16")	1.6 (1/16")	8 (5/16")
	≥ 1.2 (.045")	10 (3/8")	≥ 2.0 (5/64")	10 (3/8")
Horizontal	0.9 (.035")	5 (3/16")	≥ 1.6 (1/16")	8 (5/16")
	1.2(.035")	8 (5/16")		
Vertical up	≥ 2.4 (3/32")	10 (3/8")	1.6 (1/16") 2.0 (5/64")	6 (1/4") 8 (5/16")
	0.9 (.035")	5 (3/16")		
Overhead	1.2(.035")	8 (5/16")	1.6 (1/16") 2.0 (5/64")	6 (1/4") 8 (5/16")
	≥ 2.4 (3/32")	10 (3/8")		
Overhead	0.9 (.035")	5 (3/16")	1.6 (1/16") 2.0 (5/64")	6 (1/4") 8 (5/16")
	≥ 1.2 (.045")	8 (5/16")		

***The cross sectional area of any single pass shall not exceed an area equivalent to the maximum sized fillet weld for each of the electrode sizes, as shown above**

2.1.4 Thickness of weld layers shall not exceed 6 mm (1/4 inch).

2.1.5 Split layer technique shall be used when the width of the layer exceeds 16 mm (5/8 inch) and 25 mm (1") for vertical up. When the root opening of a groove weld is 12 mm (1/2 inch) split layer technique shall be used with the exception of the finishing weld layers.

2.2 Complete Joint Penetration Groove Welds

2.2.1 Complete penetration groove welds, welded from both shall be backgouged to sound metal prior to welding from the other side except where it is expressly stated that backgouging is not mandatory.

2.2.2 Back-gouging shall produce a groove contour substantially conforming to the prequalified single U-joint and its depth shall be adequate to ensure complete penetration into the previously deposited weld metal.

2.2.3 Groove welds to be used without procedure qualification are detailed in Annex and are subject to the limitations specified in Clauses 10.4.1 and Fig.10.5 of CSA W59 within the following limits:

- The groove angle as shown is the minimum permitted.
- The radius of the J- and U-grooves is a minimum permitted dimension. U-grooves may be prepared before or after fitting.
- Double groove welds may have grooves of unequal depth.

2.3 Partial Penetration Groove Welds

- 2.3.1 Minimum depth of grooves shall be as shown in Table 4.3 of CSA W59, which is reproduced in this document as Table 2.2.
- 2.3.2 Groove welds to be used without procedure qualification are detailed in Annex and are subject to the limitations specified in Clause 10.4.2 and Fig. 10.6 of CSA W59 and within the following limits:
- a) The groove angle as shown is the minimum permitted.
 - b) The radius of the J- and U-grooves is a minimum permitted dimension. U-grooves may be prepared before or after fitting.
 - c) Double groove welds may have grooves of unequal depth.

TABLE 2.2
Minimum Depth of Groove of Partial Penetration Groove Welds

Thickness, t, of thicker part joined		V-, Bevel-grooves		J-, U-Grooves
		Groove angle ≥ 45° and < 60°	Groove angle ≥ 60°	Prequalified groove geometry
mm	in	mm (in)	mm (in)	mm (in)
t ≤ 12	t ≤ ½	8 (5/16)	5 (3/16)	5 (3/16)
12 < t ≤ 20	1/2 < t ≤ 3/4	10 (3/8)	6 (1/4)	6 (1/4)
20 < t ≤ 40	3/4 < t ≤ 1-1/2	11 (7/16)	8 (5/16)	8 (5/16)
40 < t ≤ 60	1-1/2 < t ≤ 2-1/4	12 (1/2)	10 (3/8)	10 (3/8)
60 < t	2-1/4 < t	16 (5/8)	12 (1/2)	12 (1/2)

* For applicable effective throat, see Clause 4.3.1.4 in CSA W59.

Note: The size of any single-pass weld or the size of the first pass of a multiple-pass weld shall be such as to minimize the possibility of cracking.

3 BASE METAL

- 3.1 The base metal of 3.2mm (1/8") minimum thickness shall be as shown in CSA W59: Table 11.1, Steel Groups 1 to 7; or in Table 12.1, Steel Groups 1 to 7. This information has been adapted as part of this specification in Table 3.1.
- 3.2 This specification is not intended to apply to quenched and tempered steel without additional considerations from CSA W59 or any steel other than those listed in Table 3.1 of this specification.

Table 3.1
Base Metals and Matching Electrode, Selection Guide

Steel Group	Specified min. tensile strength of base metal, MPa (ksi)	CSA Standard G40.21	CSA Standard G40.21	ASTM	CSA W48 Electrode Classifications ^{(1) (2)} (AWS 5.29)
					FCAW
1	Up to 400 incl when $F_y < 250$ (Up to 60 incl. when $F_y < 36$)			A36 [t > 203 mm (8")] A53 Grade B A106 Grade B A131 Grades A,B,CS,D,DS and E A139 Grade B, A381 Grade Y3 A441 [Normalized t > 102 mm (4")] A500 Grade A A515 Grades 55 and 60 A516 Grades 55 and 60 A524 Grade I and II, A573 Grade 58 A709 Grade 36 [≤ 20 mm (3/4")] A1008 SS Grades 30 and 33 type 1 A1011 SS Grades 30 and 33 A1018 SS Grades 30 and 33	E49XT-X ⁽⁷⁾ (E7XT-X) ⁽⁷⁾
2	Up to 400 incl when $F_y \geq 250$ (Up to 60 incl. when $F_y \geq 36$)	260W 260WT 300W(HSS)	38W 38WT 44W(HSS)	A36 [t ≤ 203 mm (8")] A441 [102 \leq t \leq 203 or Norm. 38<t< 102mm] A500 Grade B, A501, A572 Grade 42 A709 Grade 36 [> 20 mm (3/4")] A1008 SS Grades 40 Type 1 A1008 HSLAS Grade 45 Class 1 and 2 A1008 HSLAS Grade 50 Class 2 A1008 HSLAS-F Grade 50 A1011SS Grade 36 Type 1, 40 and 45 A1011 HSLAS Grade 45 Class 1 and 2 A1011 HSLAS Grade 50 Class 2 A1011 HSLAS-F Grade 50 A1018 SS Grades 36 and 40 A1018 HSLAS Grade 45 Class 1 and 2 A1018 HSLAS Grade 50 Class 2 A1018 HSLAS-F Grade 50	E49XT-X ⁽⁷⁾ (E7XT-X) ⁽⁷⁾
3	Over 400 to 480 inclusive (Over 60 to 70 inclusive)	300W 300WT 350W 350WT 350A ⁽³⁾ 350AT ⁽³⁾ 380W(HSS) 380WT(HSS)	44W 44WT 50W 50WT 50A ⁽³⁾ 50AT ⁽³⁾ 55W(HSS) 55WT(HSS)	*A252 Grades 1, 2, 3 * A131 Grades AH32, DH32 and EH32 A242 ⁽³⁾⁽⁴⁾ A441 [t ≤ 102 mm or Norm. t ≤ 38 mm] A500 Grade C A516 Grades 65 and 70 A529 Grades 50 and 55, A537 Class 1 A572 Grades 50 and 55, A573 Grade 65 A588 ⁽³⁾ , A595 Grades A, B and C A606A618 Grades Ia and Ib, II, and III A633 Grades A, C, and D A709 Grades 50, 50W, 50S, HPS 50W A710 Grade A, Class 2 > 50 mm A808 [t < 65mm], A847 A913 Grade 50, , A992 A1008 HSLAS Grade 50 Class 1 A1008 HSLAS Grade 55 Class 1 & 2 A1011 SS Grades 50 and 55 A1011 M SS Grade 340 and 380 A1011 HSLAS Grade 50 Class 1 A1011 HSLAS Grade 55 Clasess 1-2 A1018 HSLAS Grade 50 Class 1 A1018 HSLAS Grade 55 Class 1 & 2 A1018 HSLAS Grade 60 Class 2 A1018 HSLAS-F Grade 60 Class 2	E49XT-X ⁽⁷⁾ (E7XT-X) ⁽⁷⁾

