

Mosher ENGINEERING 1007 Cobequid Road, Windsor Junction, Nova Scotia B2T 1K1	SAW Welding Procedure Specification Number SAW-1		SECTION: 1 SCOPE PAGE: 2 of 20
DATE ISSUED:	July 22, 2008	REVISION NO.:	
APPROVED BY:	Sean Keay, P.Eng IWE	APPROVED BY:	



1007 Cobequid Road, Windsor Junction, Nova Scotia B2T 1K1

WELDING PROCEDURE SPECIFICATION NUMBER SAW-1 Submerged Arc Welding

1 SCOPE

This Welding Procedure Specification covers welding and related operations of steel structures that are fabricated in accordance with the terms outlined in CSA Standard W47.1 and W59, latest revisions. The attached Data Sheets form an essential part of this specification.

A change in any of the essential variables contained in the succeeding paragraphs or detailed on applicable Welding Procedure Data Sheets shall require a new Welding Procedure Specification and/or new Welding Procedure Data Sheets.

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2 WELDING PROCEDURE

The welding shall be done automatically or semi-automatically using the SAW (Submerged Arc Welding) process.

Joints shall be made following the procedural stipulations indicated in CSA Standard W59 and may consist of single or multiple passes, in accordance with the approved welding procedure data sheets to which this specification refers.

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3 BASE MATERIAL

The base metal shall conform to the specifications for the steel groups 1, 2, and 3 per Table 11.1 or Table 12.1 of CSA W59. Other groups may be welded providing the Canadian Welding Bureau accepts the Welding Procedure Data Sheets (WPDS).

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4 BASE METAL THICKNESS

Base metal thickness from over 3.2 mm ($\frac{1}{8}$ ") to an unlimited thickness (inclusive) may be welded under this specification providing the respective welding procedure data sheets have been supplied and approved for an appropriate weld size.

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5 FILLER METAL

The filler metal shall conform to specification for CSA Standard W48 and shall be compatible with the base metal, as specified in Table 11.1 and 12.1 of CSA Standard W59. The classification of electrode to be used is shown on the appropriate Welding Procedure Data Sheet.

5.1 Storage and Conditioning of Electrodes and Fluxes

Electrodes (wire) shall be stored in a clean, dry environment in original containers until ready for use. All wire contaminated by surface rust or foreign material shall be discarded.

Flux used for SAW shall be dry and free from contamination of dirt, mill scale or other foreign material. All flux shall be purchased in packages capable of being stored under normal conditions for at least six (6) months without such storage affecting its welding characteristics or weld metal properties. Flux from damaged packages that have been exposed to free moisture shall be discarded or shall be dried before use in shallow layers (2 in. / 50 mm maximum) at a minimum temperature of 500°F (260°C) for at least one (1) hour or at time and temperature conditions as recommended by the flux manufacturer. Any flux that has been fused during welding shall not be reused.

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6 POSITION

The welding shall be done in the flat position or horizontal positions provided approved Welding Procedure Data Sheets referring to those positions and this procedure specification are followed.

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7 PREHEAT

The minimum preheat before welding will comply with Table 5-3 shown in the CSA Standard W59. Welding will be done at sufficient speed to ensure that the minimum preheat is maintained or exceeded.

If welding is interrupted for some time so that the temperature of the base metal falls below the minimum preheat temperature, then arrangements will be made to preheat again prior to recommencing welding.

The weldment shall be allowed to cool to the ambient temperature, without an external quench media being supplied. In other words, cooling water or placement in frigid conditions that cause a quick temperature change shall not be used.

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8 HEAT TREATMENT AND STRESS RELIEVING

This will not be applicable to structures welded under this specification unless a specification showing all the parameters is submitted to the Canadian Welding Bureau and approval is obtained.

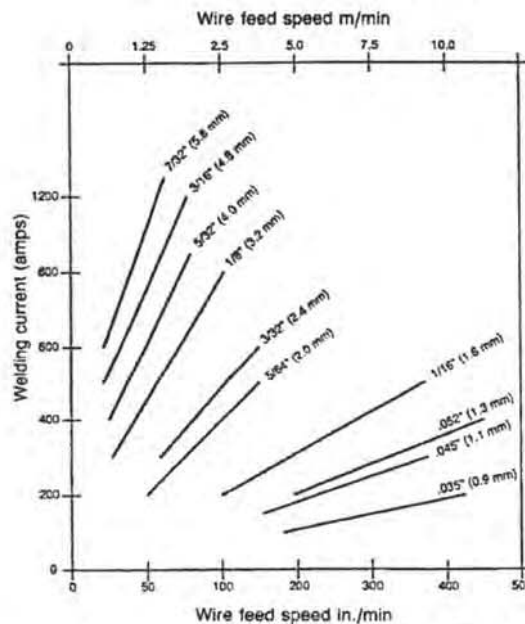
Mosher ENGINEERING 1007 Cobequid Road, Windsor Junction, Nova Scotia B2T 1K1	SAW Welding Procedure Specification Number SAW-1		SECTION: 9 ELECTRICAL CHARACTERISTICS WELDING TECHNIQUE PAGE: 10 of 20
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9 ELECTRICAL CHARACTERISTICS WELDING TECHNIQUE

The Welding Procedure Data Sheets show details of the electrical characteristics to be used. The current used shall be direct current (DC) or alternating current (AC) as indicated on the welding procedure data sheets. However, unless otherwise noted on the data sheets or recommended by the consumable supplier, current and voltage ranges and electrode stick outs shall be as shown below:

Wire Diameter, in.	Current Range DC(+), amp	Arc Voltage Range	Stick out (standard), in
1/16	150 – 400	19 – 37	5/8" - 1 1/4"
5/64	200 – 600	20 – 37	5/8" - 1 1/4"
3/32	350 – 700	22 – 37	5/8" - 1 1/4"
1/8	300 – 900	23 – 37	5/8" - 1 1/4"
5/32	400 – 1000	25 – 37	5/8" - 1 1/4"
3/16	500 - 1100	27 – 37	5/8" - 1 1/4"
7/32	600 – 1200	30 – 37	5/8" - 1 1/4"
1/4	700 - 1600	30 – 38	5/8" - 1 1/4"

CURRENT (AMPS) VS. WIRE FEED SPEED
 DC(+) Polarity, Single Arc, Normal Stickout



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9.1 Effect of Parameters

9.1.1 Amperage

Increasing the amperage results in an increased deposition rate and penetration

Amperage too high

- Unstable arc
- Undercutting
- High narrow bead
- Burn through

Amperage too Low

- Unstable Arc
- Poor Penetration



Weak Medium Strong

9.1.2 Voltage

An increased in voltage will increase the arc length, create a flatter and wider bead, increases flux consumption, improves slag removal; reduce penetration; increases resistance to porosity caused by rust or scale; increase alloy pick-up from the flux and will reduces flattening (root gap).

Voltage too high

- Produces a "hat-shaped" bead (cracking)
- Poor slag removal
- Concave fillet weld - crack-sensitive
- Increases transfer of alloying elements
- Undercuts at weld connection



Low Medium High

Voltage too low

- Produces a high, narrow bead

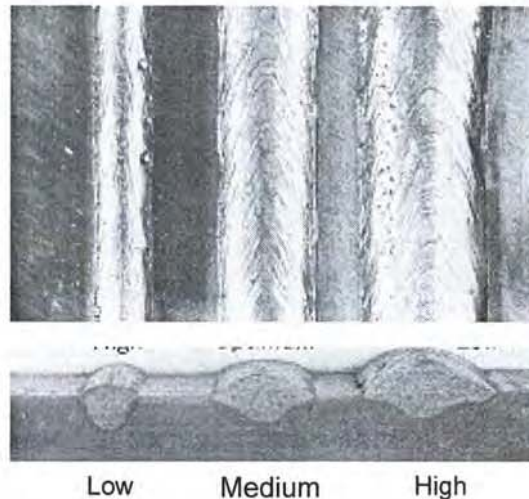
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Poor slag removal

9.1.3 Welding (Travel) Speed

Welding speed greatly affects penetration and bead shape. An increase in speed will reduce penetration, increases tendency to undercut, increase possibility of arc blow, increases porosity, can cause an irregular bead and may result in bad degassing.

If your welding speed too low it may result in bead profile subject to cracking, arc visibility, large difficult to control molten pool, rough looking bead, slag inclusions, make it difficult to remove slag and causes a risk of burn through



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10 PREPARATION OF BASE MATERIAL

The edges or surfaces of parts to be joined by welding shall be prepared by suitable means (e.g. Oxy-acetylene, plasma, etc.). Where hand cutting is involved the edge will be ground to a smooth surface. All surfaces and edges shall be free from fins, tears, cracks or any other defects that could adversely affect the quality of the weld.

All loose or thick scale, rust, moisture or other foreign material that would prevent proper welding or produce objectionable fumes shall be removed.

Typical joint preparations can be found in the appendix of this WPS.

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11 TREATMENT OF UNDERSIDE OF WELDING GROOVE{tc 112 "12.0 TREATMENT OF UNDERSIDE OF WELDING GROOVE}

Prior to depositing weld metal on the underside of a welding groove, the root shall be back gouged to sound metal, unless otherwise specified on the applicable data sheet.

Machining, air carbon arc or oxygen gouging, chipping or grinding may be used for back gouging.

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12 QUALITY

Cracks or blowholes that appear on the surface of any pass shall be removed before depositing the next covering pass. The procedure and technique shall be such that undercutting of base metal or adjacent passes is minimized. Fillet and butt welds shall meet the desirable or acceptable fillet weld profiles shown in Figure 5.4 of CSA Standard W59. The reinforcement in groove welds shall not exceed 3 mm (1/8") and shall have a gradual transition to the plane of the base metal surface. In general, the weld quality will be such as to meet the requirements of Clause 11.5.4 or 12.5.4 (as applicable) of CSA W59.

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13 WELD METAL CLEANING

Glass remaining after a pass shall be removed before applying the next covering pass. Prior to painting, all glass shall be removed and the parts shall be free of loose scale, oil and dirt.

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14 DATA SHEETS

Welding Procedure Data Sheets are specifications setting broad guidelines for the shop and field welding practice of the fabricator for each anticipated combination of essential variables. From the practical point of view, it is essential to include all variables that would make the weld easier or more difficult to make. The practical men will find that this will cover suitable tolerances for the geometry of joint and the other parameters involved.

The attached data sheets form part of this specification.

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15 TROUBLE SHOOTING

The solutions below should only be used where they do not conflict with the Welding Procedure Data Sheets. Contact welding engineer for problems that cannot be corrected without conflict

Problem

Porosity

Causes

- Moist flux
- Rust, carbon deposit or paint on plate surface
- Oxidized electrode wire
- Base metal chemistry
- Contaminants
- Excessive or insufficient flux thickness

Lack of Penetration

- Excessive root face
- Insufficient amperage or wire speed
- Travel speed too high
- Voltage too high
- Bad positioning of electrode wire
- Excessive final length

Lack of Fusion

- Amperage too low
- Travel speed too high
- Bad positioning of electrode wire
- Presence of carbon deposits or other foreign matters

Undercutting

- Travel speed too high
- Excessive amperage
- Excessive voltage
- Bad positioning of electrode wire (angle, distance)

Hot Cracking

- Bad width/depth ratio
- Base metal chemistry (presence of sulphur, carbon or phosphor)
- Presence of contaminants
- Concave fillet weld
- Stress

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Cold Cracking

- Presence of hydrogen
- Inappropriate pre-heat
- Base metal chemistry
- Tack welds too small

Unstable arc

- Check wire feed system

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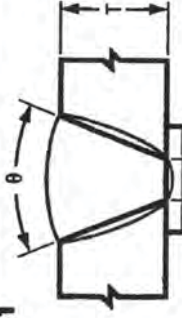
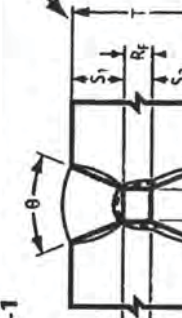
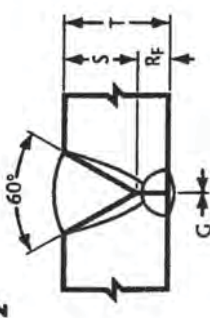
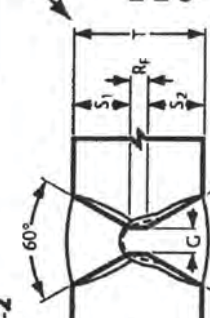
16 APPROVALS

