

WELDING PROCEDURE SPECIFICATION
(WPS)

GMAW-STEEL

GAS METAL ARC WELDING (GMAW)

RJV Gasfield Services(Plant)

4901 Bruce Rd.
Vegreville, AB

Governing codes: CSA W47.1 - 2009
CSA W59 - 2013
CSA W48-06
CSA-ISO 14341
AWS 5.18/5.28

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Engineer's Seal
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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 low carbon steel listed in Table 3.1.
 - b) Use of filler metal which conforms to CSA-ISO 14341 and listed in Table 5.1.
 - c) Base metal thickness is from over 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) 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 essential variables contained in the succeeding paragraphs or listed in Clause 11.

2 WELDING PROCEDURE

2.1 General

- 2.1.1 Welding shall be done using automatic or semi-automatic GMAW (Gas Metal Arc Welding) process in single- and multi-pass welds shall be welded using a stringer pass technique.
- 2.1.2 The minimum diameter of electrode wire shall be 0.9 mm (0.035 ") for fillet welds and restrictions in base metal thickness in table 2.1 shall apply.
- 2.1.3 Use split layer technique when exceeding the maximum single pass fillet size or any single pass equivalent area for each of the electrode sizes as defined in table 2.1.
- 2.1.4 The mode of metal transfer across the arc shall be spray except for the root pass when it is removed to sound metal in preparation for welding the second side.

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 in CSA W59 and its depth shall be adequate to ensure complete penetration into the previously deposited weld metal.
- 2.2.3 Groove welded joint to be used without procedure qualification are detailed in the prequalified joint details in annex and detailed in Figures 10.7 of CSA W59 and 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 welded joints to be used without procedure qualification are detailed on the prequalified joint details in annex and in Figure 10.8 of CSA W59 and 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.

Table 2.1
Electrode Size, Weld Size & Base Metal Thickness Restrictions

Wire size Diameter	Maximum Single Pass Fillet Size	Maximum Any Single Pass Equivalent Area*	Maximum material thickness Butt	Maximum material thickness Fillet	Position
mm (in)	mm (in)	mm ²	mm (in)	mm (in)	
0.9 (0.035)	6 (1/4)	18	12 (1/2)	20 (3/4)	Flat & Horizontal
1.2 (0.045)	8 (5/16)	32	25 (1)	UNLIMITED	Flat & Horizontal
1.4 (0.052)	10 (3/8)	50	UNLIMITED	UNLIMITED	Flat & Horizontal
1.6 (0.063)	10 (3/8)	50	UNLIMITED	UNLIMITED	Flat & Horizontal

*Use split layer technique when exceeding the maximum single pass size

Note: 1) Adapted from clause 10.5.3 in W59-03.

2) Minimum diameter of electrode wire shall be 0.9 mm (0.035 ") for fillet welds.

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 (inch)	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	CAN/CSA-ISO 14341 Electrode Classifications ^{(1) (2)} (AWS 5.18/5.28)
					GMAW ⁽⁷⁾
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 [≤ 20mm (3/4 in)] A1008 SS Grades 30 and 33 type 1 A1011 SS Grades 30 and 33 A1018 SS Grades 30 and 33	B-G 49A 3 C G X ER49S-X (ER70S-X)
2	Up to 400 incl when F _y ≥ 250 (Up to 60 incl. when F _y ≥ 36)	260W 260WT 300W(HSS)	38W 38WT 44W(HSS)	A36 [t ≤ 203 mm (8")] A441 [102≤t≤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	B-G 49A 3 C G X ER49S-X (ER70S-X)
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 ≤ 102mm 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 and 2 A1011 SS Grades 50 and 55 A1011 M SS Grade 340 and 380 A1011 HSLAS Grade 50 Class 1 A1011 HSLAS Grade 55 Classes 1-2 A1018 HSLAS Grade 50 Class 1 A1018 HSLAS Grade 55 Class 1 and 2 A1018 HSLAS Grade 60 Class 2 A1018 HSLAS-F Grade 60 Class 2	B-G 49A 3 C G X ER49S-X (ER70S-X)

Table 3.1 continued next page

Table 3.1 (continued)
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	CAN/CSA-ISO 14341 Electrode Classifications ^{(1) (2)} (AWS 5.18/5.28)
					GMAW ⁽⁶⁾⁽⁷⁾
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	ER55S-XX (ER80S-X)
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	ER62S-XX (ER90S-X)
6	Over 620 to 700 inclusive Over 90 to 100 inclusive			A514 [64 mm(2-1/2") < t < 152 mm(6")] A1011 Grade 80	ER69S-XX (ER100S-X)
7	Over 700 ⁽⁵⁾ Over 100 ⁽⁵⁾	700Q 700QT	100Q 100QT	A 514 [t < 64 mm (2 ½")] A517M	ER76S-XX (ER110S-X)

*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:

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

Notes:

- (1) For exceptions, see CSA W59 tables 12.2
- (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.
- (3) 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.
- (4) Only types with properties suitable for welding
- (5) Complete joint penetration groove welds made with the designated matching electrodes classifications may not develop the specified minimum tensile strength of the base metal.
- (6) Only when $X_u > 480$ Mpa (70 Ksi).
- (7) "X" represents number 2, 3, 4, 6, or 7 refer to Table 5.1. Restrictions exist for wire electrode / shielding gas combinations: See clause 5.3 and Table 9.1 in this specification.

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-ISO 14341, and shall be selected from Table 3.1 and listed in Table 5.1.

TABLE 5.1
Equivalent Electrode Designation

CAN/CSA-ISO 14341	CSA W48-01	CSA W48.4-95	AWS A5.18/A5.18M and AWS A5.28
B-G 49A SZ	ER49S-G*	ER480S-G†	ER70S-G†
B-G 49 A 3 C1 S2	ER49S-2	ER480S-2†	ER70S-2†
B-G 49 A 2 C1 S3	ER49S-3	ER480S-3†	ER70S-3†
B-G 49 A 3 C1 S4	ER49S-4	ER480S-4†	ER70S-4†
B-G 49 A 3 C1 S6	ER49S-6	ER480S-6†	ER70S-6†
B-G 49 A 3 C1 S7	ER49S-7	ER480S-7†	ER70S-7†
B-G 55 A 5 M22 SN2	—	—	ER80S-Ni1
B-G 55 P 6 M22 SN5	—	—	ER80S-Ni2
B-G 55 P 7 M22 SN71	—	—	ER80S-Ni3
B-G 55 A 3 C1 SN23 MT	—	—	ER80S-D2

Reference: CSA W48-06

*Composition and shielding gases used shall be the same.

†Not to be considered for equivalency. See CSA W48-06, Clauses A.1.2 and A.1.3.

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 have a mixture of 83% or more of argon, with or without the addition of Helium, with the remaining being carbon dioxide or oxygen. 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 silica 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 on the data sheets (normally 30 to 40 cfh) or shall be as indicated in Table 9.1. Where slight drafts occur or where weld access is difficult this should be increased by 10 cfh.
- 5.3.5 Adequate shielding must be provided in the arc area to reduce drafts below 6km/h.

6 WELDING TECHNIQUES

- 6.1 Welding shall preferably be done in the flat position. Horizontal position is 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 welder shall position the welding electrode (gun) with respect to the weld joint depending upon the joint configuration and position. Two electrode angles used for reference are travel angle and work angle:
 - a) 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.
 - b) Work angle is the angle between the work piece and the electrode in the plane perpendicular to travel. That is; a transverse plane across the joint.

- 6.3** 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:
- Work angles from 40° to 90° and 5° to 15° push angles may be used.
 - Stay on the leading edge of the puddle to avoid inadequate fusion. Refer to minimum Arc Travel Speed (ATS) and parameters ranges in Table 9.1.
 - Welding operators will 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.
- 6.4** 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.

