MANGO

Welding Procedure Qualification Test Reports

CU ADOPTED - MANGO WELDING PROCEDURE No. 1 :SMAW E6010

Specification for Shielded Metal Arc Welding with Class E6010 electrodes

Procedure Qualification Record Nos: MANGO 1104 1-1(04-25-00), MANGO 1104 1-2(04-25-00), MANGO 1104 1-3(04-26-00), MANGO 1104 1-4(04-26-00), MANGO 1104 1-5(04-26-00), MANGO 1104 1-6(04-26-00), MANGO 1104 1-7(04-25-00), MANGO 1104 1-8(04-25-00), MANGO 1104 1-9(04-25-00) MANGO 1104 1-10(04-25-00), MANGO 1104 1-11(07-28-00), MANGO 1104 1-12(07-28-00), MANGO 1104 1-13(07-28-00) .

Application: Use this procedure on all systems and pressures.

Procedure:

A. PROCESS: The welding shall be done with the Shielded Metal Arc Welding (SMAW) process.

B. PARENT METALS: The materials to which the procedure applies are identified below :

Existing Unknown Steel (24,000psi)
ASTM: A53, A106
API 5L: Grade A25 through X56 (Note limit* on less than 3/16" wall thickness)

which fall into the two following groups:

1) Specified minimum yield strength less than or equal to 42,000 pounds per square inch.
2) Specified minimum yield strength greater than 42,000 pounds per square inch through 56,000 pounds per square inch.

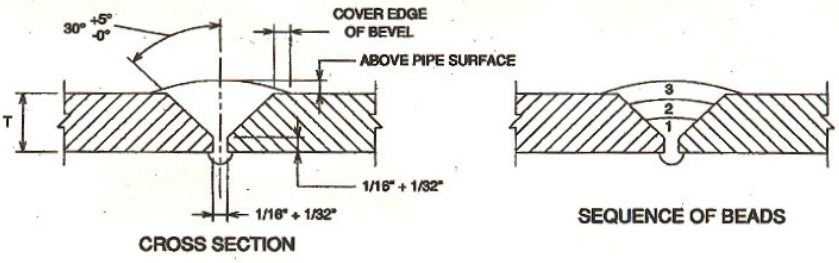
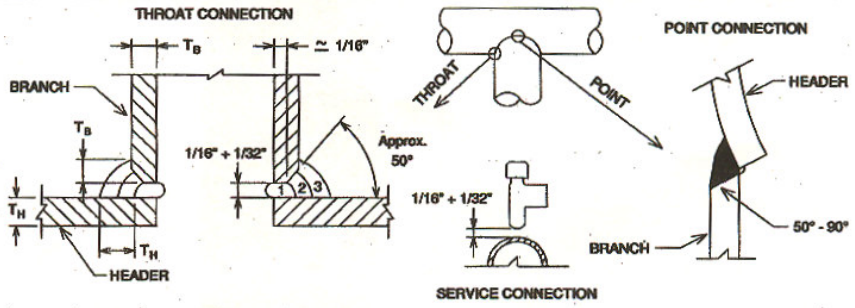
C. DIAMETER AND WALL THICKNESS: This procedure shall apply to all diameters through 48" and wall thicknesses identified in the following groups:

1) Nominal pipe wall thickness less than 3/16 inch.*(Existing Unknown Steel, ASTM:A53, A106, API 5L: Grade A25 through X42 only)
2) Nominal pipe wall thickness from 3/16 inch through ¾ inch.

D. JOINT DESIGN:

- BUTT: Bevel the welding ends to an angle of 30°, +5°, -0°, with a root face of 1/16", +/- 1/32". The bevel shall form a V groove with an included angle of 60°+10/-0. The root opening shall be 1/16", +/- 1/32".

- FILLET: Bevel the welding ends to an angle between 50° and 90° as required for various branch diameter ratios, with a root face of 1/16", +/- 1/32". The bevel shall form a V groove with an included angle of approximately 50°. The root opening shall be 1/16", +/- 1/32".