Table 3.1 Continued next page

Steel Group	Specified min. tensile strength of base metal, MPa (ksi)	CSA Standard G40.21	CSA Standard G40.21	ASTM	CSA W48 Electrode Classifications ^{(1) (2)} (AWS 5.29)
					FCAW
4	Over 480 to 550 inclusive Over 70 to 80 inclusive	400W 400WT 400A ⁽³⁾ 400AT ⁽³⁾	60W 60WT 60A ⁽³⁾ 60AT ⁽³⁾	A131 Grades AH36, DH36 and EH36 A537 Class 2 A572 Grades 60 and 65 A633 Grade E A710 Grade A, Class 2 ≤ 50 mm A710 Grade A, Class 3 > 50 mm A913 Grade 60, 65 A1011 Grades 60 and 65 A1018 HSLAS Grade 70 Class 2 A1018 HSLAS-F Grade 70 Class 2	E55XT-X ⁽⁷⁾ (E8XT-X) ⁽⁷⁾
5	Over 550 to 620 inclusive Over 80 to 90 inclusive	480W 480WT 480A ⁽³⁾ 480AT ⁽³⁾	70W 70WT 70A ⁽³⁾ 70AT ⁽³⁾	A709 Grade HPS70W A852 A1011 Grade 70	E62XT-X ⁽⁷⁾ (E9XTX-X) ⁽⁷⁾
6	Over 620 to 700 inclusive Over 90 to 100 inclusive			A514 [64 mm(2-1/2") < t < 152 mm(6")] A1011 Grade 80	E69XT-H4 (E10XTX-H4)
7	Over 700 ⁽⁵⁾ Over 100 ⁽⁵⁾	700Q 700QT	100Q 100QT	A 514 [t < 64 mm (2 ½ ")] A517M	E76XT--H4 (E11XTX-H4)

*ASTM A252 material specification has no limitations on chemical elements with the exception of phosphorus. This lack of control on chemical composition may lead to the production of material, which is not considered weldable due to high carbon equivalents or high sulphur levels. This material can be used in accordance with Clause 3.2 in CSA Standard W59 if the following conditions are being met:

- $S \leq 0.05$ and $P \leq 0.04$, and
- Carbon equivalent (C.E.) of the material shall be less than 0.50 using $C.E. = C + (Mn+Si)/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15$
- Mechanical properties are similar to those of prequalified materials listed in CSA Standard W59.

Notes:

- For exceptions, see CSA W59 tables 12.2
- In case of exception under Note (1) for electrodes lower than matching, the value of X_u is that of the lower electrode classification; for electrodes higher than matching, the value of X_u is that of the matching electrode classification.
- For unpainted applications where the deposited weld metal shall have similar atmospheric corrosion resistance and/or similar colour characteristics to the base metal, the requirements of Clauses 5.2.1.4 and 5.2.1.5 in CSA W59 shall apply.
- Only types with properties suitable for welding
- Complete joint penetration groove welds made with the designated matching electrodes classifications may not develop the specified minimum tensile strength of the base metal.
- NA
- FCAW wire electrodes shall have a low hydrogen designator of -H8, or -H4.

4 PREPARATION OF BASE METAL

- 4.1** The base material and assembly shall be prepared in accordance with Clause 5.3 and 5.4 of CSA W59 with the limitation of table 4.1 below.
- 4.2** Surfaces and edges to be welded shall be smooth, uniform, and free from fins, cracks, and other defects that would adversely affect the quality or strength of the weld.
- 4.3** Surfaces to be welded shall also be free, within 50 mm (2 in) of any weld locations, from loose or thick scale (except for tightly adhering small islands of scale), slag, loose rust, paint, grease, moisture, and other foreign material that will prevent welding or produce objectionable fumes while welding.
- 4.4** Machining, grinding, air carbon-arc or oxygen gouging may be used for joint preparation, back gouging, or the removal of defective work material except that oxygen-fuel gouging shall not be used on quenched and tempered steels..
- 4.5** All slag, flux, blow holes or porosity remaining on any bead of welding shall be removed before laying down the next successive bead.

TABLE 4.1
Workmanship tolerance

	<u>Root not gouged</u>	<u>Root gouged</u>
Root face of joint	±2 mm (±1/16")	Not limited
Root without steel backing	±2 mm (±1/16")	+2 mm (+1/16") -3 mm (-1/8")
Root with steel backing	+6 mm(+1/4") -2 mm (-1/16")	Not applicable
Groove angle of joint	+10° -5°	+10° -5°

5 FILLER METAL / SHIELDING GAS

5.1 General

- 5.1.1** The filler metal shall conform to the requirements of CSA W48, latest edition, and shall be selected from Table 3.1.

5.2 Storage of Electrodes

- 5.2.1 Electrodes shall be dry and free from rust and foreign material.
- 5.2.2 All rolls of wire shall be stored in warm and dry conditions and kept free from oil, grease, and other deleterious matter once they have been removed from their packages.

5.3 Shielding Gas

- 5.3.1 Shielding gas mixture may only be used when electrode (wire) manufacturer's recommendations on shielding gas / wire electrode combinations are permissible under CSA W48 latest edition, and specified in Table 9.1.
- 5.3.2 The shielding gas shall be a welding grade having a dew point of -40°C (-40°F) or lower.
- 5.3.3 The use of mixtures of argon with carbon dioxide (CO_2) and/or oxygen (O_2), with or without the additions of helium, increase the levels of manganese and silicon in the weld deposits compared with carbon dioxide (CO_2) shielding. Increasing the amount of alloy elements in the weld metal may result in higher tensile and yield strength and correspondingly lower elongations. Impact properties may also be affected.
- 5.3.4 Gas flow shall be as indicated in Table 9.1.
- 5.3.5 Shielding must be provided for the arc area to reduce drafts below 6km/h.

6 WELDING TECHNIQUES

- 6.1 Welding shall be done preferably in the flat position. Horizontal, Vertical, and Overhead positions are acceptable when shown on applicable prequalified joint welding detail in Annex except for the root pass which can be done in any position or progression when it is removed to sound metal in preparation for welding the second side.
- 6.2 The travel angle is the angle between the joint and electrode in the longitudinal plane along the joint and referred to as a push angle when the electrode points in the direction of travel and a drag angle when the electrode points in the direction opposite to travel.
- 6.3 The work angle is the angle between the work and the electrode in the plane perpendicular to travel. That is; a transverse plane across the joint.

- 6.4** In general the following techniques and critical electrode angles shall be used or follow techniques and electrode angles which are recommended by the electrode manufacturer:
- a) Work angle range is from 40° to 90° and 5° to 15° drag angle. Push angle is only to be used with FCAW processes progressing upwards in the vertical position.
 - b) Stay on the leading edge of the puddle to avoid inadequate fusion. Refer to minimum Arc Travel Speed (ATS) and typical parameter ranges. in Table 9.1.
 - c) Welding operators should avoid techniques that could involve a danger of cold lapping or non-fusion and undercutting. Stringer beads are preferred; weaving or shipping of gun shall be avoided.
- 6.5** The wire diameter, voltage, and amperage shall be suited to the thickness of the material, type and groove, welding position and other circumstances associated with the assembly.

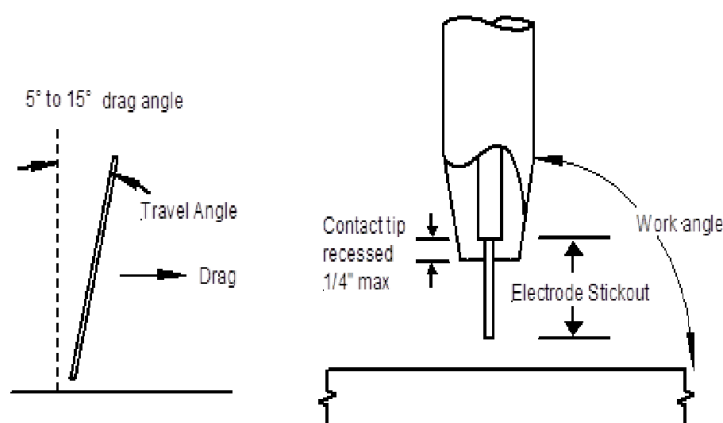


Figure 6.1
Travel Angle, Work Angle and Electrode Stickout

7 PREHEAT AND INTERPASS TEMPERATURE

- 7.1** Unless otherwise specified by the drawings or Engineer minimum preheat and interpass temperature shall be in accordance with values from Table 5.3 of CSA W59 which has been adapted in this specification in Table 7.1.
- 7.2** Preheat and interpass temperatures above the minimum shown in Table 7.1 may be required:
- a) for highly restrained welds
 - b) for certain combinations of steel thickness and weld energy input levels when the steel composition contains elements such as Carbon, Manganese, Chromium, Nickel that are at or near the maximum values permitted by the steel specifications
 - c) for high strength weld metal
 - d) for joints where transfer of tensile stress occurs in the through-thickness direction of the material.

