

# ATSM-2130: SHEET METAL WELDING II

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## Cuyahoga Community College

**Viewing: ATSM-2130 : Sheet Metal Welding II**

**Board of Trustees:**

November 2020

**Academic Term:**

Fall 2021

**Subject Code**

ATSM - Applied Ind Tech- Sheetmetal

**Course Number:**

2130

**Title:**

Sheet Metal Welding II

**Catalog Description:**

Covers gas metal arc welding (GMAW) and gas tungsten arc welding (GTAW) processes used in the sheet metal industry. Equipment set up, electrode selection for various sheet metal operations and safety precautions is presented as part of the completion requirements. In addition, the student will demonstrate the ability to apply weld related metals and gauges including grooves and fillet beads in accordance with the American Welding Society.

**Credit Hour(s):**

3

**Lecture Hour(s):**

3

## Requisites

**Prerequisite and Corequisite**

Departmental approval: admission to Sheet Metal Worker's apprenticeship program or a member in good standing with the sheet metal workers union.

## Outcomes

**Course Outcome(s):**

Discuss and review the welding processes for sheet metal workers related to gas metal arc welding (GMAW) and shielded metal arc welding (SMAW) including welding machine set-up, electrode selection and application of the processes in four positions.

**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. Differentiate between GMAW and SMAW welding processes.
2. List and explain the four different welding positions and discuss the application of each.
3. Identify and discuss the safety precautions and required personal protective equipment (PPE) related to welding.
4. List the different types of gases used in GMAW and discuss the application of each.
5. Perform safety inspections on GMAW and SMAW equipment and identify faulty components.
6. Demonstrate ability to set-up welding equipment for GMAW and SMAW processes and perform the welding techniques for each with respect to the American Welding Society codes.

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**Course Outcome(s):**

II. Discuss the welding processes applied using gas tungsten arc welding (GTAW) including the applied purposes, electrode selection, history and equipment safety inspections employed.

**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. Perform safety inspections of GTAW systems and accessories, tools and work area.
  2. Identify the safety hazards related to GTAW equipment and accessories and demonstrate the ability to perform minor repairs.
  3. Identify the GTAW components, describe the function of each and assemble the welding equipment.
  4. Demonstrate the ability to operate GTAW equipment by determining and setting the required amperage, proper gas flow rate, tungsten selection and proper settings.
  5. Demonstrate the ability to apply welding beads on various flat plates and properly clean the base metal filler.
  6. Demonstrate the ability to deposit groove, fillet and vertical groove weld beads on typical sheet metal applications.
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**Methods of Evaluation:**

1. Class participation
2. Quizzes and test
3. Student must demonstrate the ability to perform welding operations using GMAW and GTAW processes in accordance with the AWS.

**Course Content Outline:**

1. Welding: equipment set-up, electrode selection and application
  - a. GMAW vs SMAW
    - i. GMAW
      1. Gas
      2. MIG gun metal inert gas
      3. Unshielded electrode
    - ii. SMAW
      1. Flux covered electrode
      2. Shielded
      3. Slower process
      4. Various flux coatings
  - b. Welding positions
    - i. Flat
      1. Greater penetration
      2. Versatile
    - ii. Horizontal
      1. Limited access
      2. Selective electrode
    - iii. Vertical up
      1. Structural D.1.1 certification
      2. Excellent deposition rate
    - iv. Overhead
      1. More difficult
      2. Out of position weld
      3. High heat input
  - c. Safety precautions and PPE
    - i. Safety precautions
      1. Burns
        - a. Eyes
        - b. Skin
      2. Electrocutation
      3. Flashing hearing injuries
    - ii. PPE
      1. General
        - a. Clothing
        - b. Eye protection
      2. Specific
        - a. Jacket
        - b. Hood