CWB APPROVAL



COMPANY'S APPROVAL



Welds Joints		1 – Square Groove		2 – Single V-Groove		3 – Double V-Groove																								
Butt (B)	S1-1	 Effective Throat = T $T \leq 12 \text{ mm (1/2 in)}$ $G = 0$ Note: Welds shall be centred on the joint.	S2-1	 <table><tr><th>θ</th><th>G</th><th>Notes</th></tr><tr><td>20°</td><td>$\geq 16 \text{ mm (5/8 in)}$</td><td>Split pass mandatory in root layer</td></tr><tr><td>30°</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td>—</td></tr><tr><td>45°</td><td>$\geq 3 \text{ mm (1/8 in)}$</td><td>—</td></tr></table>	θ	G	Notes	20°	$\geq 16 \text{ mm (5/8 in)}$	Split pass mandatory in root layer	30°	$\geq 6 \text{ mm (1/4 in)}$	—	45°	$\geq 3 \text{ mm (1/8 in)}$	—	S3-1	 Effective Throat = T $R_f \leq t_1$ Spacer bar: $G \times t_1$ or a round bar with diameter = G <table><tr><th>θ</th><th>G</th><th>t_1</th><th>Notes</th></tr><tr><td>20°</td><td>$\geq 16 \text{ mm (5/8 in)}$</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td>Mandatory</td></tr><tr><td>30°</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td>Mandatory</td></tr></table>	θ	G	t_1	Notes	20°	$\geq 16 \text{ mm (5/8 in)}$	$\geq 6 \text{ mm (1/4 in)}$	Mandatory	30°	$\geq 6 \text{ mm (1/4 in)}$	$\geq 6 \text{ mm (1/4 in)}$	Mandatory
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B-L1-S		B-U2a-S		B-U3a-S																										
Butt (B)	S1-2	 Effective Throat = T $G = 0$	S2-2	 Effective Throat = T $R_f = 6 \text{ mm (1/4 in)}$ $G = 0$	S3-2	 Effective Throat = T $R_f = 2 \text{ mm (1/16 in)}$ $G = 3 \text{ mm (1/8 in)}$ Notes: (1) Deposit a SMAW or FCAW root weld 10 mm (3/8 in) thick minimum. (2) GTSM prior to welding from other side.																								
	B-U1-S		B-U2b-S		B-U3b-S																									
Butt (B) or Corner (C)	S1-3	 Effective Throat = T $T \leq 8 \text{ mm (5/16 in)}$ $G = 0$ Note: Outside weld shall be centred on the joint.	S2-3	 Effective Throat = T $R_f > 6 \text{ mm (1/4 in)}$ $G = 0$	S3-3	 Effective Throat = T $G = 0$ See table <table><tr><th>R_f</th><th>GTSM</th></tr><tr><td>$\leq 6 \text{ mm (1/4 in)}$</td><td>Not mandatory</td></tr><tr><td>$> 6 \text{ mm (1/4 in)}$</td><td>Mandatory</td></tr></table>	R_f	GTSM	$\leq 6 \text{ mm (1/4 in)}$	Not mandatory	$> 6 \text{ mm (1/4 in)}$	Mandatory																		
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C-L1-S		B-U2c-S		B-U3c-S																										

See **NOTES** at bottom left of following page
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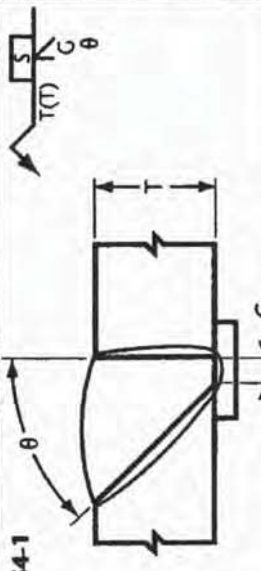
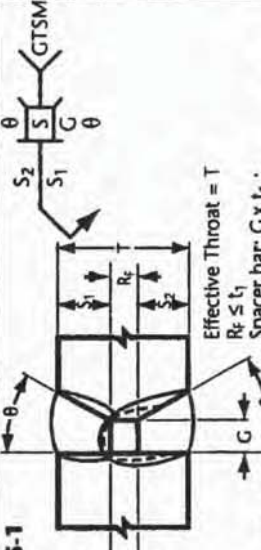
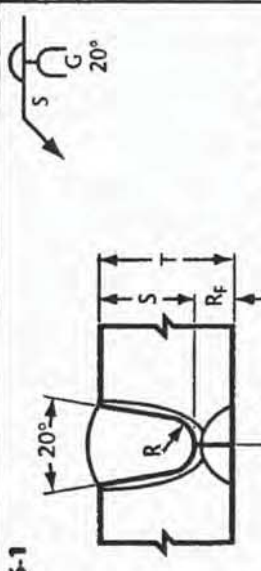
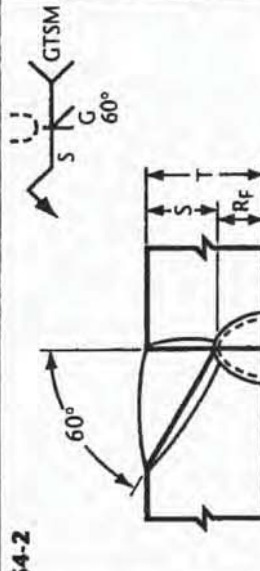
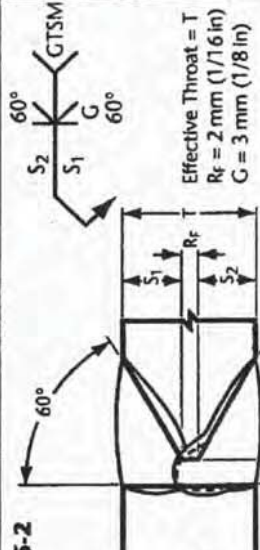
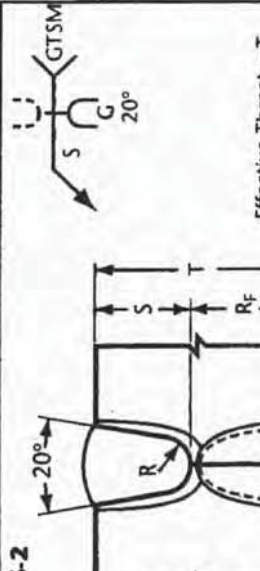
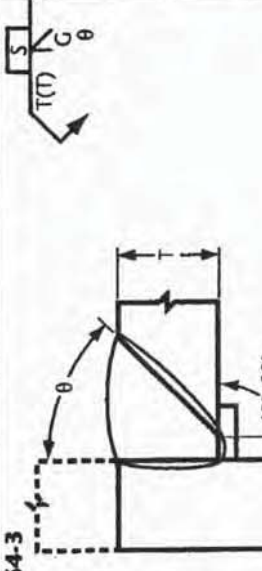
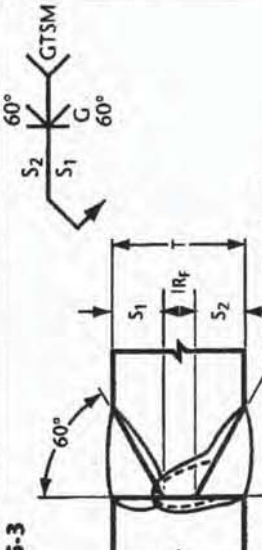
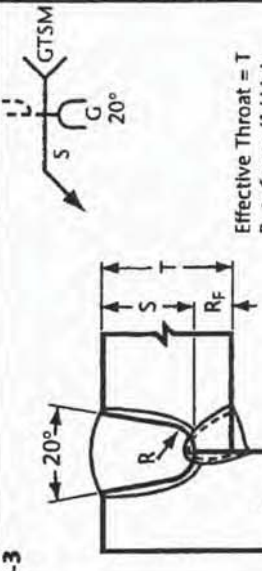
Figure 10.3

Prequalified Complete Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)
 (See Clauses 10.1.1 and 10.3.1.)

Figure 10.3 (Continued)

Prequalified Complete Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)

(Continued)

	4 – Single Bevel Groove	5 – Double Bevel Groove	6 – Single U-Groove																																																	
Welds Joints	Butt (B)	S4-1  B-U4a-S <table><thead><tr><th>θ</th><th>G</th><th>Notes</th></tr></thead><tbody><tr><td>20°</td><td>≥ 16 mm (5/8 in)</td><td>Split pass mandatory in root layer</td></tr><tr><td>30°</td><td>≥ 10 mm (3/8 in)</td><td>—</td></tr><tr><td>45°</td><td>≥ 6 mm (1/4 in)</td><td>—</td></tr></tbody></table>	θ	G	Notes	20°	≥ 16 mm (5/8 in)	Split pass mandatory in root layer	30°	≥ 10 mm (3/8 in)	—	45°	≥ 6 mm (1/4 in)	—	S5-1  B-U5a-S Effective Throat = T $R_f \leq t_1$ Spacer bar: $G \times t_1$; For $G \leq 10 \text{ mm (3/8 in)}$ use round bar <table><thead><tr><th>θ</th><th>G</th><th>t₁</th><th>Notes</th></tr></thead><tbody><tr><td>20°</td><td>≥ 16 mm (5/8 in)</td><td>≥ 6 mm (1/4 in)</td><td>Split pass mandatory in root layer</td></tr><tr><td>30°</td><td>≥ 10 mm (3/8 in)</td><td>≥ 6 mm (1/4 in)</td><td>—</td></tr><tr><td>45°</td><td>≥ 6 mm (1/4 in)</td><td>≥ 6 mm (1/4 in)</td><td>—</td></tr></tbody></table>	θ	G	t ₁	Notes	20°	≥ 16 mm (5/8 in)	≥ 6 mm (1/4 in)	Split pass mandatory in root layer	30°	≥ 10 mm (3/8 in)	≥ 6 mm (1/4 in)	—	45°	≥ 6 mm (1/4 in)	≥ 6 mm (1/4 in)	—	S6-1  B-U6a-S Effective Throat = T $R_f = 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 5 \text{ mm (3/16 in)}$	Butt (B)	S4-2  B-U4b-S Effective Throat = T $R_f > 6 \text{ mm (1/4 in)}$ $G = 0$	S5-2  B-U5b-S Effective Throat = T $R_f = 2 \text{ mm (1/16 in)}$ $G = 3 \text{ mm (1/8 in)}$ Note: Deposit a SMAW or FCAW root weld 10 mm (3/8 in) thick minimum.	S6-2  B-U6b-S Effective Throat = T $R_f > 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 5 \text{ mm (3/16 in)}$	Butt (B) Tee (T) Corner (C)	S4-3  TC-U4a-S <table><thead><tr><th>θ</th><th>G</th><th>Notes</th></tr></thead><tbody><tr><td>20°</td><td>≥ 16 mm (5/8 in)</td><td>Split pass mandatory in root layer</td></tr><tr><td>30°</td><td>≥ 10 mm (3/8 in)</td><td>—</td></tr><tr><td>45°</td><td>≥ 6 mm (1/4 in)</td><td>—</td></tr></tbody></table>	θ	G	Notes	20°	≥ 16 mm (5/8 in)	Split pass mandatory in root layer	30°	≥ 10 mm (3/8 in)	—	45°	≥ 6 mm (1/4 in)	—	S5-3  B-U5c-S Effective Throat = T $G = 0$ $R_f \geq 6 \text{ mm (1/4 in)}^*$ *If R_f is less than 6 mm (1/4 in) deposit a SMAW or FCAW weld from other side.	S6-3  C-U6a-S Effective Throat = T $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 5 \text{ mm (3/16 in)}$
	θ	G	Notes																																																	
	20°	≥ 16 mm (5/8 in)	Split pass mandatory in root layer																																																	
30°	≥ 10 mm (3/8 in)	—																																																		
45°	≥ 6 mm (1/4 in)	—																																																		
θ	G	t ₁	Notes																																																	
20°	≥ 16 mm (5/8 in)	≥ 6 mm (1/4 in)	Split pass mandatory in root layer																																																	
30°	≥ 10 mm (3/8 in)	≥ 6 mm (1/4 in)	—																																																	
45°	≥ 6 mm (1/4 in)	≥ 6 mm (1/4 in)	—																																																	
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45°	≥ 6 mm (1/4 in)	—																																																		

See NOTES at bottom left of following page
(Continued)

Figure 10.3 (Continued)

Prequalified Complete Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)