Table 7.1
Minimum Preheat and Interpass Temperature

Thickness of Thickest Part At Point of Welding, mm (in)		FCAW with diffusible hydrogen designators ≤ H8		FCAW hydrogen designators ≤ H4
		CSA Standard G40.21-M 260W, 260WT (38 W, 38 WT) 300W, 300WT (44 W, 44 WT) 350W, 350WT (50 W, 50 WT) 350A, 350AT (50 A, 50 AT) 380W, 380WT (60 W, 60 WT) 400A, 400AT (60 A, 60 AT)	CSA Standard G40.21-M 400W, 400WT (60 W, 60 WT) 480W, 480WT (70 W, 70 WT) 480A, 480AT (70 A, 70 AT)	CSA Standard G40.21-M 700Q (100Q), 700QT (100QT)
		ASTM A36 ,A53 Gr. B ,A106 Gr. B A131 Grades A, B, CS, D, DS, and E A131 Grades AH 32 and 36 A131 Grades DH 32 and 36 A131 Grades EH 32 and 3 A139 Grade B ,A242 ⁽²⁾ ,A381 Grade Y35 A441 ,A500 Gr. A, B, C, A501 A 515 Grade 55, A516 All Grades, A524 A529 Grade 50-55 ,A537 Classe 1 and 2 A572 Gr. 42, 50, 55 ,A588, A595 Grades A,B,C, A606, A607 All Grades A618 Grades Ib, II, and III A633 Gr. A, C, D A709 Grade 36,50,50S, 50W A710 Grade A Class 2≥50 mm A710 Grade A Class 3 >50mm 808 [t < 65 mm] A847 ,A913 Grade 50 ,A992 1008 HSLAS Grade 45 Class 1 and 2 Grade 50 Class 1 and 2 Grade 55 Class 1 and 2 A1008 SS Grades 30, 33Type 1, 40 Type 1 A1008 HSLAS-F Grade 5 A1011 HSLAS Grade 45 Class 1 and 2 Grade 50 Class 1 and 2 ,Grade 55 Class 1 & 2 A1011 SS Grades 30,33,36 Type 1,40,45,50,55 A1011 HSLAS-F Grade 50 A1018 HSLAS Grade 45 Class 1 and 2 Grade 50 Class 1 and 2, Grade 55 Class 1 & 2 A1018 HSLAS-F Grade 50 A1018 SS Grades 30, 33, 36 and 40	ASTM A515 Gr. 60-65 A572 Gr. 60, 65 A633 Gr. E A709 Grade HPS70 A710 Grade A Class 2 ≤50mm A852 A913 Grade 60, 65 A1018 HSLAS Grade 60 Class2 Grade 70 Class 2 A1018 HSLAS-F Grade 60 Class 2 Grade 70 Class	ASTM A 514 A 517M
≤ 20mm	≤ 3/4"	None ⁽³⁾	10°C (50°F)	10°C (50°F)
20 – 40mm	3/4 - 1-1/2"	10°C (50°F)	60°C (150°F)	50°C (125°F)
40 – 60mm	1-1/2 - 2-1/2"	65°C (150°F)	107°C (225°F)	80°C (175°F)
≥ 60mm	≥ 2-1/2"	107°C (225°F)	150°C (300°F)	110°C (225°F)

(1) Only for thicknesses up to 8 mm (5/16").

(2) Grades suitable for welding. See clause 3.2.2

(3) When the base metal temperature is below 0°C (32°F), the base metal shall be preheated to at least 10°C (50°F) and this temperature maintained during welding.

Notes:

- Welding shall not be done when the ambient temperature is below -18°C (0°F), except with the expressed consent of the engineer.
- When the base metal is below the temperature listed for the welding process being used and for the thickness of the material being welded, it shall be preheated (except as otherwise provided) in such a manner that the surfaces of the parts on which weld metal is being deposited are at or above the specified minimum temperature for a distance equal to the thickness of the part being welded – but not less than 75 mm (3") – both laterally and in advance of the welding. Preheat and interpass temperatures must be sufficient to prevent crack formation.
- For quenched and tempered steel, the maximum preheat and interpass temperature shall not exceed 200 °C (400°F) for thicknesses up to 40 mm (1-1/2 ") inclusive and 230 °C (450°F) for greater thicknesses. Heat input, when welding quenched and tempered steel, shall not exceed the steel producer's recommendations.

8 WELD METAL CLEANING

- 8.1** Flux, slag, or silica remaining after a layer shall be removed before applying the next covering pass. Prior to painting all flux, slag, and silica shall be removed and the parts shall be free of loose scale, or dirt.
- 8.2** Prior to depositing weld metal on the underside of welding groove the root shall be gouged, ground, or chipped to sound metal unless otherwise specified on the applicable prequalified joint detail in Annex.
- 8.3** Groove welds shall be terminated at the ends of a joint in a manner that will ensure sound welds. Where possible, this shall be done by use of extension bars or run-off plates. When used, extensions shall be removed upon completion and cooling of the weld. The ends of the welds shall be made smooth and flush with the edges of the abutting parts.
- 8.4** Tack welds that are incorporated into the final weld shall be made with electrodes meeting the requirements of the final welds and shall be cleaned thoroughly.
- 8.5** Unless otherwise noted, tack welds that are located in areas not included in the final welds shall either be removed and ground smooth or build up to sizes equivalent to minimum fillet size requirements.

9 ELECTRICAL CHARACTERISTICS

- 9.1** The electrical power source used shall be a Constant Voltage (CV) type.
- 9.2** The welding current, voltage, polarity, electrode (wire) and gas combinations shall be as outlined in published data from electrode (wire) manufacturer and as per Table 9.1.
- 9.3** The welding current or wire feed speed, arc voltage, gas flow, mode of metal transfer, and speed of travel shall be such that each pass will have complete fusion with adjacent base metal and weld metal and there shall be no overlap or excessive porosity or undercutting.

Table 9.1
Typical Parameters FCAW ⁽¹⁻³⁾

Classification Hydrogen designator required: - H4, -H8	Position	Polarity	Electrode Size mm (in)	Current Amps ± 10%	Wire Feed Speed In/min. ± 10%	Volt Gas Group 1 (100% CO ₂)	Volt Gas Group 2	Volt Gas Group 3
FCAW, flux cored self shielded wire								
E491T-8	Flat & Horizontal	DCEN	1.6 (1/16")	245	200	19-21	N/A	N/A
			2.0 (5/64")	320	125	21-23		
	V-up & Overhead	DCEN	1.6 (1/16")	200	150	17-19		
			2.0 (0.078")	280	130	19-21		
FCAW, flux cored gas shielded 100 CO2								
E491T-1(M) E492T-1(M) E491T-9(M) E492T-9(M) E491T-12(M) E551T-1(M) E621T-1(M) E761T-1(M)	Vup & Overhead	DCEP	0.9 (.035")	135	325	22-26	Reduce by 1 or 2 Volts	Reduce by 2 or 3 Volts
	Flat/Horizontal			175	500	24-28		
	Vup & Overhead	DCEP	1.2 (.045")	200	330	24-28		
	Flat/Horizontal			240	430	26-30		
	Vup & Overhead	DCEP	1.4 (.052")	230	280	24-28		
	Flat/Horizontal			275	350	25-29		
	Vup & Overhead	DCEP	1.6 (1/16")	265	225	24-28		
	Flat/Horizontal			320	295	26-30		

Shielding Gas Groups:

Group 1

100 % CO₂
None

Group 2

75 % Argon / 25 % CO₂

Group 3

85 % Argon / 15 % CO₂
83 % Argon/17 % CO₂

**Shielding gas/wire combination shall be certified by the CWB and only used when following wire manufacturer's recommendations permissible under CSA W48 latest edition.*

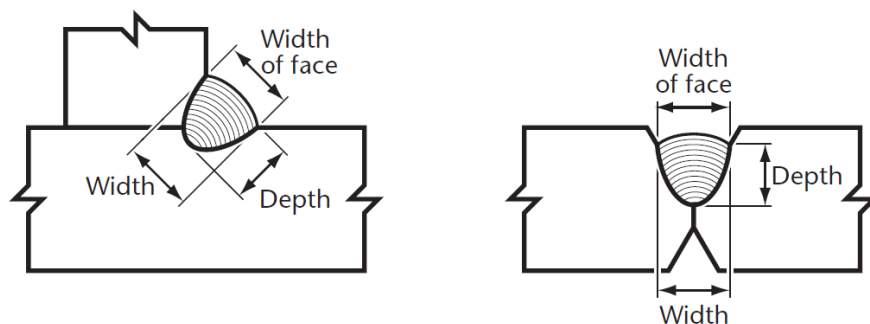
***Other Shielding gas/wire combination may be used when certified by the CWB.*

NOTES:

- (1) Above parameters shall be used in conjunction with published data by the wire manufacturer.
- (2) Electrode stick-out (ESO), contact tip to work distance: 5/8" to 3/4".
- (3) Shielding gas flow rate FCAW: 30 to 55cfh.

