

WPS NUMBER 105

PQR NUMBER 105A

QUALIFIED FOR

MATERIAL (TYPICAL): P1 to P1 (SA 105, SA 106, SA 516, etc.)

PROCESS: GMAW, FCAW, SMAW JOINT DESIGN: Groove & Fillet

POSITION: All DIAMETER: All

AWS CLASSIFICATION: ER70S-6, E70T-1, E7018, E7018-1

BASE METAL THICKNESS RANGE QUALIFIED:

P.W.H.T.: 4.8 to 50.8mm (3/16 to 2.0 in.)

**ALBERTA
LABOUR
BOILERS & PRESSURE VESSELS ACT
WELDING PROCEDURE**

Reg. No. WP 1312-2
Spec No. #105
Weld Process GMAW / SMAW / FCAW
Matl. Gr. P.No. 1 to P No. 1
Elec. Gr. F No. 6+4+6 A No. 1
Th. Qual. For 50.8mm Position 1G
..... PWHT

Yr. 88 Mo. 3 Day 3 Signed R. Roseberg
R. ROSEBERG, P. ENG.
WELDING SPECIALIST

Boilers Branch Registration

WELDING PROCEDURE SPECIFICATION

R.J.V. Gasfield Service Ltd., 4901 - Bruce Rd., Box 295, Vegreville, Alberta T0B 4L0

WELDING PROCEDURE SPECIFICATION NUMBER 105 DATE September 8, 1987

REVISIONS _____

SUPPORTING PQR NUMBERS(S) 105A

WELDING PROCESS(ES) GMAW, FCAW, SMAW TYPES Semi-Automatic, Manual, Semi-Auto.

JOINTS (QW-402)

Joint Design See attached sketches, figures 1 to 15

Backing Weld metal where applicable Other _____

BASE METALS (QW-403)

P-Number 1 to P-Number 1

Thickness Range: Groove 4.8 to 50.8mm (3/16 to 2.0 in.)

Fillet All

Pipe Diameter Ranges: Groove All

Fillet All

Other _____

FILLER METALS (QW-404)

Specification No. (SFA) 5.18 5.20 5.1

AWS No. (Class) ER70S-6 E70T-1 E7018, E7018-1, E7018-A1

F-No. F6 F6 F4

A-No. 1 1 1

Size See table next page

Deposited Weld Metal Thickness Range: No single pass with over $\frac{1}{2}$ " (12.7mm) of deposited metal

Groove GMAW: 4.4mm; SMAW: 16mm; FCAW: 48mm

Fillet All

Electrode - Flux (Class) _____

Other _____

POSITION (QW-405)

Position of Groove 1G Weld Progression _____

REHEAT (QW-406)

Preheat Temp. Min. See attached section Interpass Temp. Max. Weld build up

Preheat Maintenance _____

POSTWELD HEAT TREATMENT (QW-407)

Temperature See attached section Time Range

GAS (QW-408)

Shielding Gas(es) Carbon DioxideFlow Rate 10 - 25 litres/min. (20 - 50 cfh)Other 99.9%

ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity ReverseAmps See table below Volts Tungsten Electrode Size and Type N/AMode of Metal Transfer GMAW: Short circuit; FCAW: GlobularElectrode Wire Feed Speed Range Other

TECHNIQUE (QW-410)

String or Weave Both Travel Speed (Range) Initial and Interpass Cleaning Brushing, chipping, grindingMethod of Back Gouging Air carbon arc when requiredMultiple or Single Pass (per side) MultipleMultiple or Single Electrodes SingleOther