Joint Design **Butt**	
Joint Design **Branch or Fillet**	 The fitting or branch shall be contoured to fit the curvature of the main or header. The fitting or branch shall be tacked sufficiently to prevent shifting during welding.

E. FILLER METAL: The filler metal shall conform to AWS Classification E-6010.

F. SIZE OF ELECTRODES AND NUMBER OF BEADS:

Wall Thickness (Inches)	Electrode Size in Inches		Minimum Number of Passes
	Stringer Bead and Hot Pass	Fill and Cap	
0 - 0.186	3/32	1/8	3
0.187 - 0.249	1/8	5/32	3
0.250 - up	5/32	3/16	3

NOTE: For tie in welds only, the rod diameter may be increased or decreased by one size for up to one third (33%) of the weld length to accommodate varying bevel space at the weldor's election. Tie in welds are those welds made in their final service location or where one or both ends of the pipe to be welded are fixed (stiff).

G. ELECTRICAL CHARACTERISTICS: Use only DC reverse polarity (electrode positive) welding current.

Rod Diameter	Amperage	Voltage
3/32"	40-70	20-26
1/8"	65-130	22-28
5/32"	90-175	24-30
3/16"	140-200	24-30

H. DIRECTION OF WELDING: Welding shall proceed downward from the top center, or any point on the side to the bottom center.

I. NUMBER OF WELDORS: When the nominal diameter is less than 16", one weldor may be used to complete the root pass and all successive passes. When the nominal diameter is 16" or larger, two weldors are required to complete the root pass. One weldor may complete all successive passes. However, the Company reserves the right to require additional weldors for the root pass. It is the opinion of the Company that additional weldors will be required if there exists any danger of stringer bead cracking or if slow progress is experienced.

J. SPEED OF TRAVEL: The speed of travel for all passes shall be within the range of 5 to 15 inches per minute, inclusive.

K. TIME LAPSE BETWEEN PASSES: The second pass shall follow the first pass within five minutes, except when unavoidable circumstances prevail which make this requirement impractical. If 5 minutes are exceeded, follow the preheat requirements listed in O. of this procedure. Complete all welds on the same day they are started.

L. TYPE OF LINE UP CLAMP: For nominal diameters less than 12", external line up clamps may be used. For 12" and larger nominal diameters on contract jobs, internal line up clamps should be used for all but tie in welds. For small jobs on 12" and larger pipe, external clamps may be used.

M. REMOVAL OF LINE UP CLAMP: For nominal diameters less than 12", the line up clamps may be removed when the joint has been tack welded sufficiently to maintain root space and to prevent development of hi-low. For nominal diameters 12" and larger, the line up clamp may be removed after 50% of the root pass (stringer bead) is completed. At no time may the line up clamp be removed while welding is in progress or while the weld metal is above 400°F. The Company may require that the line up clamp be left in place until 100% of the stringer bead is completed.

N. CLEANING: All rust, dirt and foreign matter shall be removed from the bevel surface before welding. The bevel surface includes that area on the inside and outside of the pipe in the immediate proximity of the pipe end. Slag shall be removed from the weld bead surface before the next bead is applied. Stringer beads shall be ground and cleaned with power tools. Grind out all holes. The finished weld and adjacent outside surface of the pipe shall be cleaned of all flux, smoke and weld spatter.

O. PREHEAT: Preheat shall be required when the ambient or parent metal temperature is below 40°F. The pipe shall be preheated evenly around the pipe circumference. The preheat temperature shall be 250°F for 3" on both sides of the weld. The preheat temperature shall be monitored and controlled before and during welding using a temperature indicating crayon or pyrometer or equivalent device. If moisture is present on the parent metal, it shall be driven off by preheating to a temperature at which it will not re-form before welding is completed.