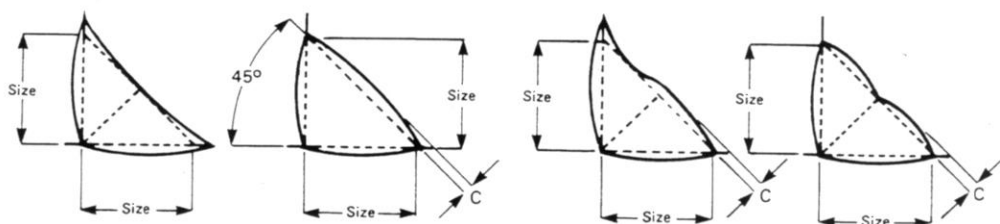
10 QUALITY

- 10.1** Cracks or blow holes that appear on the surface of any pass shall be removed before depositing the next covering pass.
- 10.2** Welds shall be free from overlap.
- 10.3** Undercutting shall be minimized by selecting the most suitable process and procedure and applying the correct technique.
- 10.4** Arc strikes outside the weld area are to be avoided.
- 10.5** Fillet and butt weld profiles shall meet the requirements in Clause 5.9 and Figure 5.3 of CSA W59 which is reproduced as part of this specification and shown in Figure 10.1.
- 10.6** If nondestructive examination is not specified in the contract documents or drawings it shall be done in accordance with Clause 11.5.4 and 12.5.4 of CSA W59.
- 10.7** Neither the depth nor the maximum width in the cross-section of weld metal deposited in each weld pass shall exceed the width of the face of the weld pass as shown in Figure 10.1.



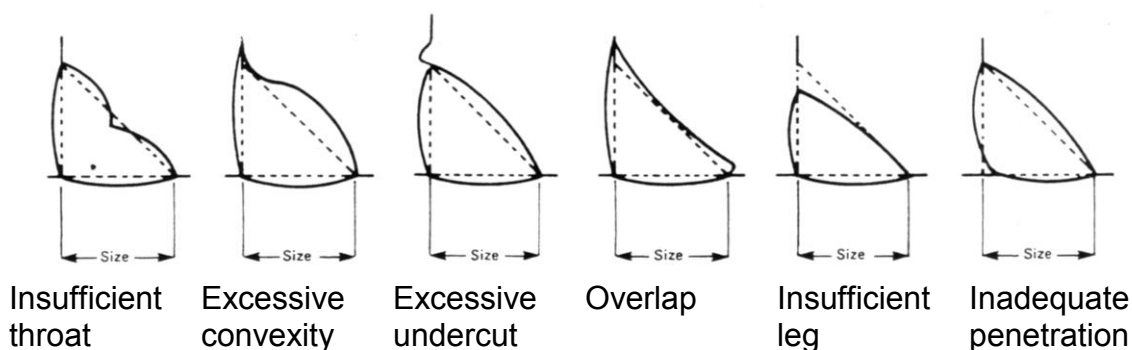
Depth and width shall not exceed the width of face

Figure 10.1
Width to Depth Ratio

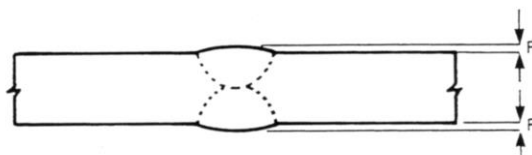


a) Desirable Fillet Weld Profiles b) Acceptable Fillet Weld Profiles

Note: Convexity, C, shall not exceed $0.1S + 1.5 \text{ mm } (.06")$

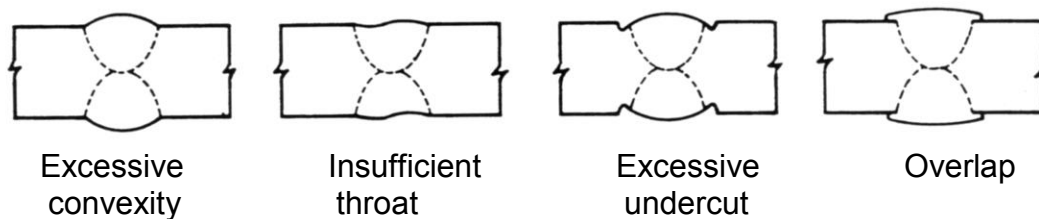


c) Unacceptable Fillet Weld Profiles



Note: Reinforcement, R, shall not exceed 3 mm (1/8")

d) Acceptable Groove Weld Profiles in Butt Joints



e) Unacceptable Groove Weld Profiles in Butt Joints

Figure 10.2
Acceptable and Unacceptable Weld Profiles

11 ESSENTIAL VARIABLES

11.1 A change in any of the following essential variables shall require the use of different welding procedure specifications (WPS) and associated welding procedure data sheets (WPDS):

- a) A change to filler metal classification not covered in CSA Standard W48 (see Clause 11.8 CSA W47.1).
- b) A change to electrical characteristics not shown in Clause 9, Table 9.1.
- c) A decrease in voltage or amperage below the minimum as defined in Table 9.1
- d) A decrease in Arc Travel Speed below the minimum as defined in Table 9.1.
- e) The omission of steel backing material or the substitution of other than steel backing material.
- f) A change from backgouging or backing plate to non-backgouging.
- g) A change in the mode of metal transfer except for the root pass when it is removed to sound weld metal in preparation for welding the second side.
- h) A change from upward to downward or from downward to upward in the progression specified for any pass of a vertical weld. Except that the root pass may run either up or down when the root pass is removed to sound weld metal in preparation for welding the second side.
- i) A change of fillet welds larger than the single-pass size and/or smaller than the multiple-pass size shown on prequalified joint details and/or smaller than single pass size shown in Table 4.4 of CSA W59.
- j) A change in welding process (es).
- k) A decrease in minimum preheat temperature as defined in Table 7.1.
- l) A change to base metal or steel group not listed in Table 3.1.
- m) A change in shielding gas or omission of gas shielding not listed in Table 9.1.
- n) A change in electrode wire diameter not listed in Table 9.1.

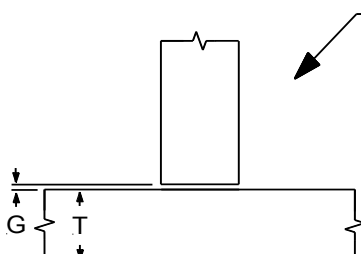
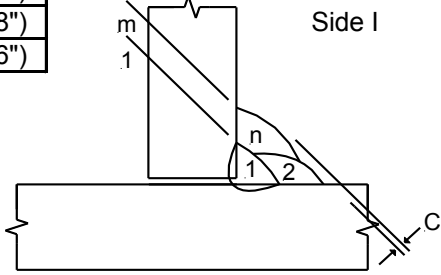
12 ANNEX (WPDS)