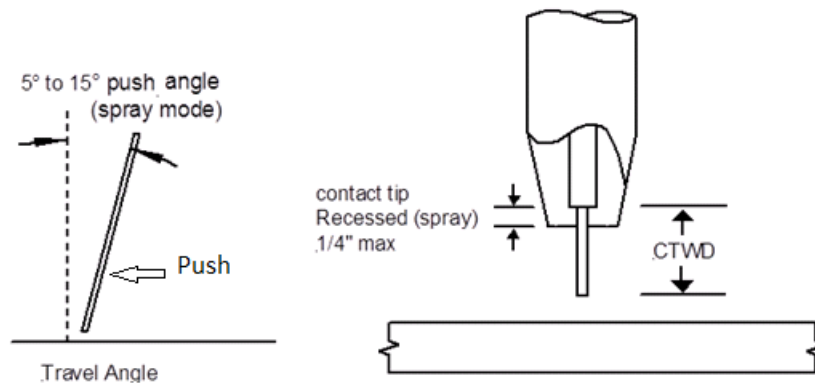


Figure 6.1
Spray Arc Travel Angle and Contact Tip to Work Distance

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 of Table 7.1 may be required:
- For highly restrained welds.
 - 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.
 - For high strength weld metal.
 - 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)		GMAW			
		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 Clasee 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 A808 [t < 65 mm] A847 ,A913 Grade 50 ,A992 A1008 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** Silica remaining after a layer shall be removed before applying the next covering pass. Prior to painting, all 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 shall be made with the same care and choice of electrodes as permanent welds. Preheat requirements shall be the same as for final welds, except for tack welds which will be completely fused out by automatic submerged arc welds.
- 8.5** 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.
- 8.6** 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 normally be a Constant Voltage (CV) type.
- 9.2** The 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
Parameter Limitations GMAW Spray Transfer Mode

Wire size Diameter	Wire feed speed (WFS)	Current DCEP	Minimum voltage / shielding gas (volts)			Minimum Arc travel Speed, ATS
			Inch (mm)	in / Min	Amps	
	± 10%	± 0%	-0% /+ 14%	-0% /+ 14%	-0% /+ 14%	-0% /+ 30%
0.035 (0.9 mm)	400	195-210	25.0	26.5	-	9
	475	210-235	26.0	27.0	30.0	11
	575	240-280	26.5	27.5	30.5	13
	800	280-295	26.5	27.5	31.5	17
0.045 (1.1 mm) (1.2 mm)	250	215-240	26.0	-	-	5
	275	230-255	26.0	26.5	-	6
	425	330-365	27.0	27.5	30.0	9
0.052 (1.3 mm) (1.4 mm)	225	275-300	26.0	-	-	4
	240	295-325	26.0	26.5	-	5
	300	325-360	26.5	27.5	28.5	6
0.063 (1.6 mm)	185	265-270	26.0	-	-	6
	210	280-310	26.0	26.5	27.5	8
	250	360-440	26.0	27.0	28.0	10

Shielding Gas Groups

Group 1 *96 % Argon / 3 % CO₂ / 1 % O₂
*95 % Argon / 3 % CO₂ / 2 % O₂

Group 2 90 % Argon / 10 % CO₂
92 % Argon / 8 % CO₂
90 % Argon / 8 % CO₂ / 2 % O₂
*95 % Argon / 5 % CO₂
*93 % Argon / 2 % CO₂ / 5 % O₂
*91 % Argon / 5 % CO₂ / 4 % O₂
86 % Argon / 12 % CO₂ / 2 % O₂

Group 3 85 % Argon / 15 % CO₂
83 % Argon / 17 % CO₂

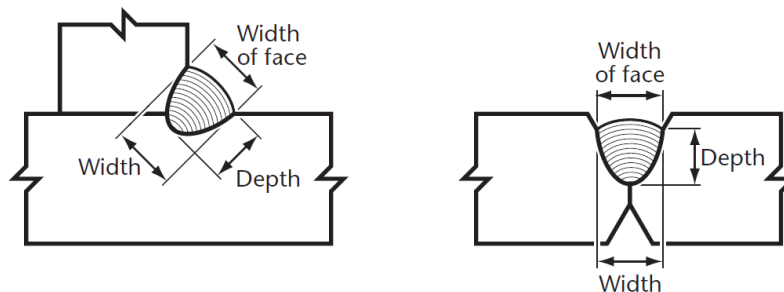
*Shielding gas/wire combination shall be certified by the CWB and only used when following wire manufacturer's recommendations permissible under CSA W48 latest edition.

NOTES:

- (1) Voltage shown is minimum voltage, measured from gun block to work.
- (2) Maximum Contact Tip to Work Distance (CTWD): 3/4" for 0.035 (0.09 mm), 0.045 (1.2 mm), 0.052 (1.4 mm) wire diameter, and 7/8 " for 1/16 " (1.6 mm) wire diameter.
- (3) Shielding gas flow rate: 40 cubic feet per hour (40cfh). Flow rate limit variations: 30 to 55cfh ±0%.
- (4) The mode of metal transfer across the arc shall be spray except for the root pass when it is removed to sound metal in preparation for welding the second side.

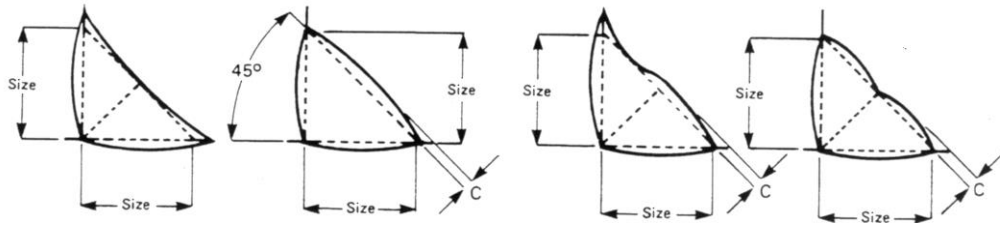
10 QUALITY

- 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 Arc strikes outside the weld area are to be avoided.
- 10.4 Undercutting shall be minimized by selecting the most suitable process and procedure, and applying the correct technique.
- 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 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.



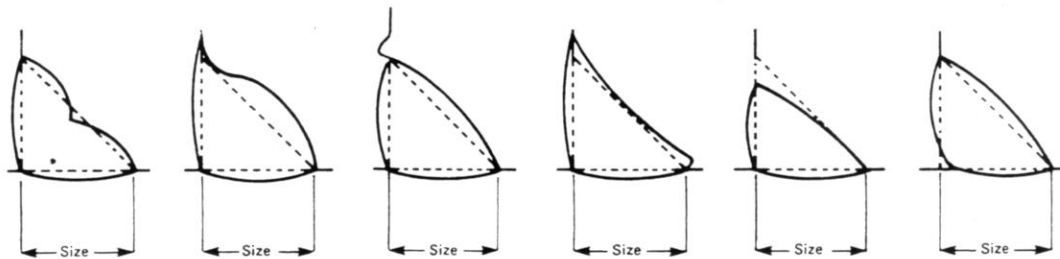
Depth and width shall not exceed the width of face

Figure 10.1
Width to Depth Ratio



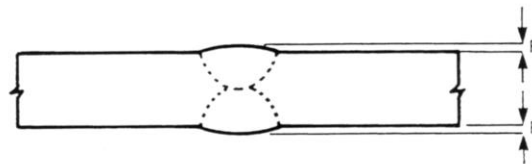
a) Desirable Fillet Weld Profiles b) Acceptable Fillet Weld Profiles

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



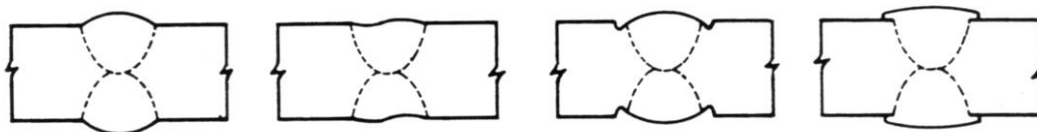
Insufficient throat Excessive convexity Excessive undercut Overlap leg Insufficient penetration Inadequate penetration

c) Unacceptable Fillet Weld Profiles



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

d) Acceptable Groove Weld Profiles in Butt Joints



Excessive convexity Insufficient throat Excessive undercut Overlap

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-ISO 14341 (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 **back gouging** 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 a steel group not listed in Table 3.1.
 - m) A change in **shielding gas** 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: 22-Oct-14
	Ref. WPS: GMAW-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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	PROCESS: GMAW

Position: F, H
Process mode: SEMI-AUTO./SPRAY
Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1
Gas flow rate: 35 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

El. Diam.	Smax mm	Smax in
0.9	6	1/4"
1.2	8	5/16"
1.4+	10	3/8"

T mm	S mm
3 - 6	3
6 - 12	5
12 - 20	6
20+	8

G, C max as per W59
See Table 4.4 in W59 for minimum fillet size

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:
 → WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 → Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 → Use split layer technique for groove widths: 8 x Electrode diameter
 → Spray arc transfert only
 → Quality and weld profiles shall meet section 10 of this WPS
 → General suitability and mechanical properties must be evaluated by design authority.

