Georgia-Pacific
CONSUMER PRODUCTS (CAMAS) LLC
401 NE Adams Street, Camas, WA 98607
Telephone: (360) 834-3021

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

August 22, 2012

David D. Lykken
Pipeline Safety Director
Washington Utilities & Transportation Commission
1300 S. Evergreen Park Drive SW
P. O. Box 47250
Olympia, WA 98504-7250

RE: Docket No. PG-110017

Dear Director Lykken:

In response to WUTC Stipulated Agreement Part III, Item No. 4 and Status Report Items 15.1 and 15.2, Georgia-Pacific, Camas has requalified weld procedure GP-CAMAS-01. This work was conducted and documented in accordance with API 1104 (20th edition) and 49 CFR 192, Subpart E.

Enclosed is documentation package containing the weld procedure and qualification records for review and comment by WUTC Staff. This is organized into three sections:

<u>WPS - Weld Procedure Specification</u>

- GP Weld Procedure Specification: GP CAMAS-01 Rev. 1

<u>PQR - Procedure Qualification Record</u>

- GP Coupon Test Report
- Carlson Testing, Inc. – Weld Coupon Tensile Strength Lab Test
- GP Welding Procedure Qualification Record of Test Data

<u>Supporting Documentation</u>

- GP Audit Check List & Code Reconciliation for evaluating Welding Procedures, Meeting the API 1104 Code (Section 5 – Qualification of Welding Procedures for Welds Containing Filler-metal Additives). Total of 4 pages.
- GP Photo documentation of test coupon preparation with written discussion. Total of 12 pages.

We believe this submission will bring the welding concerns to closure. After receipt of a favorable response from WUTC Staff this weld procedure will be added to the GP Camas O&M Manual procedures.

If you have any questions concerning this submission or need additional information, please contact Steve Ringquist at 360-834-8166 or steve.ringquist@gapac.com.

Sincerely,

Gary W. Kaiser
Vice President

GWK/ml

Enclosure

cc:

Steve Ringquist	- GP/Camas
Ron Simmons	- GP/Atlanta
Patricia Johnson	- WUTC/Olympia

Georgia-Pacific CONSUMER PRODUCTS (CAMAS) LLC	PROCEDURE WPS - NO:	GP CAMAS-01
	Procedure Qualification Record - PQR	GP CAMAS-01
API 1104, 20th edition	PROCEDURE TYPE:	Manual SMAW V Groove Butt Weld

WELDING PROCEDURE SPECIFICATIONS QUALIFIED IN ACCORDANCE WITH API STANDARD 1104 FOR USE ON NATURAL GAS PIPELINES

Company Name **Georgia Pacific** By Pat Terry

Welding Procedure Specification No **GP CAMAS-01**

Revision No **R1**

Revision Date **4/15/2012**

Supporting PQR No (s) **GP CAMAS-01**

Welding Process(es) SMAW Type(s) Manual

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WPS

WELD PROCEDURE
SPECIFICATION

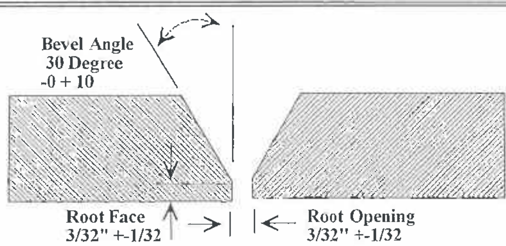
Georgia-Pacific **WELD PROCEDURE SPECIFICATION**	PROCEDURE NO: Rev:	**GP CAMAS-01** **Rev - 1**
API 1104 **20th** EDITION	PROCEDURE TYPE:	**Manual SMAW** V- Groove **Butt Weld**

GP CAMAS-01 Rev-**1** **Date** 4 -15-2012

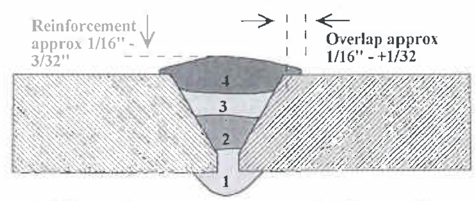
Process	*Manual Welding Shielded Metal Arc Welding (SMAW)*		
Material	*API* ***5LX****, grade -* ***X52*** *Butt Weld Pipe and Fittings (WPB)*		
Pipe OD and Wall Thickness	*4-1/2" to 12-3/4" OD* .1875" to 0.750" wall thickness		
Joint Design	*Single V- groove see sketch*		
Filler Metal - Number of Beads	*E6010 root pass E8010 Hot Pass and Filler, Cap* ***3-6*** *beads depending upon filler metal size used*		
Electrical Characteristics	*DCEP only*	**Position (S)**	*Position welding only - not rolled*
Position (S)	*Horizontal (axis of pipe)*	**Direction of welding**	*Down Hill only*
Pre Heat	*Min preheat temp is* ***50F.***	**Pre Heat Method**	*Manual Torch oxy fuel -verify with pyrometer or temp stick*
Max time between all passes	10 minutes	**Stress Relief**	*No stress relief is required-As -welded condition.*
Type and removal of line up clamp	*None required - May use external clamp - if used do not remove until all tacks are completed and cooled to ambient air temp ****		
Cleaning / Grinding	*Wire brushing of all surfaces prior to welding, and between passes. Grinding of root prior to hot pass is preferred*		
No. of Welders Permitted	*One or two*	**** or- root bead is completed and cooled to ambient temp*	

