



TOPCOR BELCO

P.O. BOX 1019

PRAIRIEVILLE, LA. 70769

Welding Procedure Specification (WPS)

WPS No.: TopCorBelco-106-GM Date: 4/18/2008 Rev.: 0 Page: 1 of 5

By: _____ Date Signed: 4/18/2008

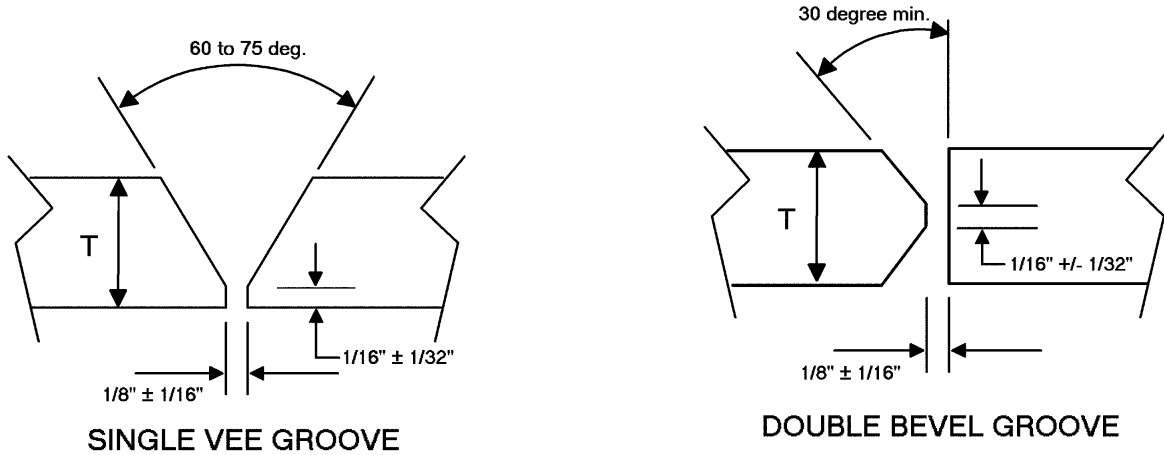
Supporting PQR's: TopCorBelco-106-GM/A

Welding Process(es) / Type(s): GMAW / Automatic

Joints (QW-402)

Joint Design: Groove and fillet welds

Backing: With or without backing Backing Material: Weld metal or P1 base metal.



Fillet Welds: All fillet sizes on all base metal thicknesses and all diameters.

Retainers: None

No nonmetallic retainers allowed. No single pass deposit should exceed 5/16" and shall not exceed 1/2".

WELD JOINT DESCRIPTIONS SHOWN ARE NOT INCLUSIVE OF ALL THOSE FOUND ON A JOB. WELD JOINT DESIGN REFERENCE IN AN ENGINEERING SPECIFICATION OR A DESIGN DRAWING SHALL TAKE PRECEDENCE OVER WELD JOINTS SHOWN IN THIS WPS.

Base Metals (QW-403)

P-No.: 1 Group No.: 1 & 2 Thickness Range (in.): 0.1875 to 1.5000

to P-No.: 1 Group No.: 1 & 2

Typical Materials: A53-X, A-105, A-106-X, A-192, A-36, A-515-XX, & B31.3 listed Materials.

Minimum preheat must be maintained during thermal cutting, tacking, and welding operations.

Welds shall be cleaned between each pass. When completed, remove all slag and projections.

Filler Metals (QW-404)

Spec. No. (SFA): 5.18

AWS No. (Class): ER70S-6

F No.: 6 A No.: (verify chemistry)

Weld Metal Thickness Range: 0.187 to 1.5000 in. No Pass Greater Than 1/2" Allowed

Flux Type: N/A

Flux Trade Name: N/A

Consumable Insert: N/A

Other: _____

Product Form: Bare (Solid)

Trade Name: Weld Cote Metals

Supplemental Filler Metal: No supplementals or alloying agents.

