ATSM-2120: SHEET METAL WELD I

Cuyahoga Community College

Viewing: ATSM-2120 : Sheet Metal Weld I

Board of Trustees:
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Academic Term:
Fall 2021

Subject Code
ATSM - Applied Ind Tech- Sheetmetal

Course Number:
2120

Title:
Sheet Metal Weld I

Catalog Description:
Course covers the application of welding in the sheet metal industry including cutting and burning and a discussion of the various welding groups and positions, electrode classifications, and maintenance and repair of welding machines. Included is a demonstration and student application of the various welding techniques, fit-ups, and welding processes.

Credit Hour(s):
3

Lecture Hour(s):
3

Requisites

Prerequisite and Corequisite
Departmental approval: admission to Sheet Metal Worker's apprenticeship program.

Outcomes

Course Outcome(s):
Discuss the welding processes required in the sheet metal industry including cutting and burning, the welding groups, machine set up with electrode selection, and welding applications.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Identify and define the terms related to sheet metal welding.
2. Discuss the purpose and application of the welding groups with respect to sheet metal tasks.
3. List the different types of welding machines used for industrial and food service applications.
4. Identify the cutting and burning equipment used by sheet metal workers.
5. Demonstrate the ability to properly adjust the torch regulators and correctly light the torch for safely cutting steel and sheet metal.
6. Adjust and set up different welding machines for welding and rod type and material use.
7. Identify the different welding electrodes and discuss the application of each.
8. Interpret mechanical drawings to identify correct welding symbols required for welding specifications including rod selection and application processes.

Course Outcome(s):
Describe the procedures followed for maintenance checks and repairs of the metal inert gas (MIG) welding machine including drive roll controls, tensioning and tank and gun pressures.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. List the different MIG guns and various liners used as part of a MIG machine.
2. Verify the wire speed of the MIG whip using the count method and basic calculations.
3. List the different MIG wires used in the sheet metal industry.
4. Match the drive rolls with the proper wire size.
5. Verify the tensioning nut with specified wire applications using the manufacturers' recommendations or manual adjustments.
6. Explain the importance of proper drive roll tensioning with respect to wire size.
7. Identify proper electrical connections and amperages for MIG machines.
8. Verify the proper cubic feet per hour (CFH) of gas and tank pressure to maintain prescribed pressure to the MIG gun contact tip to avoid porosity and provide cleaning process of the weld.

Course Outcome(s):

Explain the different welding positions and classifications, electrode design and respective application and distinguish between shielded metal arc welding (SMAW) and flux cork arc welding (FCAW) with respect to welding in the sheet metal industry.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. List and explain the different welding positions and applications used in the sheet metal industry.
2. List and describe the different types of "fit-up" used in sheet metal welding.
3. Explain the basic welding rod design.
4. Distinguish between the various electrode classifications with respect to the AWS.
5. Explain the welding process with respect to specific weld types.
6. Differentiate between tubular electrode and solid wire electrode.
7. Discuss the relationship between electrode selection, coatings, and amperage settings.
8. Interpret the weld position chart for respective application.
9. Differentiate between SMAW and FCAW.

Course Outcome(s):

Demonstrate the ability to set-up and use constant current welding machines properly welding, in various positions, metals in different thickness ranges in compliance with industry standards.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Identify the material thicknesses that are to be welded and set-up welding machine for the appropriate weld.
2. Interpret shop and mechanical drawings to apply proper weld processes.
3. Select the proper electrodes with respect to welding process used.
4. Apply correct welding techniques to ensure complete fusion and penetration of material to be joined.
5. Employ all welding positions as required, including out of position techniques to complete the welding process.
6. Apply the DASH (distance, angle, speed, and heat) techniques to maintain industry compliant welds.
7. Visually inspect welds to determine penetration, fusion, reinforcement, and quality.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Class participation

4. Student mus demonstrate the ability to perform the described welding processes in accordance with the standards set forth by the American Welding Society AWS

Course Content Outline:

1. Sheet metal welding: purpose and application
    a. Terminology
        i. Weld
        ii. Polarity
        iii. Technique
        iv. Electrode
        v. Fit-up
        vi. Travel speed
        vii. DASH
        viii. MIG
        ix. AWS
        x. Stick
        xi. Plasma
        xii. Torch
        xiii. MIG gun
        xiv. Electrode holder
        xv. Leads
        xvi. Rose bud
    b. Welding groups: purpose and application
        i. Groups
            1. Torch cutting
                a. Demolition
                b. Heavy material
                c. Material preparation
            2. Stick
                a. Structural
                b. Field application
                c. Specialty application alloys
            3. MIG
                a. Sheet metal
                b. Stainless steel
                c. Aluminum
        ii. Purpose
            1. Structural strength
            2. Efficiency
            3. Fabrication
    c. Machine types
        i. Electric
        ii. Gas
        iii. Portable
        iv. Stationary
    d. Cutting and burning
        i. Equipment
            1. Hand held plasma
            2. Machine operated
            3. Cutting torch
            4. Soldering/brazing
            5. Regulator
            6. Hose
            7. Flash back suppressor
            8. Tip cleaner
        ii. Set-up
            1. Tip selection and preparation
            2. Gas valve adjustment
            3. Tank pressure

4. Output pressure
5. Lighting procedure
6. Regulator adjustment

iii. Cutting/burning safety
1. Proper personal protective equipment
2. Leak test
3. Regulator set up
4. Flame identification
5. Environment
6. Inspect for contamination
7. Distance
8. Angle
9. Speed
10. Height

e. Torch set-up
i. Safety
ii. DASH

f. Welding machine set-up
i. Parameters
1. Amperage
2. Polarity
3. Gas type
4. Speed selection
5. Voltage
6. Grounding

ii. Inspections

g. Electrodes
i. Stick
1. Classification
2. Specification
3. Filler material

ii. Wire feed
1. Tubular
2. Solid wire

h. Welding specifications
i. Mechanical drawing
1. Details
2. Sections
3. Notes

ii. Welding electrode specifications
1. Selection
2. Application

2. MIG machine maintenance
a. MIG guns and liners
i. Guns
1. Type I: light duty
2. Type II: medium duty
3. Type III: heavy duty
4. Selection
a. Wire size
b. Amperage
c. Voltage
d. Material thickness

ii. Liners
1. Wire diameter
2. Material type

b. Wire speed verification
i. Count method
ii. Calculation

1. Trigger depression
2. Wire length
3. Wire length times 10 equal number of feet per minute

iii. Machine indicator

c. MIG wire sizes
   i. .023 inches
   ii. .030 inches
   iii. .035 inches
   iv. .045 inches
   v. 1/16 inch
d. Drive rolls and wire size
   i. Wire size matches drive roll size
   ii. Oversize drive roll allows slippage
   iii. Undersize drive roll promotes wire deformity
e. Tensioning nut and specified wire applications
   i. Manufacturer specifications
      1. Chart
      2. Machine flash cards
   ii. Manual adjustment
      1. Wire to hand
      2. Wire coil
      3. Adjustment to prevent coil
f. Drive roll tensioning
   i. Wire deformation
   ii. Weld deposition
g. Electrical connecting and amperages
   i. Proper amperage and voltage
   ii. Weld parameter
   iii. Connection failure
   iv. Machine failure
h. CPH and tank pressure
   i. Adequate gas for CFH
   ii. Adequate CFH for weld cleaning
   iii. Porosity control
   iv. Trapped oxygen and shielding gas