Weld Joint Design Single V-Groove

Wall thickness values of **.250", .279", .307" and .365".**



Weld Layers and Number of Passes *** Electrode Sizes may be interchanged for each Weld Layer or Pass



.307" pipe wall thickness with single pass cap shown

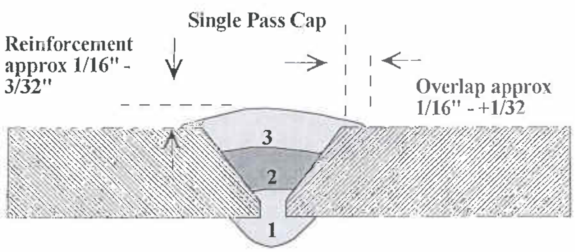
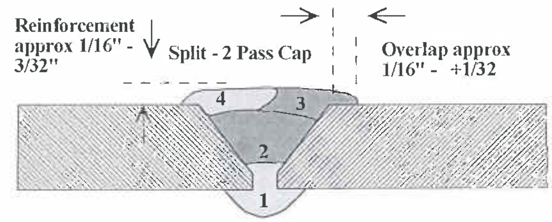
Note that ***3-6*** *beads may occur depending upon filler metal rod size used or if a split cap is performed for top layer. See page* ***2*** *for additional wall thicknesses, weld layer and bead sequence details.*

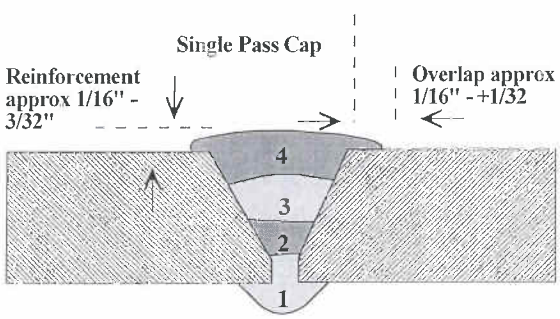
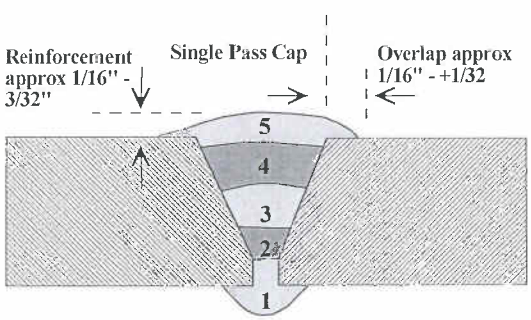
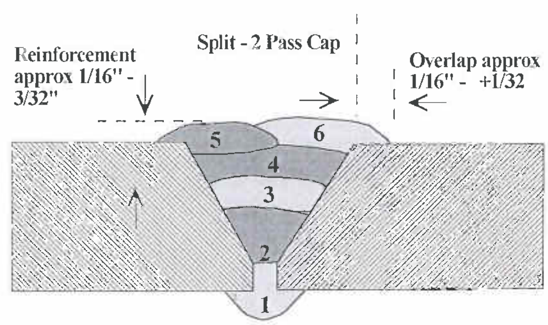
Bead Pass No.	Size ***	Electrodes Group No.	AWS SFA No.	Electrode Classification	Electrode Mfg	Amps	Volts	Max. Time Between Layers or Beads	Travel Speed Range Min Max	Heat Input (K-Joules)	
1	1/8"	1	5.1	E6010	Lincoln-5P+	75-120	24-26	10 minutes	9-10.5	12	17.8
1	5/32"	1	5.1	E6010	Lincoln-5P+	90-145	25-28	10 minutes	9-10.5	15	23.2
2	1/8"	2	5.5	E8010	Lincoln	85-120	24-28	10 minutes	10-11.5	12.2	17.5
2	5/32"	2	5.5	E8010	Lincoln	95-145	25-28	10 minutes	6-8.5	23.7	28.7
3-6	5/32"	2	5.5	E8010	Lincoln	95-160	25-28	10 minutes	5-7.5	28.5	35.8

Preparation Accepted By Pat Jerry 8/20/12 GP Camas Facility QC – Manager

Approved By [signature] 8/20/2012 GP Camas Facility Reliability Leader

Georgia-Pacific **WELD PROCEDURE SPECIFICATION**	PROCEDURE NO: Rev:	**GP CAMAS-01** **Rev - 1**
API 1104 **20th** EDITION	PROCEDURE TYPE:	**Manual SMAW** V- Groove **Butt Weld**

Weld Joint Design Single V-Groove **For pipe wall thickness that = .250", or .279".** *The root pass* **(1)** *and the Hot pass* **(2)** *shall be performed using* **1/8"** *electrodes. Min* ***3*** *passes*	**Weld Layers and Number of Passes** *** Electrode Sizes may be interchanged for each Weld Layer or Pass *3-4 beads may occur depending upon filler metal size used or if a split cap is performed for layer* ***3*** *as shown*
	

Weld Joint Design Single V-Groove **For pipe wall thickness that = .307" or .365".** *The root pass* **(1)** *and the Hot pass* **(2)** *May be performed using* **1/8"** *or* ***5/32"*** *dia. electrodes. Min* ***4*** *passes*	**Weld Layers and Number of Passes** *** Electrode Sizes may be interchanged for each Weld Layer or Pass *5-6 beads may occur depending upon filler metal size used or if a split cap is performed- for layers* ***4 / 5*** *as shown for the split cap or single pass cap weld joint.*
 **0.307" Wall thickness**  **0.365" Wall thickness**	 **0.307" or 0.365" Wall thickness** ***May have additional weld passes or layers similar to what is shown.***