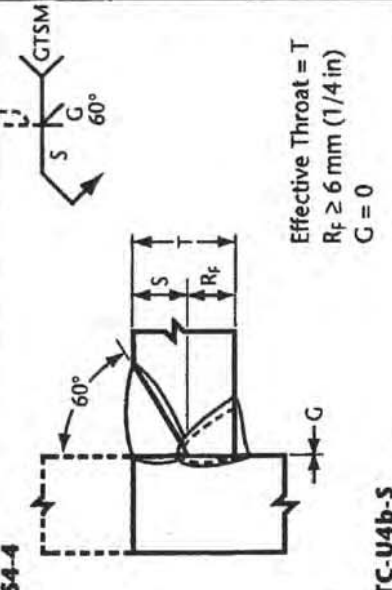
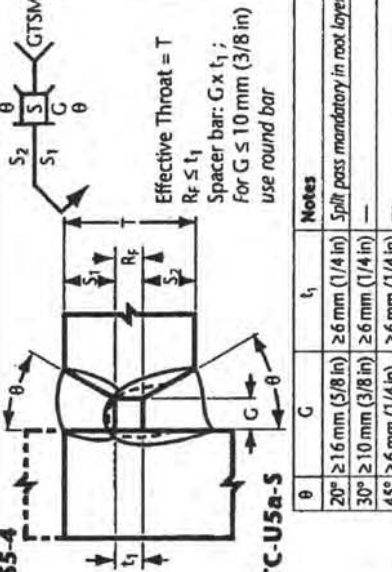
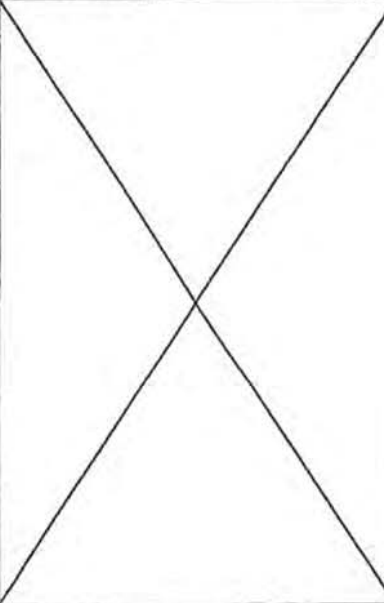
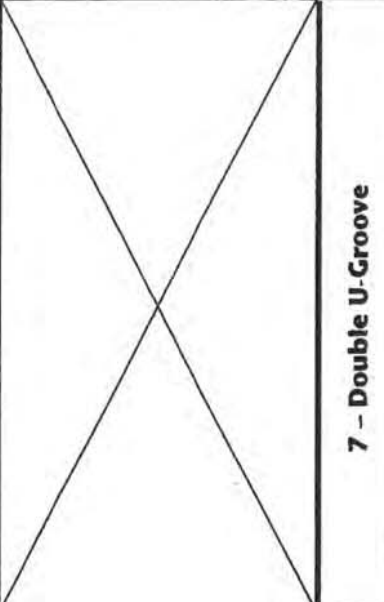
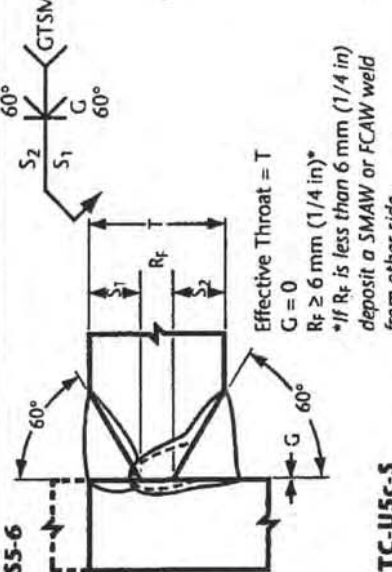
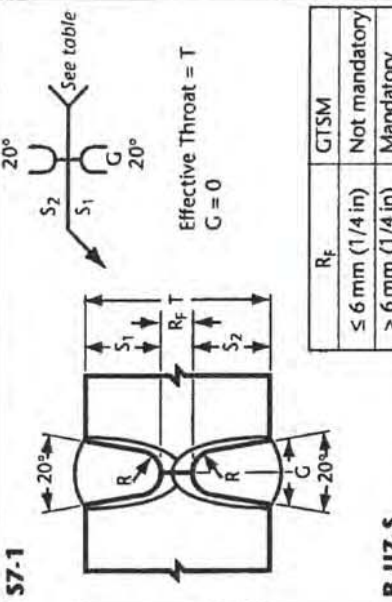
Welds Joints	4 – Single Bevel Groove (cont'd)	5 – Double Bevel Groove (cont'd)	6 – Single U-Groove (cont'd)													
	S4-4  Effective Throat = T $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ TC-U4b-S	S5-4  Effective Throat = T $R_f \leq t_1$ Spacer bar: $G \times t_1$; For $G \leq 10 \text{ mm (3/8 in)}$ use round bar <table border="1"><thead><tr><th>θ</th><th>G</th><th>t_1</th><th>Notes</th></tr></thead><tbody><tr><td>20°</td><td>$\geq 16 \text{ mm (5/8 in)}$</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td rowspan="3">Split pass mandatory in root layer</td></tr><tr><td>30°</td><td>$\geq 10 \text{ mm (3/8 in)}$</td><td>$\geq 6 \text{ mm (1/4 in)}$</td></tr><tr><td>45°</td><td>$\geq 6 \text{ mm (1/4 in)}$</td><td>$\geq 6 \text{ mm (1/4 in)}$</td></tr></tbody></table> TC-U5a-S	θ	G	t_1	Notes	20°	$\geq 16 \text{ mm (5/8 in)}$	$\geq 6 \text{ mm (1/4 in)}$	Split pass mandatory in root layer	30°	$\geq 10 \text{ mm (3/8 in)}$	$\geq 6 \text{ mm (1/4 in)}$	45°	$\geq 6 \text{ mm (1/4 in)}$	$\geq 6 \text{ mm (1/4 in)}$
θ	G	t_1	Notes													
20°	$\geq 16 \text{ mm (5/8 in)}$	$\geq 6 \text{ mm (1/4 in)}$	Split pass mandatory in root layer													
30°	$\geq 10 \text{ mm (3/8 in)}$	$\geq 6 \text{ mm (1/4 in)}$														
45°	$\geq 6 \text{ mm (1/4 in)}$	$\geq 6 \text{ mm (1/4 in)}$														
Tee (T) Corner (C)																
Tee (T) Corner (C)																
Butt (B) Tee (T) Corner (C)	S5-5  Effective Throat = T $R_f = 2 \text{ mm (1/16 in)}$ $G = 3 \text{ mm (1/8 in)}$ Notes: (1) Deposit a SMAW or FCAW root weld 10 mm (3/8 in) thick minimum. (2) GTSM prior to welding from other side. TC-U5b-S	S7-1  Effective Throat = T $G = 0$ See table <table border="1"><thead><tr><th>R_f</th><th>GTSM</th></tr></thead><tbody><tr><td>$\leq 6 \text{ mm (1/4 in)}$</td><td>Not mandatory</td></tr><tr><td>$> 6 \text{ mm (1/4 in)}$</td><td>Mandatory</td></tr></tbody></table> B-U7-S	R_f	GTSM	$\leq 6 \text{ mm (1/4 in)}$	Not mandatory	$> 6 \text{ mm (1/4 in)}$	Mandatory								
R_f	GTSM															
$\leq 6 \text{ mm (1/4 in)}$	Not mandatory															
$> 6 \text{ mm (1/4 in)}$	Mandatory															

Figure 10.3 (Continued)

Prequalified Complete Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)

(Continued)

Welds Joints	8 – Single J-Groove	9 – Double J-Groove
Butt (B)	S8-1 B-U8a-S S8-2 B-U8b-S Effective Throat = T $R_f \leq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 12 \text{ mm (1/2 in)}$	S9-1 B-U9-S Effective Throat = T $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 12 \text{ mm (1/2 in)}$
Tee (T) Corner (C)	S8-3 TC-U8a-S Effective Throat = T $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 12 \text{ mm (1/2 in)}$	S9-2 TC-U9-S Effective Throat = T $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 12 \text{ mm (1/2 in)}$
Tee (T) Corner (C)	S8-4 TC-U8b-S Effective Throat = T $R_f \leq 3 \text{ mm (1/8 in)}$ $G = 0$ $d \geq 6 \text{ mm (1/4 in)}$ $R = 12 \text{ mm (1/2 in)}$ Note: Weld back side first with a SMAW or FCAW min. 10 mm (3/8 in) fillet.	Notes: (1) For all joints that show the GTSM reference on the welding symbol, gouging to sound metal prior to welding from the other side is mandatory. See Clause 5.1.4 for definition. (2) The groove in a joint may be reversed where more practical or necessary. (3) See Clause 10.3.1. (4) For corner joints, see preferred preparation as shown in Figure 4.1.

Figure 10.3 (Concluded)
Prequalified Complete Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)

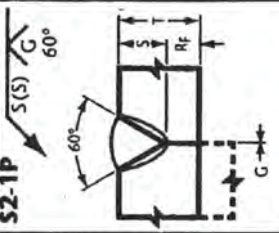
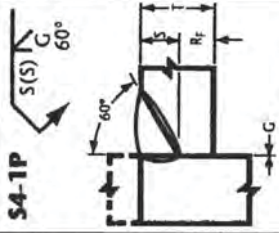
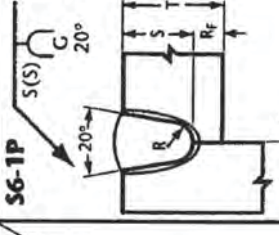
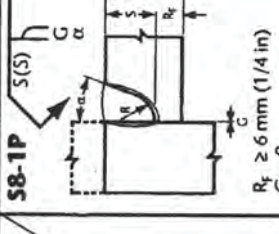
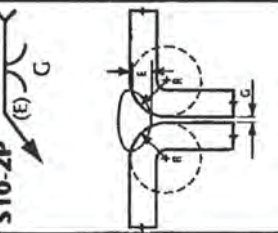
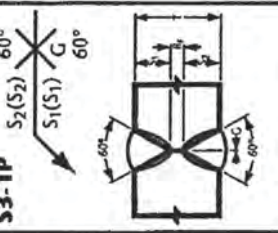
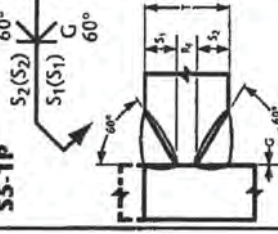
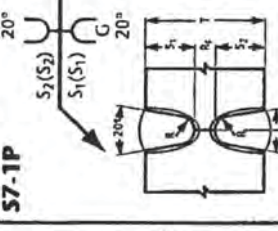
Welds Joints	V-Groove		Bevel Groove		U-Groove		J-Groove							
	2 Single V. and 10 Flare V-Groove	3 Double V- Groove	4 Single Bevel Groove	5 Double Bevel Groove	6 Single U- Groove	7 Double U- Groove	8 Single J- Groove	9 Double J- Groove						
Butt (B) Tee (T) or Corner (C)	S2-1P  $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ BC-P2-S		S4-1P  $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ TC-P4-S		S6-1P  $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 5 \text{ mm (3/16 in)}$ BC-P6-S		S8-1P  $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 12 \text{ mm (1/2 in)}$ <table><tr><td>α</td><td>Joint</td></tr><tr><td>20°</td><td>C-P8-S</td></tr><tr><td>45°</td><td>T-P8-S</td></tr></table>	α	Joint	20°	C-P8-S	45°	T-P8-S	
	α	Joint												
20°	C-P8-S													
45°	T-P8-S													
Butt (B) Tee (T) or Corner (C)	S10-2P  $E = 0.5R$ $G \leq 2 \text{ mm (3/32 in)}$ B-P10-S	S3-1P  $S_1 + S_2 = \text{Effective Throat}$ $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ B-P3-S	Note: For corner joints, see preferred preparation as shown in Figure 4.1.	S5-1P  $S_1 + S_2 = \text{Effective Throat}$ $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ TC-P5-S	Notes: (1) The groove in a joint may be reversed where more practical or necessary. (2) See Clause 10.3.2. (3) For minimum depth of groove "S" see Table 4.3. (4) For application of single partial joint penetration groove welds, see Clause 4.1.3.3.2 and for application under Clause 12.3.6 see Clause 12.4.1.4.	S7-1P  $S_1 + S_2 = \text{Effective Throat}$ $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 5 \text{ mm (3/16 in)}$ B-P7-S								
							S9-1P  $S_1 + S_2 = \text{Effective Throat}$ $R_f \geq 6 \text{ mm (1/4 in)}$ $G = 0$ $R = 13 \text{ mm (1/2 in)}$ <table><tr><td>α</td><td>Joint</td></tr><tr><td>20°</td><td>C-P9-S</td></tr><tr><td>45°</td><td>T-P9-S</td></tr></table>	α	Joint	20°	C-P9-S	45°	T-P9-S	
α	Joint													
20°	C-P9-S													
45°	T-P9-S													

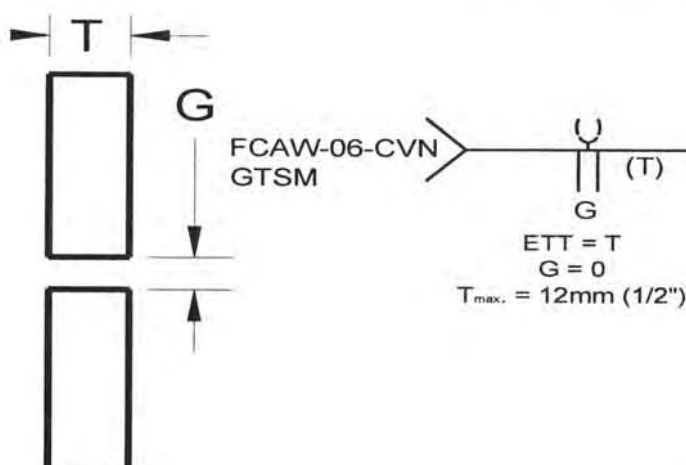
Figure 10.4

Prequalified Partial Joint Penetration Groove Welds for the Submerged Arc Welding Process (SAW)
(See Clause 10.3.2.)