- c. Lens
  - d. Gloves
- d. Gas/GMAW
  - i. Carbon dioxide (100%) CO<sup>2</sup>
    - 1. Dual shielding
    - 2. GMAW
  - ii. Argon/CO<sup>2</sup> 75/25
  - iii. Trimix: stainless steel
  - iv. Argon/CO<sup>2</sup> 98/2 structural
- e. Safety inspection and faulty components
  - i. Inspection/SMAW
    - 1. Cable
    - 2. Connections
    - 3. Disconnects
    - 4. Gas cylinders
    - 5. Electrode holder
    - 6. PPE
  - ii. Inspection/GMAW
    - 1. Surrounding areas(s)
    - 2. Cylinders
    - 3. Regulator
    - 4. Visual hose inspection
    - 5. Connections
    - 6. PPE
    - 7. Others/screen protection
  - iii. Faulty components
    - 1. Hoses
    - 2. Cylinder connection
    - 3. Leads
    - 4. Cagle
    - 5. Cylinder
    - 6. Electrode holder
      - a. Lead attachment
      - b. Insulation
    - 7. Lens
    - 8. Jackets
  - iv. Application
    - 1. Set-up
      - a. GMAW
        - i. Identify weld material
        - ii. Select technique
        - iii. Wire selection
        - iv. Shield gas
        - v. Voltage and amperage setting
        - vi. Wire feed speed
        - vii. Cubic feet per hour/wire feed
      - b. SMAW
        - i. Electrode selection
        - ii. Amperage setting
    - 2. Welding processes/technique
      - a. Position
      - b. Distance
      - c. Speed
      - d. Angle
      - e. Heat
    - 3. Clean/grind/slag removal/spatter
- 2. GTAW processes

- a. Inspections/safety
  - i. High frequency
  - ii. Electrical safety
    - 1. Grounding
    - 2. Connections
  - iii. Cylinder
    - 1. Pressure reduction/regulator
    - 2. Storage
  - iv. Visual
    - 1. Leaks
    - 2. Fittings/hoses
    - 3. Pressure regulator
- b. Hazards and repairs
  - i. Cables
    - 1. Replacement
    - 2. Shielding damage
  - ii. Torch
    - 1. Collet
    - 2. Collet cap
    - 3. Collet body
    - 4. Nozzle/gas
    - 5. Gas cap
  - iii. Maintenance
    - 1. Dust removal
    - 2. Capacitor awareness
- c. Components and function
  - i. Torch: diffuse gas/arc
    - 1. Holder: electrode
    - 2. Conduit for shielding gas
    - 3. Conductor of current
    - 4. Parts
      - a. Electrode
      - b. Collet
      - c. Collet cap
      - d. Collet body
      - e. Nozzle
      - f. Body
  - ii. Electrodes
    - 1. Types
      - a. EWP classification
      - b. Melting point 6170 °F
      - c. 99.5% pure tungsten
      - d. Pure tungsten
      - e. Thoriated tungsten
      - f. Zirconium
  - iii. Shielding gases
    - 1. Conducts current
    - 2. Transfers heat
  - iv. Argon
    - 1. Cleaning agent
    - 2. Shallow penetration
    - 3. Smooth, quiet arc
- d. GTAW and settings: amperage, gas flow, tungsten, and settings
  - i. Amperage
    - 1. Material thickness determines amperage
    - 2. .125 thickness requires 125 amps
  - ii. Gas flow
    - 1. More is not better
    - 2. 15-20 cubic feet per hour
  - iii. Tungsten selection

1. Pure tungsten—general purpose
2. D C welds—2% thorium
3. Zirconium
  - a. Contaminate resistant
  - b. Aluminum welds (A C)
- iv. Selecting tungsten
  1. Current proportional to amperage
  2. Migration of arc
    - a. Excess current
    - b. Preparation angle
    - c. Electrode diameter
- v. Settings
  1. Voltage
  2. Frequency
  3. Tungsten
    - a. Type
    - b. Extension
- e. Application
  - i. Weld bead on plate
    1. Distance: electrode to metal
    2. Angle: torch
    3. Speed: travel of electrode
    4. Heat: amperage to material
  - ii. Safety
    1. Electrical
    2. PPE
    3. Respiratory
    4. Eye
- f. Groove, fillet, and vertical groove
  - i. Groove
    1. Root opening equals base metal divided by 2
    2. Angle
      - a. 70 degrees lead angle
      - b. 20 degrees to 25 degrees fillet metal angle
  - ii. Fillet groove
    1. Unequal heat transfer
    2. Bead is twice base metal thickness
    3. Convex bead with even ripples
    4. Zero gap between pieces
  - iii. Vertical groove
    1. Thin material: downhill
    2. Thick material: uphill
    3. Aluminum: vertical up

## Resources

American Welding . *Welding 1-4 (ITI)* . Fifth Edition. AWS Education Dept. Miami, Florida, Copyright 2008.

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American Welding Society Miami, Florida. *AWS D1/1 D1/TM* . current. American Welding Society Miami, Florida, 2015.

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American Welding Society. *Welding Inspection Technology* . Fifth Edition. American Welding Society Miami, FL, 2008.

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## Resources Other

<https://www.weldingmania.com/mig/how-to-weld-thin-metal-body-panels>  
[redwingsteelworks.com/articles/weld-sheet-metal-stick-welder](http://redwingsteelworks.com/articles/weld-sheet-metal-stick-welder)

Top of page

Key: 4858