PQR

PROCEDURE QUALIFICATION RECORD

Georgia-Pacific COUPON TEST REPORT	PROCEDURE NO:	GP CAMAS-01
	Record of Test Data	2012.01
API 1104 20th EDITION	PROCEDURE TYPE:	Manual SMAW V Groove Butt Weld

Date 4 -15-2012 Location = Washington Page 1 of 1

Welder	Chris Baier	**ID** Mark	*CB-1*
Welding Time	Total time approx. 4 hrs	**Weld Position**	*Horizontal (axis of pipe)*
Mean Temperature	40 -45 degrees	**Time of Day**	*1:PM to 5:30 PM*
Weather Conditions	Wind Rain - sheltered area	**Wind Break used**	*Yes partially decreased direct impingement of wind no rain occurred on coupon*
Voltage	DCEP Ranges are shown on test data sheet	**Amperage**	*Ranges are shown on test data sheet*
Welding Machine Type	Lincoln Gas Driven	**Welding Machine Size**	*300 amp*
Filler Metal	E6010 root pass E8010 Hot Pass Filler, Cap 4 passes	**Type and Grade- Pipe**	*API 5LX, grade - **X52** Butt Weld Pipe*
Reinforcement Size	1/16" – 3/32" per joint sketch	**Wall Thickness / Outside Diameter**	*T= 0.307" / Dia.= 10-3/4"*
Max time between passes	10 minutes		

Procedure - Yes	Qualifying Test - Yes	Qualified - *Yes*
Welder– Yes	Line Test- No	*Disqualified*- No

TENSILE TEST

SPECIMEN NO.	WIDTH	THICKNESS	AREA	ULTIMATE TOTAL LOAD LB.	ULTIMATE Tensile Strength UNIT STRESS PSI	TYPE OF FAILURE AND LOCATION
T-1	1.307	.307	.4012	29,436	73,400 **	***Ductile Failure / PIPE /*** **Base Material**
T-2	1.374	.307	.4218	30,354	72,000 **	***Ductile Failure / PIPE /*** **Base Material**

** WITHIN RANGE min. VALUE = **60 ksi**

Guided Bend and Nick Break Tests

ROOT OR SIDE BEND		FACE OR SIDE BEND		NICK BREAK	
SPECIMEN #	RESULTS	SPECIMEN NO.	RESULTS	SPECIMEN NO.	RESULTS
Root Bend 1	**Accept**- no defects	Face Bend 1	**Accept**- no defects	Nick Break 1	**Accept**- no defects >1/32"
Root Bend 2	**Accept**- no defects	Face Bend 2	**Accept**- no defects	Nick Break 2	**Accept**- no defects >1/32"
Remarks	None	Remarks	None	Remarks	*1- Indication < 1/32"*

Welder's Name *Chris Baier* Identification No. *CB-1*

Testing Conducted by: ***Georgia Pacific*** Bend and Nick Break & ***Carlson Testing -Lab*** Tensile specimens Laboratory Test Log No. **M4656A**

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 the **API 1104 20th** Ed. 2005 and the reaffirmed (2010) year

Weld Test Coupons Welded At Steamfitters Training Center - Oregon Date 4-15-2012

Tested, Supervised & Witness Qualifications - Forms Prepared By A J Ciapanno Jr

Preparation Accepted By Pat Terry 8/20/12 GP Camas Facility QC – Manager

Approved By 8/20/12 GP Camas Facility Reliability Leader

Carlson Testing, Inc.

Bend Office	(541) 330-9155
Geotechnical Office	(503) 601-8250
Eugene Office	(541) 345-0289
Salem Office	(503) 589-1252
Tigard Office	(503) 684-3460

April 20, 2012
T1201000.CTI

Weld Tech
56635 Country Villa Lane
Warren, Oregon 97053

For GP API Weld Procedure Qualification
Georgia-Pacific contract #1007809
Georgia-Pacific; 401 NE Adams St;
Camas, WA 98607

Gentlemen:

The following is the test data obtained from (2) two welded steel samples submitted to our lab, our metal lab log #M4656A.

Tested to API 1104

ID#	Width (in.)	Thickness (in.)	Area (sq.in.)	Tensile Strength	Disposition
1	1.307	.307	.4012	29,436 lb.	Ductile parent
				73,400 psi.	
2	1.374	.307	.4218	30,354 lb.	Ductile parent
				72,000 psi.	

Tests performed on our Tinius Olsen Universal testing machine, SN105750.

Our reports pertain to the material tested/inspected only. Information contained herein is not to be reproduced, except in full, without prior authorization from this office.

If there are any further questions regarding this matter, please do not hesitate to contact this office.

Respectfully submitted,

CARLSON TESTING, INC.

