

ATPF-2808: SPECIAL TOPICS: FIXED 45 DEGREE 6G PIPE FITTER WELD

Cuyahoga Community College

Viewing: ATPF-2808 : Special Topics: Fixed 45 Degree 6G Pipe Fitter Weld

Academic Term:

Fall 2026

Subject Code

ATPF - Applied Ind Tech - Pipefitters

Course Number:

2808

Title:

Special Topics: Fixed 45 Degree 6G Pipe Fitter Weld

Catalog Description:

Basic pipefitter welding course covering open root welding including joint design, material selection and prep and the welding process. Included in this course are technique demonstration and application. The 6G position is for weld test compliance.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

Departmental Approval: admission to Pipefitter's Apprenticeship program.

Outcomes

Course Outcome(s):

Discuss the purpose of 45 degree pipe weld and how it relates to weld testing applications.

Objective(s):

1. Discuss the purpose of pipe groove welds in the 45 degree position and identify respective uses.
2. List and define the terms related to 6G groove welding.
3. List the different methods used to bevel carbon steel pipe.
4. Explain the purpose of beveling pipe in position to be welded
5. Identify the physical properties of carbon steel pipe.
6. Identify the various types of groove welds used with 6G welders
7. Differentiate between field welding and 6G position welding
8. State examples of 45 degree groove welding for test qualifications.

Course Outcome(s):

Discuss the joint design required for pipe groove welding in the 45 degree position, including engineered specifications, bevel angle, and the effects of land and root gap dimensions and the weld process.

Objective(s):

1. Explain the challenge of welding with respect to engineering specifications and 6G positions.
2. Explain the importance of adhering to the prescribed tolerances.
3. Explain how bevel angle, land thickness, and joint design directly affect the quality of the open root.
4. Explain how the pipe weld process is affected by the 6G, 45 degree welding.

Course Outcome(s):

Demonstrate the ability to pipe groove weld in the fixed 45 degree and properly prepare the coupons, correctly adjust the machine settings, and perform welding operations with respect to rod selection and technique.

Objective(s):

1. Apply the proper safety procedures to prepare the pipe and perform 6G welding operations.
 2. Prepare welding materials with respect to the correct land, bevel, and root gap in accordance with prescribed tolerances.
 3. Discuss the difference in machine set-up with the change in positions.
 4. Select the proper electrode for open root pass.
 5. Assemble weld coupons and tack to establish a proper root gap.
 6. Operate power equipment and use hand tools to prepare the tacks to root pass.
 7. Verify the fit-up of welding coupons to be welded in the 6G position.
 8. Apply proper welding techniques, weave bead, for fill and gap to perform an open root pipe groove weld.
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Methods of Evaluation:

1. Attendance
2. Participation
3. Assignments
4. Exams/quizzes

Course Content Outline:

1. Pipe groove welding
 - a. Purpose
 - i. Test applications for 6G
 1. Fabrication
 2. Common field welds
 - ii. Fit up application
 1. Jewel clamp
 2. Fit up dogs
 3. Pipe test stands
 - b. Terminology
 - i. Root opening
 - ii. Deep groove weld
 - iii. Bevel angle
 - iv. Root gap
 - v. Root penetration
 - vi. 6G
 - vii. Outside diameter reinforcement
 - viii. Inside diameter reinforcement
 - ix. Porosity
 - x. Travel speed
 - xi. Stringer bead overlap
 - xii. Stringer bead height
 - xiii. Undercut
 - c. Bevel methods
 - i. Oxygen/acetylene
 - ii. Hand/mechanical
 - iii. Machine cut
 - d. Purpose
 - i. Body position change from left to right
 - ii. Technique
 - iii. Methods of holding the electrode
 - e. 6G bead properties

- i. Root technique
 - ii. Fill layers
 - iii. Proper stringer bead stacking
 - f. Pipe groove weld types
 - i. Single bevel
 - ii. Vertical up
 - iii. Vertical down
 - iv. Single U
 - v. Double bevel
 - vi. Double bevel J
 - vii. Double bevel V
 - viii. Double bevel U
 - ix. Deep groove
 - x. Fillet weld types
 - 1. Slip on flange
 - 2. Socket weld
 - 3. Weld o-let
 - 4. Thread o-let
 - g. Material
 - i. A-106
 - ii. B-53
 - iii. Schedule 40
 - iv. Schedule 80
 - v. 304 stainless steel
- 2. Joint design
 - a. Parameters
 - i. Weld procedure specifications WPS
 - 1. Minimum gaps, land and bevel angle
 - 2. Maximums
 - ii. Engineered specifications
 - iii. All bead after root bead start on the overhead position
 - b. Prescribed tolerances
 - i. Acceptance
 - 1. No visible grinding
 - 2. Appearance
 - 3. Penetration
 - 4. Complete fusion
 - ii. Discontinuity
 - 1. Under fill
 - 2. Porosity
 - 3. Lack of fusion
 - 4. Undercut
 - c. Open root quality
 - i. Consistent width
 - ii. Complete penetration
 - iii. Complete fusion
 - iv. Adjust arc speed to obtain proper root thickness
 - d. Weld process
 - i. Shield metal arc welding (SMAW)
 - ii. Gas tungsten metal arc welding (GTAW)
 - iii. Gas machine arc welding (GMAW)
- 3. Welding operations
 - a. Safety procedures
 - i. PPE
 - 1. Safety glasses
 - 2. Gloves
 - 3. Fire retardant jacket
 - 4. Hood with lens
 - 5. Footwear