WELDING PROCEDURE DATA SHEET PREQUALIFIED JOINT



EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB				ID No.: FILLET Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: W59 10.1.3.3																																
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)				FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)																																
THICKNESS: 3mm (1/8") to UNLIMITED				PROCESS: FCAW																																
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER, LAP Penetration: N/A Eff. throat thickness: ETT = .7S Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na				<div style="text-align: center;">  <p>FILLET</p> </div> <table border="1" style="margin: 10px auto; width: 80%; border-collapse: collapse;"> <thead> <tr> <th colspan="3">Maximum fillet size</th> </tr> <tr> <th>Position</th> <th>El. Diam.</th> <th>Smax mm</th> </tr> </thead> <tbody> <tr> <td>F</td> <td>1.2+</td> <td>10 (3/8")</td> </tr> <tr> <td rowspan="2">H, Vup</td> <td>1.2</td> <td>8 (5/16")</td> </tr> <tr> <td>1.4+</td> <td>10 (3/8")</td> </tr> <tr> <td>OH</td> <td>1.2+</td> <td>8 (5/16")</td> </tr> </tbody> </table> <div style="text-align: center;">  <p>Side I</p> </div> <table border="1" style="margin: 10px auto; width: 80%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Minimum fillet size</th> </tr> <tr> <th>T mm</th> <th>Smin mm</th> </tr> </thead> <tbody> <tr> <td>3 - 6</td> <td>3 (1/8")</td> </tr> <tr> <td>6 - 12</td> <td>5 (3/16")</td> </tr> <tr> <td>12 - 20</td> <td>6 (1/4")</td> </tr> <tr> <td>20+</td> <td>8 (5/16")</td> </tr> </tbody> </table> <p style="text-align: center;">G, C max as per W59 See Table 4.4 & 10.2 in W59 for minimum and maximum fillet sizes</p>				Maximum fillet size			Position	El. Diam.	Smax mm	F	1.2+	10 (3/8")	H, Vup	1.2	8 (5/16")	1.4+	10 (3/8")	OH	1.2+	8 (5/16")	Minimum fillet size		T mm	Smin mm	3 - 6	3 (1/8")	6 - 12	5 (3/16")	12 - 20	6 (1/4")	20+	8 (5/16")
Maximum fillet size																																				
Position	El. Diam.	Smax mm																																		
F	1.2+	10 (3/8")																																		
H, Vup	1.2	8 (5/16")																																		
	1.4+	10 (3/8")																																		
OH	1.2+	8 (5/16")																																		
Minimum fillet size																																				
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E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS																																				
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)																										
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15																										
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15																										
FCAW	UNLIMITED	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15																										
Notes: <ul style="list-style-type: none"> → WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1) → Maximum layer thickness: 6 mm → Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm → Quality and weld profiles shall meet section 10 of this WPS → Weld in sequence to control distortion → General suitability and mechanical properties must be evaluated by design authority. 																																				



EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: F1-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-L1a-FC
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to 10mm (3/8")	PROCESS: FCAW
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: AS BASE METAL Backing tickness: 1/4" MINIMUM	<div style="text-align: center;"> <p>Side I</p> <p>Layers</p> </div> <p style="text-align: center;">Effective Throat = T $G \geq T$ $T \leq 10 \text{ mm (3/8 in)}$</p>

E491T-9 WITH 100% CO₂ OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum		Side	Layer	Pass	Elec. Size	Current pol.	Amperes	WFS (in/min)	Volts	ATS (in/min)
	mm	in				mm		(+/-10%)	(+/-10%)	(+/-0%)	(+/-15%)
FCAW	10	3/8	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	10	3/8	I	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	10	3/8	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



RJV Gasfield Services
4901 Bruce Rd.
Vegreville AB

Date: 29-Jul-14

Ref. WPS: FCAW-STEEL

Ref. Standards: CSA W59, W47.1

Prequalified Joint No: B-L1b-FC

Coating: N/A

FILLER METAL / CLASSIFICATION:

CSA W48-06:	E491T-9 (M) -H8 or -H4
AWS A5.20:	E71T-9 (M) -H8 or -H4
OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	

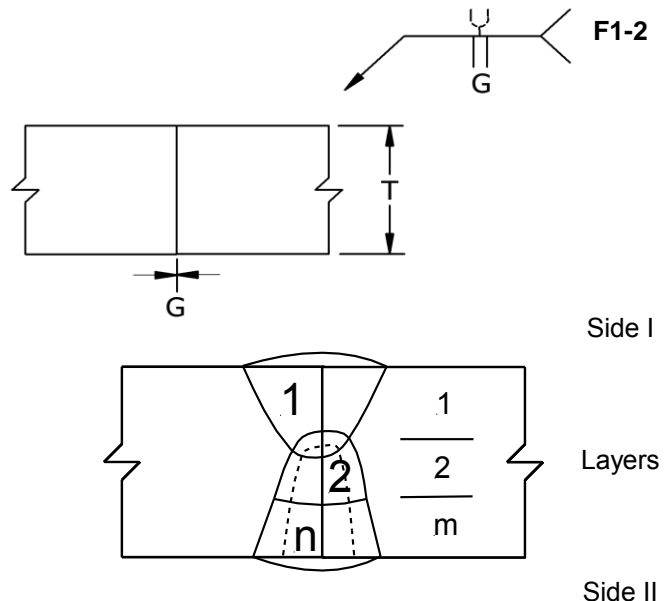
FCAW

THICKNESS: 3mm (1/8") to 12mm (1/2")

F, H, V, OH

Process mode:	SEMI-AUTOMATIC
Shielding Gas:	100%CO ₂ /TABLE 9.1
Gas flow rate:	40 CFH / TABLE 9.1
Electrode stickout:	5/8" / TABLE 9.1

Joint type:	BUTT
Penetration:	COMPLETE
Eff. throat thickness:	ETT = T
Preheating temp. min.:	TABLE 7.1 in this WPS
Interpass temps.:	260°C (500°F) MAX
Backgouging method:	GOUGING/GRINDING
Backgouging depth:	TO SOUND METAL
Backing material:	na
Backing tickness:	na



Effective Throat = T
G ≤ 3mm (1/8")
T ≤ 12 mm (1/2 in)
*Gouging to sound metal (GTSM) is mandatory.

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	12 1/2	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	12 1/2	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	12 1/2	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F1-3 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-L1c-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 3mm (1/8") - 6mm (1/4")		PROCESS: FCAW	
Position: F Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na		<p>Effective Throat = T G = 0 T ≤ 6 mm (1/4 in) **Welding parameters must be validated by macro-etch test</p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in		Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	6	1/4	I - II	1-2	1-2	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	6	1/4	I - II	1-2	1-2	1.4 (.052)		275	350	25-29	15
FCAW	6	1/4	I - II	1-2	1-2	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F1-4 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: T-L1b-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 3mm (1/8") to 12mm (1/2")		PROCESS: FCAW	
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: right; font-weight: bold;">F1-4</div> <div style="text-align: center; margin-top: 20px;"> Effective Throat = T G = 2 mm (1/16 in) T ≤ 12 mm (1/2 in) </div> <div style="text-align: right; margin-top: 20px;"> *Gouging to sound metal (GTSM) is mandatory. </div>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum		Side	Layer	Pass	Elec. Size	Current pol.	Amperes	WFS (in/min)	Volts	ATS (in/min)
	mm	in				mm		(+/-10%)	(+/-10%)	(+/-0%)	(+/-15%)
FCAW	12	1/2	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	12	1/2	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	12	1/2	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

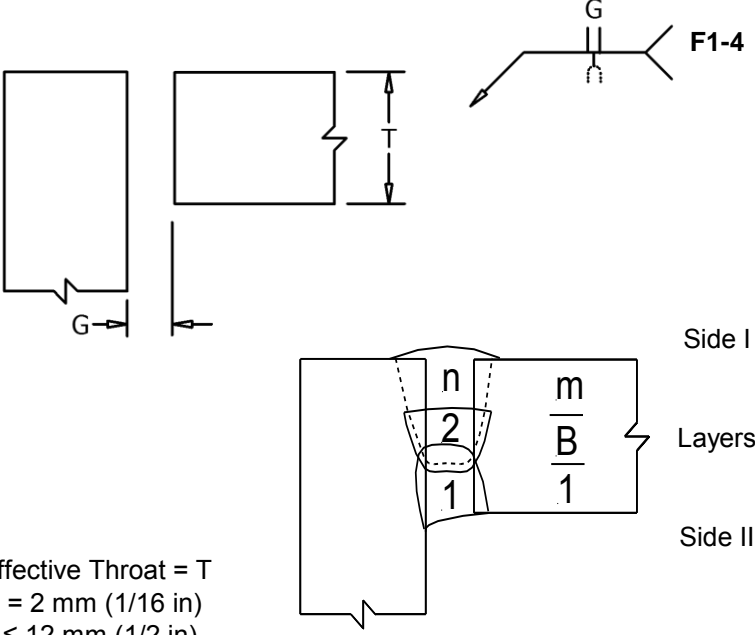
Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F1-4 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-L1c-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 3mm (1/8") to 12mm (1/2")		PROCESS: FCAW	
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		 <p>Effective Throat = T G = 2 mm (1/16 in) T ≤ 12 mm (1/2 in)</p> <p>See preferred corner preparation in Figure 4.1 of CSA W59 *Gouging to sound metal (GTSM) is mandatory.</p>	