P. POSTHEAT: Postheat is not required.

Q. POSITION: The welding position may be fixed or rolled.

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Test Location: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-1

Weldor: Paul Mitchell Welding Time: 6 minutes Weather: sunny, 75°F

Pipe Grade: X42 O.D.: 2.375" Wall Thickness: 0.154 Manufacturer: unk

TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.:. none °F Width: N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30° +5°-0°, Root Face: 1/16±1/32 in., Root opening 1/16±1/32 in.

FILLER METAL: Class E 6010 Name: Lincoln Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate:

SHIELDING FLUX: None☒ Type Size:

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	85	83	75	70			
Size of Electrode, in	1/32	1/32	1/8	1/8			
Number of Electrodes Used	2	2	2	2			
Speed of Travel, in./min.	9.3	14.9	11.1	9.5			
Max Time Between Passes. Min.	5	1	1				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	4	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	1	Root	No Failure
2	3	Root	No Failure
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor: Paul Mitchell Supervised by: Lisa Ulrich

Approved by: Bruce Beatty Signature: Bruce Beatty Date: 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-2
Weldor: Paul Mitchell Welding Time: 47 min. Weather: sunny, 75°F
PIPE: Grade: X42 O.D.: 12.75 Wall Thickness: 0.250 Manufacturer: unk
TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.: none °F Width N/A inches each side of weld
WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒
WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐
LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒
JOINT DESIGN: Bevel Angle 30+5-0 °, Root Face 1/16±1/32 in., Root opening 1/16±1/32 in.
FILLER METAL: Class E6010 Name Fleetweld 5P+
SHIELDING GAS: None☒ Type Flow Rate
SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	142	137	135				
Size of Electrode, in	5/32	5/32	3/16				
Number of Electrodes Used	4	6	8				
Speed of Travel, in./min.	10.3	10.8	8.1				
Max Time Between Passes. Min.	5	3					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1	1	0.252 x 1.065	0.268	20061	74855	Failed in pipe
2	5	0.254 x 1.081	0.275	22870	83166	Failed in pipe
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	6	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	3	Root	No Failure
2	7	Root	No Failure
3	4	Face	No Failure
4	8	Face	No Failure
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Paul Mitchell Supervised by Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/26/2000 Test No.: MANGO 1104 1-3

Weldor: Jim Heim Welding Time: 1 hour Weather: sunny, 75°F

PIPE: Grade: X56 O.D.: 12.75" Wall Thickness: 0.375" Manufacturer: unk

TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30 +5 -0 °, Root Face 1/16"±1/32 in., Root opening 1/16"±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	135	130	145	145			
Size of Electrode, in	5/32	5/32	3/16	3/16			
Number of Electrodes Used	6	6	8	12			
Speed of Travel, in./min.	7.6	8.6	6.9	5.5			
Max Time Between Passes. Min.	60	3	3				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1	1	0.375 x 1.169	0.438	31395	71679	Failed in pipe
2	5	0.376 x 1.014	0.381	27796	72958	Failed in pipe
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	6	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	3	Root	No Failure
2	7	Root	No Failure
3	4	Face	No Failure
4	8	Face	No Failure
5			
6			
7			
8			

Additional qualification requirements:

The stringer bead was allowed to cool to ambient temperature (about 1 hour), ground and hot passed without any re-heating (pre-heating), without any discernible detrimental effect.