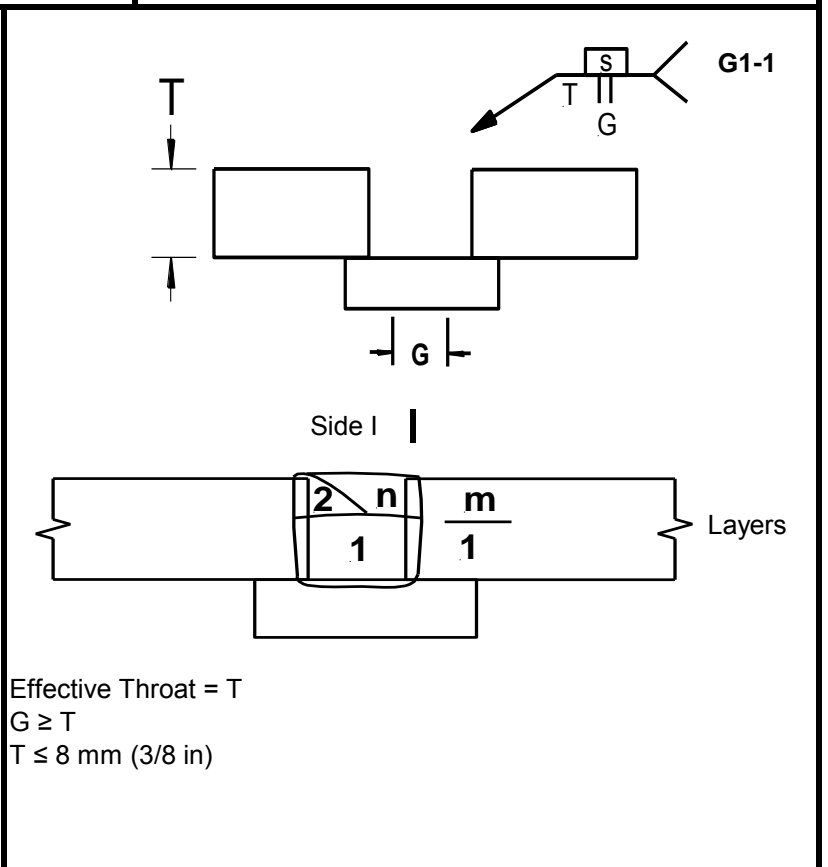


EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G1-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-L1a-G
	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) THICKNESS: 3mm (1/8") to 8mm (5/16") <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>

Position:	F
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	8 (5/16")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	8 (5/16")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	8 (5/16")	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



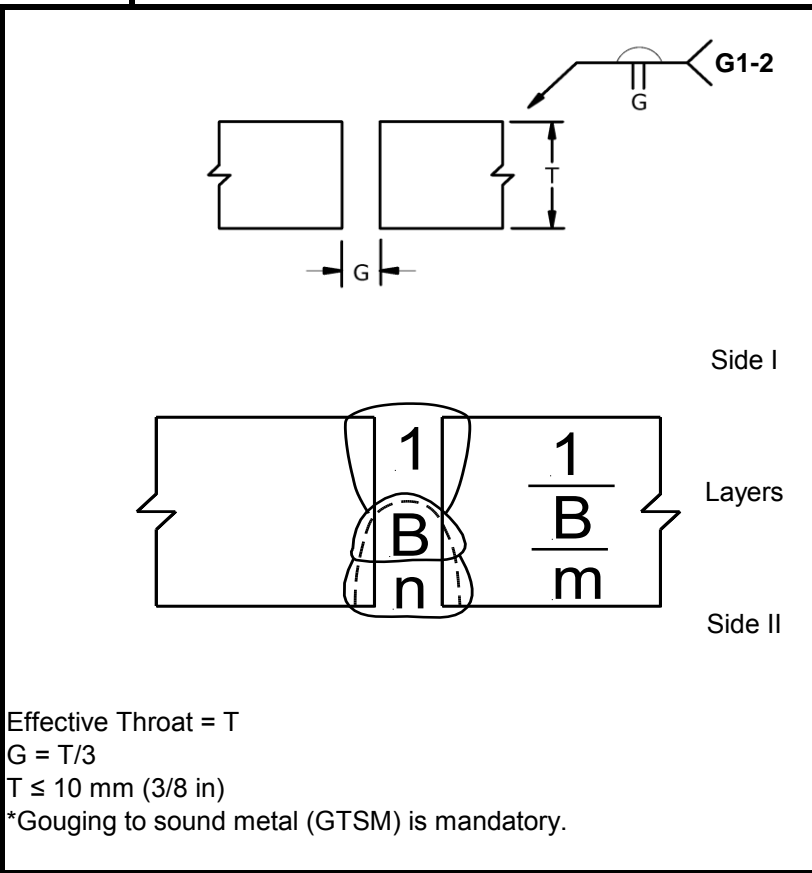
EXPERTS-CONSEILS • CONSULTING INC.

PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G1-2
	Date: 22-Oct-14
	Ref. WPS: GMAW-STEEL
	Ref. Standards: CSA W59, W47.1
Prequalified Joint No: B-L1b-G	

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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to 10mm (3/8") <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	PROCESS: GMAW

Position:	F
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 / TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	10 (3/8")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	10 (3/8")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	10 (3/8")	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



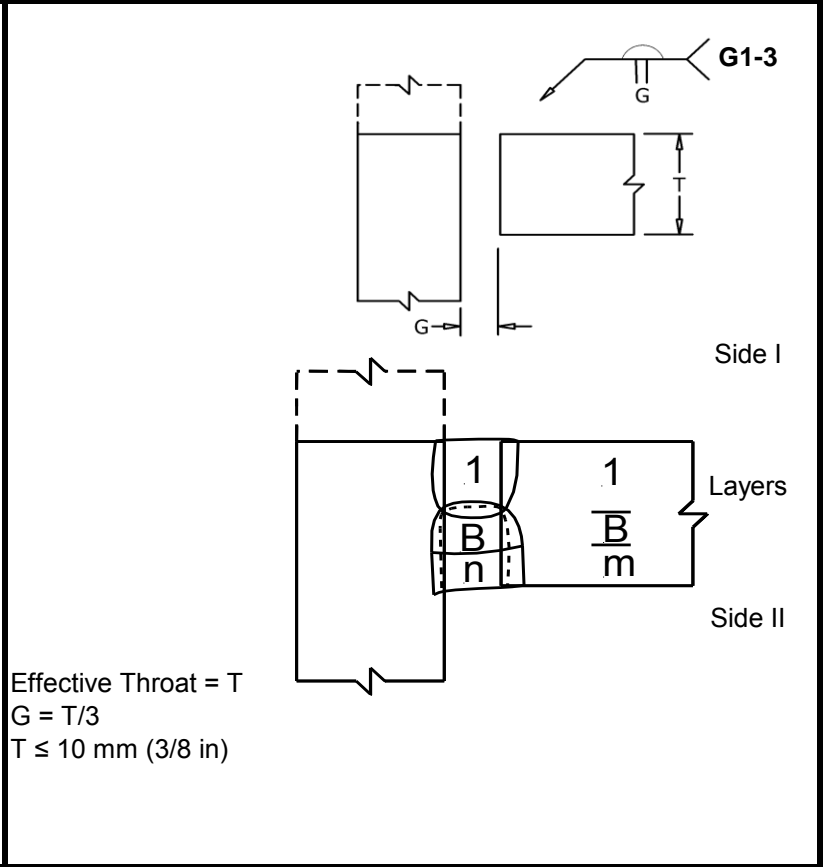
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G1-3 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-L1b-G
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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) THICKNESS: 3mm (1/8") to 10mm (3/8") <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
--	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
--