WELD LAYER	PROCESS	FILLER METAL		CURRENT		VOLTAGE RANGE	T/S RANGE mm/min. (ipm)	OTHER
		CLASS.	DIAMETER mm. (in.)	TYPE POLAR.	AMP RANGE			
	GMAW	ER70S-X	0.9 (.035)	DCRP	90-150	18-22	100-600 (5-25)	Size of electrode, number of passes, amperage voltage and travel speed will differ with thickness and joint configuration.
	SMAW	E7018 E7018-1 E7018-A1	3.2 (1/8)	DCRP	90-160	20-25	38-350 (1.5-14)	
	SMAW	As above	4.0 (5/32)	DCRP	125-200	21-26	100-400 (4-16)	
	SMAW	As above	5.0 (5/16)	DCRP	200-310	21-27	125-400 (5-16)	
	SMAW	As above	6.0 (1/4)	DCRP	280-380	22-30	175-350 (7-14)	
	FCAW	E70T-1	1.6 (1/16)	DCRP	200-300	24-28		
	FCAW	As above	2.0 (5/64)	DCRP	250-400	24-28		
	FCAW	As above	2.4 (3/32)	DCRP	350-500	26-32		

GROOVE DESIGN

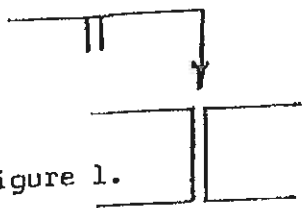


Figure 1.

Single Square Butt

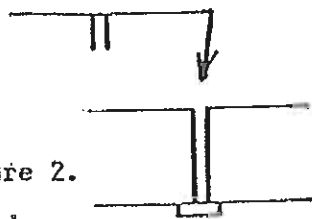


Figure 2.

Single Square Butt with Backing Strip

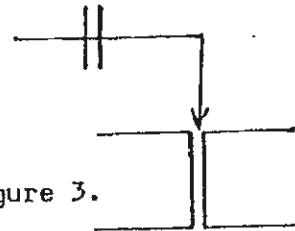


Figure 3.

Double Square Butt

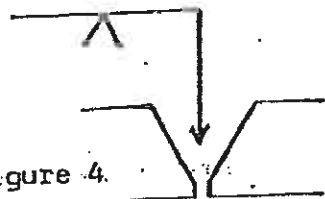


Figure 4.

Single Vee Butt

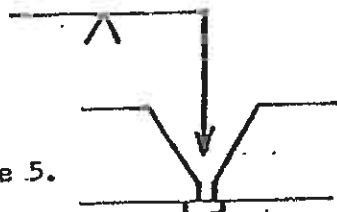


Figure 5.

Single Vee Butt With Backing Strip

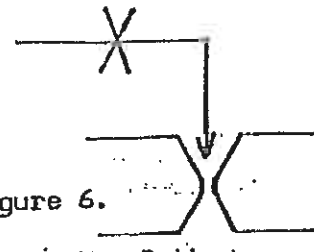


Figure 6.

Double Vee Butt

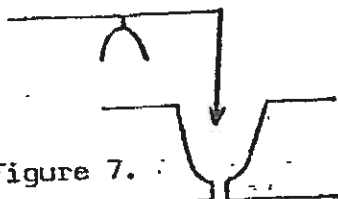


Figure 7.

Single U Butt

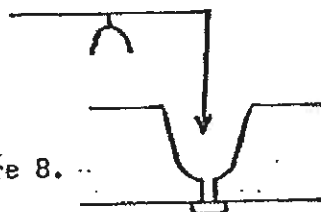


Figure 8.

Single U Butt With Backing Strip

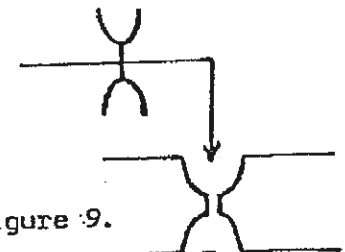


Figure 9.

Double U Butt

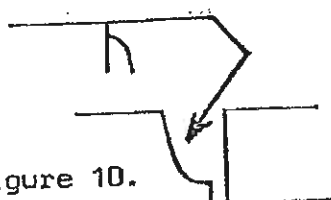


Figure 10.

