

**G&G Fabrication & Machining**  
2605 S. HWY 66  
Claremore, OK 74019

**AWS D1.1 Welding Procedure Specification (WPS)**

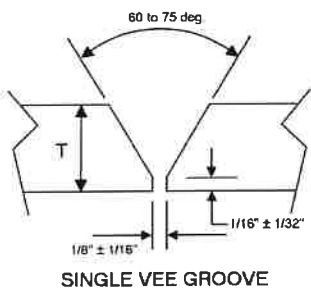
WPS No. GG-FCAW-1 Date 3/6/2020 Rev. No. 1 Date 4/18/2022

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Supporting PQR(s): GG-FCAW-1a, GG-FCAW-1b, GG-FCAW-1c

Approved By: [Signature] Date 4-18-22

Welding Process(es)/Type(s): FCAW / Semiautomatic

<p><b>Joint Design Used</b> Weld Type: <u>CJP Groove, fillet, and plug welds</u> Joint Type: <u>Butt joint</u> Double Welded: <u>No</u> Backing: <u>Yes</u> Material: <u>Back welded.</u> Root Opening: <u>0-1/16 in.</u> Root Face: <u>0 - 1/8"</u> Groove Angle: <u>60°-70°</u> Radius: <u>N/A</u> Back Gouging: <u>Yes</u> Method: <u>Gouge/grind to sound WM</u></p> <p><b>Base Metals</b> Base Metal: <u>ASTM A 36</u> Thickness: Groove <u>1/8 - 1.500 in.</u> Thickness: Fillet <u>1/8 in. min.</u> Pipe Diameter: <u>24 in. min.</u> Thickness: Plug/Slot <u>1/8 in. min.</u></p> <p><b>Filler Metals</b> AWS Specification: <u>5.20</u> AWS Classification: <u>E71T-1M</u> Trade Name: <u>Frontiarc-711</u></p> <p><b>Shielding</b> Gas: <u>75% Argon, 25% CO2</u> Flow Rate: <u>36 - 48 CFH</u> Gas Cup Size: <u>5/8"</u> Electrode-Flux (Class): <u>N/A</u> Flux Trade Name: <u>N/A</u></p> <p><b>Preheat</b> Preheat Temperature, Min.: <u>69°F</u> Interpass Temperature, Min.: <u>69°F</u> Max.: <u>500°F</u></p>	<p><b>Joint Detail</b></p>  <p align="center"><b>SINGLE VEE GROOVE</b></p> <p><b>Position</b> Weld Position: Fillet <u>All Positions</u> Weld Position: Groove <u>All Positions</u> Vertical Progression: <u>Uphill</u></p> <p><b>Electrical Characteristics</b> Power Source: <u>N/A</u> Output: <u>Constant Voltage</u> Current / Polarity: <u>DCEP (reverse)</u> Transfer Mode: <u>Globular arc</u> Tungsten Electrode: Type <u>N/A</u> Tungsten Electrode: Size <u>N/A</u></p> <p><b>Technique</b> Stringer or Weave Bead: <u>Stringer bead</u> Multi/Single Pass: <u>Single and multipass</u> Number of Electrodes: <u>1</u> Electrode Spacing: Longitudinal: <u>N/A</u> Lateral: <u>N/A</u> Angle: <u>N/A</u> Contact Tube to Work Distance: <u>3/8"-1"</u> Peening: <u>N/A</u> Interpass Cleaning: <u>Power wire wheel or brush</u></p> <p><b>Postweld Heat Treatment</b> Temperature: <u>None</u> Time (hr.): <u>None</u></p>
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**Welding Procedure**