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Jim Heim Supervised by Bruce Beatty

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/26/2000 Test No.: MANGO 1104 1-4

Weldor: Paul Micthell Welding Time: 6 min. Weather: sunny, 75°F

PIPE: Grade: X42 x X42 O.D.: 2.375 Wall Thickness: 0.154 Manufacturer: unk

TYPE OF WELD: Butt☐ Fillet☒☐ PREHEAT TEMP.: ____°F Width ____ inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30 +5 -0 °, Root Face 1/16 ±1/32 in., Root opening 1/16 ±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type ____ Flow Rate ____

SHIELDING FLUX: None☒ Type ____ Size ____

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	84	80	78				
Size of Electrode, in	3/32	3/32	1/8				
Number of Electrodes Used	3	3	3				
Speed of Travel, in./min.	9.6	11.2	7.7				
Max Time Between Passes. Min.	5	2					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	1	Clean
2	2	Clean
3	3	Clean
4	4	Clean

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1			
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Paul Mitchell Supervised by Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/26/2000 Test No.: MANGO 1104 1-5

Weldor: Jim Heim Welding Time: 53 min. Weather: sunny, 75°F

PIPE: Grade: X42 x X42 O.D.: 12.75" Wall Thickness: 0.250 Manufacturer: unk

TYPE OF WELD: Butt☐ Fillet☒ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 45 +5-30 °, Root Face 1/16±1/32 in., Root opening 1/16±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	125	140	150	125			
Size of Electrode, in	5/32	5/32	3/16	5/32			
Number of Electrodes Used	8	9	8	10			
Speed of Travel, in./min.	8.3	8.8	6.0	7.0			
Max Time Between Passes. Min.	5	3	3				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	1	Clean
2	2	Clean
3	3	Clean
4	4	Clean

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1			
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Jim Heim Supervised by Bruce Beatty

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/26/2000 Test No.: MANGO 1104 1-6

Weldor: Paul Mitchell Welding Time: 1 hour Weather: sunny, 75°F

PIPE: Grade: X56 x X56 O.D.: 12.75 Wall Thickness: 0.375 Manufacturer: unk

TYPE OF WELD: Butt☐ Fillet☒ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒☐

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 45 +5-30 °, Root Face 1/16±1/32 in., Root opening 1/16±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	133	137	140	121			
Size of Electrode, in	5/32	5/32	3/16	5/32			
Number of Electrodes Used	8	10	10	12			
Speed of Travel, in./min.	8.3	7.0	6.1	7.6			
Max Time Between Passes. Min.	5	3	3				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	1	Clean
2	2	Clean
3	3	Clean
4	4	Clean

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1			
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Paul Mitchell Supervised by Bruce Beatty, Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-7

Weldor: Jim Heim Welding Time: 6 min. Weather: sunny, 75°F

PIPE: Grade: B x X42 O.D.: ¾ x 12 Wall Thickness: 0.133 x 0.250 Manufacturer: unk

TYPE OF WELD: Butt☐ Fillet☒ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 60 °, Root Face 1/16 ±1/32 in., Root opening 1/16 ±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	85	85	85				
Size of Electrode, in	3/32	3/32	1/8				
Number of Electrodes Used	2	2	1				
Speed of Travel, in./min.	5.1	3.1	3.3				
Max Time Between Passes. Min.	5	2					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1		
2		
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	entire weld	hammer bend	pipe broke away from weld
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Jim Heim Supervised by Bill Burnett

Approved by Bruce Beatty Signature Bruce Beatty Date 9/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-8

Weldor: Jim Heim Welding Time: 1 hour Weather: sunny, 75°F

PIPE: Grade: A O.D.: 12.75 Wall Thickness: 0.410 Manufacturer: unk

TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30 +5 -0 °, Root Face 1/16 ±1/32 in., Root opening 1/16 ±1/32 in.

FILLER METAL: Class E 6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	121	140	160	160	160		
Size of Electrode, in	5/32	5/32	3/16	3/16	3/16		
Number of Electrodes Used	6	8	10	10	12		
Speed of Travel, in./min.	9.5	9.5	6.7	6.7	6.7		
Max Time Between Passes. Min.	5	3	3	3			

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1	1	0.418 x 1.088	0.455	25768	56633	Failed in pipe
2	5	0.416 x 1.010	0.420	25231	60074	Failed in pipe
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	6	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	2	Root	No Failure
2	7	Root	No Failure
3	4	Face	No Failure
4	8	Face	No Failure
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Jim Heim Supervised by Bruce Beatty