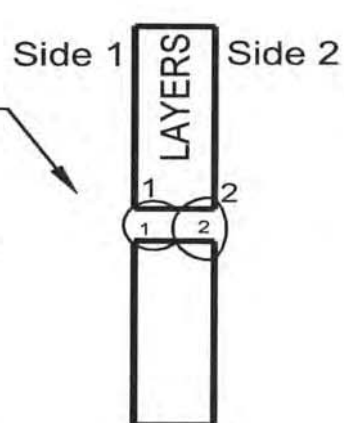
Company Name: Mosher Engineering				Wldg. Specification No: RTR-4			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48	

Material Information:							
Position: Horizontal		Welding Process: FCAW		Consumable: E491T-12MJ-H4			
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Globular Transfer		Shielding Gas: 75% Ar 25% CO2			
		Process Mode: Semi-Automatic		Gas Flow: 45 ft ³ /h			
		Tungsten Type:		Tungsten Dia.: in			
Cleaning: Wire brush and remove slag in between passes				PHT Temp: 15°C or 59 °F			
				PWHT Temp: NA °F			

Typical Joint Details:



Typical Pass & Layer Sequence:



Joint Configuration:				Joint Details:				Technique & Process Information:			
Joint Type: Butt, Tee, Corner				G = 0.045 θ (°) = 0				Electrical Stickout: 3/4 ± 1/8 in			
Weld Type: Complete Joint Penetration				R _F = 0				Nozzle Diameter: 1/2 in			
Backgouging: Backgouged to Sound Metal								Average Deposition Rate: 7.0 lbs/h			

Welding Parameters:																								
Weld Size		Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)						
in.	mm	in		Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max							
1/4	6.4	1/4	1	1	-	1	1	-	1	0.045	1.2	200	-	240	300	-	400	27	-	29	31.4	-	42.5	10.0
			2			2	2	-	2	0.045	1.2	200	-	240	300		400	27	-	29	21.0		28.4	15.0
5/16	7.9	5/16	1	1	-	1	1	-	1	0.045	1.2	200	-	240	300		400	27	-	29	25.1		34.0	12.5
			2			2	2	-	2	0.045	1.2	200	-	240	300		400	27	-	29	21.0		28.4	15.0
3/8	9.5	3/8	1	1	-	1	1	-	1	0.045	1.2	200	-	240	300		400	27	-	29	21.0		28.4	15.0
			2			2	2	-	2	0.045	1.2	200	-	240	300		400	27	-	29	21.0		28.4	15.0

Revision Status:		CWB Approval:		Company's Approval:	
Date:	Explanation:	CWB Accepted  Jul 25, 2008 Valid only if welding consumables are certified by the CWB			
22/07/2008	Per PQR P5745				

NOTES:

1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.
2. Weld Sizes represent effective weld throat thickness for qualified T range.
3. Target heat inputs at calculated average.
4. Tack weld parameters to be per main weld parameters
5. Backgouge as necessary to repair side 2.

Prepared by: FORGERON ENGINEERING LIMITED Tel: (902) 835-7225

WELDING PROCEDURE DATA SHEET

No.: **FCAW-10-CVN**

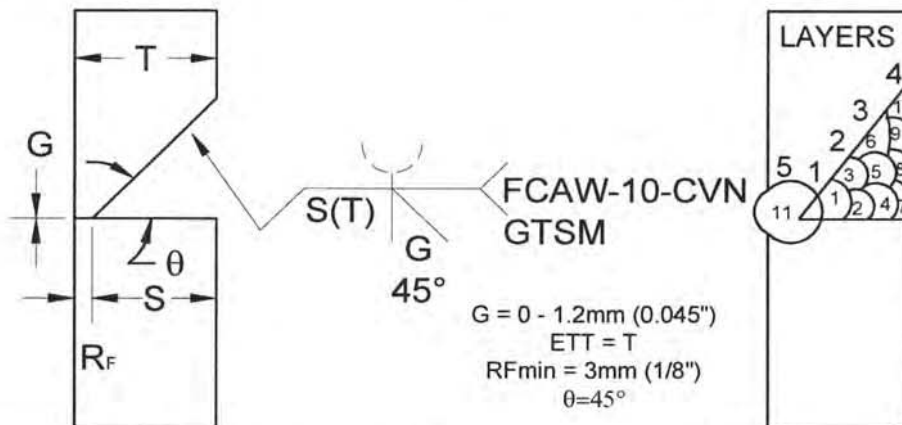
Date: May 5, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	RTR-4
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:

Position:	Horizontal	Welding Process:	FCAW	Consumable:	E491T-12MJ-H4
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer:	Globular Transfer	Shielding Gas:	75% Ar 25% CO2
		Process Mode:	Semi-Automatic	Gas Flow:	45 ft ³ /h
		Tungsten Type:		Tungsten Dia.:	in

Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	15°C or 59 °F
		PWHT Temp:	NA °F

Typical Joint Details:
Typical Pass & Layer Sequence:


Joint Configuration:	Joint Details:	Technique & Process Information:
Joint Type: Butt, Tee, Corner	$G = 0$ $\theta (^\circ) = 45$	Electrical Stickout: $3/4 \pm 1/8$ in
Weld Type: Complete Joint Penetration	$R_F = 1/8$	Nozzle Diameter: $1/2$ in
Backgouging: Backgouged to Sound Metal		Average Deposition Rate: 7.0 lbs/h

Welding Parameters:

Weld Size	Depth of Prep'n	Side No.	Layer No.	Pass No.	Electrode Size	Current (Amps)	Wire Feed Speed	Arc Volts	Travel Speed	Average Heat Input
in. mm	in		Min Max	Min Max	in. mm	Min Max	(in/min)	(Volts)	(in/min)	(kJ/in)
3/8 9.5	1/4	1	1 - 2	1 - 3	0.045 1.2	200 - 240	300 - 400	27 - 29	22.6 - 30.6	13.9
		2	3 - 5	4 - 11	0.045 1.2	200 - 240	300 - 400	27 - 29	17.0 - 23.0	18.5
5/8 16	1/2	1	1 - 3	1 - 6	0.045 1.2	200 - 240	300 - 400	27 - 29	17.0 - 23.0	18.5
		2	4 - 5	7 - 11	0.045 1.2	200 - 240	300 - 400	27 - 29	17.0 - 23.0	18.5
3/4 19	5/8	1	1 - 4	1 - 10	0.045 1.2	200 - 240	300 - 400	27 - 29	18.1 - 24.5	17.3
		2	5 - 5	11 - 11	0.045 1.2	200 - 240	300 - 400	27 - 29	17.0 - 23.0	18.5

Revision Status:

Date:	Explanation:	CWB Approval:	Company's Approval:
22/07/2008	P5744		

NOTES:

1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.
2. Weld Sizes represent effective weld throat thickness for qualified T range.
3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in
4. Tack weld parameters to be per main weld parameters
5. Backgouge as necessary to repair side 2.

CWB Accepted



Jul 25, 2008

Valid only if welding consumables
are certified by the CWB


Prepared by: FORGERON ENGINEERING LIMITED

Tel: (902) 835-7225

Company Name: Mosher Engineering				Wldg. Specification No: RTR-4			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48	

Material Information:							
Position: Vertical Up		Welding Process: FCAW		Consumable: E491T-12MJ-H4			
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Globular Transfer		Shielding Gas: 75% Ar 25% CO2			
		Process Mode: Semi-Automatic		Gas Flow: 38 ft3/h			
		Tungsten Type:		Tungsten Dia.: in			

Cleaning: Wire brush and remove slag in between passes		PHT Temp: 15°C or 59 °F	
		PWHT Temp: NA °F	

Typical Joint Details:

Typical Pass & Layer Sequence:

Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type: Butt, Tee, Corner		G = 0 θ (°) = 45		Electrical Stickout: 5/8 ± 1/8 in	
Weld Type: Complete Joint Penetration		Rf = 1/8		Nozzle Diameter: 5/8 in	
Backgouging: Backgouged to Sound Metal				Average Deposition Rate: 6.5 lbs/h	

Welding Parameters:																	
Weld Size	Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max	
3/8	9.5	1/4	1	1 - 2	1	- 3	0.045	1.2	155	- 175	175	- 225	24	- 27	13.1	- 19.7	15.4
			2	5 - 6	11	- 13	0.045	1.2	155	- 175	175	- 225	24	- 27	15.4	- 18.7	14.8
1/2	13	3/8	1	1 - 3	1	- 6	0.045	1.2	155	- 175	175	- 225	24	- 27	13.1	- 19.7	15.4
			2	5 - 6	11	- 13	0.045	1.2	155	- 175	175	- 225	24	- 27	15.4	- 18.7	17.5
5/8	16	1/2	1	1 - 3	1	- 6	0.045	1.2	155	- 175	175	- 225	24	- 27	13.1	- 19.7	15.4
			2	5 - 6	11	- 13	0.045	1.2	155	- 175	175	- 225	24	- 27	15.4	- 18.7	17.5
3/4	19	5/8	1	1 - 4	1	- 10	0.045	1.2	155	- 175	175	- 225	24	- 27	13.1	- 19.7	15.4
			2	5 - 6	11	- 13	0.045	1.2	155	- 175	175	- 225	24	- 27	15.4	- 18.7	17.5

Revision Status:		CWB Approval:		Company's Approval:	
Date:	Explanation:	CWB Accepted Jul 25, 2008 Valid only if welding consumables are certified by the CWB			
22/07/2008	P5744				
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.					
Prepared by: FORGERON ENGINEERING LIMITED		Tel: (902) 835-7225			

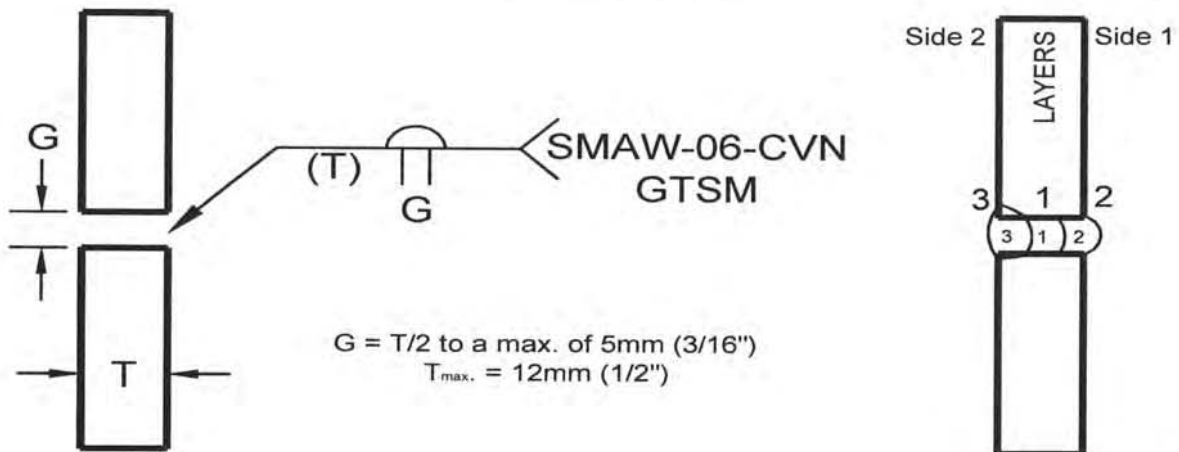
DATA SHEET

Date: May 5, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	RTR-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:			
Position:	Horizontal	Welding Process:	SMAW
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @ -40°C)	Mode of Transfer:	N/A
		Process Mode:	Manual
		Tungsten Type:	
		Consumable:	E4918/E48018/E7018
		Shielding Gas:	N/A
		Gas Flow:	ft3/h
		Tungsten Dia.:	in
Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	15°C or 59 °F
		PWHT Temp:	NA °F

Typical Joint Details: Typical Pass & Layer Sequence:



Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type:	Butt, Tee, Corner	G =	T/2	Electrical Stickout:	3/4 ± 1/8 in
Weld Type:	Complete Joint Penetration	R _p =	0	Nozzle Diameter:	1/2 in
Backgouging:	Backgouged to Sound Metal			Average Deposition Rate:	2.6 lbs/h