Pass or Weld Layer(s)	Process	Filler Metal		Current		Volts	Travel Speed (in/min)
		AWS Classification	Size (in.)	Type & Polarity	Amps		
Root F&H	FCAW	E71T-1M	0.045	DCEP (reverse)	194 - 195	22.5-25.0	9 - 15
Fill F&H	FCAW	E71T-1M	0.045	DCEP (reverse)	189 - 236	22.5-25.5	9 - 15
Cap F&H	FCAW	E71T-1M	0.045	DCEP (reverse)	189 - 236	22.5-25.5	9 - 15
Root Vert	FCAW	E71T-1M	0.045	DCEP (reverse)	133 - 159	21.5-24.5	7 - 11
Fill Vert	FCAW	E71T-1M	0.045	DCEP (reverse)	135 - 159	21.5-24.5	7 - 11
Cap Vert	FCAW	E71T-1M	0.045	DCEP (reverse)	133 - 159	21.5-24.5	7 - 11
Root OH	FCAW	E71T-1M	0.045	DCEP (reverse)	138 - 165	21.5-24.5	7.5 - 12.5
Fill OH	FCAW	E71T-1M	0.045	DCEP (reverse)	138 - 165	21.5-24.5	7.5 - 12.5
Cap OH	FCAW	E71T-1M	0.045	DCEP (reverse)	138 - 165	21.5-24.5	7.5 - 12.5

**Rev. 1 4/18/2022: Added PQRs# GG-FCAW-3G & 4G to allow welding in all positions,**

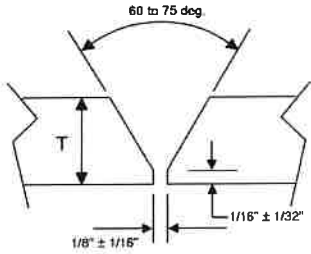
**G&G Fabrication & Machining**

**AWS D1.1 Procedure Qualification Record (PQR)**

PQR No. GG-FCAW-1a      Date 3/5/2020      WPS No. GG-FCAW-1

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Welding Process: FCAW / Semiautomatic

<p><b>Joint Design Used</b>                  Weld Type: <u>CJP Groove weld</u>                  Groove Type: <u>Single-V groove</u>                  Double Welded: <u>No</u>                  Backing: <u>Yes</u>      Material: <u>Back welded.</u>                  Root Opening: <u>1/16 in.</u>      Root Face: <u>1/16in.</u>                  Groove Angle: <u>60°</u>      Radius: <u>N/A</u>                  Back Gouging: <u>Yes</u>      Method: <u>Grind to sound weld metal.</u></p> <p><b>Base Metals</b>                  Base Metal: <u>ASTM A 36</u>                  Thickness: <u>0.750 in.</u>                  Pipe Diameter: <u>N/A</u></p> <p><b>Filler Metals</b>                  AWS Specification: <u>5.20</u>                  AWS Classification: <u>E71T-1M</u>                  Trade Name: <u>Frontiarc-711</u></p> <p><b>Shielding</b>                  Gas: <u>75% Argon, 25% CO2</u>                  Flow Rate: <u>40 CFH</u>                  Gas Cup Size: <u>5/8"</u>                  Electrode-Flux (Class): <u>N/A</u>                  Flux Trade Name: <u>N/A</u></p> <p><b>Preheat</b>                  Preheat Temperature, Min.: <u>70°F</u>                  Interpass Temperature, Min.: <u>70°F</u>      Max.: <u>400°F</u></p>	<p><b>Joint Detail</b></p>  <p align="center"><b>SINGLE VEE GROOVE</b></p> <p><b>Position</b>                  Weld Position: <u>2G - Horizontal</u>                  Vertical Progression: <u>N/A</u></p> <p><b>Electrical Characteristics</b>                  Power Source: <u>N/A</u>                  Output: <u>Constant Voltage</u>                  Current / Polarity: <u>DCEP (reverse)</u>                  Transfer Mode: <u>Globular arc</u>                  Tungsten Electrode: Type <u>N/A</u>                  Tungsten Electrode: Size <u>N/A</u></p> <p><b>Technique</b>                  Stringer or Weave Bead: <u>Stringer bead</u>                  Multi/Single Pass: <u>Single and multipass</u>                  Number of Electrodes: <u>1</u>                  Electrode Spacing: Longitudinal: <u>N/A</u>                                                   Lateral: <u>N/A</u>      Angle: <u>N/A</u>                  Contact Tube to Work Distance: <u>1/2-3/4"</u>                  Peening: <u>N/A</u>                  Interpass Cleaning: <u>Power wire wheel or brush</u></p> <p><b>Postweld Heat Treatment</b>                  Temperature: <u>None</u>                  Time (hr.): <u>None</u></p>
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**Welding Procedure**