Effective Throat = T
 G = T/3
 T ≤ 10 mm (3/8 in)

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	10 (3/8")	I - II	1-2	1-2	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	10 (3/8")	I - II	1-2	1-2	1.2 (.045)		350	425	30-32	9
GMAW	10 (3/8")	I - II	1-2	1-2	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



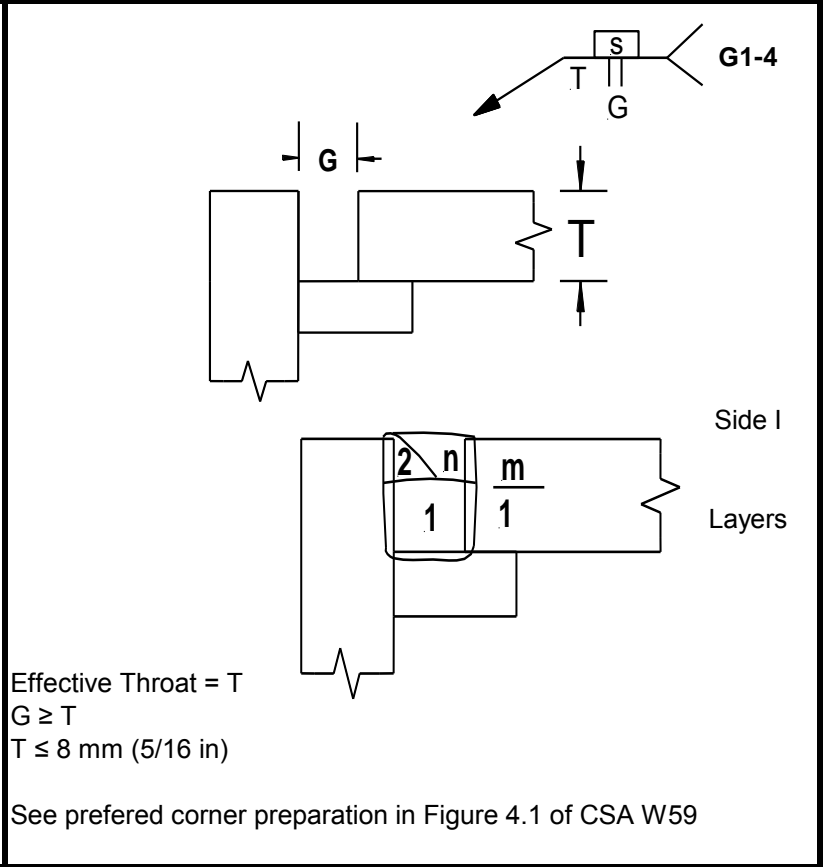
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G1-4 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-L1a-G
---	--

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) THICKNESS: 3mm (1/8") to 8mm (5/16") <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
--



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	8 (5/16")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	8 (5/16")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	8 (5/16")	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



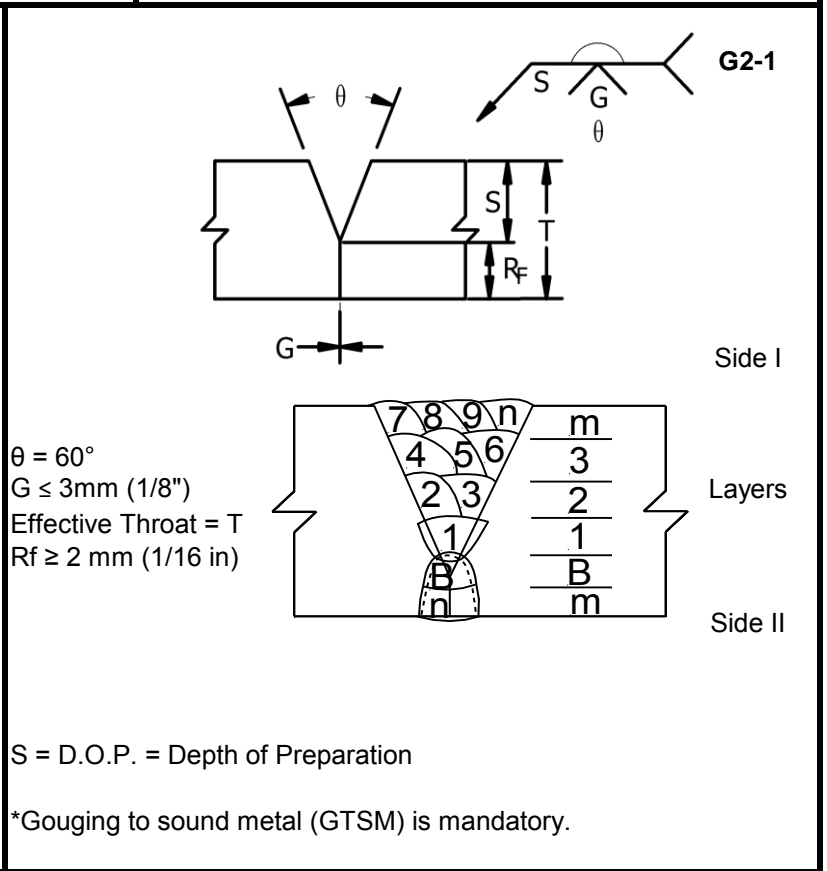
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G2-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U2a-G
---	--

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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



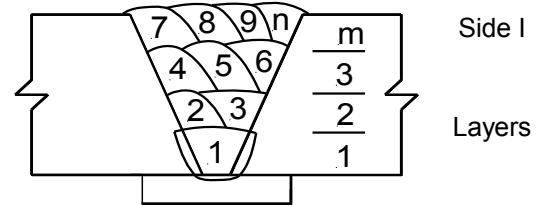
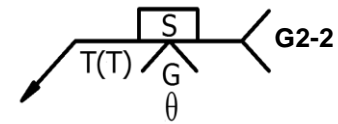
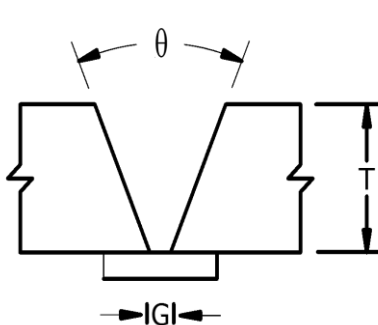
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G2-2
	Date: 22-Oct-14
	Ref. WPS: GMAW-STEEL
	Ref. Standards: CSA W59, W47.1
Prequalified Joint No: B-U2b-G	

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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	PROCESS: GMAW

Position:	F
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



θ	G
30°	10 mm (3/8 in)
45°	6 mm (1/4 in)
60°	5 mm (3/16 in)

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS										
Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- 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.: G2-3
	Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-U2a-G

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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
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Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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

$\theta = 60^\circ$
 $G \leq 3\text{mm (1/8")}$
 Effective Throat = T
 $R_f \geq 2\text{ mm (1/16 in)}$