Approved by Bruce Beatty Signature Bruce Beatty Date 8/[illegible]/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-9

Weldor: Paul Mitchell Welding Time: 5 min. Weather: sunny, 75°F

PIPE: Grade: B O.D.: 1.315 Wall Thickness: 0.133 Manufacturer: unk

TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30 +5 -0 °, Root Face 1/16 ±1/32 in., Root opening 1/16 ±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type Flow Rate

SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	78	50	50				
Size of Electrode, in	3/32	3/32	1/8				
Number of Electrodes Used	2	2	2				
Speed of Travel, in./min.	12.2	8.1	8.7				
Max Time Between Passes. Min.	5	2					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	1	Clean
2		
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1			
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Paul Mitchell Supervised by Bill Burnett

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

MANGO (Missouri Assoc. of Natural Gas Operators)

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test: Sedalia, MO Test Date: 4/25/2000 Test No.: MANGO 1104 1-10

Weldor: Paul Mitchell Welding Time: 5 min. Weather: sunny, 75°F

PIPE: Grade: B O.D.: 1.315 Wall Thickness: 0.133 Manufacturer: unk

TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP.: none °F Width N/A inches each side of weld

WELD POSITION: Roll☐ Position☒ DIRECTION OF TRAVEL: Uphill☐ Downhill☒

WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐

LINEUP CLAMP: External☐ Internal☐ None☒ BACKING STRIP: Yes☐ No☒

JOINT DESIGN: Bevel Angle 30 +5 -0 °, Root Face 1/16 ±1/32 in., Root opening 1/16 ±1/32 in.

FILLER METAL: Class E6010 Name Fleetweld 5P+

SHIELDING GAS: None☒ Type _____ Flow Rate _____

SHIELDING FLUX: None☒ Type _____ Size _____

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	85	60	50				
Size of Electrode, in	3/32	3/32	1/8				
Number of Electrodes Used	2	2	2				
Speed of Travel, in./min.	12.2	11.6	7.9				
Max Time Between Passes. Min.	5	2					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1		
2		
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	2	Root	No Failure
2			
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Paul Mitchell Supervised by Bill Burnett

Approved by Bruce Beatty Signature Bruce Beatty Date 5/22/00

UTILICORP UNITED

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test Wichita, KS Test Date 7/28/2000 Test No. MANGO 1104 1-11
Weldor Tracy Gaylord Welding Time 35 min. Weather Cloudy, 80°F
PIPE: Grade X56 O.D. 12.75" Wall Thickness 0.375" Manufacturer UNK
TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP. none °F Width none inches each side of weld
WELD POSITION: Roll☒ Position☐ DIRECTION OF TRAVEL: Uphill☐ Downhill☒
WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐
LINEUP CLAMP: External☒ Internal☐ None☐ BACKING STRIP: Yes☐ No☒
JOINT DESIGN: Bevel Angle 30, +5, -0°, Root Face 1/16±1/32in., Root opening 1/16±1/32 in.
FILLER METAL: Class E6010 Name Lincoln 5P+
SHIELDING GAS: None☒ Type Flow Rate
SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	145	145	140	140			
Size of Electrode	5/32	5/32	3/16	3/16			
Number of Electrodes Used	4	4	9	4			
Speed of Travel, in./min.	17	17	12	11			
Max Time Between Passes. Min.	5	5	5				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1	1	0.368X1.089	0.404	30638	75837	Failed in pipe
2	5	0.371X1.115	0.414	30932	74715	Failed in pipe
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	6	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	3	Root Bend	No Failure
2	4	Face Bend	No Failure
3	7	Root Bend	No Failure
4	8	Face Bend	No Failure
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Tracy Gaylord Supervised by Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/28/00