Pass or Weld Layer(s)	Process	Filler Metal		Current		Volts	Travel Speed (in/min)
		AWS Classification	Size (in.)	Type & Polarity	Amps		
Root	FCAW	E71T-1M	0.045	DCEP (reverse)	215	23.8	12
Fill	FCAW	E71T-1M	0.045	DCEP (reverse)	210	24.1	12
Cap	FCAW	E71T-1M	0.045	DCEP (reverse)	210	24.1	12

**G&G Fabrication & Machining**

**AWS D1.1 Procedure Qualification Record (PQR)  
Test Results**

PQR No. GG-FCAW-1a

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**Tensile Test**

Specimen No.	Width (in.)	Thickness (in.)	Area (in <sup>2</sup> )	Ultimate Tensile Load (lb)	Ultimate Unit Stress (PSI)	Character of Failure and Location
Flat 1	0.758	0.626	0.4745	38038	80164	Ductile - BM
Flat 2	0.756	0.644	0.4869	38726	79536	Ductile - BM

**Guided Bend Test**

Specimen No.	Type of Bend	Result	Remarks
1	Side Bend 2G	Satisfactory	
2	Side Bend 2G	Satisfactory	
3	Side Bend 2G	Satisfactory	
4	Side Bend 2G	Satisfactory	

**Visual Inspection**

Appearance: Satisfactory      Undercut: None      Piping Porosity: None  
 Concavity: None      Inspected By: Gerit Smith      Date: 3/5/2020

**Radiographic - Ultrasonic Examination**

RT Report No.: 030420-1      Result: Satisfactory      UT Report No.: N/A      Result: N/A

Welder's Name: Moore, James      I.D.: \_\_\_\_\_      Stamp No.: R

Test conducted by: American Piping Inspection, Inc.      Test No.: 20030033

Welding of coupon was witnessed by: G&G Fabrication & Machining, Inc.

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded and tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M Structural Welding Code - Steel.

Approved By:       4-18-22  
 Date

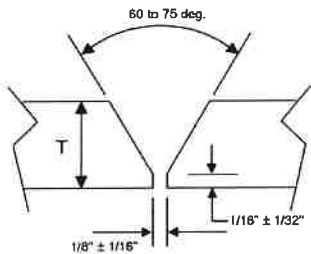
**G&G Fabrication & Machining**

**AWS D1.1 Procedure Qualification Record (PQR)**

PQR No. GG-FCAW-1b      Date 4/18/2022      WPS No. GG-FCAW-1

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Welding Process: FCAW / Semiautomatic

<p><b>Joint Design Used</b>                  Weld Type: <u>CJP Groove weld</u>                  Groove Type: <u>Single-V groove</u>                  Double Welded: <u>No</u>                  Backing: <u>Yes</u>      Material: <u>Back welded.</u>                  Root Opening: <u>1/16 in.</u>      Root Face: <u>1/16in.</u>                  Groove Angle: <u>60°</u>      Radius: <u>N/A</u>                  Back Gouging: <u>Yes</u>      Method: <u>Grind to sound weld metal.</u></p> <p><b>Base Metals</b>                  Base Metal: <u>ASTM A516-70</u>                  Thickness: <u>0.750 in.</u>                  Pipe Diameter: <u>N/A</u></p> <p><b>Filler Metals</b>                  AWS Specification: <u>5.20</u>                  AWS Classification: <u>E71T-1M</u>                  Trade Name: <u>Frontiarc-711</u></p> <p><b>Shielding</b>                  Gas: <u>75% Argon, 25% CO2</u>                  Flow Rate: <u>40 CFH</u>                  Gas Cup Size: <u>5/8"</u>                  Electrode-Flux (Class): <u>N/A</u>                  Flux Trade Name: <u>N/A</u></p> <p><b>Preheat</b>                  Preheat Temperature, Min.: <u>70°F</u>                  Interpass Temperature, Min.: <u>70°F</u>      Max.: <u>400°F</u></p>	<p><b>Joint Detail</b></p>  <p align="center"><b>SINGLE VEE GROOVE</b></p> <p><b>Position</b>                  Weld Position: <u>3G - Vertical</u>                  Vertical Progression: <u>Uphill</u></p> <p><b>Electrical Characteristics</b>                  Power Source: <u>N/A</u>                  Output: <u>Constant Voltage</u>                  Current / Polarity: <u>DCEP (reverse)</u>                  Transfer Mode: <u>Globular arc</u>                  Tungsten Electrode: Type <u>N/A</u>                  Tungsten Electrode: Size <u>N/A</u></p> <p><b>Technique</b>                  Stringer or Weave Bead: <u>Stringer bead</u>                  Multi/Single Pass: <u>Single</u>                  Number of Electrodes: <u>1</u>                  Electrode Spacing: Longitudinal: <u>N/A</u>                     Lateral: <u>N/A</u>      Angle: <u>N/A</u>                  Contact Tube to Work Distance: <u>1/2-3/4"</u>                  Peening: <u>N/A</u>                  Interpass Cleaning: <u>Power wire wheel or brush</u></p> <p><b>Postweld Heat Treatment</b>                  Temperature: <u>None</u>                  Time (hr.): <u>None</u></p>
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**Welding Procedure**