Single J Butt

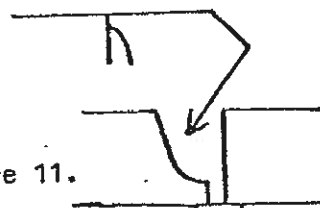


Figure 11.

Single J Butt With Backing Strip

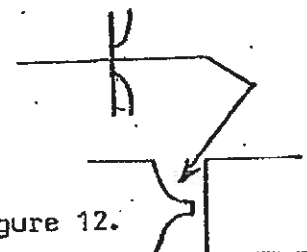


Figure 12.

Double J Butt

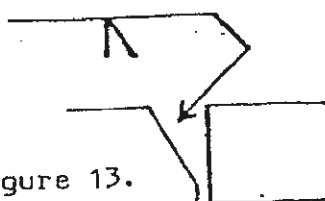


Figure 13.

Single Bevel Butt

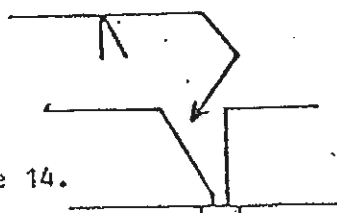


Figure 14.

Single Bevel Butt With Backing Strip

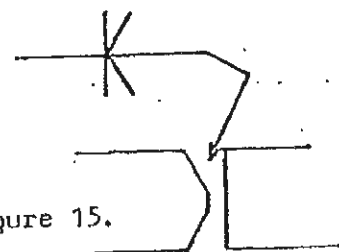


Figure 15.

Double Bevel Butt

PREHEAT

1. Welds joining pressure parts or attachments shall be preheated to not less than the minimum preheat temperature stated in 6.
2. The preheat temperature shall be maintained until welding is completed.
3. If welding is interrupted, the weld joint and adjacent areas shall be re-heated to the minimum preheat temperature specified in 6.
4. The preheated area shall not be less than 50.8mm (2.0 in.) wide on each side of the weld.
5. Preheat temperatures shall be checked by the welder or inspector, using temperature indicating crayons or other reputable methods.
6. Minimum preheating temperatures:

PRESSURE VESSELS

THICKNESS

MINIMUM PREHEATING TEMPERATURES

0 to 31.75mm (0 to 1 1/4 in.)

24°C (75°F)

Over 31.75 to 203mm (1 1/4 to 8 in.)

80°C (175°F)

PRESSURE PIPING

THICKNESS

MINIMUM SPECIFIED TENSILE STRENGTH, BASE METAL MPa (Ksi)

MINIMUM PREHEATING TEMPERATURE

Less than 25.4mm (1.0 in.)

≤490 (71)

24°C (75°F)

Greater than 25.4mm (1.0 in.)

A11

80°C (175°F)

A11

>490 (71)

80°C (175°F)

POSTWELD HEAT TREATMENT

P-No.1 Groups 1, 2 & 3

Pressure Vessels in accordance with ASME BPVC Section VIII, Division I

1. All postweld heat treatment shall be done in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, Division I, UW-40 & UCS-56, 1986 edition.
2. Postweld heat treatment temperatures and minimum holding times are as follows:

NOMINAL THICKNESS	HEAT TREATMENT TEMPERATURE		HOLDING TIME
	°C	(°F)	
Up to 50.8 mm (2.0 in.)	595	(1100) minimum	1 hr./25.4 mm (inch), 15 minutes minimum
Over 50.8 mm (2.0 in.)	595	(1100) minimum	2 hours plus 15 minutes for each additional 25.4 mm (inch) over 50.8 mm (2.0 in.)