- ii. Electrical
 - 1. Grounding
 - 2. Nicks and abrasions
 - 3. Polarity
 - 4. Wet outside conditions
- iii. Jobsite hazards
 - 1. Fire
 - 2. Water
 - 3. Falls
 - 4. Pinch points
- iv. Physical hazards
 - 1. Burns
 - 2. Weld flash
 - 3. Electrical shock
 - 4. Respiratory
 - 5. Hearing
- b. Material preparation
 - i. Land
 - ii. Bevel
 - 1. Angle
 - 2. Application
- c. Machine set up
 - i. Power
 - ii. Electrode holder and ground
 - iii. Amperage selection
- d. Electrode
 - i. Number and material
 - ii. Size
 - iii. Amperage setting
- e. Coupon assembly
 - i. Root gap
 - ii. Fit up
 - iii. Tacks
 - iv. Fixture adjustment
- f. Hand and power tools
 - i. Selection
 - ii. Application
 - iii. Operation
- g. Verification
 - i. Machine adjustment
 - ii. Set up and tack
 - iii. Gap gage
- h. Welding technique
 - i. Rod angle
 - ii. Rod selection
 - iii. Arc length
 - iv. Travel speed
 - v. Key hole
 - vi. Electrode holder and ground
 - vii. Amperage selection
- i. Electrode
 - i. Number
 - ii. Size
 - iii. Amperage setting
- j. Coupon assembly
 - i. Root gap
 - ii. Fit up
 - iii. Tacks
 - iv. Fixture adjustment

- k. Verification
 - i. Machine adjustment
 - ii. Set up and tack
 - iii. Gap gage
- l. Welding technique
 - i. Rod angle
 - ii. Rod selection
 - iii. Arc length
 - iv. Travel speed
 - v. Key hole

Religious Accommodation

Before reviewing the course schedule, students should carefully review the following religious accommodation policy and other required instructional policies:

Religious Accommodation:

Students seeking an accommodation for absences permitted under Ohio’s Testing Your Faith Act must provide the instructor with written notice of the specific dates for which the student requires an accommodation and must do so not later than fourteen (14) days after the first day of instruction. Please submit requests for accommodations at this link: <https://portal2.tri-c.edu/ReligiousAccommodation/ReligiousAccommodationForm>. Students with questions about their religious accommodations under Ohio’s Testing Your Faith Act may contact the College’s Office of General Counsel and Legal Services by phone at 216.987.4856 or via email at legal@tri-c.edu.

Other Required Instructional Policies:

<https://www.tri-c.edu/student-resources/curriculum/documents/syllabus-part-b.pdf>

Weekly Schedule

	Topics
Week 1	Welding Safety and Pipe Groove Welding * Personal Protective Equipment * Purpose of Pipe Groove Welding * Pipe Groove Welding Progression * Shop
Week 2	Welding Safety and Pipe Groove Welding * Personal Protective Equipment * Purpose of Pipe Groove Welding * Pipe Groove Welding Progression * Shop
Week 3	Coupon prep; changes in gap, and bevel angle; * Shop
Week 4	Coupon prep; changes in gap, and bevel angle; * Shop
Week 5	Tack and fit up technique; root pass; machine setting for tacking
Week 6	Tack and fit up technique; root pass; machine setting for tacking
Week 7	Machine settings; electrode selection
Week 8	Machine settings; electrode selection
Week 9	Body positioning; machine settings; fill pass
Week 10	Body positioning; machine settings; fill pass
Week 11	6G vertical up welding; body positioning; stringer bead
Week 12	6G vertical up welding; body positioning; stringer bead
Week 13	Weld acceptance and inspection process
Week 14	Weld acceptance and inspection process
Week 15	Review
Week 16	Weld test and evaluation

The Course Schedule is subject to change due to pedagogical needs, instructor discretion, parts of term, and unexpected events.

Required/Recommended Readings

Instructor-provided materials

Resources for the Instructor

Frankland, Thomas W. . *Pipe Trades Manual*. McGraw-Hill, 1965.

United Association Training Department. *Welding Skills Manual*. Annapolis, MD: United Association, www.ua.org/training

Additional Resources for the Instructor

www.ua.org (<https://catalog.tri-c.edu>www.ua.org)

<http://www.thefabricator.com/article/arcwelding/stick-welding-tips-for-top-performance> (<http://www.thefabricator.com/article/arcwelding/stick-welding-tips-for-top-performance/>)

<http://www.millerwelds.com/resources/articles/stick-electrode-selection/>

<http://www.millerwelds.com/resources/articles/smaw-stick-arc-welding-tips-techniques/>

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