ATPF-2807: SPECIAL TOPICS: FIXED VERTICAL 5G PIPE FITTER WELD

Cuyahoga Community College

Viewing: ATPF-2807 : Special Topics: Fixed Vertical 5G Pipe Fitter Weld

Academic Term:
Fall 2026

Subject Code
ATPF - Applied Ind Tech - Pipefitters

Course Number:
2807

Title:
Special Topics: Fixed Vertical 5G 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 with respect to root gap, land and fit up in compliance with industry standards.

Credit Hour(s):
2

Lecture Hour(s):
2

Requisites

Prerequisite and Corequisite
Departmental approval: admission to program.

Outcomes

Course Outcome(s):
Discuss the purpose of vertical pipe weld and how it relates to field applications.

Objective(s):
1. Discuss the purpose of pipe groove welds in the vertical position and identify respective uses.
2. List and define the terms related to vertical pipe groove welding.
3. List the different methods used for beveling carbon steel pipe.
4. Explain the purpose of beveling the pipe in the position to be welded.
5. Identify the physical properties of carbon steel pipe.
6. Identify the various types of groove welds.
7. Differentiate between roll welding and test booth position welding.
8. State examples of vertical pipe groove welding.

Course Outcome(s):
Discuss the joint design required for pipe groove welding in the vertical position including engineered specifications, bevel angle and the effects of land and root gap dimensions and the weld process.

Objective(s):
1. Explain the parameters of pipe groove welding in the vertical position with respect to engineering specifications and function.
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 vertical welding.

Course Outcome(s):

Demonstrate the ability to pipe groove weld in the fixed vertical position 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 vertical welding operations.
2. Prepare welding materials with respect to correct land, bevel and root gap in accord with prescribed tolerances.
3. Discuss the difference in machine set-up with the change in positions.
4. Select proper electrode for open root pass.
5. Assemble weld coupons and tack to establish proper root gap.
6. Operate power equipment and use hand tools to prepare the tacks to root pass.
7. Verify fit up of welding coupons to achieve prescribed results.
8. Apply proper welding techniques, weave bead, for fill and gap to perform open root pipe groove weld.

Methods of Evaluation:

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

Course Content Outline:

1. Pipe groove welding
1. Purpose
    a. Field application 5G
        i. Fabrication
        ii. Common field welds
    b. Fit up application
        i. Jewel clamp
        ii. Fit up dogs
        iii. Roller pipe stands

B. Terminology

1. Root opening
2. Groove weld
3. Bevel angle
4. Root gap
5. Root penetration
6. 5-G
7. Outside diameter reinforcement
8. Inside diameter reinforcement
9. Porosity
10. Heat Affected Zone HAZ
11. Weave bead width
12. Bead height
13. undercut

1. Bevel methods
1. Oxygen /acetylene
2. Hand/mechanical
3. Plasma arc
4. Grind

1. Purpose

1. Body position
2. Technique
3. Hand prop

1. 5-G weld bead properties

1. Root technique
2. Fill layers
3. Proper weave bead stacking

1. Pipe groove weld types

1. Single bevel
2. Single J
3. Single V
4. Single U
5. Double bevel
6. Double bevel J
7. Double bevel V
8. Double bevel U
9. Square
10. Fillet weld types
    a. Slip on flange
    b. Socket weld
    c. Weld o-let
    d. Thread o-let

G. Material

1. A-106
2. B-53
3. Schedule 40
4. Schedule 80
5. 304 stainless steel

1. Joint design

1. Parameters
    a. Weld Procedure Specifications WPS
2. Minimum gaps, land and bevel angle
3. Maximums
    a. Engineered specifications
    b. National Pipe Welding Bureau

1. Prescribed tolerances
    a. Adherence
    b. Discontinuity
        i. Weld crack
        ii. Porosity
        iii. Lack of fusion
        iv. Undercut
    c. Acceptance
        i. No visible grinding
        ii. Appearance
        iii. Penetration
        iv. Complete fusion
2. Open root quality

1. Consistent width
2. Complete penetration
3. Complete fusion
4. Root thickness/reinforcement

1. Weld process

1. Shielded Metal Arc Welding SMAW
2. Gas tungsten Metal Arc Welding TIG
3. Gas Machine Welding MIG

1. 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

1. Jobsite hazards
    a. Fire
    b. Water
    c. Falls
    d. Pinch points
2. Physical hazards
    a. Burns
    b. Weld flash
    c. Electrical shock
    d. Respiratory
    e. Hearing
3. Material preparation
    a. Land
    b. Bevel
        i. Angle
        ii. Application
4. Machine set up
    a. Power
    b. Electrode holder and ground
    c. Amperage selection
5. Electrode
    a. Number
    b. Size
    c. Amperage setting
6. Coupon assembly
    a. Root gap
    b. Fit up
    c. Tacks
    d. Fixture adjustment
7. Hand and power tools
    a. Selection
    b. Application
    c. Operation
8. Verification
    a. Machine adjustment
    b. Set up and tack
    c. Gap gage
9. Welding technique
    a. Rod angle
    b. Rod selection
    c. Arc length
    d. Travel speed
    e. Key hole

1. Electrode holder and ground
2. Amperage selection
3. Electrode

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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/ Religious Accommodation Form. 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	Course orientation; welding shop safety; PPE; jobsite hazards; overview of pipe groove welding and 5G position
Week 2	Purpose and field applications of vertical (5G) pipe groove welding; common field welds
Week 3	Pipe materials and specifications (A 106, B 53, Sch 40/80, stainless steel); physical properties
Week 4	Terminology: root opening, bevel angle, root gap, penetration, HAZ, discontinuities
Week 5	Joint design fundamentals; engineered specifications; tolerances; WPS requirements
Week 6	Beveling methods (oxy fuel, mechanical, plasma, grinding); preparing bevel and land
Week 7	Coupon preparation; measuring land and root gap; use of gap gauges
Week 8	Fit up methods and equipment (dog clamps, jigs, stands); tack welding techniques
Week 9	Welding machine setup; polarity; amperage selection; electrode types and sizes
Week 10	Open root weld theory; keyhole control; root pass technique in fixed vertical position
Week 11	Root pass practice (5G); body positioning; rod angle; travel speed
Week 12	Fill pass techniques; weave bead control; bead profile and stacking
Week 13	Cap pass techniques; appearance standards; reinforcement and undercut control
Week 14	Weld discontinuities (porosity, lack of fusion, cracks); inspection and acceptance criteria
Week 15	Complete weld practice (root, fill, cap); mock weld test; instructor feedback
Week 16	Final weld test and evaluation; review of outcomes; course wrap up

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

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

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

American Technical Publishers. *Welding Skills Workbook*. American Technical Publishers,

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Additional Resources for the Instructor

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/

www.ua.org (https://catalog.tri-c.eduwww.ua.org)

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