E491T-9 WITH 100% CO₂ OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum		Side	Layer	Pass	Elec. Size	Current pol.	Amperes	WFS (in/min)	Volts	ATS (in/min)
	mm	in				mm		(+/-10%)	(+/-10%)	(+/-0%)	(+/-15%)
FCAW	12	1/2	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	12	1/2	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	12	1/2	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F1-5 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-L1a-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 3mm (1/8") to 10mm (3/8")		PROCESS: FCAW	
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: AS BASE METAL Backing tickness: 1/4" MINIMUM		<div style="text-align: right; margin-bottom: 10px;">F1-5</div> <p style="text-align: right;">Side I Layers</p> <p>Effective Throat = T Gmin = T $T \leq 10 \text{ mm (3/8 in)}$</p> <p>See preferred corner preparation in Figure 4.1 of CSA W59</p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum		Side	Layer	Pass	Elec. Size	Current pol.	Amperes	WFS (in/min)	Volts	ATS (in/min)
	mm	in				mm		(+/-10%)	(+/-10%)	(+/-0%)	(+/-15%)
FCAW	10	3/8	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	10	3/8	I	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	10	3/8	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F2-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U2a-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 6mm (1/4") to UNLIMITED		PROCESS: FCAW	
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: center;"> </div> <p> $\theta = 45^\circ$ $G \leq 3\text{mm (1/8")}$ Effective Throat = T $R_f \geq 3\text{ mm (1/8 in)}$ </p> <p>S = D.O.P. = Depth of Preparation</p> <p>*Gouging to sound metal (GTSM) is mandatory.</p>	

E491T-9 WITH 100% CO₂ OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F2-2 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U2b-FC													
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)													
THICKNESS: 3mm (1/8") to UNLIMITED		PROCESS: FCAW													
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: AS BASE METAL Backing tickness: 1/4" MINIMUM		<div style="text-align: center;"> </div> <div style="text-align: right; margin-top: 10px;"> Side I Layers </div> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; width: 80%;"> <thead> <tr> <th>Shielding</th> <th>Polarity</th> <th>G</th> </tr> </thead> <tbody> <tr> <td>No Gas Shielding</td> <td>DCEP</td> <td>≥ 10 mm (3/8 in)</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEN</td> <td>≥ 5 mm (3/16 in)</td> </tr> <tr> <td>Gas Shielding</td> <td>DCEP</td> <td>≥ 5 mm (3/16 in)</td> </tr> </tbody> </table>		Shielding	Polarity	G	No Gas Shielding	DCEP	≥ 10 mm (3/8 in)	No Gas Shielding	DCEN	≥ 5 mm (3/16 in)	Gas Shielding	DCEP	≥ 5 mm (3/16 in)
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E491T-9 WITH 100% CO₂ OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
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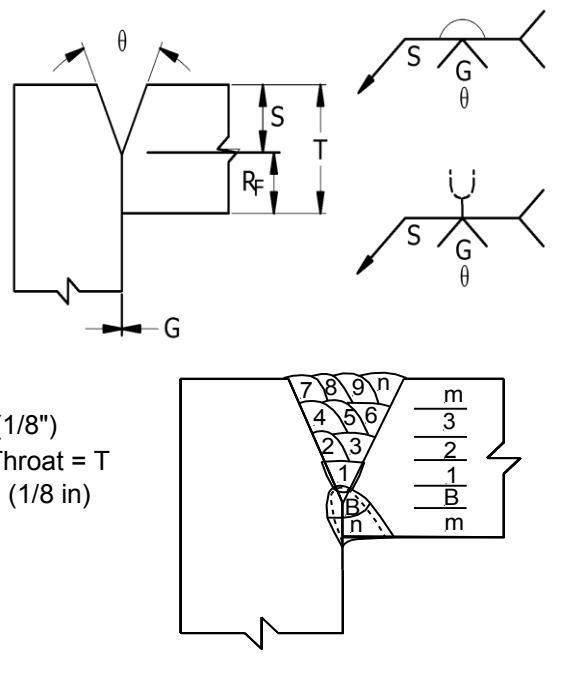
Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
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- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F2-3 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-U2a-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 6mm (1/4") to UNLIMITED		PROCESS: FCAW	
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: right; font-weight: bold;">F2-3</div>  <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div> $\theta = 45^\circ$ $G \leq 3\text{mm (1/8")}$ Effective Throat = T $R_f \geq 3\text{ mm (1/8 in)}$ </div> <div style="text-align: right;"> Side I Layers Side II </div> </div> <p>S = DOP = Depth of Preparation</p> <p>*Gouging to sound metal (GTSM) is mandatory.</p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
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Notes:

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- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F2-4 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-U2b-FC													
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)													
THICKNESS: 3mm (1/8") to UNLIMITED		PROCESS: FCAW													
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: AS BASE METAL Backing tickness: 1/4" MINIMUM		<div style="text-align: center;"> </div> <div style="text-align: right; margin-top: 10px;"> Side I Layers </div> <div style="text-align: center; margin-top: 20px;"> $\theta = 30^\circ$ </div> <table border="1" style="width: 100%; margin-top: 20px; border-collapse: collapse;"> <thead> <tr> <th>Shielding</th> <th>Polarity</th> <th>G</th> </tr> </thead> <tbody> <tr> <td>No Gas Shielding</td> <td>DCEP</td> <td>$\geq 10 \text{ mm (3/8 in)}$</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEN</td> <td>$\geq 5 \text{ mm (3/16 in)}$</td> </tr> <tr> <td>Gas Shielding</td> <td>DCEP</td> <td>$\geq 5 \text{ mm (3/16 in)}$</td> </tr> </tbody> </table>		Shielding	Polarity	G	No Gas Shielding	DCEP	$\geq 10 \text{ mm (3/8 in)}$	No Gas Shielding	DCEN	$\geq 5 \text{ mm (3/16 in)}$	Gas Shielding	DCEP	$\geq 5 \text{ mm (3/16 in)}$
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E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
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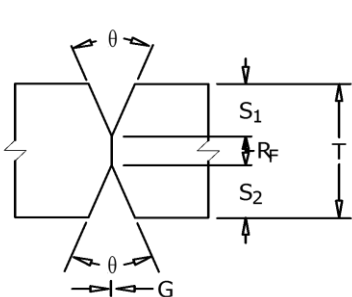
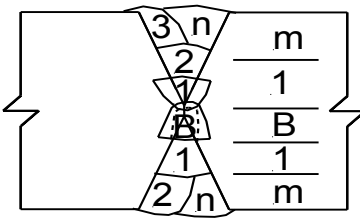
Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F3-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U3-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 6mm (1/4") to UNLIMITED		PROCESS: FCAW	
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: center;">  </div> <div style="text-align: center;">  </div> <p style="text-align: right;">Side I</p> <p style="text-align: right;">Layers</p> <p style="text-align: right;">Side II</p> <p>$\theta = 45^\circ$ Effective Throat = T $R_f \geq 3 \text{ mm (1/8 in)}$ $G \leq 3 \text{ mm (1/8")}$</p> <p>S = DOP = Depth of Preparation</p> <p>*Gouging to sound metal (GTSM) is mandatory.</p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
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Notes:

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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F4-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U4a-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
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Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
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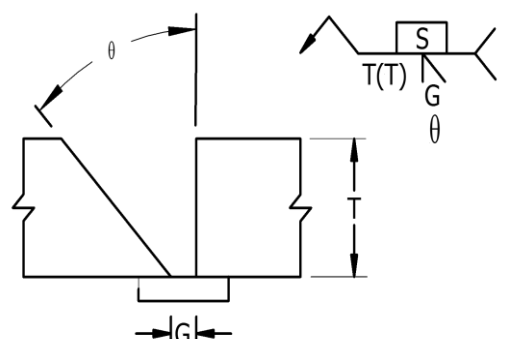
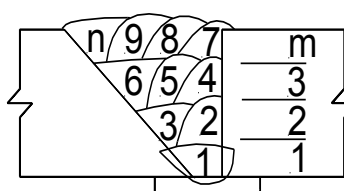
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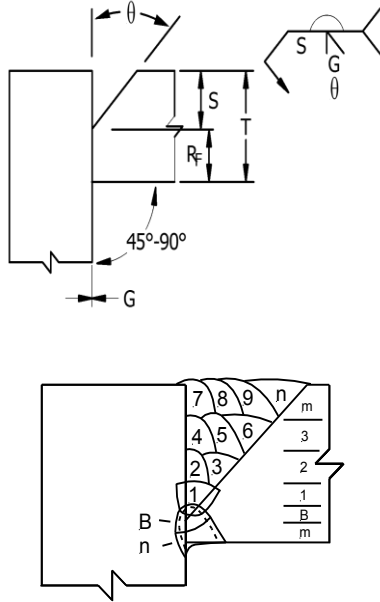