S = DOP = Depth of Preparation

*Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



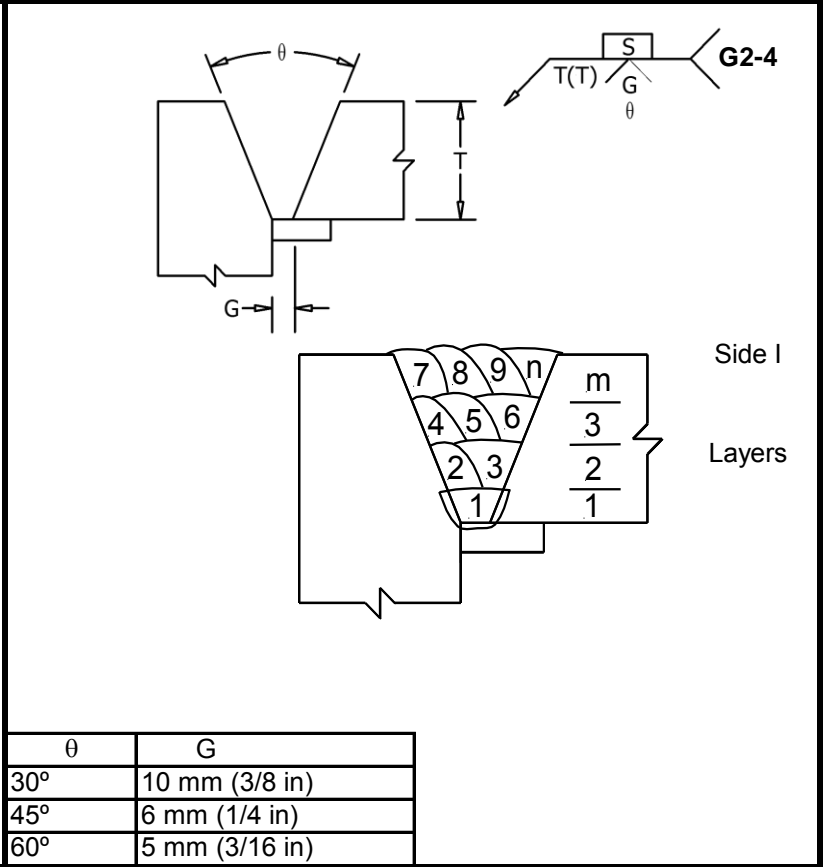
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G2-4 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-U2b-G
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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) THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position:	F
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



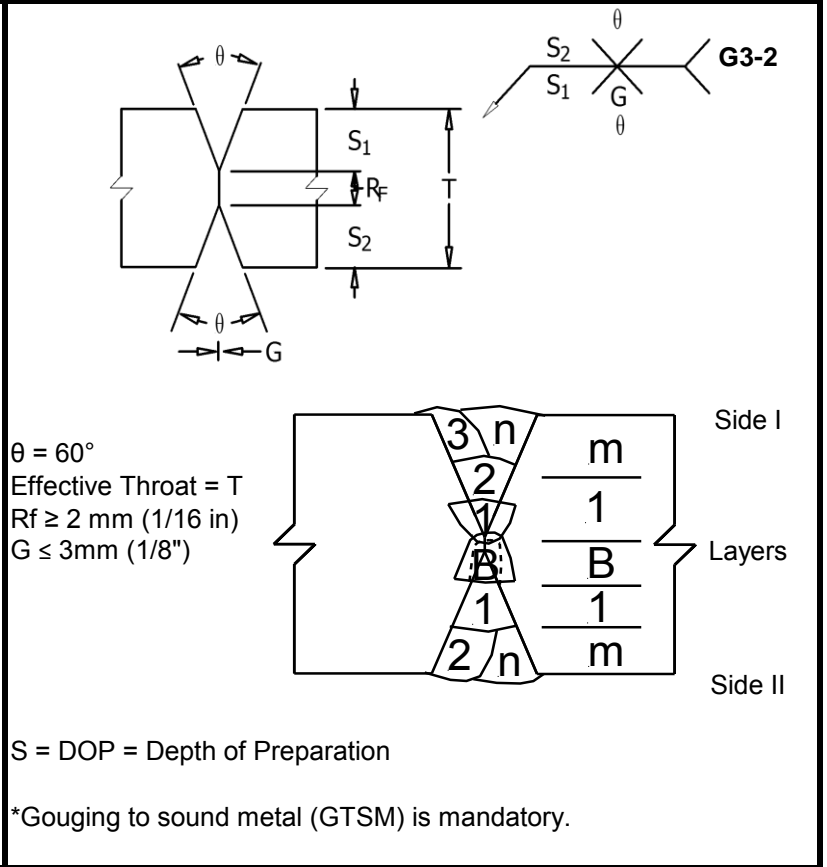
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G3-2 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U3b-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.

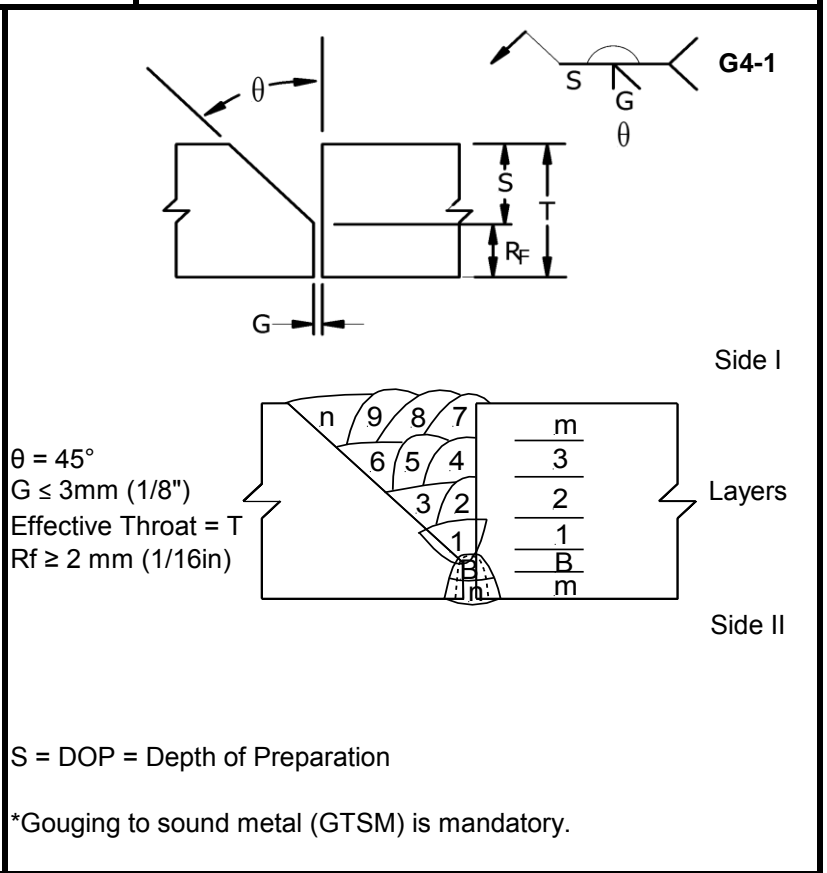


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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G4-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U4a-G
	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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G4-2
	Date: 22-Oct-14
	Ref. WPS: GMAW-STEEL
	Ref. Standards: CSA W59, W47.1
Prequalified Joint No: B-U4b-G	

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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	PROCESS: GMAW

Position:	SEE TABLE
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

Effective Throat = T

θ	G	Position
30°	10 mm (3/8 in)	F
45°	6 mm (1/4 in)	F,H
60°	5 mm (3/16 in)	F,H

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T MAXIMUM mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



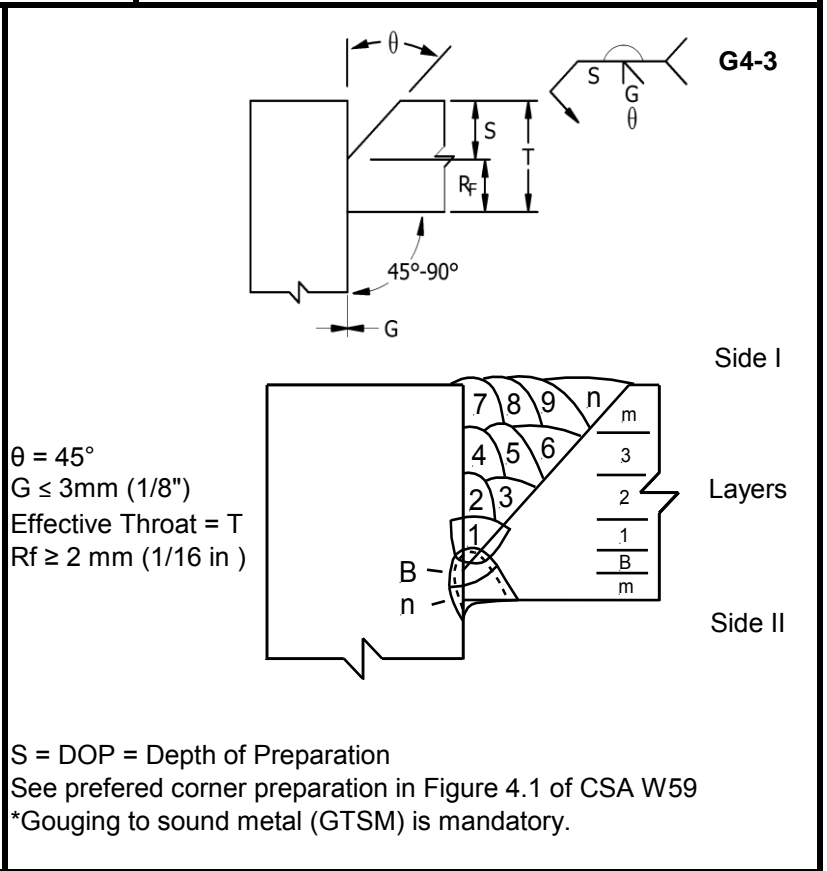
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G4-3 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U4a-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G4-4
	Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U4b-G