Chemical Plant and Petroleum Refinery Piping in accordance with ANSI B31.3

1. All postweld heat treatment shall be done in accordance with Table 331.1.1 of ANSI B31.3-1984.
2. Postweld heat treatment temperatures and minimum holding times as follows:

NOMINAL THICKNESS	HEAT TREATMENT TEMPERATURE		HOLDING TIME
	°C	(°F)	
All	595 - 650	(1100 - 1200)	1 hour/25.4 mm (inch), 1 hour minimum

Power Piping in accordance with ANSI B31.1

1. All postweld heat treatments shall be done in accordance with Table 132 of ANSI B31.1-1983 edition.
2. Postweld heat treatment temperatures and minimum holding times are as follows:

NOMINAL THICKNESS	HEAT TREATMENT TEMPERATURE		HOLDING TIME
	°C	(°F)	
Up to 50.8 mm (2.0 in.)	595 - 650	(1100 - 1200)	1 hr./25 mm (inch), 15 minutes minimum
Over 50.8 mm (2.0 in.)	595 - 650	(1100 - 1200)	2 hr. plus 15 min. for each additional 25 mm (inch) over 50.8 mm (2.0 in.)

PROCEDURE QUALIFICATION RECORD

R.J.V. Gasfield Service Ltd., Box 295, 4901 - Bruce Rd., Vegreville, Alberta T0B 4L0

PROCEDURE QUALIFICATION RECORD NUMBER 105-A DATE August 3, 1987

WELDING PROCEDURE SPECIFICATION NUMBER 105

WELDING PROCESS(ES) GMAW, SMAW, FCAW TYPES Semi-automatic, Manual, Semi-automatic

JOINTS (QW-402)

Type Butt: single vee

BASE METALS (QW-403)

Material Spec. SA 516 Type or Grade Grade 70N

P-No. 1 Grp. 2 to P-No. 1 Grp. 2 Thickness 38.1mm (1.50 in.)

Diameter _____ Other _____

FILLER METALS (QW-404)

SFA Specification 5.18 5.1 5.20

AWS Classification ER70S-6 E7018 E70T-1

Filler Metal F-No. 6 4 6

Weld Metal Analysis A-No. 1 1 1

Size of Filler Metal See sketch next page

Deposited Weld Metal Thickness GMAW: 4mm SMAW: 8mm FCAW: 24mm

Other No single pass with over 1/2" (12.7mm) of deposited metal

POSITION (QW-405)

Position of Groove 1G Weld Progression _____

PREHEAT (QW-406)

Preheat Temp. 80°C (175°F) Interpass Temp. Weld build up

POSTWELD HEAT TREATMENT (QW-407)

Temperature 607°C (1125°F) Time 90 minutes

GAS (QW-408)

Type of Gas(es) Carbon Dioxide Composition of Mixtures Welding grade

Other Flow Rate: 18 litres/min. (35 cfh)

ELECTRICAL CHARACTERISTICS (QW-409)

Current Direct Polarity Reverse

Amps See sketch next page Volts _____

Other _____

TECHNIQUE (QW-410)