UTILICORP UNITED

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test Wichita, KS Test Date 7/28/2000 Test No. MANGO 1104 1-12
Weldor Tracy Gaylord Welding Time 15 min Weather Cloudy, 80°F
PIPE: Grade X42 O.D. 6.625" Wall Thickness 0.250" Manufacturer UNK
TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP. none °F Width none inches each side of weld
WELD POSITION: Roll☒ Position☐ DIRECTION OF TRAVEL: Uphill☐ Downhill☒
WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐
LINEUP CLAMP: External☒ Internal☐ None☐ BACKING STRIP: Yes☐ No☒
JOINT DESIGN: Bevel Angle 30°+5°-0°, Root Face 1/16±1/32 in., Root opening 1/16±1/32 in.
FILLER METAL: Class E6010 Name Lincoln Fleetweld 5P+
SHIELDING GAS: None☒ Type Flow Rate
SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	130	125	130	130			
Size of Electrode	1/8	1/8	5/32	5/32			
Number of Electrodes Used	3	4	4	4			
Speed of Travel, in./min.	12	17	15	13			
Max Time Between Passes. Min.	5	5	5				

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1	1	0.213X1.080	.230	16480	71656	Failed in pipe
2	5	0.213X1.043	.222	16472	74198	Failed in pipe
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	6	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	3	Root Bend	No Failure
2	4	Face Bend	No Failure
3	7	Root Bend	No Failure
4	8	Face Bend	No Failure
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Tracy Gaylord Supervised by Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00

UTILICORP UNITED

WELDING PROCEDURE QUALIFICATION TEST REPORT

Location of Test Wichita, KS Test Date 7/28/2000 Test No. MANGO 1104 1-13
Weldor Tracy Gaylord Welding Time 10 Weather Cloudy, 80°F
PIPE: Grade X42 O.D. 4.5" Wall Thickness 0.156 Manufacturer UNK
TYPE OF WELD: Butt☒ Fillet☐ PREHEAT TEMP. none °F Width none inches each side of weld
WELD POSITION: Roll☒ Position☐ DIRECTION OF TRAVEL: Uphill☒ Downhill☐
WELDING PROCESS: Arc☒ Oxy Fuel Gas☐ Manual☒ Semi-auto☐ Auto☐
LINEUP CLAMP: External☒ Internal☐ None☐ BACKING STRIP: Yes☐ No☒
JOINT DESIGN: Bevel Angle 30°+5°-0°, Root Face 1/16±1/32 in., Root opening 1/16±1/32 in.
FILLER METAL: Class E6010 Name Lincoln Fleetweld 5P+
SHIELDING GAS: None☒ Type Flow Rate
SHIELDING FLUX: None☒ Type Size

Bead number	1	2	3	4	5	6	7
Amperage: AC☐ DCSP☐ DCRP☒	85	85	86				
Size of Electrode	3/32	3/32	1/8				
Number of Electrodes Used	4	4	4				
Speed of Travel, in./min.	15	14	8				
Max Time Between Passes. Min.	5	5					

DESTRUCTIVE TEST RESULTS

TENSILE TESTS

Test Specimen	Stencil Mark	Orig. Size Inches (wt, w)	Orig. Area. (wt. X w = Sq. In.)	Maximum Load Lb.	Tensile Strength PSI	Remarks (Include location and character of failure)
1						
2						
3						
4						

NICK BREAK TESTS

Specimen	Stencil Mark	Remarks (Include location and character of failure)
1	2	Clean
2	4	Clean
3		
4		

BEND TESTS

Specimen	Stencil Mark	Type	Remarks (Include location and character of failure)
1	1	Root Bend	No Failure
2	3	Root Bend	No Failure
3			
4			
5			
6			
7			
8			

Additional qualification requirements:

The above Welding Procedure Qualification Test was performed in accordance with API 1104 requirements.

Weldor Tracy Gaylord Supervised by Lisa Ulrich

Approved by Bruce Beatty Signature Bruce Beatty Date 8/22/00