Pass or Weld Layer(s)	Process	Filler Metal		Current		Volts	Travel Speed (in/min)
		AWS Classification	Size (in.)	Type & Polarity	Amps		
Root	FCAW	E71T-1M	0.045	DCEP (reverse)	147	23.0	9
Fill	FCAW	E71T-1M	0.045	DCEP (reverse)	145	23.0	9
Cap	FCAW	E71T-1M	0.045	DCEP (reverse)	147	23.0	9

**G&G Fabrication & Machining**

**AWS D1.1 Procedure Qualification Record (PQR)**

PQR No. GG-FCAW-1b

**Test Results**

**Tensile Test**

Specimen No.	Width (in.)	Thickness (in.)	Area (in <sup>2</sup> )	Ultimate Tensile Load (lb)	Ultimate Unit Stress (PSI)	Character of Failure and Location
Flat 1	0.752	0.683	0.5136	42209	82200	Ductile - BM
Flat 2	0.752	0.671	0.5046	41670	82600	Ductile - BM

**Guided Bend Test**

Specimen No.	Type of Bend	Result	Remarks
1	Side Bend 3G	Satisfactory	
2	Side Bend 3G	Satisfactory	
3	Side Bend 3G	Satisfactory	
4	Side Bend 3G	Satisfactory	

**Visual Inspection**

Appearance: Satisfactory      Undercut: None      Piping Porosity: None  
 Concavity: None      Inspected By: Gerit Smith      Date: 4/18/2022

**Radiographic - Ultrasonic Examination**

RT Report No.: 22040225      Result: Satisfactory      UT Report No.: N/A      Result: N/A

Welder's Name: Williams, Donnell      I.D.: \_\_\_\_\_      Stamp No.: \_\_\_\_\_

Test conducted by: American Piping Inspection, Inc.      Test No.: 22040225

Welding of coupon was witnessed by: G&G Fabrication & Machining, Inc.

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded and tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M Structural Welding Code - Steel.

Approved By: *F. C. A. S. C.*      *4-18-22*  
 Date

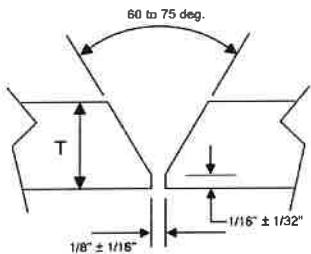
**G&G Fabrication & Machining**

**AWS D1.1 Procedure Qualification Record (PQR)**

PQR No. GG-FCAW-1c      Date 4/18/2022      WPS No. GG-FCAW-1

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Welding Process: FCAW / Semiautomatic