Weld Size		Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
in.	mm			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max	
1/4	6.4	1/4	1		1		1	3/32	2.4	75	- 95			20	- 22	5.7	7.7	16.0
			2		2		2	3/32	2.4	75	- 95			20	- 22	5.7	7.7	16.0
5/16	7.9	5/16	1	1	- 2	1	- 2	3/32	2.4	75	- 95			20	- 22	4.6	6.2	16.0
			2		3	3	- 3	3/32	2.4	75	- 95			20	- 22	5.7	7.7	16.0
3/8	9.5	3/8	1	1	- 2	1	- 2	3/32	2.4	75	- 95			20	- 22	3.8	5.1	16.0
			2		3	3	- 3	3/32	2.4	75	- 95			20	- 22	5.7	7.7	16.0

Revision Status:		CWB Approval:		Company's Approval:	
Date:	Explanation:	CWB Accepted  Jul 25, 2008 Valid only if welding consumables are certified by the CWB			
22/07/2008	Per PQR P65JR78				
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calculated average. 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.		Prepared by: FORGERON ENGINEERING LIMITED Tel: (902) 835-7225			

DATA SHEET

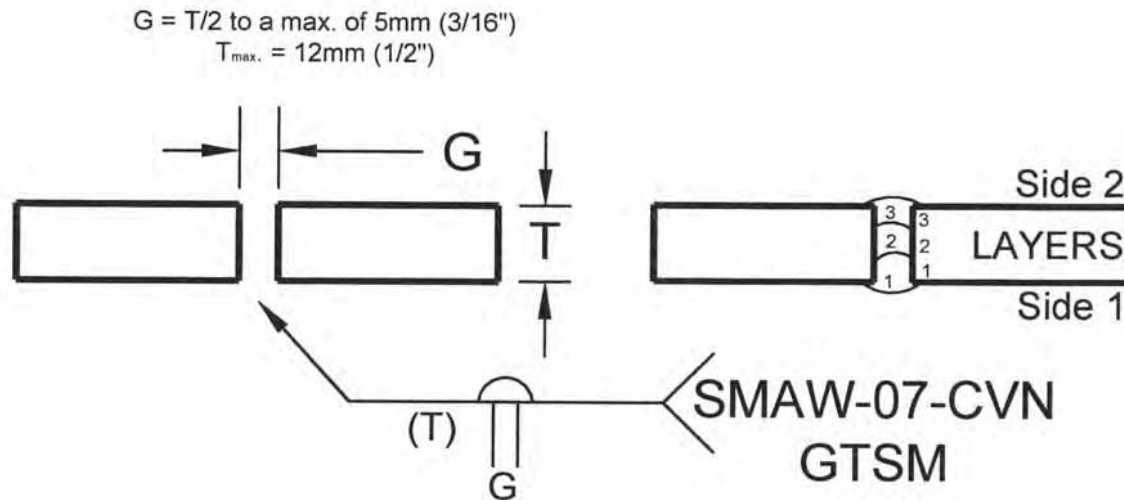
Date: May 5, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	RTR-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:			
Position:	Vertical Up	Welding Process:	SMAW
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @-40°C)	Consumable:	E4918/E48018/E7018
		Mode of Transfer:	N/A
		Shielding Gas:	N/A
		Process Mode:	Manual
		Gas Flow:	ft3/h
		Tungsten Type:	
		Tungsten Dia.:	in
Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	175°C or 347 °F
		PWHT Temp:	NA °F

Typical Joint Details:

Typical Pass & Layer Sequence:



Joint Configuration:	Joint Details:	Technique & Process Information:
Joint Type: Butt, Tee, Corner	$G = T/2$ $\Theta (^{\circ}) = 0$	Electrical Stickout: 3/4 $\pm$ 1/8 in
Weld Type: Complete Joint Penetration	$R_F = 0$	Nozzle Diameter: 1/2 in
Backgouging: Backgouged to Sound Metal		Average Deposition Rate: 2.5 lbs/h

Welding Parameters:																							
Weld Size		Depth of Prep'n in	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)					
in.	mm			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max						
1/4	6.4	1/4	1			1			1	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7
			2			2			2	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7
5/16	7.9	5/16	1	1	-	2	1	-	2	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7
			2			3	3	-	3	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7
3/8	9.5	3/8	1	1	-	2	1	-	2	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7
			2			2	3	-	3	3/32	2.4	75	-	95			20	-	22	2.8	-	3.2	35.7

Revision Status:		CWB Approval:	Company's Approval:
Date:	Explanation:	CWB Accepted  Jul 25, 2008 Valid only if welding consumables are certified by the CWB	
22/07/2008	Per PQR P65JR78		
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calculated average. 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.			
Prepared by: FORGERON ENGINEERING LIMITED		Tel: (902) 835-7225	

WELDING PROCEDURE DATA SHEET

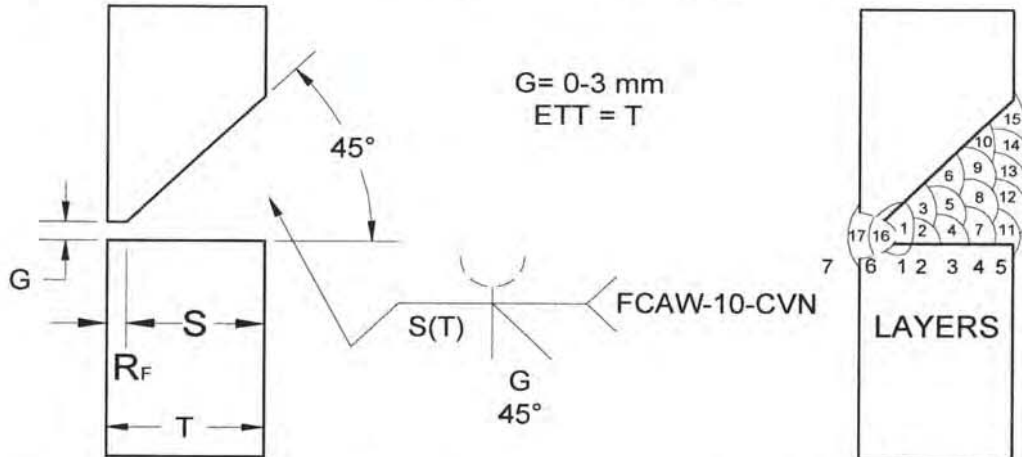
No.: **SMAW-10-CVN**

Date: May 5, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	RTR-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:

Position:	Horizontal	Welding Process:	SMAW	Consumable:	E4918/E48018/E7018
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @ -40°C)	Mode of Transfer:	N/A	Shielding Gas:	N/A
		Process Mode:	Manual	Gas Flow:	ft3/h
		Tungsten Type:		Tungsten Dia.:	in
Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	15°C or 59 °F		
		PWHT Temp:	NA °F		

Typical Joint Details:
Typical Pass & Layer Sequence:


Joint Configuration:	Joint Details:	Technique & Process Information:
Joint Type: Butt, Tee, Corner	G = 1/8 θ (°) = 45	Electrical Stickout: in
Weld Type: Complete Joint Penetration	R _F = 1/8	Nozzle Diameter: in
Backgouging: Backgouged to Sound Metal		Average Deposition Rate: 3.5 lbs/h

Welding Parameters:

Weld Size	Depth of Prep'n	Side No.	Layer No.	Pass No.	Electrode Size	Current (Amps)	Wire Feed Speed	Arc Volts	Travel Speed	Average Heat Input
in. mm	in		Min Max	Min Max	in. mm	Min Max	(in/min)	(Volts)	(in/min)	(kJ/in)
3/8 9.5	1/4	1	1 - 3	1 - 6	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2	7 - 16	16 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
1/2 13	3/8	1	1 - 4	1 - 10	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2	7 - 16	16 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
5/8 16	1/2	1	1 - 5	1 - 10	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2	7 - 16	16 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
3/4 19	5/8	1	1 - 6	1 - 15	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2	7 - 16	16 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4

Revision Status:	CWB Approval:	Company's Approval:
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Date:	Explanation:
22/07/2008	P036388

NOTES:

1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.
2. Weld Sizes represent effective weld throat thickness for qualified T range.
3. Target heat inputs at calculated average.
4. Tack weld parameters to be per main weld parameters
5. Backgouge as necessary to repair side 2.

CWB Accepted


Jul 25, 2008

Valid only if welding consumables
are certified by the CWB

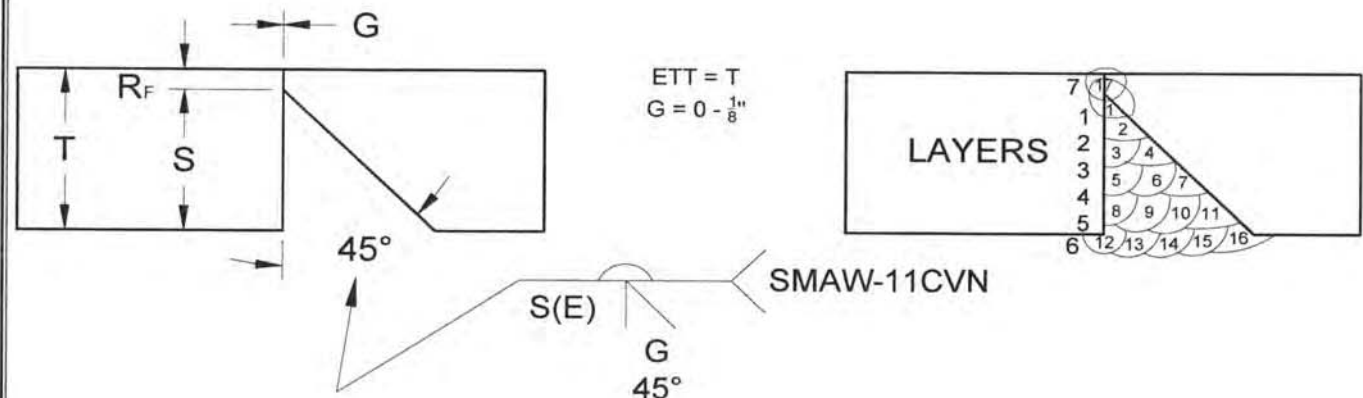

Prepared by: FORGERON ENGINEERING LIMITED

Tel: (902) 835-7225

Company Name:	Mosher Engineering	Wldg. Specification No:	RTR-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:

Position:	Vertical Up	Welding Process:	SMAW	Consumable:	E4918/E48018/E7018
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @ -40°C)	Mode of Transfer:	N/A	Shielding Gas:	N/A
		Process Mode:	Manual	Gas Flow:	ft ³ /h
		Tungsten Type:		Tungsten Dia.:	in
Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	175°C or 347 °F		
		PWHT Temp:	NA		°F

Typical Joint Details:
Typical Pass & Layer Sequence:


Joint Configuration:	Joint Details:	Technique & Process Information:
Joint Type: Butt, Tee, Corner	G = 0 θ (°) = 45	Electrical Stickout: in
Weld Type: Complete Joint Penetration	R _F = 1/16	Nozzle Diameter: in
Backgouging: Backgouged to Sound Metal		Average Deposition Rate: 2.5 lbs/h

Welding Parameters:

Weld Size	Depth of Prep'n	Side No.	Layer No.	Pass No.	Electrode Size	Current (Amps)	Wire Feed Speed	Arc Volts	Travel Speed	Average Heat Input
in. mm	in		Min Max	Min Max	in. mm	Min Max	(in/min) Min Max	(Volts) Min Max	(in/min) Min Max	(kJ/in)
3/8 9.5	5/16	1	1 - 3	1 - 7	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2		7 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
1/2 13	7/16	1	1 - 4	1 - 10	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2		7 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
5/8 16	9/16	1	1 - 5	1 - 11	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2		7 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
3/4 19	11/16	1	1 - 6	1 - 16	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4
		2		7 - 17	1/8 3.2	115 - 127		22 - 25	3.4 - 8.6	28.4

Revision Status:	CWB Approval:	Company's Approval:
Date: 22/07/2008		
Explanation: P036388		

NOTES:

1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.
2. Weld Sizes represent effective weld throat thickness for qualified T range.
3. Target heat inputs at calculated average.
4. Final weld parameters to be per main weld parameters
5. Backgouge as necessary to repair side 2.