Mark Powlison
Project Manager

mc

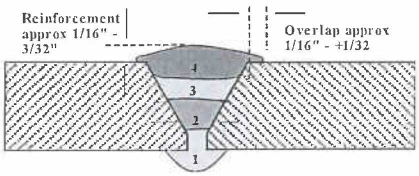
Georgia-Pacific

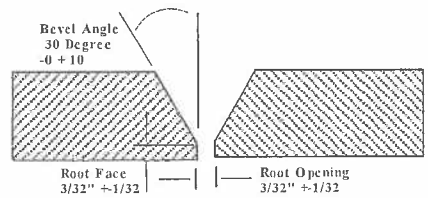
GP Welding Procedure Qualification Record of Test Data

GP Test No.__**GP-2012-01** __WPS / PQR NO__**GP CAMAS-01**____Welder ID NO__CB-1_____ Date__4-15-2012___
Base Material Form and Dimensions : Plate _____ Pipe __**X**__ Size: __**10" X** ______" Thickness =_**0.307"**_ nom
Material Spec _**API 5L**_ Tp/Cl/Grd __**X-52**___ P-No __**1**__ Grp No **1**__ S No __none__ Heat No______
Material Spec _**API 5L**_ Tp/Cl/Grd __**X-52**___ P-No __**1**__ Grp No **1**__ S No __none__ Heat No______
Comments_______this page represents **Side One (1)** of the coupon ______________________________

Process __**SMAW**_____ Position ____**5G**__ Progression __**Down-Hill**___Current _**DC**_ Polarity _**EP**_
Filler Class = **Root**-_ **E6010** __ Dia __ **1/8"**____ Size _______ Heat Lot No._________
Filler Class = **Hot Pass** **E8010** __ Dia __ **1/8"**____ Size _______ Heat Lot No._________
Filler Class = **Fill / Cap** **E8010** __ Dia __**5/32"**____ Size _______ Heat Lot No._________

Weld Joint Design





Welding Parameters

Layer no	Pass no	Pre - Heat (F)	Inter Pass (F)	Length of Bead	Total Time	Bead Width	Amps	Volts	Travel Speed IPM	Heat Input KJ/in	Comments	Notes
Side1	Side1			Inches	Min	Inches						Weather
1 Root	Top to Side	50	50	7	.6667	Na	85	25	10.5	12.14	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
1 Root	Side to Bottom	50	50	4.5	.45	Na	95	24	10	13.68	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
2 Hot Pass	Top to Side	50	50	8.5	.8333	1/4-5/16"	105	27	10.2	17.29	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
2 Hot Pass	Side to Bottom	50	50	8.5	.75	1/4-5/16"	100	28	11.5	14.29	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
3 Fill	Top to Bottom	50	50	16.5	2.766	3/8-1/2"	120	26/28 27 ave	6	32.6	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
4 Cap	Top to Bottom	50	50	17.5	2.3	5/8-3/4"	115	26/28 27 ave	7.5	24.48	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area

Georgia-Pacific

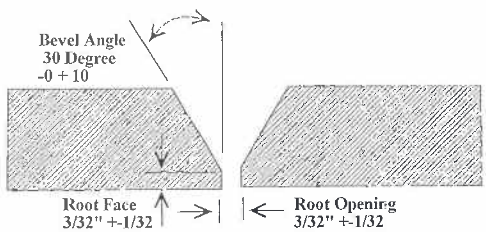
GP Welding Procedure Qualification Record of Test Data

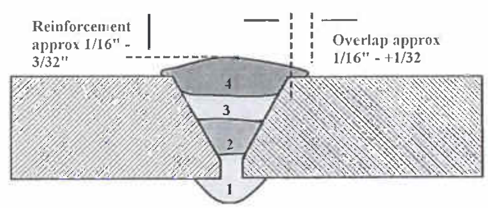
GP Test No.__GP-2012-01 __WPS / PQR NO__GP CAMAS-01____Welder ID NO________ Date__4-15-2012
Base Material Form and Dimensions : Plate ____ Pipe __X__ Size: __10" X ______" Thickness =_0.307"_nom
Material Spec _API 5L_ Tp/Cl/Grd __X-52___ P-No __1__ Grp No_1__ S No __none__ Heat No______
Material Spec _API 5L_ Tp/Cl/Grd __X-52___ P-No __1__ Grp No_1__ S No __none__ Heat No______
Comments_______This page represents Side Two (2) of the coupon ____________________________

Process __SMAW_____ Position ____5G__ Progression __Down-Hill___Current _DC_ Polarity _EP_

Filler Class = Root-_ E6010__ Dia __5/32"____ Size _ 5/32"______ Heat Lot No.______none___
Filler Class = Hot Pass E8010__ Dia __5/32"____ Size _ 5/32"______ Heat Lot No.______none___
Filler Class = Fill / Cap E8010__ Dia __3/16"____ Size _ 3/16"______ Heat Lot No.______none___
Comments____

Weld Joint Design





Welding Parameters

Layer no	Pass no	Pre - Heat (□F)	Inter Pass (F)	Length of Bead	Total Time min	Bead Width	Volts	Amps	Travel speed IPM	Heat Input (KJ/in.)	Comments	Notes
Side 2	Side 2			Inches	Min	Inches						**Weather**
1 Root	Top-Side	50	50	7	.7	Na	26/ 27.5	105	10	16.38 17.3	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
1 Root	Side to Bottom	50	50	7.25	.766	Na	26	115	9.456	18.97	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
2 Hot Pass	Top to Side	60	60	9	.8833	1/4-5/16"	28	125	10.18	20.61	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
2 Hot Pass	Side to Bottom	60	60	9	.8	1/4-5/16"	28	120	11	16.6	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
3 Fill	Top to Bottom	60	60	17	2	3/8-1/2"	26	145	8.5	26.6	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area
4 Cap	Top to Bottom	60	60	17	2.667	5/8-3/4"	26	145	6.375	35.48	Waited 10 minutes between passes for cooling	air temp 40 rain covered welding area

SUPPORTING DOCUMENTATION

Section 5

Qualification of Welding Procedures for Welds Containing Filler-metal Additives

5.1 PROCEDURE QUALIFICATION

Before production welding is started, a detailed procedure specification shall be established and qualified to demonstrate that welds with suitable mechanical properties (such as strength, ductility, and hardness) and soundness can be made by the procedure. The quality of the welds shall be determined by destructive testing. These procedures shall be adhered to except where a change is specifically authorized by the company, as provided for in 5.4.

