# Welding

Part §192

Not applicable to welding during manufacture of pipe and components

#### <u>5192.225</u>

# Velding Procedures

> Welding Performed by "Qualified" Welder > Welding Procedures "Qualified" Using API 1104 Section 5 or **ASME B&PV Section IX** Recorded in Detail and "Qualified" by **Destructive Testing** Followed when the Procedure is Used





"Qualified Procedure" vs "Qualified Welder"

"qualified procedure test" verifies integrity/ metallurgy of that weld

"qualified welder test" verifies ability of that welder

# Procedure must be qualified by Destructive Testing





APJ 1104 Procedure Qualification

#### Section 5, Figure 3

Number, Type, and Locations of Test Straps Required for Procedure Qualification Tests



#### Notes:

 At the company's option, the locations may be rotated, provided they are equally spaced around the pipe; however, specimens shall not include the longitudinal weld.

2. One full-section tensile specimen may be used for pipe with an outside diameter less than or equal to 1.315 in. (33.4 mm).

Figure 3—Location of Test Butt-Weld Specimens for Procedure Qualification Test

**Reference : API Standard 1104, 2.2** 

#### PROCEDURE SPECIFICATION NO.

For	Welding of	Pipe and Fittings
Process		
Material		
Diameter	Wall thickness	
Joint design		
Filler metal	Number of beads	
Electrical or flame characteristics		
Position		
Direction of welding		
No. of welders		
Time lapse between passes		
Type and removal of lineup clamp		
Cleaning and/or grinding		
Preheat stress relief		
Shielding gas and flow rate		
Shielding flux		
Speed of travel		
Sketches and tabulations attached		

Date tested	Welder
Date approved	Welding supervisor
Date adopted	Chief engineer

Change in Process or Method of Application

> Pipe Grades
 > ≤ 42,000 SMYS
 > > 42,000 but < 65,000</li>
 > ≥ 65,000 - Separate Test for Each Grade

Joint Design (U or V groove)

Position (fixed or rolled, horizontal or tilted)

Wall Thickness Group
< 3/16" (.188)</p>
> 3/16" - 3/4" (.188 - .750)
> 3/4" (.750)



 Time Between Passes
 Max time between root and second

Direction of welding
 Uphill or downhill



#### Shielding Gas and Flow Rate

# Shielding Flux Speed of Travel Filler Metal Group

Group	AWS Specification	Electrode
1	A5.1 A5.5	E6010 E6011 E7010 E7011
2	A5.5	E8010 E8011
3	A5.1 or A5.5	E7015 E7016 E7018
	A5.5	E8015 E8016 E8018



Section 6 of API Standard 1104

Section IX of ASME Boiler and Pressure Vessel Code



# **5192.227 Qualification of** Welders

# (§192 ONLY)

Less than 20% SMYS -Appendix C





> Welder Qualified under Earlier Edition of API 1104 or ASME Section IX---

May Continue to Weld

May Not Re-qualify under that Edition



# Qualified Velders



# Qualified Velders

# Not Quite

# API 1104 Velder Single Qualification (Butt or Fillet)



 If Qualified on Butt Welds in Fixed Position @ 45° Angle, Qualified for Butt Welds and Lap Fillet Welds in all Positions

# Essential Variables - Welder Single Qualification



Change in any one of: Process Direction of Welding Filler-metal Classification Outside Diameter Group > < 2.375" > 2.375 - 12.750" > > 12.750 " Wall Thickness Group Position Joint Design

# APJ 1104 Welder Multiple Qualification



Must Make Butt Weld First Layout, Cut & Fit **Branch** Connection Cut Hole in Run for Branch Make Fillet Weld on **Branch/Run Joint** 

# APJ 1104 - Welder Multiple Qualification

Butt & Branch Welds Must Be Made on Pipe at Least 6.625"