Prepared by: FORGERON ENGINEERING LIMITED

Tel: (902) 835-7225

CWB Accepted


Jul 25, 2008

Valid only if welding consumables are certified by the CWB



DATA SHEET

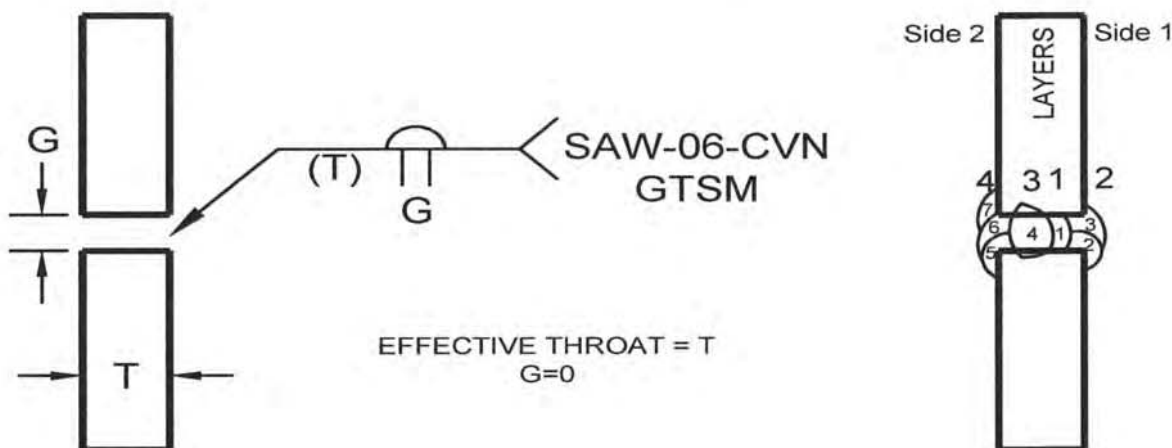
Date: June 11, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	SAW-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:

Position:	Horizontal	Welding Process:	SAW	Consumable:	F7A4-EM12K-H8
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer:	Spray Transfer	Shielding Gas:	N/A
		Process Mode:	Automatic	Gas Flow:	NA ft ³ /h
		Tungsten Type:		Tungsten Dia.:	NA in

Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	15°C or 59 °F
		PWHT Temp:	NA °F

Typical Joint Details:
Typical Pass & Layer Sequence:


Joint Configuration:	Joint Details:	Technique & Process Information:
Joint Type: Butt	G = 3/32 θ (°) = 0	Electrical Stickout: 1 1/2 ± 1/4 in
Weld Type: Complete Joint Penetration	R _F = 0	Nozzle Diameter: 3/4 in
Backgouging: Backgouged to Sound Metal		Average Deposition Rate: 11.1 lbs/h

Welding Parameters:

Weld Size	Depth of Prep'n	Side No.	Layer No.	Pass No.	Electrode Size	Current (Amps)	Wire Feed Speed	Arc Volts	Travel Speed	Average Heat Input
in. mm	in		Min Max	Min Max	in. mm	Min Max	(in/min)	(Volts)	(in/min)	(kJ/in)
3/8 9.5		1	1 - 2	1 - 3	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3
		2	3 - 4	4 - 6	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3
7/16 11		1	1 - 2	1 - 3	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3
		2	3 - 4	4 - 6	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3
1/2 13		1	1 - 2	1 - 2	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3
		2	3 - 4	4 - 6	1/8 3.3	350 - 450	415 - 505	25 - 29	19.1 - 25.3	30.3

Revision Status:	CWB Approval:	Company's Approval:
Date: 7/22/08 Explanation: Per PQR P5709		
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calculated average. 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.		
Prepared by: FORGERON ENGINEERING LIMITED	Tel: (902) 835-7225	

WELDING PROCEDURE

 No.: **SAW-10-CVN**
DATA SHEET

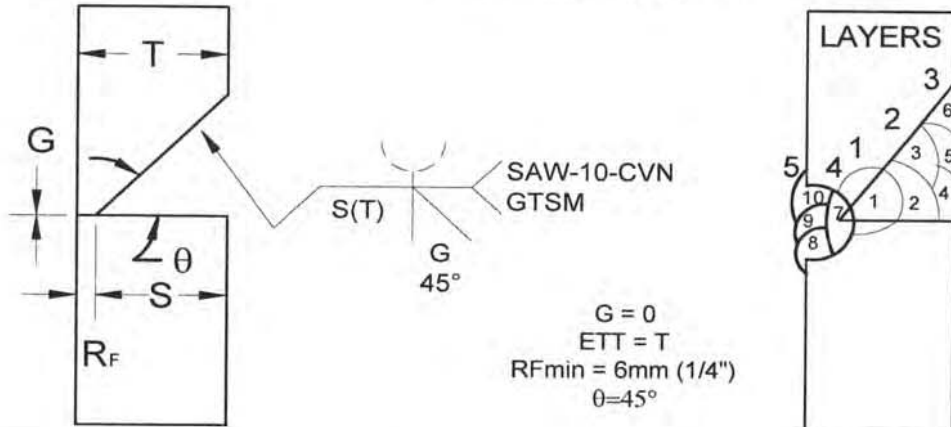
Date: June 11, 2008

Company Name:	Mosher Engineering	Wldg. Specification No:	SAW-1
Address:	1358 Queen Street	Reference WPQR:	
	Halifax Nova Scotia B3J 2H5	Ref. Standards:	CSA W47.1, W59 & W48

Material Information:			
Position:	Horizontal	Welding Process:	SAW
Base Mat'l:	CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer:	Spray Transfer
		Process Mode:	Automatic
		Tungsten Type:	
Consumable:	F7A4-EM12K-H8	Shielding Gas:	N/A
		Gas Flow:	NA ft ³ /h
		Tungsten Dia.:	NA in
Cleaning:	Wire brush and remove slag in between passes	PHT Temp:	15°C or 59 °F
		PWHT Temp:	NA °F

Typical Joint Details:

Typical Pass & Layer Sequence:



Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type:	Butt	$G = 0$	$\theta (^\circ) = 45$	Electrical Stickout:	1 1/4 ± 1/4 in
Weld Type:	Complete Joint Penetration	$R_F = 1/4$		Nozzle Diameter:	3/4 in
Backgouging:	Backgouged to Sound Metal			Average Deposition Rate:	11.1 lbs/h

Welding Parameters:

Weld Size	Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max	
7/16	11	3/16	1	1 - 2	1	- 2	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
			2	4 - 5	7	- 10	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
1/2	13	1/4	1	1 - 2	1	- 2	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
			2	4 - 5	7	- 10	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
5/8	16	3/8	1	1 - 3	1	- 5	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
			2	4 - 5	7	- 10	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
3/4	19	1/2	1	1 - 3	1	- 6	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5
			2	4 - 5	7	- 10	1/8	3.3	450	- 550	415	- 510	25	- 29	15.4	- 23.6	41.5

Revision Status:		CWB Approval:		Company's Approval:	
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Date:	Explanation:				
22/07/2008	P5710				

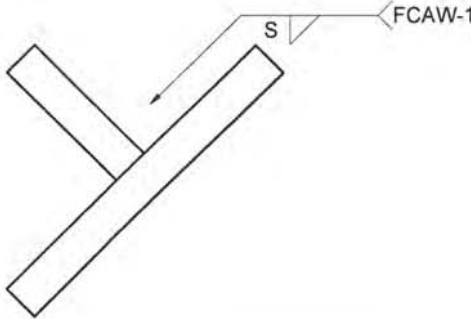
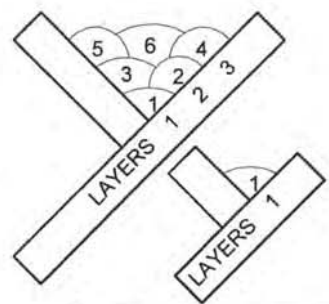
NOTES:

1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.
2. Weld Sizes represent effective weld throat thickness for qualified T range.
3. Target heat inputs at calculated average.
4. Tack weld parameters to be per main weld parameters
5. Backgouge as necessary to repair side 2.

Prepared by: FORGERON ENGINEERING LIMITED

Tel: (902) 835-7225

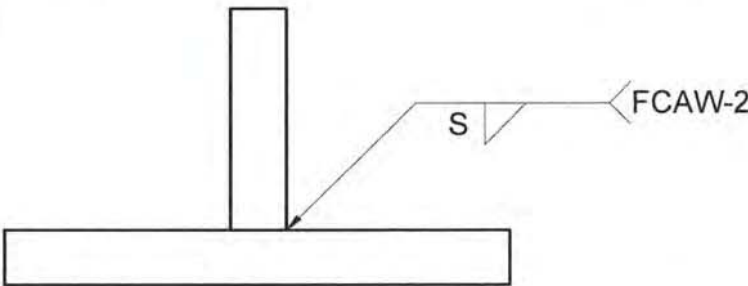
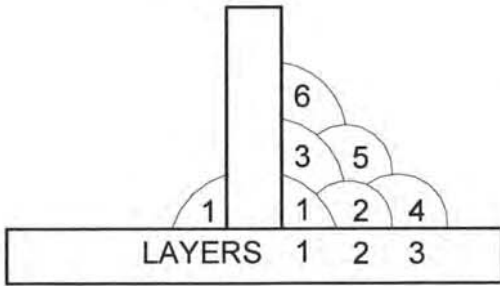


Company Name: Mosher Engineering										Wldg. Specification No: RTR-4									
Address: 1358 Queen Street										Reference WPQR:									
Halifax Nova Scotia B3J 2H5										Ref. Standards: CSA W47.1, W59 & W48									
Material Information:																			
Position: Flat				Welding Process: FCAW						Consumable: E491T-9MJ-H16/E4801T-9CH									
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)				Mode of Transfer: Spray Transfer						Shielding Gas: 75% Ar 25% CO2									
				Process Mode: Semi-Automatic						Gas Flow: 35 ft3/h									
				Tungsten Type:						Tungsten Dia.: in									
Cleaning: Wire brush and remove slag in between passes										PHT Temp: As per Table 5.3 of CSA W59 °F									
										PWHT Temp: N/A °F									
Typical Joint Details:										Typical Pass & Layer Sequence:									
																			
Joint Configuration:										Joint Details:					Technique & Process Information:				
Joint Type: Tee, Corner, Lap										G = 0-1/16" Q (°) =					Electrical Stickout: 3/4 ± 1/8 in				
Weld Type: Fillet Weld										R _F =					Nozzle Diameter: 1/2 in				
Backgouging: N/A															Average Deposition Rate: 8.0 lbs/h				
Welding Parameters:																			
Weld Size		Depth of Prep'n		Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps)		Wire Feed Speed		Arc Volts		Travel Speed		Average
in. mm		in			Min Max		Min Max		in. mm		Min Max		(in/min)		(Volts)		(in/min)		Heat Input
3/16 4.8				1	1		1		0.045 1.2		225 - 275		380 - 460		29 - 31		20.0 - 24.0		20.5
1/4 6.4				1	1		1		0.045 1.2		225 - 275		380 - 460		29 - 31		20.0 - 24.0		20.5
5/16 7.9				1	1		1		0.045 1.2		225 - 275		380 - 460		29 - 31		16.6 - 22.4		20.5
3/8 9.5				1	1 - 2		1 - 3		0.045 1.2		225 - 275		380 - 460		29 - 31		17.3 - 23.4		22.1
1/2 13				1	1 - 2		1 - 3		0.045 1.2		225 - 275		380 - 460		29 - 31		12.4 - 16.8		30.8
5/8 16				1	1 - 3		1 - 6		0.045 1.2		226 - 275		380 - 460		29 - 31		12.4 - 16.8		30.8
Revision Status:										CWB Approval:					Company's Approval:				
Date:		Explanation:																	
22/07/2008		Per PQR P5745																	
NOTES:																			
1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.																			
2. Weld Sizes represent effective weld throat thickness for qualified T range.																			
3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in																			
Prepared by: FORGERON ENGINEERING LIMITED										Tel: (902) 835-7225									
										CWB Accepted Sep 09, 2008 Valid only if welding consumables are certified by the CWB									
										REGISTERED PROFESSIONAL ENGINEER DATE 07/22/2008 7681 PROVINCE OF NOVA SCOTIA									

**WELDING PROCEDURE
DATA SHEET**

No.: **FCAW-2**

Date: July 22, 2008

Company Name: Mosher Engineering				Wldg. Specification No: RTR-4																	
Address: 1358 Queen Street				Reference WPQR:																	
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48															
Material Information:																					
Position: Horizontal		Welding Process: FCAW		Consumable: E491T-9MJ-H16/E4801T-9-CH																	
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Spray Transfer		Shielding Gas: 75% Ar 25% CO2																	
		Process Mode: Semi-Automatic		Gas Flow: 35 ft ³ /h																	
		Tungsten Type:		Tungsten Dia.: in																	
Cleaning: Wire brush and remove slag in between passes				PHT Temp: As per Table 5.3 of CSA W59 °F		°F															
				PWHT Temp: N/A		°F															
Typical Joint Details:				Typical Pass & Layer Sequence:																	
																					