3. Welding positions, electrodes, and applications
   a. Welding positions
      i. Fillet weld
         1. #1 flat
         2. #2 horizontal
         3. #3 vertical up
         4. #4 overhead
   b. Fit ups
      i. Groove joint
         1. AWS D1.1 code book
         2. Root specification
            a. Open
            b. Closed
         3. Bevel angle
            a. Code
            b. Calculation
      ii. Fillet joint
         1. Beveled
         2. Open root
         3. Closed root
      iii. Butt
         1. AWS D9.1
         2. Root
   c. Butt/vertical down

   i. Closed root
   ii. Open root without backer
d. Electrode design
   i. Wire
   ii. Tensile strength
      1. 60,000 psi (pounds per square inch)
      2. 70,000 psi
      3. 80,000 psi
      4. 100,000 psi
      5. Specialty
   iii. Flux
      1. Celluolistic
      2. Low hydrogen
      3. Iron oxide powder
      4. Specialty
e. Electrode classifications
   i. Weld metal chemistry
      1. Alloy
      2. Tensile strength in psi
   ii. Position
      1. #1 flat
      2. #2 horizontal
      3. #3 vertical up
      4. #4 overhead
   iii. Flux coatings
      1. Weld cleaner
      2. Deoxidizes
      3. Prevents water in weld
   iv. Current
      1. A-C
      2. D-C
      3. Electrode positive
      4. Electrode negative
f. Welding process
   i. Metal fusion
   ii. Electrical charge
   iii. Molten metal
   iv. Filler metal
   v. Flux: shielding from contaminates
g. Tubular versus solid wire
   i. Tubular
      1. Flux cored wire
      2. Used without shielding gas
      3. Used with shielding gas
      4. Hydrogen resistant
   ii. Solid wire
      1. Requires shielding gas
      2. Various diameter
      3. Short circuit process
h. Electrode selection, coatings, and amperage
   i. Welding parameters
      1. Electrode diameter
      2. Material thickness
   ii. Coatings
      1. Flux penetration
      2. Selection
   iii. Amperage
      1. Flux selection
      2. Electrode diameter

i. Weld position chart
    i. Electrode type
        1. Flat
        2. Horizontal
        3. Vertical up
        4. Overhead
    ii. Current
        1. A-C
        2. D-C
        3. Electrode positive
        4. Electrode negative
    iii. Penetration
    iv. Flux type
j. SMAW vs. FCAW
    i. SMAW
        1. AC/DC stick welder
        2. Flux coated electrode
        3. Electrode holder
        4. Field application
    ii. FCAW
        1. Shop application
        2. Wire feed
        3. Tubular electrode
        4. Flux core
        5. With or without gas shielding

4. Welding
a. Machine set-up
    i. Weld parameters
        1. Amperage
        2. Voltage
        3. Wire speed
    ii. Material thickness
        1. MIG
            a. Weld chart
            b. Manufacturer specifications
        2. Constant current machine
            a. Amperage/electrode diameter
            b. Meter test
b. Drawings
    i. Weld process
        1. SMAW
        2. MIG
        3. FCAW
    ii. Specification
        1. Staggered weld
        2. Continuous
        3. Field
    iii. Fit-up
        1. Electrode
            a. Weld size
            b. Weld type
c. Electrode selection
    i. Weld process
        1. FCAW
        2. SMAW
    ii. Material thickness
    iii. Material type
d. Technique

i. Fit-up
    1. Tack weld
    2. Clean material
    3. Penetration requirement
        a. Gap
        b. Butt
ii. ARC striking
    1. Quick
    2. Slow
iii. Fusion
iv. Penetration
v. DASH

e. Welding positions
i. Flat
ii. Horizontal
iii. Vertical up
iv. Overhead

f. DASH
i. Distance
ii. Angle
iii. Speed
iv. Heat

g. Visual inspection
i. Penetration
ii. Complete fusion
iii. Reinforcement
iv. Appearance
    1. Quality
    2. Width
    3. Consistent

Resources

International Training Institute. *Welding 1-4* . 2014 edition. Fairfax, Virginia; International Training Institute, 2014.

American welding society education department . *Welding Inspection Technology* . fifth edition. Miami Florida; American Welding Society, 2008.

SMACNA. *Core Curriculum/ Architectural Sheet Metal*. 6th edition. SMACNA; Chantilly, Va., 2004.

Resources Other

1. http://www.weldersuniverse.com/welding_symbols.html. 2018 (http://www.weldersuniverse.com/welding_symbols.html)
2. https://www.aws.org/. 2020.

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