12.75" Qualifies for <u>all</u> Pipe Diameters

Butt Weld Made in Fixed Horizontal or 45° Angle Position



# APJ 1104 Velder Multiple Qualification



## Cut Full-Size Hole in Run Pipe

Run Pipe Shall Be Horizontal

Branch Shall Extend Vertically Downward From Run Pipe

# Essential Variables Welder

Change in welding processes

## Change in direction of welding

Change in filler metal classifications



# 5192,229 Limitations on Welders

 Welder whose qualification is based on nondestructive testing may not weld on compressor station pipe and components
 Must have welded with particular

process within the preceding 6 calendar months



# 192,229 Additional Limitations

Welder qualified under Section 6 of API 1104 or Section IX of ASME

To weld on pipe operating at 20% SMYS or more, must have weld tested:
Every 6 months per API 1104 Section 6 or 9, or
Twice each CY at intervals Not exceeding 7-1/2 months



5192,229 Additional Limitations Welder qualified under Section 6 of API 1104 or Section IX of ASME To weld on pipe operating at less than 20% SMYS, must: Have weld tested every 6 months per API 1104 Section 6 or 9, or Re-qualify under Appendix C every calendar year not to exceed 15 months, or Out out and test a production weld twice each calendar year

# 5192,229 Additional Limitations

Welder qualified under Appendix C Must re-qualify under Appendix C every calendar year not to exceed 15 months, or Must cut out and test a production weld twice each calendar year (interval cannot exceed 7 1/2 months), or For service lines 2 inches and smaller only, 2 welds tested per App. C, Sec. III

# Vhere Are the Velding Procedures?

Procedures do not have to be with the welder and chances are the welder will not have them.

Inspectors are encouraged to have a copy of the procedure and verify that the welder is following the procedure.

# Can Operators Share?

#### Procedures

Yes, if the operator has the procedures and procedure qualification test records.

# > Qualified welders > Yes in API 1104 20th edition > Section 6.1 General - "The qualification of welders shall be conducted in the presence of a representative acceptable to the company."

# 5192.231 Protection from Weather

The welding operation must be protected from weather conditions that would impair the quality of the completed weld.



### 5192,233 Miter Joints

> 30% or more SMYS, Maximum of 3°

> >10% SMYS <30%, Maximum of 12<sup>1/2°</sup> Must be one diameter from any other miter

> 10% or less SMYS,
 Maximum of 90°



# **5192.235 Preparation for Welding**

Before beginning any welding, the welding surfaces must be clean and free of any material that may be detrimental to the weld, and

Must be aligned to provide the most favorable condition for depositing the root bead. This alignment must be preserved while root is deposited.





# 5192.241 Inspection and Test of Velds

Visual inspection (by individual qualified by training & experience) of the WELDING must be done to insure –

Welding is done according to procedure, and
 Weld is acceptable per API 1104 Section 9.

# **5192.241 Inspection and Test of** Velds

number.

Welds on pipelines operating > 20% SMYS must be Nondestructively tested, except: Welds visually inspected and approved by a welding inspector qualified by training & experience if: > Pipe is  $\leq 6''$  nom. dia.; or Line operates below 40% SMYS and welds are limited in

# Part 192 Alternative Acceptance Criteria API 1104 – Appendix "A" (20th Edition Errata/Addendum July 2007) Appendix "A" <u>Is Incorporated by Reference in</u> Part 192.241 (c) as an alternative acceptance criteria if API 1104 Section 9 requirements cannot be met for any reason other than a crack. Removed Appendix "A" 20<sup>th</sup> Edition (2005)

and added new Appendix "A" (2007) -Alternate Acceptance Standards for Girth Welds.

# Part 192 Alternative Acceptance Criteria

API 1104 – Appendix "A" (20<sup>th</sup> Edition Errata/Addendum July 2007)

- Uses "Fracture Mechanics Analysis" and "Fitness-for-Purpose Criteria" to Determine Weld Alternate Acceptance Criteria.
- >Additional Qualification Tests, Stress Analysis, and Inspection are required to use the "Fitness-for-Purpose" criteria.
- Restricted use, not applicable in all conditions.