Joint Configuration:				Joint Details:		Technique & Process Information:															
Joint Type: Tee, Corner, Lap				G = 0-1/16" Q (°) =		Electrical Stickout: 3/4 ± 1/8 in															
Weld Type: Fillet Weld				R _F =		Nozzle Diameter: 1/2 in															
Backgouging: N/A						Average Deposition Rate: 8.0 lbs/h															
Welding Parameters:																					
Weld Size in. mm	Depth of Prep'n in	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)				
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max					
3/16 4.8		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	20.0	-	24.0	20.5
1/4 6.4		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	20.0	-	24.0	20.5
5/16 7.9		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	16.6	-	22.4	20.5
3/8 9.5		1	1	2	1	3	0.045	1.2	225	-	275	380	-	460	29	-	31	17.3	-	23.4	22.1
1/2 13		1	1	2	1	3	0.045	1.2	225	-	275	380	-	460	29	-	31	12.4	-	16.8	30.8
5/8 16		1	1	3	1	6	0.045	1.2	226	-	275	380	-	460	29	-	31	12.4	-	16.8	30.8
Revision Status:				CWB Approval:				Company's Approval:													
Date: 22/07/2008		Explanation: Per PQR P5745																			
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in																					
Prepared by: FORGERON ENGINEERING LIMITED																					
Tel: (902) 835-7225																					

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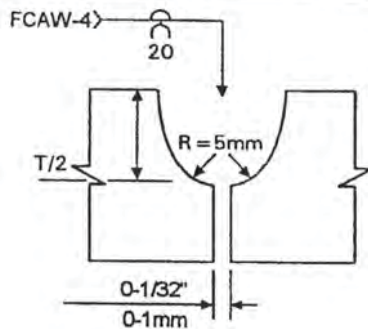
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RTR FORM S-101, 1992
to CSA W47.1

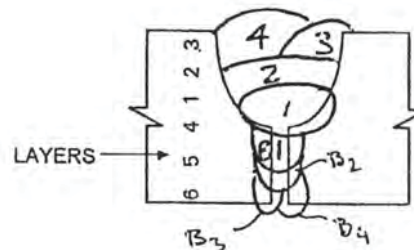
**RTR ENGINEERING
WELDING PROCEDURE
DATA SHEET**

No. **FCAW4-INI** Date **MARCH 28, 2002**

Company Name and Complete Address	MOSHER ENGINEERING LIMITED		WPS No.	RTR-4(A)
	2089 Upper Water Street		Applicable Standard(s)	CSA W47.1, W59 & W48.
	Halifax, Nova Scotia, B3J 2R7		Electrode Classification	E49XT9M-H16 X=1 or 2
Welding Process & Mode	☐ SMAW ☐ SAW ☐ GTAW (Tungsten) Type: _____ ☒ FCAW ☐ GMAW ☐ ESW ☐ SW Size: _____		☒ Preheat Minimum as per CSA W59 ☐ Other	
	☐ Manual ☒ Semi-Automatic ☐ Machine ☐ Automatic			
Material Designation	Steel groups 1,2 & 3 of Table 11-1 W59 for type A (without color matching), for type T (without regard to impact values)		Welding Position	FLAT
			Interpass Temperature	Minimum as above Maximum 500 deg. F



Sketch Of Typical Joint Preparation



Typical Pass and Layer Sequence

Groove Weld Complete Joint Penetration			Groove Weld Partial Joint Penetration			Joint Type as per CSA W59		Automatic or Semi-Automatic			
☒ Back-gouged to sound metal ☐ Welded onto steel backing ☐ Other			☐ Minimum as per CSA W59 ☐ Others			☒ Butt ☐ Tee ☐ Edge ☐ Lap ☐ Corner		Electrical Stickout	3/4" +/- 3/16"		
			☐ Fillet Weld ☐ Minimum as per CSA W59					Shielding Gas	75Ar/25CO2	cu.ft /hr.	30-45
								Flux			
Material Thickness	ETT, or Fillet Size	Side No.	Layer Number	Pass Number	Electrode (in) Size (mm)	Current Polarity	Amperes +/-8%	Wire Feed Speed (in/min)	Volts +/-8%	Arc Travel Speed (in/min)	
1/4" 6mm		1	1	1	.045 1.2	DCRP	180	250-325	23	11 +/- 3	
		2	6	B1*	.045 1.2	DCRP	180	250-325	23	12 +/- 4	
5/16" 8mm		1	1	1/2	.045 1.2	DCRP	180	250-325	23	11 +/- 3	
		2	5-6	B1-B2*	.045 1.2	DCRP	180	250-325	23	12 +/- 4	
3/8" 10mm		1	1-2	1-2	.045 1.2	DCRP	190	265-340	23	11 +/- 3	
		2	5-6	B1-B3*	.045 1.2	DCRP	190	265-340	23	12 +/- 4	
1/2" 12mm		1	1-3	1-3	.045 1.2	DCRP	200	275-350	24	11 +/- 3	
		2	5-6	B1-B3*	.045 1.2	DCRP	200	275-350	24	12 +/- 4	
5/8" 16mm		1	1-3	1-4	1/16 1.6	DCRP	275	230-300	27	11 +/- 3	
		2	4-6	B1-B4*	1/16 1.6	DCRP	275	230-300	27	12 +/- 4	

Revision Date	Explanation	CWB Approval	Engineer's Stamp

NOTES: *NUMBER OF PASSES MAY BE INCREASED TO
FILL BACK-GOUGING

CWB Accepted



Sep 16, 2008

Valid only if welding consumables are certified by the CWB



DATA SHEET

Date: June 11, 2008

Company Name: Mosher Engineering				Wldg. Specification No: SAW-1			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48	

Material Information:							
Position: Horizontal		Welding Process: SAW		Consumable: F7A4-EM12K-H8			
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Spray Transfer		Shielding Gas: N/A			
		Process Mode: Automatic		Gas Flow: NA ft ³ /h			
		Tungsten Type:		Tungsten Dia.: NA in			
Cleaning: Wire brush and remove slag in between passes				PHT Temp: 15°C or 59 °F		PWHT Temp: NA °F	

Typical Joint Details:

WORK ANGLE 15° - 20° from Horizontal
TRAVEL ANGLE (PULL/DRAG) - 5° - 15°

SAW-06-CVN
GTSM

EFFECTIVE THROAT = T
G=0

FLUX SHELF 1/4" BELOW JOINT

Typical Pass & Layer Sequence:

Side 2 Side 1

LAYERS

4 3 1 2

6 5 4 1 3 2

Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type: Butt		G = 3/32 ϕ (°) = 0		Electrical Stickout: 1 1/2 ± 1/4 in	
Weld Type: Complete Joint Penetration		R _F = 0		Nozzle Diameter: 3/4 in	
Backgouging: Backgouged to Sound Metal				Average Deposition Rate: 11.1 lbs/h	

Welding Parameters:																		
Weld Size		Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
in.	mm	in		Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max	
3/8	9.5		1	1	2	1	3	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3
			2	3	4	4	6	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3
7/16	11		1	1	2	1	3	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3
			2	3	4	4	6	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3
1/2	13		1	1	2	1	2	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3
			2	3	4	4	6	1/8	3.3	350	450	41	51	25	29	19.1	25.3	30.3

Revision Status:		CWB Approval:		Company's Approval:	
Date: 7/22/08	Explanation: Per PQR P5709	CWB Accepted Jul 28, 2008 Valid only if welding consumables are certified by the CWB			
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calculated average. 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.					
Prepared by: FORGERON ENGINEERING LIMITED		Tel: (902) 835-7225			

Company Name: Mosher Engineering				Wldg. Specification No: SAW-1			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48	

Material Information:

Position: Horizontal	Welding Process: SAW	Consumable: F7A4-EM12K-H8
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer: Spray Transfer	Shielding Gas: N/A
	Process Mode: Automatic	Gas Flow: NA ft ³ /h
	Tungsten Type:	Tungsten Dia.: NA in

Cleaning: Wire brush and remove slag in between passes	PHT Temp: 15°C or 59 °F
	PWHT Temp: NA °F

Typical Joint Details:

Typical Pass & Layer Sequence:

Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type: Butt		G = 0	θ (°) = 45	Electrical Stickout: 1 1/4 ± 1/4 in	
Weld Type: Complete Joint Penetration		R _F = 1/4		Nozzle Diameter: 3/4 in	
Backgouging: Backgouged to Sound Metal				Average Deposition Rate: 11.1 lbs/h	

Welding Parameters:

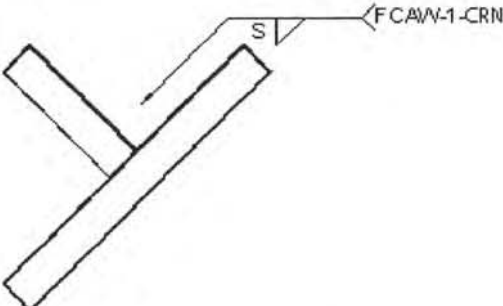
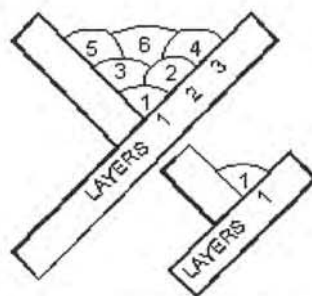
Weld Size in. mm	Depth of Prep'n in	Side No.	Layer No.		Pass No.		Electrode Size in. mm		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max			
7/16 11	3/16	1	1	- 2	1	- 2	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
		2	4	- 5	7	- 10	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
1/2 13	1/4	1	1	- 2	1	- 2	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
		2	4	- 5	7	- 10	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
5/8 16	3/8	1	1	- 3	1	- 5	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
		2	4	- 5	7	- 10	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
3/4 19	1/2	1	1	- 3	1	- 6	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5
		2	4	- 5	7	- 10	1/8	3.3	450	- 550	42	- 51	25	- 29	15.4	- 23.6	41.5

Revision Status:		CWB Approval:		Company's Approval:	
Date: 22/07/2008	Explanation: P5710	CWB Accepted Jul 28, 2008 Valid only if welding consumables are certified by the CWB			
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calculated average. 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.					
Prepared by: FORGERON ENGINEERING LIMITED		Tel: (902) 835-7225			

**WELDING PROCEDURE
DATA SHEET**

No.: **FCAW-1-CVN**

Date: July 22, 2008

Company Name: Mosher Engineering				Wldg. Specification No: RTR-4														
Address: 1358 Queen Street Halifax Nova Scotia B3J 2H5				Reference WPQR: Ref. Standards: CSA W47.1, W59 & W48														
Material Information:																		
Position: Flat		Welding Process: FCAW		Consumable: E491T-9MJ-H16/E4801T-9CH														
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Spray Transfer		Shielding Gas: 75% Ar 25% CO2														
		Process Mode: Semi-Automatic		Gas Flow: 35 ft ³ /h														
		Tungsten Type:		Tungsten Dia.: in														
Cleaning: Wire brush and remove slag in between passes				PHT Temp: As per Table 5.3 of CSA W59 °F														
				PWHT Temp: N/A °F														
Typical Joint Details:				Typical Pass & Layer Sequence:														
																		
Joint Configuration:				Joint Details:		Technique & Process Information:												
Joint Type: Tee, Corner, Lap				G = 0-1/16" Q (°) =		Electrical Stickout: 3/4 ± 1/8 in												
Weld Type: Fillet Weld				R _F =		Nozzle Diameter: 1/2 in												
Backgouging: N/A						Average Deposition Rate: 8.0 lbs/h												
Welding Parameters:																		
Weld Size in. mm	Depth of Prep'n in	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)	
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max		
3/16 4.8		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	24.0	20.5
1/4 6.4		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	24.0	20.5
5/16 7.9		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	22.4	20.5
3/8 9.5		1	1	-	2	1	-	3	0.045	1.2	225	-	275	380	-	17.3	-	22.1
1/2 13		1	1	-	2	1	-	3	0.045	1.2	225	-	275	380	-	12.4	-	30.8
5/8 16		1	1	-	3	1	-	6	0.045	1.2	226	-	275	380	-	12.4	-	30.8
Revision Status:				CWB Approval:				Company's Approval:										
Date:		Explanation:		 CWB Accepted Mar 03, 2009 Valid only if welding consumables are certified by the CWB														
7/22/2008		Per PQR P5745																
2/10/2009		Rev. WPDSnumber, added "CVN" to #																
NOTES:																		
1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.																		
2. Weld Sizes represent effective weld throat thickness for qualified T range.																		
3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in																		
Prepared by: FORGERON ENGINEERING LIMITED				Tel: (902) 835-7225														