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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB				ID No.: F4-2 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U4b-FC																																									
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)				FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)																																									
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F4-3 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U4a-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 6mm (1/4") to UNLIMITED		PROCESS: FCAW	
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: right; font-weight: bold;">F4-3</div>  <div style="text-align: right;">Side I</div> <div style="text-align: right;">Layers</div> <div style="text-align: right;">Side II</div> <p> $\theta = 45^\circ$ $G \leq 3\text{mm (1/8")}$ Effective Throat = T $R_f \geq 3\text{ mm (1/8 in)}$ </p> <p> S = DOP = Depth of Preparation See preferred corner preparation in Figure 4.1 of CSA W59 *Gouging to sound metal (GTSM) is mandatory. </p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB					ID No.: F4-4 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U4b-FC																																							
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)					FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)																																							
THICKNESS: 3mm (1/8") to UNLIMITED					PROCESS: FCAW																																							
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: AS BASE METAL Backing tickness: 1/4" MINIMUM					<div style="text-align: center;"> </div> <p style="text-align: center;">See preferred corner preparation in Figure 4.1 of CSA W59</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>Shielding</th> <th>Polarity</th> <th>Position</th> <th>θ</th> <th>G</th> </tr> </thead> <tbody> <tr> <td>Gas Shielded</td> <td>DCEP</td> <td>F, H, V, OH</td> <td>45°</td> <td>≥ 5mm</td> </tr> <tr> <td>Gas Shielded</td> <td>DCEP</td> <td>F, H, V, OH</td> <td>30°</td> <td>≥ 6mm</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEN</td> <td>F, H, V, OH</td> <td>45°</td> <td>≥ 5mm</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEP</td> <td>F, H, V, OH</td> <td>30°</td> <td>≥ 6mm</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEP</td> <td>F Only</td> <td>30°</td> <td>≥ 10mm</td> </tr> <tr> <td>No Gas Shielding</td> <td>DCEP</td> <td>F, H, V, OH</td> <td>45°</td> <td>≥ 6mm</td> </tr> </tbody> </table>					Shielding	Polarity	Position	θ	G	Gas Shielded	DCEP	F, H, V, OH	45°	≥ 5mm	Gas Shielded	DCEP	F, H, V, OH	30°	≥ 6mm	No Gas Shielding	DCEN	F, H, V, OH	45°	≥ 5mm	No Gas Shielding	DCEP	F, H, V, OH	30°	≥ 6mm	No Gas Shielding	DCEP	F Only	30°	≥ 10mm	No Gas Shielding	DCEP	F, H, V, OH	45°	≥ 6mm
Shielding	Polarity	Position	θ	G																																								
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E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS																																												
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)																																		
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15																																		
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15																																		
FCAW	UNLIMITED	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15																																		
Notes: → WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1) → Maximum layer thickness: 6 mm → Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm → Quality and weld profiles shall meet section 10 of this WPS → Weld in sequence to control distortion → General suitability and mechanical properties must be evaluated by design authority.																																												



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F5-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U5-FC	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 6mm (1/4") to UNLIMITED		PROCESS: FCAW	
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na		<div style="text-align: center;"> </div> <p> $\theta = 45^\circ$ $G \leq 3\text{mm (1/8")}$ Effective Throat = T $R_f \geq 3\text{ mm (1/8 in)}$ </p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> Side I Layers Side II </div> </div> <p>S1 + S2 = DOP = Depth of Preparation</p> <p>*Gouging to sound metal (GTSM) is mandatory.</p>	

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS										
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: F10-1 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U10
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 6mm (1/4") to UNLIMITED	PROCESS: FCAW
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 50 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na	<p style="text-align: center;"> $G \geq 6\text{mm (1/4")}$ $E \leq T_1, T_2$ </p>

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I - II	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: F5-2 Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U5-FC
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 6mm (1/4") to UNLIMITED	PROCESS: FCAW
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER Penetration: COMPLETE Eff. throat thickness: ETT = T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: GOUGING/GRINDING Backgouging depth: TO SOUND METAL Backing material: na Backing tickness: na	<div style="text-align: right; font-weight: bold;">F5-2</div> <p> $\theta = 45^\circ$ $G \leq 3\text{mm (1/8")}$ Effective Throat = T $R_f \geq 3\text{ mm (1/8 in)}$ </p> <p>S = DOP = Depth of Preparation See preferred corner preparation in Figure 4.1 of CSA W59 *Gouging to sound metal (GTSM) is mandatory.</p>

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I - II	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
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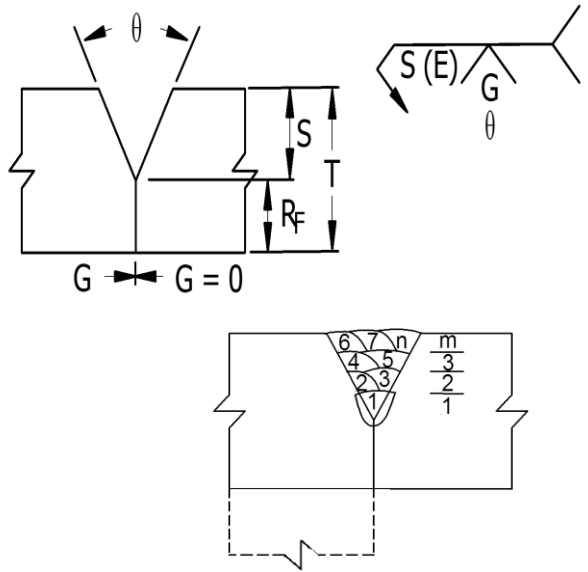
Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
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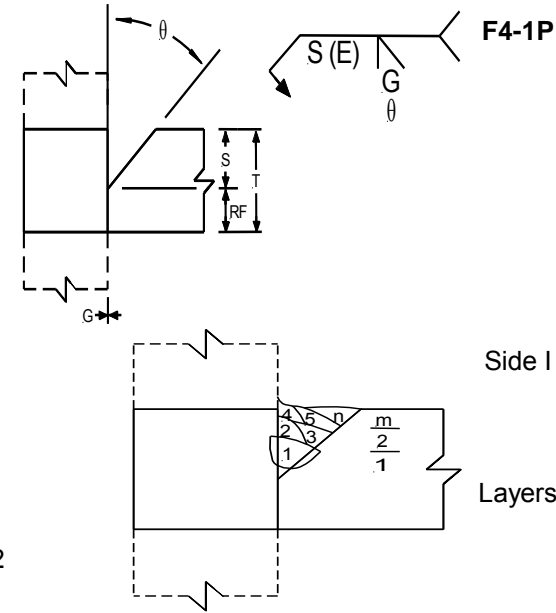
PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB					ID No.: F2-1P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: BC-P2-FC																					
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)					FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)																					
THICKNESS: 8mm (5/16") to UNLIMITED					PROCESS: FCAW																					
Position: F, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: CORNER, BUTT Penetration: PARTIAL Eff. throat thickness: SEE TABLE Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na					 <p style="text-align: right;">F2-1P</p> <p style="text-align: right;">Side I</p> <p style="text-align: right;">Layers</p> <p>G = 0</p> <p>Smin per Table 2.2</p> <p>**Welding parameters must be validated by macro-etch test</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>θ</th> <th>T</th> <th>E=Effective Throat</th> <th>Rf</th> </tr> </thead> <tbody> <tr> <td>45°≤θ<60°</td> <td>8mm ≤ T ≤ 10mm</td> <td>S-2mm(S-1/8")</td> <td>≥ 3mm</td> </tr> <tr> <td>45°≤θ<60°</td> <td>T > 10mm</td> <td>S-3mm(S-1/8")</td> <td>≥ 3mm</td> </tr> <tr> <td>≥ 60°</td> <td>T ≥ 8mm</td> <td>S</td> <td>≥ 3mm</td> </tr> </tbody> </table>						θ	T	E=Effective Throat	Rf	45°≤θ<60°	8mm ≤ T ≤ 10mm	S-2mm(S-1/8")	≥ 3mm	45°≤θ<60°	T > 10mm	S-3mm(S-1/8")	≥ 3mm	≥ 60°	T ≥ 8mm	S	≥ 3mm
θ	T	E=Effective Throat	Rf																							
45°≤θ<60°	8mm ≤ T ≤ 10mm	S-2mm(S-1/8")	≥ 3mm																							
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≥ 60°	T ≥ 8mm	S	≥ 3mm																							
E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS																										
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)																
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15																
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15																
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Notes: → WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1) → Maximum layer thickness: 6 mm → Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm → Quality and weld profiles shall meet section 10 of this WPS → Weld in sequence to control distortion → General suitability and mechanical properties must be evaluated by design authority.																										