5.2 RECORD

The details of each qualified procedure shall be recorded. The record shall show complete results of the procedure qualification test. Forms similar to those shown in Figures I and 2 should be used. The record shall be maintained as long as the procedure is in use.

5.3 PROCEDURE SPECIFICATION 5.3.1 General

The procedure specification shall include the information specified in 5.3.2, where applicable.

5.3.2 Specification Information 5.3.2.1 Process

The specific process or combination of processes used shall be identified. The use of a **manual**, semiautomatic, mechanized, or automatic welding process or any combination of these shall be specified. **SMAW**

5.3.2.2 Pipe and Fitting Materials

The materials to which the procedure applies shall be identified. API Spec 5L pipe, as well as materials that conform to acceptable ASTM specifications, may be grouped (see 5.4.2.2), provided that the qualification test is made on the material with the highest specified minimum yield strength in the group. **API Spec 5L pipe X52 used**

5.3.2.3 Diameters and Wall Thicknesses

The ranges of outside diameters and wall thicknesses over which the procedure is applicable shall be identified. Examples of suggested groupings are shown in 6.2.2, items d and e.

5.3.2.4 Joint Design **Recorded on documents sheets.**

The specification shall include a sketch or sketches of the joint that show the angle of bevel, the size of the root face, and the root opening or the space between abutting members. The shape and size of fillet welds shall be shown. If a backup is used, the type shall be designated.

5.3.2.5 Filler Metal and Number of Beads **Recorded on documents sheets.**

The sizes and classification number of the filler metal and the minimum number and sequence of beads shall be designated.

5.3.2.6 Electrical Characteristics

The current and polarity shall be designated, and the range of voltage and amperage for each electrode, rod, or wire shall be shown. **Recorded on documents sheets.**

5.3.2.7 Flame Characteristics NA

The specification shall designate whether the flame is neutral, carburizing, or oxidizing. The size of the orifice in the torch tip for each size of rod or wire shall be specified.

5.3.2.8 Position

The specification shall designate roll or **position welding**.

5.3.2.9 Direction of Welding

The specification shall designate whether the welding is to be performed in an uphill or **downhill** direction.

5.3.2.10 Time between Passes

The maximum time between the completion of the root bead and the start of the second bead, as well as the maximum time between the completion of the second bead and the start of other beads, shall be designated. **10 minutes**

5.3.2.11 Type and Removal of Lineup Clamp

The specification shall designate whether the lineup clamp is to be internal or external or if no clamp is required. If a clamp is used, the minimum percentage of root-bead welding that must be completed before the clamp is released shall be specified. **No clamp required**

5.3.2.12 Cleaning and/or Grinding

The specification shall indicate whether power tools or hand tools are to be used for cleaning, grinding, or **both.**

5.3.2.13 Pre- and Post-heat Treatment *as welded only no pwht*

The methods, temperature, temperature-control methods, and ambient temperature range for pre- and post-heat treatment shall be specified (see 7.11).

5.3.2.14 Shielding Gas and Flow Rate **NA**

The composition of the shielding gas and the range of flow rates shall be designated.

5.3.2.15 Shielding Flux

The type of shielding flux shall be designated. **NA**

5.3.2.16 Speed of Travel

The range for speed of travel, in inches (millimeters) per minute, shall be specified for each pass. **Recorded on documents sheets**

5.4 ESSENTIAL VARIABLES 5.4.1 General

A welding procedure must be re-established as a new procedure specification and must be completely requalified when any of the essential variables listed in 5.4.2 are changed. Changes other than those given in 5.4.2 may be made in the procedure without the need for requalification, provided the procedure specification is revised to show the changes.

5.4.2 Changes Requiring Requalification

5.4.2.1 Welding Process or Method of Application

A change from the welding process or method of application established in the procedure specification (see 5.3.2.1) constitutes an essential variable. **smaw**

5.4.2.2 Base Material

A change in base material constitutes an essential variable. When welding materials of two separate material groups, the procedure for the higher strength group shall be used. For the purposes of this standard, all materials shall be grouped as follows:

a. Specified minimum yield strength less than or equal to 42,000 psi (290 MPa).

b. Specified minimum yield strength greater than **42,000 psi** (290 MPa) but less than **65,000 psi** (448 MPa). *Used 52,000 psi*

c. For materials with a specified minimum yield strength greater than or equal to 65,000 psi (448 MPa), each grade shall receive a separate qualification test.

Note: The groupings specified in 5.4.2.2 do not imply that base materials or filler metals of different analyses within a group may be indiscriminately substituted for a material that was used in the qualification test without consideration of the compatibility of the base materials and filler metals from the standpoint of metallurgical and mechanical properties and requirements for pre- and post-heat treatment.

5.4.2.3 Joint Design

A major change in joint design (for example, from **V groove** to U groove) constitutes an essential variable. Minor changes in the angle of bevel or the land of the welding groove are not essential variables.

5.4.2.4 Position

A change in position from roll to **fixed**, or vice versa, constitutes an essential variable.

5.4.2.5 Wall Thickness

A change from one wall thickness group to another constitutes an essential variable. **0.307"** used in qualification

5.4.2.6 Filler Metal

The following changes in filler metal constitute essential variables:

a. A change from one filler-metal group to another (see Table 1).

b. For pipe materials with a specified minimum yield strength greater than or equal to 65,000 psi (448 MPa), a change in the AWS classification of the filler metal (see 5.4.2.2).