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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	PROCESS: GMAW

Position:	SEE TABLE
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

θ	G	Position
30°	10 mm (3/8 in)	F
45°	6 mm (1/4 in)	F,H
60°	5 mm (3/16 in)	F,H

Effective Throat = T

See preferred corner preparation in Figure 4.1 of CSA W59

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G5-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U5a-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

$\theta = 45^\circ$
 Effective Throat = T
 $R_f \geq 2 \text{ mm (1/16 in)}$
 $G \leq 3 \text{ mm (1/8 in)}$

Side I

Layers

Side II

$S_1 + S_2 = \text{DOP} = \text{Depth of Preparation}$

*Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G5-2 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U5a-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

$\theta = 45^\circ$
 Effective Throat = T
 $R_f \geq 2 \text{ mm (1/16 in)}$
 $G \leq 3 \text{ mm (1/8 in)}$

S = DOP = Depth of Preparation
 See preferred corner preparation in Figure 4.1 of CSA W59
 *Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



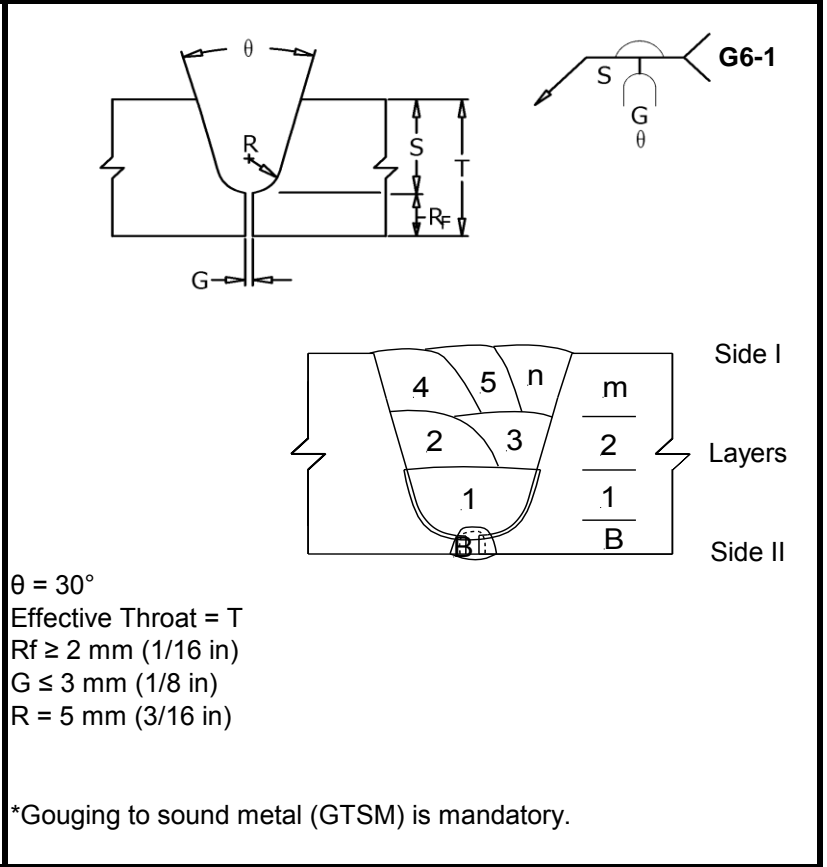
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G6-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U6-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



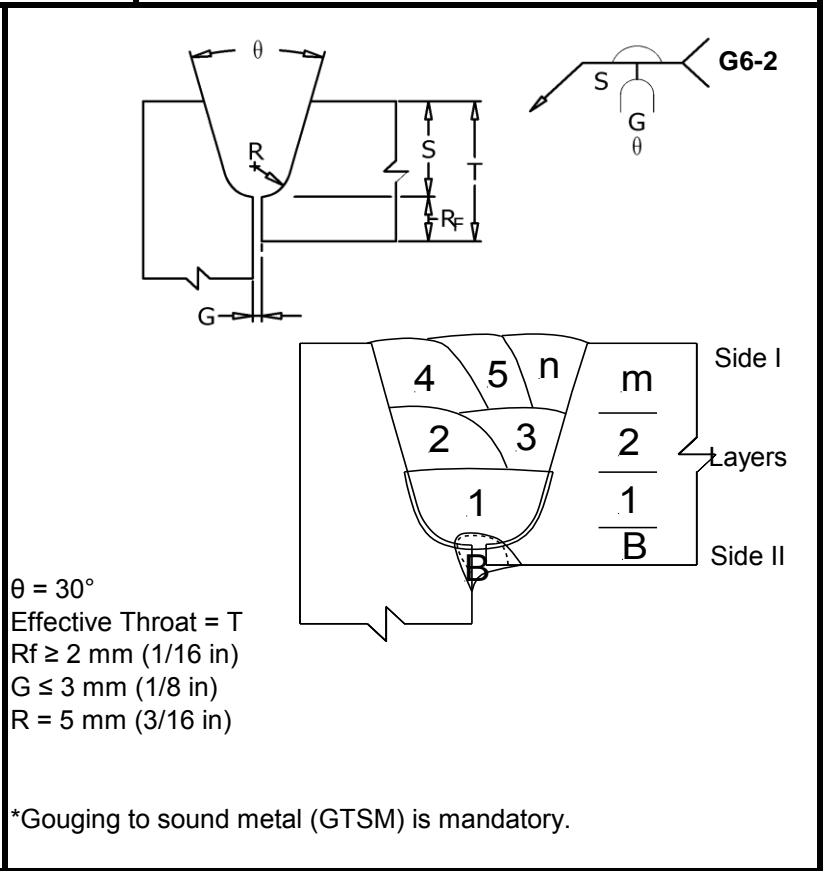
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G6-2 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: C-U6-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
--	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- General suitability and mechanical properties must be evaluated by design authority.



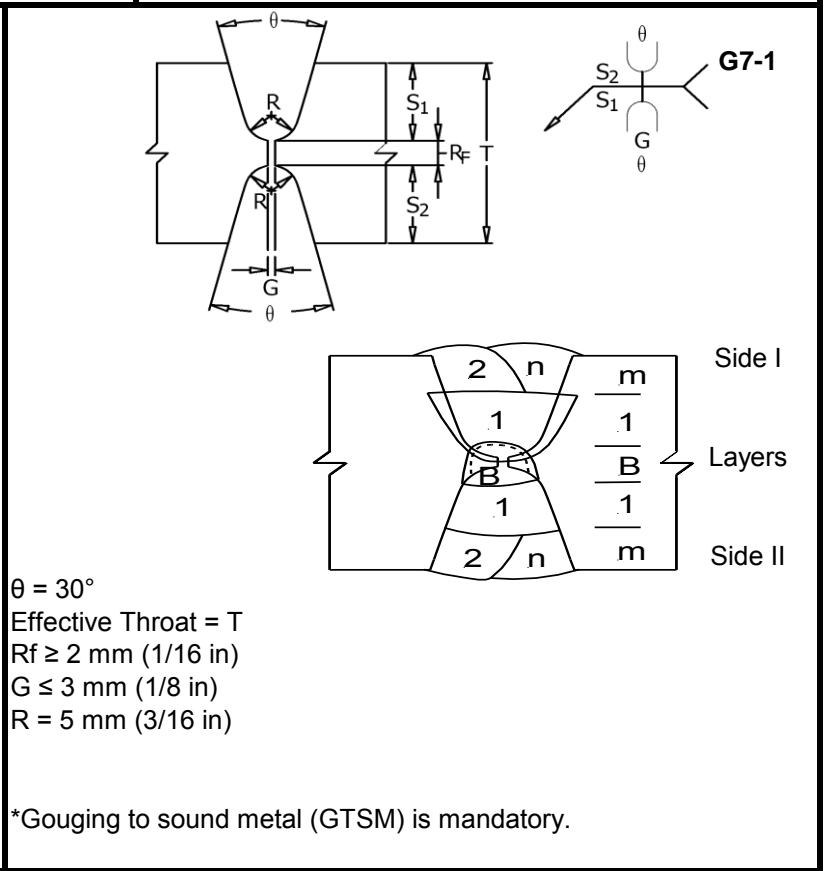
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G7-1 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U7-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
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Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- 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.: G8-1
	Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-U8-G