<p><b>Joint Design Used</b>                  Weld Type: <u>CJP Groove weld</u>                  Groove Type: <u>Single-V groove</u>                  Double Welded: <u>No</u>                  Backing: <u>Yes</u>      Material: <u>Back welded.</u>                  Root Opening: <u>1/16 in.</u>      Root Face: <u>1/16in.</u>                  Groove Angle: <u>60°</u>      Radius: <u>N/A</u>                  Back Gouging: <u>Yes</u>      Method: <u>Grind to sound weld metal.</u></p> <p><b>Base Metals</b>                  Base Metal: <u>ASTM A516-70</u>                  Thickness: <u>0.750 in.</u>                  Pipe Diameter: <u>N/A</u></p> <p><b>Filler Metals</b>                  AWS Specification: <u>5.20</u>                  AWS Classification: <u>E71T-1M</u>                  Trade Name: <u>Frontiarc-711</u></p> <p><b>Shielding</b>                  Gas: <u>75% Argon, 25% CO2</u>                  Flow Rate: <u>40 CFH</u>                  Gas Cup Size: <u>5/8"</u>                  Electrode-Flux (Class): <u>N/A</u>                  Flux Trade Name: <u>N/A</u></p> <p><b>Preheat</b>                  Preheat Temperature, Min.: <u>70°F</u>                  Interpass Temperature, Min.: <u>70°F</u>      Max.: <u>400°F</u></p>	<p><b>Joint Detail</b></p>  <p align="center"><b>SINGLE VEE GROOVE</b></p> <p><b>Position</b>                  Weld Position: <u>4G - Overhead</u>                  Vertical Progression: <u>N/A</u></p> <p><b>Electrical Characteristics</b>                  Power Source: <u>N/A</u>                  Output: <u>Constant Voltage</u>                  Current / Polarity: <u>DCEP (reverse)</u>                  Transfer Mode: <u>Globular arc</u>                  Tungsten Electrode: Type <u>N/A</u>                  Tungsten Electrode: Size <u>N/A</u></p> <p><b>Technique</b>                  Stringer or Weave Bead: <u>Stringer bead</u>                  Multi/Single Pass: <u>Single</u>                  Number of Electrodes: <u>1</u>                  Electrode Spacing: Longitudinal: <u>N/A</u>                                                    Lateral: <u>N/A</u>      Angle: <u>N/A</u>                  Contact Tube to Work Distance: <u>1/2-3/4"</u>                  Peening: <u>N/A</u>                  Interpass Cleaning: <u>Power wire wheel or brush</u></p> <p><b>Postweld Heat Treatment</b>                  Temperature: <u>None</u>                  Time (hr.): <u>None</u></p>
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**Welding Procedure**

Pass or Weld Layer(s)	Process	Filler Metal		Current		Volts	Travel Speed (in/min)
		AWS Classification	Size (in.)	Type & Polarity	Amps		
Root	FCAW	E71T-1M	0.045	DCEP (reverse)	150	23.0	10
Fill	FCAW	E71T-1M	0.045	DCEP (reverse)	153	23.0	10
Cap	FCAW	E71T-1M	0.045	DCEP (reverse)	150	23.0	10

G&G Fabrication & Machining

AWS D1.1 Procedure Qualification Record (PQR)  
Test Results

PQR No. GG-FCAW-1e

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Tensile Test

Specimen No.	Width (in.)	Thickness (in.)	Area (in <sup>2</sup> )	Ultimate Tensile Load (lb)	Ultimate Unit Stress (PSI)	Character of Failure and Location
Flat 1	0.752	0.623	0.4685	38677	82600	Ductile - BM
Flat 2	0.753	0.652	0.4910	40323	82100	Ductile - BM

Guided Bend Test

Specimen No.	Type of Bend	Result	Remarks
1	Side Bend 4G	Satisfactory	
2	Side Bend 4G	Satisfactory	
3	Side Bend 4G	Satisfactory	
4	Side Bend 4G	Satisfactory	

Visual Inspection

Appearance: Satisfactory Undercut: None Piping Porosity: None  
Concavity: None Inspected By: Gerit Smith Date: 4/18/2022

Radiographic - Ultrasonic Examination

RT Report No.: 22040226 Result: Satisfactory UT Report No.: N/A Result: N/A

Welder's Name: Williams, Donnell I.D.: \_\_\_\_\_ Stamp No.: \_\_\_\_\_

Test conducted by: American Piping Inspection, Inc. Test No.: 22040226

Welding of coupon was witnessed by: G&G Fabrication & Machining, Inc.

We, the undersigned, certify that the statements in this record are correct and that the test welds were prepared, welded and tested in conformance with the requirements of Clause 4 of AWS D1.1/D1.1M Structural Welding Code - Steel.

Approved By: [Signature]

4-18-22  
Date