Changes in filler metal within filler metal groups may be made within the material groups specified in 5.4.2.2. The compatibility of the base material and the filler metal should be considered from the standpoint of mechanical properties.

5.4.2.7 Electrical Characteristics

A change from DC electrode positive to DC electrode negative or vice versa or a change in current from DC to AC or vice versa constitutes an essential variable.

5.4.2.8 Time between Passes

An increase in the maximum time between completion of the root bead and the start of the second bead constitutes an essential variable.

5.4.2.9 Direction of Welding

A change in the direction of welding from vertical **downhill** to vertical uphill, or vice versa, constitutes an essential variable.

5.4.2.10 Shielding Gas and Flow Rate *not applicable for SMAW stick electrodes*

A change from one shielding gas to another or from one mixture of gases to another constitutes an essential variable. A major increase or decrease in the range of flow rates for the shielding gas also constitutes an essential variable.

5.4.2.11 Shielding Flux *not applicable for SMAW stick electrodes*

Refer to Table 1, Footnote a, for changes in shielding flux that constitute essential variables.

5.4.2.12 Speed of Travel

A change in the range for speed of travel constitutes an essential variable.

5.4.2.13 Pre-heat

A decrease in the specified minimum pre-heat temperature constitutes an essential variable.

5.4.2.14 Post-weld Heat Treatment (PWHT)

The addition of PWHT or a change from the ranges or values specified in the procedure shall each constitute an essential variable.

5.5 WELDING OF TEST JOINTS-BUTT WELDS

To weld the test joint for butt welds, two pipe nipples shall be joined, following all the details of the procedure specification.

5.6 TESTING OF WELDED JOINTS-BUTT WELDS

5.6.1 Preparation

To test the bun-welded joint, test specimens shall be cut from the joint at the locations shown in Figure 3.

Table 1—Filler Metal Groups

Group	AWS Specification	Electrode	Fluxc
1	**A5.1** A5.5	**E6010**, E6011 E7010, E7011	
2	**A5.5**	**E8010,** E8011 E9010	
3	A5.1 or A5.5	E7015, E7016, E7018	

Note: Other electrodes, filler metals, and fluxes may be used but require separate procedure qualification.

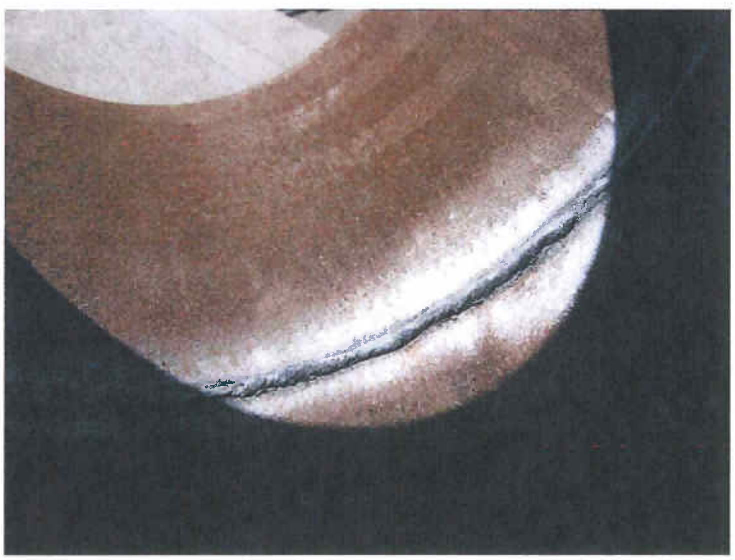
The below photo shows the: **"as-welded"** top view of the Welding Procedure Qualification Test Coupon.

The pipe is marked with a **Single** and **Double** *line set* <u>with arrows</u> on each side (1&2). This represents that each side is welded with different welding variables.

Side I - is welded using 1/8" diameter electrodes for the **<u>root pass</u>**.

The remainder of the layers, being the (**a**) hot pass, (**b**) fill and (**c**) cap passes are welded using **<u>5/32"</u>** diameter electrodes.

Side 2- is welded using **<u>5/32"</u>** diameter electrodes for the **<u>root pass</u>**. The remainder of the layers, being the (**a**) hot pass (**<u>5/32"</u>** diameter electrodes), (**b**) fill and (**c**) cap passes are welded using **<u>3/16"</u>** diameter electrodes.



The **2** similar photos are showing the "typical" inside root conditions of the weld, prior to cutting the pipe into the required specimens.

The **2** similar photos are showing the "**typical**" inside root conditions of the weld, prior to cutting the pipe into the required specimens.

The inside root sections received a visual examination using the stated code acceptance criteria.

The internal root surface was determined to be acceptable. This was performed using no magnification only the "naked eye".

This photo shows or represents the basic layout for the **"Order of removal"** and <u>locations</u> for the required specimens.