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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
---	--

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

$\theta = 45^\circ$
 Effective Throat = T
 $R_f \geq 3 \text{ mm (1/8 in)}$
 $G \leq 3 \text{ mm (1/8 in)}$
 $R = 10 \text{ mm (3/8 in)}$

*Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G8-2 Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U8-G
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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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR THICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
--	--

Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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

$\theta = 45^\circ$
 Effective Throat = T
 $R_f \geq 3 \text{ mm (1/8 in)}$
 $G \leq 3 \text{ mm (1/8 in)}$
 $R = 10 \text{ mm (3/8 in)}$

See preferred corner preparation in Figure 4.1 of CSA W59
 *Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G9-1
	Date: 22-Oct-14
	Ref. WPS: GMAW-STEEL
	Ref. Standards: CSA W59, W47.1
Prequalified Joint No: B-U9-G	

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-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1)
THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	PROCESS: GMAW

Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
--

$\theta = 45^\circ$
 Effective Throat = T
 $R_f \geq 3 \text{ mm (1/8 in)}$
 $G \leq 3 \text{ mm (1/8 in)}$
 $R = 10 \text{ mm (3/8 in)}$

*Gouging to sound metal (GTSM) is mandatory.

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



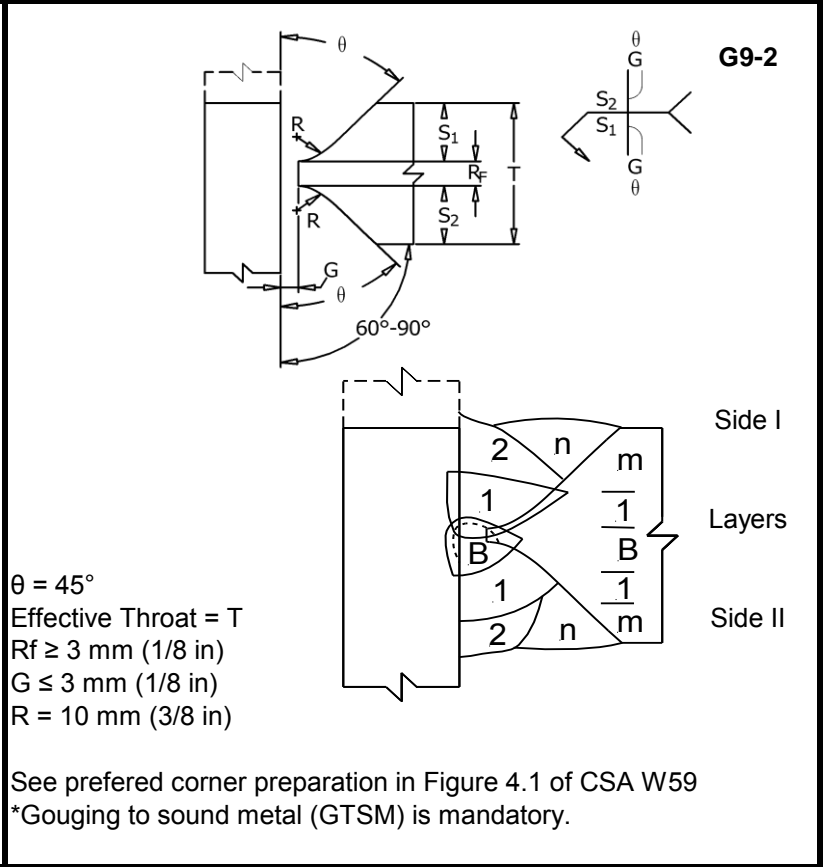
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G9-2
	Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-U9-G

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) THICKNESS: 6mm (1/4") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
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Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I - II	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I - II	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I - II	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.

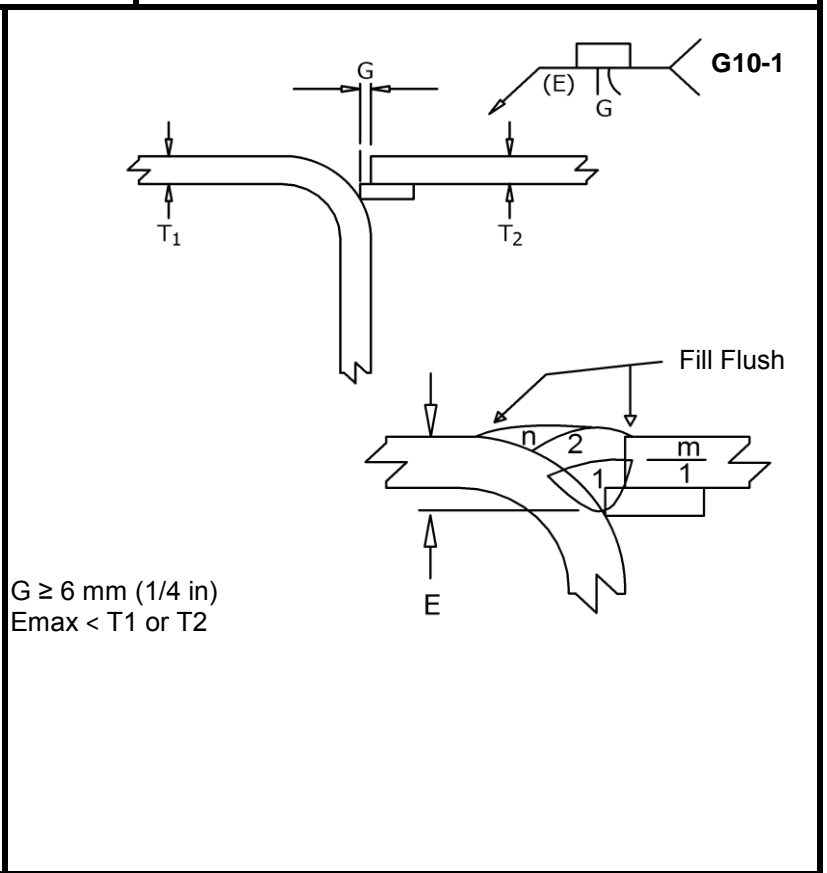


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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G10-1 Date: 22-Oct-14 Ref. WPS: GMAW-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) THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - 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.: G2-1P Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-P2b-G
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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) THICKNESS: 12mm (1/2") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
--	--

Position: F Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
--

$R_f \geq 3\text{mm (1/8")}$
 $G = 0$
 $\theta = \text{See Table}$
 S_{min} as per Table 2.2
****Welding parameters must be validated by macro-etch test**

θ	Effective Throat = E
45°	S - 3mm (S - 1/8")
60°	S

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.