Company Name: Mosher Engineering				Wldg. Specification No:				RTR-4															
Address: 1358 Queen Street				Reference WPQR:																			
Halifax Nova Scotia B3J 2H5				Ref. Standards:				CSA W47.1, W59 & W48															
Material Information:																							
Position: Horizontal		Welding Process: FCAW		Consumable: E491T-9-H16/E4801T-9-CH																			
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)		Mode of Transfer: Spray Transfer		Shielding Gas: 75% Ar 25% CO2																			
		Process Mode: Semi-Automatic		Gas Flow: 35		ft3/h																	
		Tungsten Type:		Tungsten Dia.:		in																	
Cleaning: Wire brush and remove slag in between passes				PHT Temp: As per Table 5.3 of CSA W59				°F															
				PWHT Temp: N/A				°F															
Typical Joint Details:				Typical Pass & Layer Sequence:																			
Joint Configuration:				Joint Details:				Technique & Process Information:															
Joint Type: Tee, Corner, Lap				G = 0-1/16" Q (") =				Electrical Stickout: 3/4 ± 1/8 in															
Weld Type: Fillet Weld				R _F =				Nozzle Diameter: 1/2 in															
Backgouging: N/A								Average Deposition Rate: 8.0 lbs/h															
Welding Parameters:																							
Weld Size in. mm	Depth of Prep'n in	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)						
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max							
3/16 4.8		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	20.0	-	24.0	20.5		
1/4 6.4		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	20.0	-	24.0	20.5		
5/16 7.9		1		1		1	0.045	1.2	225	-	275	380	-	460	29	-	31	16.6	-	22.4	20.5		
3/8 9.5		1	1	-	2	1	-	3	0.045	1.2	225	-	275	380	-	460	29	-	31	17.3	-	23.4	22.1
1/2 13		1	1	-	2	1	-	3	0.045	1.2	225	-	275	380	-	460	29	-	31	12.4	-	16.8	30.8
5/8 16		1	1	-	3	1	-	6	0.045	1.2	226	-	275	380	-	460	29	-	31	12.4	-	16.8	30.8
Revision Status:				CWB Approval:				Company's Approval:															
Date:		Explanation:																					
7/22/2008		Per PQR P5745																					
2/10/2009		Rev. WPDS number, added "CVN" to #																					
NOTES:																							
1. Use stringer beads only. Restrict weld bead to ≤ 16 mm.																							
2. Weld Sizes represent effective weld throat thickness for qualified T range.																							
3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in																							
Prepared by: FORGERON ENGINEERING LIMITED				Tel: (902) 835-7225																			

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**WELDING PROCEDURE
DATA SHEET**

No.: **FCAW-8-CVN**

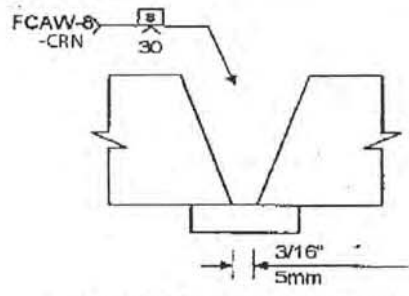
Date: February 10, 2009

Company Name: Mosher Engineering				Wldg. Specification No: RTR-4			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & W48	

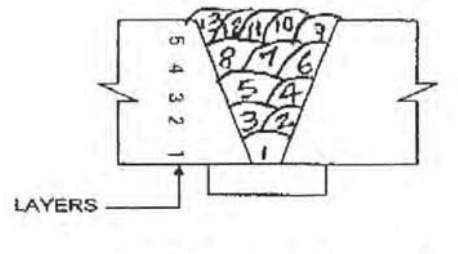
Material Information:

Position: Flat	Welding Process: FCAW	Consumable: E491T-12MJ-H4
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer: Globular Transfer	Shielding Gas: 75% Ar 25% CO2
	Process Mode: Semi-Automatic	Gas Flow: 45 ft ³ /h
	Tungsten Type:	Tungsten Dia.: in

Cleaning: Wire brush and remove slag in between passes	PHT Temp: 15°C or 59 °F
	PWHT Temp: N/A °F

Typical Joint Details:


Sketch Of Typical Joint Preparation

Typical Pass & Layer Sequence:


Typical Pass and Layer Sequence

Joint Configuration:				Joint Details:				Technique & Process Information:			
Joint Type: Butt				G = 3/16" Q (°) =				Electrical Stickout: 3/4 ± 1/8 in			
Weld Type: Complete Joint Penetration				R _F =				Nozzle Diameter: 1/2 in			
Backgouging: N/A								Average Deposition Rate: 7.0 lbs/h			

Welding Parameters:

Weld Size		Depth of Prep'n	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)
in.	mm	in		Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max	
3/8	10	3/8	1	1	2	1	3	0.045	1.2	200	240	300	400	27	29	17.0	23.0	18.5
1/2	13	1/2	1	1	3	1	5	0.045	1.2	200	240	300	400	27	29	17.0	23.0	18.5
5/8	16	5/8	1	1	4	1	8	0.045	1.2	200	240	300	400	27	29	17.0	23.0	18.5
3/4	19	3/4	1	1	5	1	13	0.045	1.2	200	240	300	400	27	29	17.0	23.0	18.5

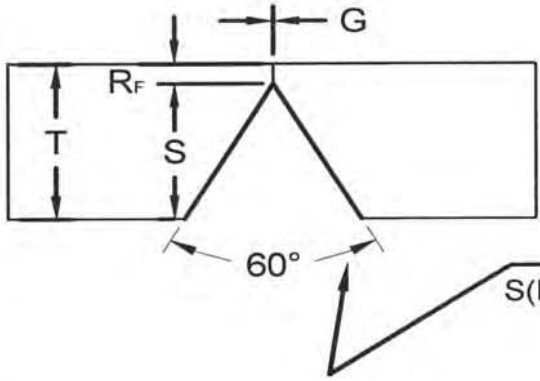
Revision Status:		CWB Approval:		Company's Approval:	
Date: 7/22/2008	Explanation: Per PQR P5744	CWB Accepted  Mar 03, 2009 Valid only if welding consumables are certified by the CWB			
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat input at calc'd average. Max. Heat Input to 46.7 kJ/in					
Prepared by: FORGERON ENGINEERING LIMITED		Tel: (902) 835-7225			

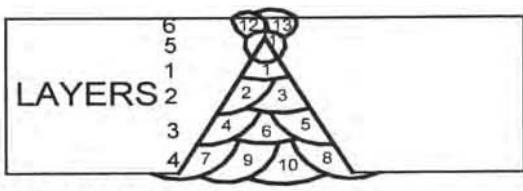
Company Name: Mosher Engineering				Wldg. Specification No: RTR-4			
Address: 1358 Queen Street				Reference WPQR:			
Halifax		Nova Scotia		B3J 2H5		Ref. Standards: CSA W47.1, W59 & AWS D1.1	

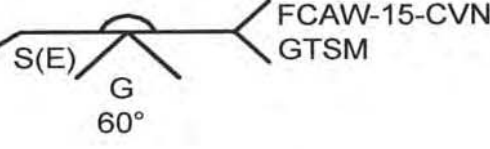
Material Information:

Position: Vertical Up	Welding Process: FCAW	Consumable: E491T-12MJ-H4
Base Mat'l: CAN G40.21 350WT Cat. 5 (27J @-40°C)	Mode of Transfer: Globular Transfer	Shielding Gas: 75% Ar 25% CO2
	Process Mode: Semi-Automatic	Gas Flow: 38 ft ³ /h
	Tungsten Type:	Tungsten Dia.: in

Cleaning: Wire brush and remove slag in between passes	PHT Temp: 15°C or 59 °F
	PWHT Temp: NA °F

Typical Joint Details:


Typical Pass & Layer Sequence:




FCAW-15-CVN
GTSM

Joint Configuration:		Joint Details:		Technique & Process Information:	
Joint Type: Butt		G = 0	Q (°) = 60	Electrical Stickout: 5/8 ± 1/8 in	
Weld Type: Complete Joint Penetration		Rf = 1/8		Nozzle Diameter: 5/8 in	
Backgouging: Backgouged to Sound Metal				Average Deposition Rate: 6.5 lbs/h	

Welding Parameters:

Weld Size in. mm	Depth of Prep'n in.	Side No.	Layer No.		Pass No.		Electrode Size		Current (Amps) DCRP		Wire Feed Speed (in/min)		Arc Volts (Volts)		Travel Speed (in/min)		Average Heat Input (kJ/in)						
			Min	Max	Min	Max	in.	mm	Min	Max	Min	Max	Min	Max	Min	Max							
3/8 9.5	1/4	1	1	-	2	1	-	3	0.045	1.2	155	-	175	175	-	225	24	-	27	21.0	-	28.0	15.4
		2	5	-	6	11	-	13	0.045	1.2	155	-	175	175	-	225	24	-	27	15.4	-	18.7	14.8
1/2 13	3/8	1	1	-	3	1	-	6	0.045	1.2	155	-	175	175	-	225	24	-	27	20.3	-	27.5	15.4
		2	5	-	6	11	-	13	0.045	1.2	155	-	175	175	-	225	24	-	27	15.4	-	18.7	17.5
5/8 16	1/2	1	1	-	3	1	-	6	0.045	1.2	155	-	175	175	-	225	24	-	27	19.0	-	25.7	15.4
		2	5	-	6	11	-	13	0.045	1.2	155	-	175	175	-	225	24	-	27	15.4	-	18.7	17.5
3/4 19	5/8	1	1	-	4	1	-	10	0.045	1.2	155	-	175	175	-	225	24	-	27	18.0	-	24.0	15.4
		2	5	-	6	11	-	13	0.045	1.2	155	-	175	175	-	225	24	-	27	15.4	-	18.7	17.5

Revision Status:		CWB Approval:		Company's Approval:	
Date:	Explanation:	 CWB Accepted Dec 04, 2008 Valid only if welding consumables are certified by the CWB			
7/22/2008	P5744				
NOTES: 1. Use stringer beads only. Restrict weld bead to ≤ 16 mm. 2. Weld Sizes represent effective weld throat thickness for qualified T range. 3. Target heat inputs at calc'd average. Max. Heat Input to 46.7 kJ/in 4. Tack weld parameters to be per main weld parameters 5. Backgouge as necessary to repair side 2.					

RTR FORM S-101, 1992
to CSA W47.1

RTR ENGINEERING WELDING PROCEDURE DATA SHEET

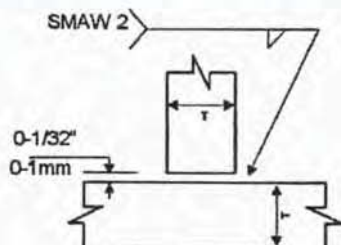
No.

SMAW-2

Date

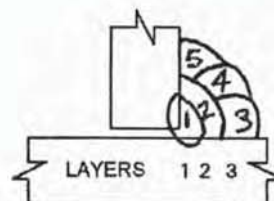
MARCH 28, 2002

Company Name and Complete Address	MOSHER ENGINEERING LIMITED		WPS No.	RTR-1(A)
	2089 Upper Water Street		Applicable Standard(s)	CSA W47.1, W59 & W48.1
	Halifax, Nova Scotia, B3J 2R7		Electrode Classification	E48018
Welding Process & Mode	☒ SMAW ☐ SAW ☐ GTAW (Tungsten) Type: _____ ☐ FCAW ☐ GMAW ☐ ESW ☐ SW Size: _____ ☒ Manual ☐ Semi-Automatic ☐ Machine ☐ Automatic		☒ Preheat Minimum as per CSA W59 ☐ Other	
Material Designation	Steel groups 1,2 & 3 of Table 11-1, W59 for type A (without color matching), for type T (without regard to impact values)		Welding Position	HORIZONTAL
			Interpass Temperature	Minimum As above Maximum 450 deg. F



Sketch Of Typical Joint Preparation

$$1/8" \leq T \leq 1 1/4"$$



Typical Pass and Layer Sequence

Groove Weld Complete Joint Penetration ☐ Back-gouged to sound metal ☐ Welded onto steel backing ☐ Other		Groove Weld Partial Joint Penetration ☐ Minimum as per CSA W59 ☐ Others		Joint Type as per CSA W59 ☐ Butt ☒ Tee ☐ Edge ☒ Lap ☐ Corner		Automatic or Semi-Automatic Electrical Stickout Shielding Gas cu.ft /hr. Flux				
☒ Fillet Weld ☐ Minimum as per CSA W59										
Material Thickness	ETT, or Fillet Size	Side No.	Layer Number	Pass Number	Electrode (in) Size (mm)	Current Polarity	Amperes	Wire Feed Speed (in/min)	Volts	Arc Travel Speed (in/min)
	1/8" 3mm		1	1	3/32 2.5	DCRP	75-95			
	3/16" 5mm		1	1	1/8 3.2	DCRP	110-140			
	1/4" 6mm		1	1	1/8 3.2	DCRP	110-140			
	5/16" 8mm		1-2	1-3	1/8 3.2	DCRP	110-140			
	OR		1-2	1-2	5/32 4.0	DCRP	160-200			
	3/8" 10mm		1-3	1-4*	5/32 4.0	DCRP	160-200			
	OR		1-2	1-3	3/16 5.0	DCRP	225-275			
	1/2" 12mm		1-3	1-5*	3/16 5.0	DCRP	225-275			

Revision Date	Explanation	CWB Approval	Engineer's Stamp
		Welding Procedure Data Sheet CWB Approved to CSA W47.1 APR 04 2002 Approval valid only when Welding Consumables certified by C.W.B. (CI.8.2.2.1, CSA W47.1)	
NOTES: *NUMBER OF PASSES MAY VARY BY +/- 1 PASS 3mm fillet can only be applied to 3mm thick sheets.			