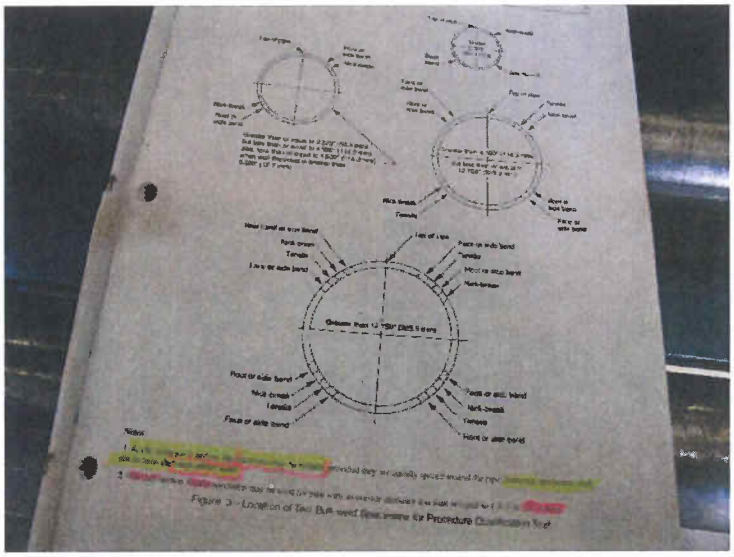
Root and **Face** Bends are shown.

<u>Side 1</u>

This photo shows the basic layout for the "Order of removal" and locations for the required specimens. Nick Break and Tensile tests. **Side 1**

Side 2- is welded using **5/32"** diameter electrodes for the **root pass**. The remainder of the layers, being the (a) hot pass (**5/32"** diameter electrodes), (b) fill and (c) cap passes are welded using **3/16"** diameter electrodes.

This photo shows the basic layout for the "Order of removal" and locations for the required specimens. **Nick Break** and **Tensile** tests. **Side 2**



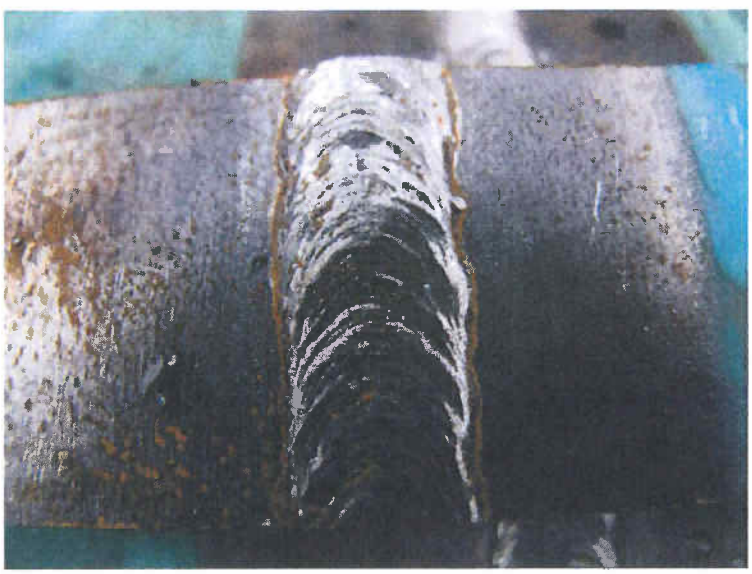
Code book is opened to the order of removal page indicating the observed requirements of meeting the API 1104 Code. The number of specimens are different for the changes in the pipe size range.

This photo shows the basic layout for the "Cutting and removal" of the required tensile specimens. Tensile specimens are removed from both **Sides 1 & 2** as shown by the **single** and **double lines** across the specimens.

This corresponds to the tensile identification number on the testing laboratory report.

Typical **Root Bend** surface prior to grinding the specimen as preparation for testing.

Additional photos are provided showing the final preparation of the bend specimens and the conditions after bending.



Typical **Face Bend** surface prior to grinding the specimen as preparation for testing.

Additional photos are provided showing the final preparation of the bend specimens and the conditions after bending.

Typical **Root Bend specimens** showing the surface prior to grinding as part of the preparation for testing.

The below photo is and enlargement of the same specimen. This is an example of a ***"preferred"*** root bead condition. The size, shape and contour are what is considered to be the "*desired appearance*". This shape allows for the observer to see the *control of the electrode* being used , *travel speed* being uniform or steady and the overall skill set of the welder to be considered ***"a good-root bead"***. This would be considered "better than normal" for the average welder.

This condition is typical for a **Root Bead "mainly"** in the upper quadrants of the pipe sections. **Travel speed** is the key to achieving this condition once the amperage is set, providing the root face and root opening are uniform. Travel speed, that is recorded on the welding procedure qualification record is not intended to be the attribute to tell the welder how fast to weld. Conditionally when traveling at a rate greater than recorded, is an indication that the root pass is being performed at to high of rate or too fast, as such, lack of fusion or penetration may be occurring. In some cases a "hollow bead" may form which is a condition when the root pass solidifies to fast and traps gas in the centerline of the root pass.

The below photo is an example of a ***"preferred"*** root bead condition as to be considered ***"a good-root bead"***. Even though this would be considered "better than normal" for the average welder. Most welders will produce similar root bead conditions when the optimum weld joint design conditions exist. As the gap or "*root opening*" closes from top to bottom ,the difficulty increases and the amperage normally is increased accordingly. It is for this reason that a range of voltage, amperage and travel speed is specified on the welding procedure and yet not primarily intended to limit the welders decision to increase the amperage when warranted. The welder needs to observe the conditions and react to the conditions by changing what is considered needed in **real time** while "running the bead". The sole purpose of the welder qualification coupon demonstration is to witness the welder welding and make an assessment of the welder's skills from observing both the welding operation and the conditions at each step of the welding operation.

Typical **Nick Break** sample, (face side) prior to testing the specimens, this is to indicate the **depth of nick** along the top of the weld reinforcement or cap pass and at the ends of the tensile section.