# 5192.241 Inspection and Test of Welds







# 5192.243 Nondestructive Testing

> NDT must be performed by any process, other than trepanning, which will clearly indicate defects that may affect the integrity of the weld.

10 ž 69 Se S 31085

# 5192,243 What is Trepanning?





# S192.243 Nondestructive Testing

#### NDT must be performed: > In accordance with written procedures; and

By persons trained and qualified in the procedures and with the equipment being utilized



# 5192.243 Nondestructive Testing

Procedures must be established for interpretation of each test to ensure acceptability of the weld per API 1104 Section 9.



## 5192.243 Nondestructive Testing

When required, random testing of each days welds must be tested at the following rates:

Class 1 areas - 10%
Class 2 areas - 15%
Class 3 & 4, offshore, rights-of-way - 100%, unless impracticable, then 90%
Tie-Ins (including replacement sections) 100%

# 5192.243 Nondestructive Testing

Must test some of each welders work each day
Must retain for life:
Record by milepost, engineering station, etc.;

- Number of welds
- Number tested
- Number rejected
- Disposition of rejects





Repair or Removal of Defects

 Each unacceptable weld under §192.241(c);
 Must be removed or repaired.
 Removed if crack is > 8% of weld length

For repairs, must remove defect down to sound metal, pre-heat if necessary, and re-inspect





# Repair or Removal of Defects

Repair of a crack or defect in a previously repaired area must be done in accordance with written repair procedures that have been qualified under §192.225

# **5192.309 Repair of Steel Pipe**

Arc Burn

(c) Each arc burn on steel pipe to be operated  $\geq 40\%$ **SMYS** must be repaired or removed. If repaired by grinding, must check remaining wall thickness. If not repairable by grinding, a cylinder of the pipe containing the arc burn must be removed.

# Part 192 Appendix "C" Basic Test

Test on pipe 12" or smaller > Weld in horizontal, fixed position > Weld according to a qualified, written procedure



# Part 192 Appendix "C" Basic Test

Cut weld into four coupons Subject to a root bend test > If two or more have a crack >1/8", weld is unacceptable Successful test qualifies welder to weld on pipe diameters  $\leq 12$  inches



# Part 192 Appendix "C" Service Connections To Mains



Weld service connection to pipe of typical main size in same position as in field

> Test destructively

Part 192 Appendix "C" Small Service Lines

Two samples 8" long are cut w/ weld in center

Subject one to guided bend test

Subject second to tensile test
 If tensile machine not available, bend test

Valintenance/Hot Valing?

Covered in API 1104 (20<sup>th</sup> ed.) Appendix "B" (prev. API RP 1107)

Appendix "B" <u>MOT</u> incorporated by reference in Part 192

Maintenance Welding includes OQ Covered Tasks

Operators must qualify Welders for Maintenance Tasks What should State/Federal inspectors or operators check for compliance regarding Subparts "E" or "D"?

Written welding procedures with qualifying test results available

- How welders are qualified (API, ASME, Part 192 Appendix C)
- Verification of use of qualified welders
- How welders maintain qualification and re-qualify

Qualifications of welding inspectors

What should State/Federal inspectors or operators check for compliance regarding Subparts "E" or "D"?
Adherence to welding procedures/code

requirements/housekeeping during field welding

Use of N.D.T./N.D.T. procedures/ qualifications of N.D.T. technicians

Special procedures for "hot" or repair welding

Repair criteria for defective welds
 Maintenance of required records

# Information Websites

PHMSA Training and Qualification http://www.phmsa.dot.gov/pipeline/TQ

PHMSA Pipeline Safety Regulations http://www.phmsa.dot.gov/pipeline/TQ/Regulations