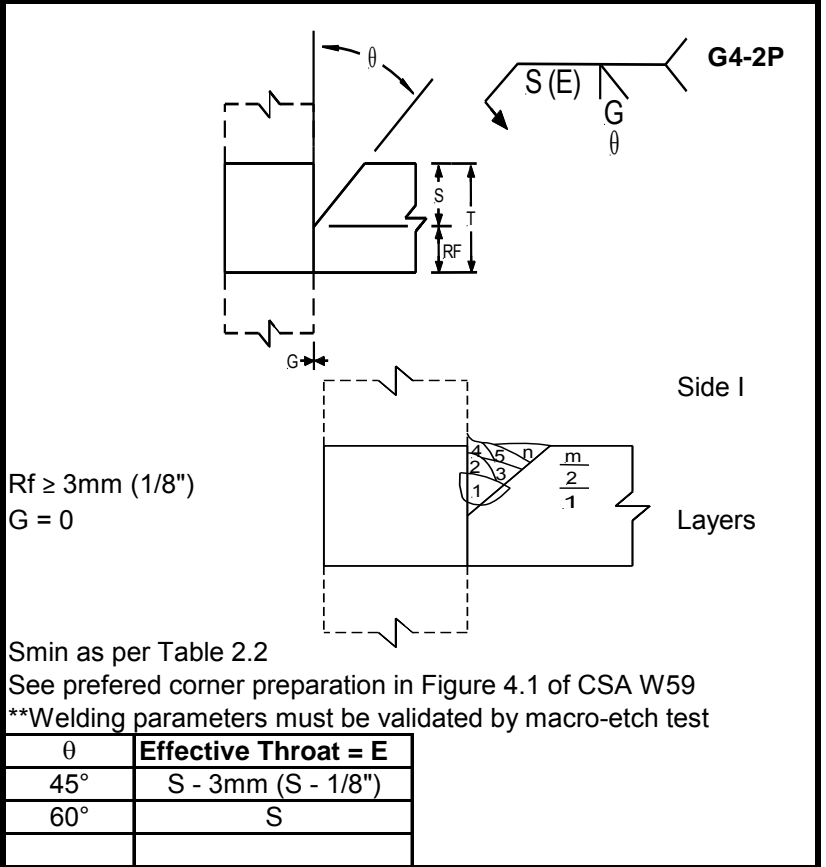
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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G4-2P Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: TC-P4b-G
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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) THICKNESS: 8mm (5/16") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
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Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
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B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T MAXIMUM mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- 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.: G10-1P Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: F-P10a
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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) THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>	FILLER METAL / CLASSIFICATION: CSA-ISO 14341: B-G 49 A 2 C1 S3, B-G 49 A 3 C1 S6 AWS A5.18: ER70S-3, ER70S-6 OR TABLE 3.1 OF WPS (CSA W59 TABLE 11.1) PROCESS: GMAW
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Position: F, H Process mode: SEMI-AUTO./SPRAY Shielding Gas: 85%Ar/15%CO2 /TABLE 9.1 Gas flow rate: 35 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
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$\alpha = 90^\circ \text{ To } 140^\circ$
 $G \leq 4 \text{ mm (} 5/32 \text{ in)}$
 $W = \text{Weld Face Width}$
 $W = 1.5 E, W \text{ min} = 6 \text{ mm (} 1/4 \text{ in)}$
 $R > 10 \text{ mm (} 3/8 \text{ in)}$ for flat and horizontal positions.
 $R < 10 \text{ mm (} 3/8 \text{ in)}$ use Fillet Pre-qualified Joint Detail.

W min	ETT=E	T
6 mm	4 mm	≤ 6 mm
12 mm	8 mm	12 mm
T	W / 1.5	UNLIMITED

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.

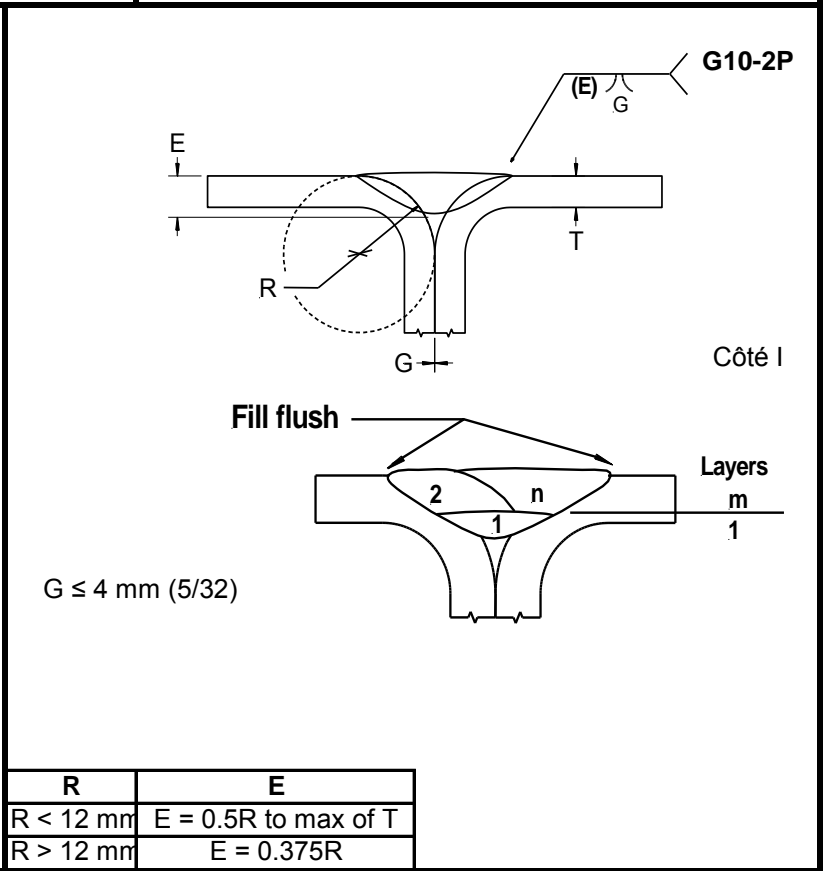


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PREQUALIFIED WELDING PROCEDURE DATA SHEET (WPDS)

RJV Gasfield Services 4901 Bruce Rd. Vegreville AB	ID No.: G10-2P Date: 22-Oct-14 Ref. WPS: GMAW-STEEL Ref. Standards: CSA W59, W47.1 Prequalified Joint No: B-P10b
	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) THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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



B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% CO2 OR TABLE 9.1 FOR OTHER PARAMETERS

Process	T Maximum mm in	Side	Layer	Pass	Elec. Size mm (in)	Current pol.	Amperes (+/-10%)	WFS (in/min) (+/-10%)	Volts (+/-0%)	ATS (in/min) (+/-15%)
GMAW	12 (1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25 (1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED	I	1-m	1-n	1.3 (.052)		350	300	28-30	6

Notes:

- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
- Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
- Use split layer technique for groove widths: 8 x Electrode diameter
- Spray arc transfert only
- Quality and weld profiles shall meet section 10 of this WPS
- 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 <p style="text-align: center;">AB</p>	ID No.: G11-1P Date: 22-Oct-14 Ref. WPS: GMAW-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) THICKNESS: 3mm (1/8") to UNLIMITED <i>*SEE TABLE 2.1 FOR TICKNESS RESTRICTION</i>

Position:	F, H
Process mode:	SEMI-AUTO./SPRAY
Shielding Gas:	85%Ar/15%CO2 /TABLE 9.1
Gas flow rate:	35 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

G11-1P

Fill Flush

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
 $G = 0 - 5 \text{ mm } (0 - 3/16")$

B-G 49 A 3 C1 S6 (E70S-6) WITH 85% AR / 15% 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									
GMAW	12	(1/2")	I	1-m	1-n	0.9 (.035)	DCEP	225	475	30-32	11
GMAW	25	(1")	I	1-m	1-n	1.2 (.045)		350	425	30-32	9
GMAW	UNLIMITED		I	1-m	1-n	1.3 (.052)		350	300	28-30	6

- Notes:**
- WPDS only valid in conjunction with entire WPS and certified by the cover page (W47.1 Cl.11.1)
 - Maximum layer thickness, see table 2.1 : 4 x Electrode diameter
 - Use split layer technique for groove widths: 8 x Electrode diameter
 - Spray arc transfert only
 - Quality and weld profiles shall meet section 10 of this WPS
 - General suitability and mechanical properties must be evaluated by design authority.