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F4-1P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: BTC-P4-FC																
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)																
THICKNESS: 8mm (5/16") to UNLIMITED		PROCESS: FCAW																
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER, BUTT Penetration: PARTIAL Eff. throat thickness: SEE TABLE Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na		 <p style="text-align: right; margin-right: 50px;">F4-1P</p> <p style="text-align: right; margin-right: 50px;">Side I</p> <p style="text-align: right; margin-right: 50px;">Layers</p> <p>G = 0 $\theta = 45^\circ$ Smin per Table 2.2</p> <p>**Welding parameters must be validated by macro-etch test</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th>T</th> <th>E = Effective Throat</th> <th>RF</th> </tr> </thead> <tbody> <tr> <td>8mm \leq T \leq 10mm</td> <td>S-2mm (S-1/16po)</td> <td>= 3mm</td> </tr> <tr> <td>T > 10mm</td> <td>S-3mm (S-1/8po)</td> <td>\geq 3mm</td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>		T	E = Effective Throat	RF	8mm \leq T \leq 10mm	S-2mm (S-1/16po)	= 3mm	T > 10mm	S-3mm (S-1/8po)	\geq 3mm						
T	E = Effective Throat	RF																
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E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T MAXIMUM mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.

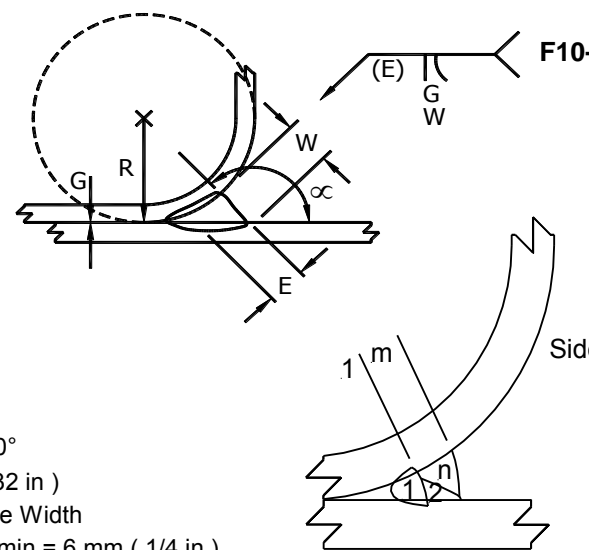


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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F8-1P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: BTC-P8-FC								
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)								
THICKNESS: 8mm (5/16") to UNLIMITED		PROCESS: FCAW								
Position: F, H, V, OH Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, CORNER, BUTT Penetration: PARTIAL Eff. throat thickness: ETT = E = S Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na		<div style="text-align: right;">F8-1P</div> <p> $\theta = 30^\circ$ $R_f \geq 3\text{mm (1/8 in)}$ $G = 0$ $R = 10\text{ mm (3/8 in)}$ $ETT = E = S$ </p> <p>Smin as per table 2.2</p> <p>**Welding parameters must be validated by macro-etch test</p>								
E491T-9 WITH 100% CO ₂ OR TABLE 9.1 FOR OTHER PARAMETERS										
	T MAXIMUM mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15
Notes: → WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1) → Maximum layer thickness: 6 mm → Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm → Quality and weld profiles shall meet section 10 of this WPS → Weld in sequence to control distortion → General suitability and mechanical properties must be evaluated by design authority.										

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB		ID No.: F10-1P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-P10a													
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)													
THICKNESS: 3mm (1/8") to UNLIMITED		PROCESS: FCAW													
Position: F, H Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: TEE, , CORNER Penetration: PARTIAL Eff. throat thickness: SEE TABLE Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na		<div style="text-align: right; font-weight: bold;">F10-1P</div>  <p>FCAW-G Only $\alpha = 90^\circ$ To 140° $G \leq 4 \text{ mm } (5/32 \text{ in})$ $W = \text{Weld Face Width}$ $W = 1.5 E, W \text{ min} = 6 \text{ mm } (1/4 \text{ in})$ $R > 10 \text{ mm } (3/8 \text{ in})$ $R < 10 \text{ mm } (3/8 \text{ in})$ use Fillet Pre-qualified Joint Detail.</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th>W min</th> <th>ETT=E</th> <th>T</th> </tr> </thead> <tbody> <tr> <td>6 mm</td> <td>4 mm</td> <td>$\leq 6 \text{ mm}$</td> </tr> <tr> <td>12 mm</td> <td>8 mm</td> <td>12 mm</td> </tr> <tr> <td>T</td> <td>W / 1.5</td> <td>UNLIMITED</td> </tr> </tbody> </table>		W min	ETT=E	T	6 mm	4 mm	$\leq 6 \text{ mm}$	12 mm	8 mm	12 mm	T	W / 1.5	UNLIMITED
W min	ETT=E	T													
6 mm	4 mm	$\leq 6 \text{ mm}$													
12 mm	8 mm	12 mm													
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E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
FCAW	UNLIMITED	I	1-m	1-n	1.4 (.052)		275	350	25-29	15
FCAW	UNLIMITED	I	1-m	1-n	1.6 (1/16)		320	295	26-30	15

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness: 6 mm
- Use split layer technique for groove widths: F, H et O = 16mm; Vup = 25mm
- Quality and weld profiles shall meet section 10 of this WPS
- Weld in sequence to control distortion
- General suitability and mechanical properties must be evaluated by design authority.



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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville <div style="text-align: right;">AB</div>	<div style="text-align: right;"> ID No.: F10-2P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-P10b </div>
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to UNLIMITED	PROCESS: FCAW
Position: F, H Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO2 /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: PARTIAL Eff. throat thickness: E=0.5R to max. of T Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na	<div style="text-align: right;">F10-2P</div> <p style="text-align: right;">Côté I</p> <div style="text-align: center;"> Fill flush <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> Layers m 1 </div> </div> </div>

E491T-9 WITH 100% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS										
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
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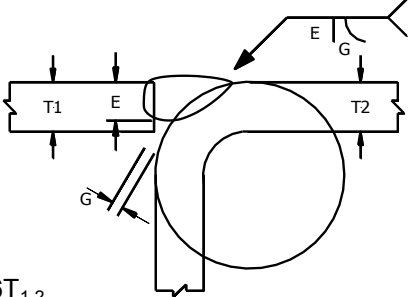
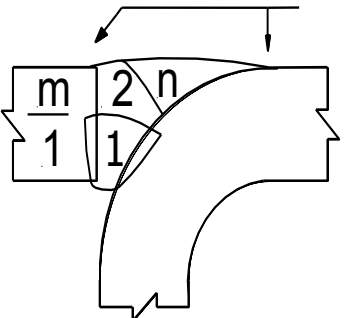
Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville <div style="text-align: right;">AB</div>		ID No.: F11-1P Date: 29-Jul-14 Ref. WPS: FCAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-P11a	
BASE METAL: Coating: N/A CSA G40-21: 300W (44W), 350W (50W) ASTM: A36, A500, A572, A618, A992 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)		FILLER METAL / CLASSIFICATION: CSA W48-06: E491T-9 (M) -H8 or -H4 AWS A5.20: E71T-9 (M) -H8 or -H4 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)	
THICKNESS: 3mm (1/8") to UNLIMITED		PROCESS: FCAW	
Position: F, H Process mode: SEMI-AUTOMATIC Shielding Gas: 100%CO ₂ /TABLE 9.1 Gas flow rate: 40 CFH / TABLE 9.1 Electrode stickout: 5/8" / TABLE 9.1 Joint type: BUTT Penetration: PARTIAL Eff. throat thickness: SEE TABLE Preheating temp. min.: TABLE 7.1 in this WPS Interpass temps.: 260°C (500°F) MAX Backgouging method: na Backgouging depth: na Backing material: na Backing tickness: na		<div style="text-align: right;">F11-1P</div>  <p style="margin-left: 40px;"> If $T_2 = T_1$, $E = 0.6T_{1,2}$ If $T_2 \geq T_1$, $E = 0.6T_1$ If $T_1 \geq T_2$, $E = 0.6T_1$ to max. of T_2 $G \leq 5 \text{ mm } (3/16")$ </p> <div style="text-align: right;">Fill Flush</div> 	

E491T-9 WITH 100% CO₂ OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
FCAW	UNLIMITED	I	1-m	1-n	1.2 (.045)	DCEP	240	430	26-30	15
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