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Positions (QW-405) Position of Joint: <u>All Positions</u> Weld Progression: <u>Vertical up and down</u> Root downward and balance upward.	Postweld Heat Treatment (QW-407) Type: <u>No PWHT will be performed</u> Temperature Range: <u>None</u> °F Time Range: <u>None</u>
Preheat (QW-406) Preheat Temp. Min.: <u>50</u> °F Interpass Temp. Max.: <u>500</u> °F Preheat Maintenance: <u>None</u> Below 50 F. or moisture present, preheat to hand warm.	Gas (QW-408) Gas Composition / Flow Rate Shielding: <u>75% Argon, 25% CO2 / 27-36 CFH</u> Trailing: <u>None</u> Backing: <u>None</u>
Electrical Characteristics (QW-409) Current Type / Polarity: <u>DCEP (reverse)</u> Tungsten Electrode Type and Size: <u>N/A</u> Mode of Metal Transfer for GMAW: <u>Short-circuiting arc</u> Max. Heat Input (J/in): <u>None</u>	
Technique (QW-410) String or Weave Bead: <u>Stringer and weave bead</u> Orifice or Gas Cup Size: <u>3/8" to 5/8"</u> Initial and Interpass Cleaning: <u>With wire brush clean 1 inch (25 mm) on both sides of weld joint.</u> Method of Back Gouging: <u>When required, grind until all defects are removed.</u> Oscillation: <u>.035" wire 1/2" max. & .045" 3/4" max weave</u> Contact Tube to Work Distance: <u>3/8" > 1/2"</u> Single or Multiple Passes (per side): <u>Multipass</u> Single or Multiple Electrodes: <u>Single electrode</u> Peening: <u>None</u> Electrode Spacing: <u>N/A</u>	

Process Welding Parameters

Weld Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)	Wire Feed Speed Range
		Class	Diameter (in.)	Type / Polarity	Amperage Range			
Any	GMAW	ER70S-6	0.035	DCEP (reverse)	80-145	17-22	4-7	126
Any	GMAW	ER70S-6	0.045	DCEP (reverse)	110-145	18-23	4-10	126
Any	GMAW	ER70S-6	1/16	DCEP (reverse)	165-300	20-25	5-12	126

Optional Notes

General Notes:

- 1) One inch each side of the weld area (ID & OD) shall be free of heavy mill scale, heavy rust deposits oils or other deleterious materials.
- 2) All deep curf gouges on torch bevels shall be blended or where required repaired prior to fit up.
- 3) Sufficient preheat shall be used to remove moisture and prevent cracking on highly restrained joints. The minimum preheat shall be in accordance with the fabrication code unless superceded by the client specification.
- 4) Tack welds which are to be incorporated into the final weld shall be:

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- (a) Subject to the same quality as the final weld.
- (b) Cleaning shall be the same as addressed in interpass.
- (c) Tacks will be of sufficient size and cross sectional area to retain the appropriate fit up and alignment.
- (d) After clean up of the tacks, they shall be visually examined for cracking or other rejectable indications.
- 5) After completing clean up of the tacks the welder shall visually check for cracking prior to depositing the root pass.

6) Cleaning:

Initial- weld joint edges shall be uniform and free from fins, notches, tears, cracks and other visual defects. The welding surfaces shall also be free from moisture, loose or thick scale, heavy oxides, grease or other foreign deleterious materials. Plasma cut surfaces shall be ground to virgin metal prior to welding. All gouges in the bevel shall be blended or where required repaired prior to fit up.

Interpass- Before welding over previously deposited weld metal all gas residues, glass beads and visible porosity shall be removed. Any unacceptable bead profile shall be ground to accommodate a defect free weld. The weld and adjacent base metal shall be brushed clean and visually examined.

Final-All excessive gas residue shall be removed from all completed welds. The weld and the adjacent base metal shall be cleaned by brushing or other suitable means. Tightly adhering weld spatter remaining after the cleaning operation shall be removed by other suitable means as required by contact specifications or as required to perform nondestructive examination or prevent masking of indications.

7) The completed weld shall blend smoothly into the surface plain of the parent metal.

8) Excessive weld reinforcement and excessive weave width shall be avoided. Reinforcement shall not exceed the allowable limits of the fabrication code.

9) The final weld shall be cleaned based on NDE inspection method and contract requirements. The final weld shall be cleared of slag and heavy weld spatter.

10) All rolls of filler wire shall be tagged as to their type and stored in a dry environment. The wire should be protected from excessive grinding contaminates both on the feeder and when not in use.

11) Other acceptable filler metal with engineering and written authorization by the client are ER70S-3 or ER70S-6

12) Weld Backing strips are not allowed with out the written approval of the client. Specific client not allowing backing strips. Written approval must be appended to welding procedure or shop traveler.

13) Amperage, voltage and travel are non-essential variable and are projected ranges that should be followed closely.

In Process Repairs:

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Significant defects that appear on the surface on any bead of weld deposit shall be removed by chipping, gouging and or grinding and re-welded before depositing the next successive weld layer.