This photo is an example of the condition of preparation for testing.

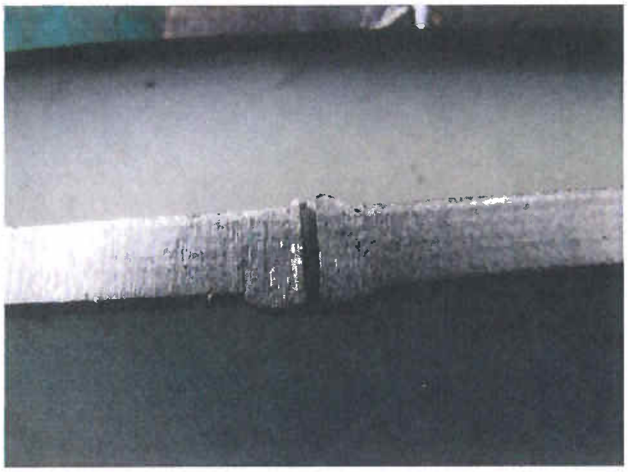
Additional photos are provided showing the final preparation of the **Nick Break** specimens and the conditions after testing.

The ***sole purpose*** of this test is to ***force*** the specimen to ***fracture*** along the path of the nick (saw cut sections). The intention is to expose the cross section along the length of the nick, in order to evaluate the volumetric or cross section of the weld center line to expose potential defects in the weld.

This method is very effective in evaluating the soundness of the weld without the usage of Radiography or Ultrasonic Examination.

Typical **Nick Break** sample, **(end view)** prior to testing the specimens, this is to indicate the depth of nick at the ends of the tensile section being the preparation for testing.

Additional photos are provided showing the final preparation of the **Nick Break** specimens and the conditions after testing.



Typical **Nick Break** sample, **(end view)** prior to testing the specimens, this is to indicate the depth of nick at the ends of the tensile section being the preparation for testing.

The difficult aspect is to line up the center of the nick region and to align it between the ***Id*** *- root width* and the ***OD*** *- cap width.*

Typically the **Nick Break** samples, provide a realistic method to visually examine the volumetric conditions in the weld specimens being tested. This method is sometimes *underestimated* as to the worthiness to indicate or expose flaws. As shown in the broken specimen (bottom right side), there are small rounded light contrasting or silver appearing dots and a hole. This is an example of the weld metal—out-gassing during solidification or forming what we term as porosity trapped in the weld.

Both photo's are of the same samples turned different directions in order to fully see or evaluate the cross section. This shows the value of the nick break specimen.

The size of the observed "porosity" or "inclusions" are not considered to be "reject able" based upon the allowable flaw size per the code. This would be considered a "clean" weld and would pass the radiographic acceptance criteria if found in a production weld. This would be considered a condition to say the ***welder*** is *capable of producing sound welds* meeting code radiographic acceptance criteria.

Normal set of Root and Face Bends. "Green" side speci-mens are Face Bends -OD of Pipe. "Brown" side specimens are Root Bends—ID or pipe.

Close up vie of root face bend sur-faces with No Visible Discontinuities. Normal set of Root and Face Bends. "Green" side specimen is a Face Bend -OD of Pipe. "Brown" side specimen is a Root Bend—ID or pipe. Taken from above group.

Top View of "**Wrap-Around**" Bend Tester, Bending Die being used for testing the bend specimens. This typically forms an even bend radius around the specimen and uniformly distributes the loading and plastic deformation that occurs during the testing. The ***outside fiber elongation*** as required by the code of reference, determines the (min - max) bend radius to be used when testing materials of variable strength values. This method of bend testing provides a realistic method to insure the weld width is within the 180 degree bend section of the specimen as shown above .

Normal set of **Tensile Specimens** being viewed from the OD or top face of the pipe. Notation should be given as to where the specimens actually necked down (reduced in cross section) and finally broke. This implies that the weld joint or weld-ment is stronger than the base material. Secondly, that the combined effects of the reinforcement played a roll to induce the failure to occur, "outside the weld Heat Affected Zone".

This set of **Tensile Specimens** being viewed from the side of the pipe, provides a realistic view showing the distance from the weld fusion line or toe of the weld face to the region at which the specimen failed. This is a reasonable and normal condition to expect when performing the weld tensile testing with the reinforcement remaining on the pipe specimens.

The above **Tensile Specimen** being viewed from the ID or" inside" face or "Root side" of the pipe. Notation should be given as to where the specimens actually necked down (reduced in cross section) and finally broke. Secondly, the observed condition that the only gray colored region on the left side of the specimens shows evidence that the specimen broke outside the areas effected by heating and cooling as being "outside the weld Heat Affected Zone". The failure occurred in the base metal that has not been heated to any significant temperature, that would change the microstructure of the material or steel.

The **Tensile Specimen** being viewed from the ID or" inside" face or "Root side" of the pipe. Notation should be given as to observed the root defects that are present in the welds. These did not become evident prior to the testing. This implies that some plastic deformation is occurring in the weld joint region during the application of the loading or stress being applied. The fact that the weld reinforcement is present plays a role in the distribution of the loading or applied stress. As the material plastically deforms some hardening occurs as to "work harden the material". This provides a reasonable observed relationship as to the benefits of reinforcement (both internal and external) on welded components or pipe welds in specific for this case. Most important to observe is that "root lack of fusion did exist in this specimen", that was not observable prior to the testing , and yet with the defect present the weld did not fail. The reinforcement provided extra strength as to redistribute the applied loading or stress to the adjacent regions.