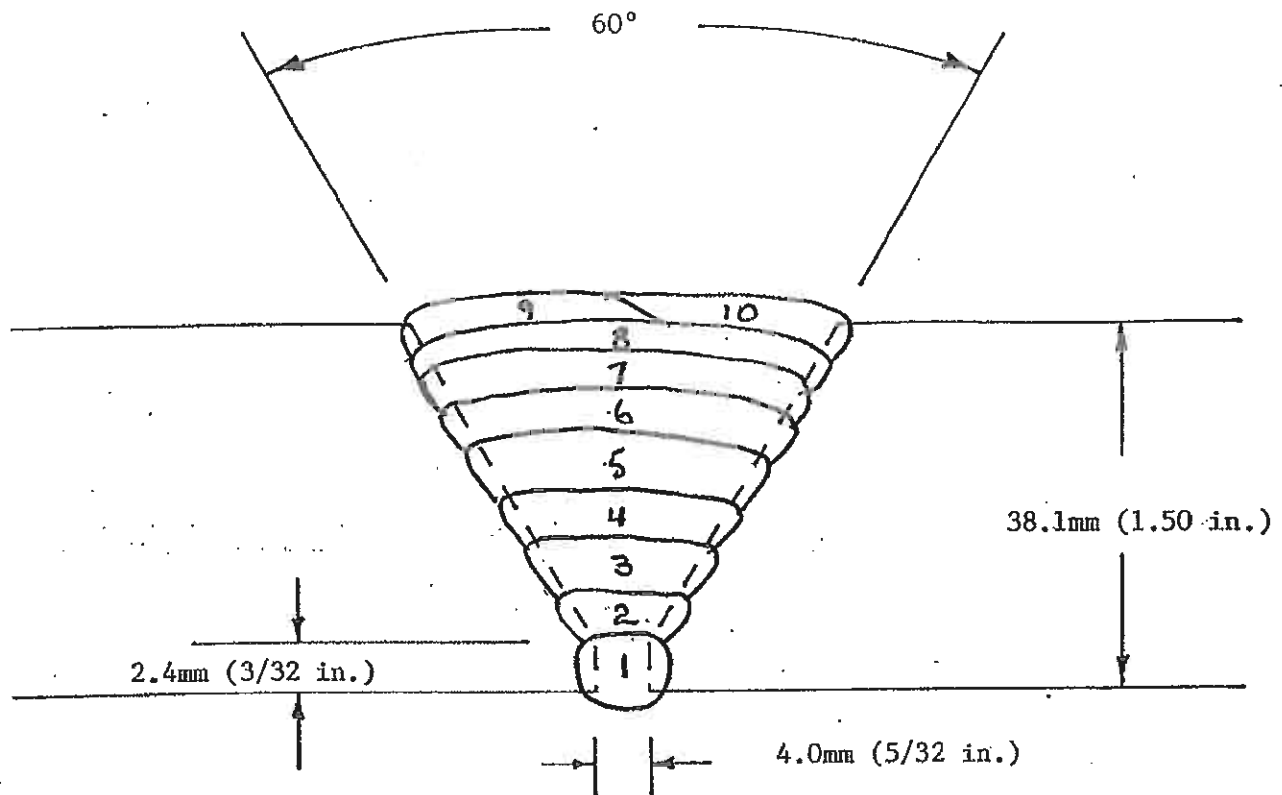
Travel Speed _____

Multipass or Single Pass (per side) Multipass

Single or Multiple Electrodes Single

Backing or Weave Bead Both

Other _____



Pass #1: .89mm (0.035 in.), ER70S-6, DCRP, 95-105 amps, 20 volts, short circuiting transfer.

Pass #2: .89mm (0.035 in.), ER70S-6, DCRP, 190-195 amps, 30 volts, globular transfer.

Pass #3: 6.0mm (1/4 in.), E7018, DCRP, 340-380 amps, 24-28 volts.

Pass #4 - #8: 2.4mm (3/32 in.), E70T-1, DCRP, 400-425 amps, 29-30 volts.

Pass #9 & #10: 6.0mm (1/4 in.), E7018, DCRP, 340-380 amps, 24-28 volts.

TENSILE TEST

Specimen Number	Width mm (in.)	Thick. mm (in.)	Area sq.mm (sq.in.)	Ultimate Load N (lbs.)	Ultimate Stress MPa (psi)	Character & Location of Failure
T-1	19.65	37.0	727	380,600	524	Partial cup & cone
	(.774)	(1.46)	(1.13)	(85,600)	(75,900)	Weld metal
T-2	19.2	36.2	695	364,700	525	Partial cup & cone
	(.756)	(1.43)	(1.08)	(82,100)	(76,100)	Parent metal

GUIDED BEND TEST

Type and Figure Number	Result	Type and Figure Number	Result
Side S-1	Pass	Side S-3	Pass
Side S-2	Pass	Side S-4	Pass

Welder's Name Ernie BullockCertificate Number W-9190Tests Conducted by Ludwig's Welding Consulting Ltd.Per: V. Lukey, C.E.T.Laboratory Test Number LWC-9703-816E

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

Signed R.J.V. Gasfield Service Ltd.Date September 24, 1987By 