Procedures:

Defective or unsound welds or base metal shall be corrected by either removal or replacement of the entire area or as follows:

1. Overlap Or Excessive Convexity- Reduce by removal of excess metal.
2. Excess Concavity Of Weld Or Crater, Undersized Welds Or Undercut-Clean and deposit additional weld metal.
3. Excessive Weld Porosity, Slag-Inclusions, Incomplete Fusion Or Penetration- Remove defective portion and re-weld. The cavity created by excavation (groove) shall have approximately a 15° bevel all around and a root radius of 1/8" minimum. Use caution NOT to nick base metal outside of groove.
4. Cracks In Weld Or Base Metal- Remove the crack to sound metal and at least 50% of the crack length, or two (2) inches (whichever is least) beyond each end of the crack and re-weld, observing all provisions of this Procedure. The minimum length of the weld repair groove should not be less than two (2) inches. Minimize removal of base metal during repair cavity excavation. Minimize heat input when excavating repair cavity with Arc-Air process. Excess heat may cause the crack to propagate.
5. Contour of repair welds shall blend smoothly into adjacent welds and base metal.
6. Slugging of welds is not permitted.
7. Improperly fitted parts should be cut apart and refitted at the discretion of supervision.
8. Minor distortion caused by welding may be corrected by mechanical means, as approved by Engineering.

Production Requirements

Workmanship, welding quality and inspection shall be as required by the fabrication code or Engineering specifications when the code criterion is superseded.

Preheat Requirements Per Codes for P1 Materials

ASME B31.1 As Welded Condition

- 1) 175°F (79°C) for material which has both a specified maximum carbon content in excess of 0.30% and a thickness at the joint in excess of 1"(25mm).
- 2) 50°F (10°C) for all other materials in this P number.

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ASME B31.3 As Welded Condition

- 1) 175°F (79°C) for material which has both a specified minimum tensile strength greater than 71ksi
- 2) 175°F (79°C) for material which has a thickness at the joint in excess of 1"(25mm) regardless of tensile strength.
- 3) 50°F (10°C) for all other materials in this P number less than 1" thick and equal to or less than 71ksi.

ASME Section I & ASME Section VIII

General requirements per Appendix A100 and Appendix R

- 1) 175°F (79°C) for material which has both a specified maximum carbon content in excess of 0.30% and a thickness at the joint in excess of 1"(25mm).
- 2) 50°F (10°C) for all other materials in this P number.

Specific Requirements to section I Table PW-39 & section VIII Table UCS-56

- 1) 200°F (93°C) for fillet welds attaching slip on flanges or socket welds to a pressure part with a size of ½" or less.
- 2) 200°F (93°C) for fillet welds attaching a non pressure part to a pressure part when the pressure part exceeds ¾".
- 3) 200°F (93°C) for seal welds on tubes or handhold and inspection plugs with a throat thickness 3/8" or less when the thickness of either part exceeds ¾".
- 4) 200°F (93°C) for tube to tubesheet welds in firetube boilers where the depth of penetration exceeds 3/8".
- 5) 200°F (93°C) for a combination of groove and fillet welds attaching a non pressure part to a pressure part when the thickness of the weld is less than ½" and the pressure part exceeds ¾".
- 6) 50°F (10°C) for all other materials in this P number.

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Additional Welding Parameters

Layer(s) and/or Pass(es)	Process	Filler Metal		Current		Voltage Range	Travel Speed Range (in/min)
		AWS Classification	Size (in.)	Type / Polarity	Amperage Range		
Root	GMAW	ER70S-6	0.035	DCEP (reverse)	100	17	6.5
Hot	GMAW	ER70S-6	0.035	DCEP (reverse)	100	17	4
3 & 4	GMAW	ER70S-6	0.035	DCEP (reverse)	145	19.5	5
5-7	GMAW	ER70S-6	0.035	DCEP (reverse)	145	19.5	6
8	GMAW	ER70S-6	0.035	DCEP (reverse)	145	19.5	6.5

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Optional Notes (Continued)

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Tensile Test (QW-150)

Specimen No.	Width (in.)	Thickness (in.)	Area (in ²)	Ultimate Total Load (lb)	Ultimate Stress (PSI)	Failure Type and Location
1	0.752	0.800	0.602	43350	72000	Ductile - BM
2	0.753	0.802	0.604	44000	72800	Ductile - BM

Guided Bend Test (QW-160)

Figure Number and Type	Result	Figure Number and Type	Result
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
QW-462.2 Side bend	Acceptable	QW-462.2 Side bend	Acceptable
None		None	

Macro-Examination Test: NA

Visual Examination: Satisfactory

Liquid Penetration Test: NA

Welder's Name: Carpenter, Barry ID: BC2 Stamp: BC2

PQR was done and welding of coupon was witnessed by: TOPCOR BELCO

Tests Conducted By: BC's Inspection and Fabrication Test ID.: 13401

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 Code.

Prepared By: _____ 4/18/2008 QA/QC Manager
RONNIE SARVIS Date