

ATSM-2820: SPECIAL TOPICS IN SHEET METAL INDUSTRIAL II WELDING

Cuyahoga Community College

Viewing: ATSM-2820 : Special Topics in Sheet Metal Industrial II Welding

Board of Trustees:

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Academic Term:

Fall 2026

Subject Code

ATSM - Applied Ind Tech- Sheetmetal

Course Number:

2820

Title:

Special Topics in Sheet Metal Industrial II Welding

Catalog Description:

Advanced sheet metal course covering the assembly and fabrication of industrial service platforms. Extensive layout procedures required for the circular cage and accompanying stairway and handrail is covered. In addition, proficiency in welding processes in a shop setting is incorporated into the course.

Credit Hour(s):

3

Lecture Hour(s):

3

Requisites

Prerequisite and Corequisite

Departmental approval, and instructor approval, and ENG-0995 Applied College Literacies, or appropriate score on English Placement Test. Note: ENG-0990 Language Fundamentals II taken prior to Fall 2021 will also meet prerequisite requirements.

Outcomes

Course Outcome(s):

Interpret different construction drawings used for fabricating ladders, platforms, stairs, and different assemblies using symbols, details, and sections to compile a bill of materials

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 define terms related to industrial platform layout and fabrication.
2. Identify the welding symbols related to general and specific fabrication requirements.
3. Explain how plans, sections and elevations are used to establish material cutting and assembly criterion for industrial fabrication.
4. Explain how a bill of materials is used to determine quantity, mark numbers and descriptions that establish component lengths.

Course Outcome(s):

Develop a bill of materials and cut list by interpreting structural drawings and calculating the respective component lengths for structural platforms.

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 materials, components, and fasteners/connectors generally found on a cut list/bill of materials.
2. Identify the components and materials used to construct the platform structures.
3. Interpret structural and shop drawings to determine the above finish floor (A.F.F.) height(s), platform, leg, and support materials, and grating and support pad requirements.
4. Calculate the length(s) of tubular steel components needed to build the platform and related components.
5. Use basic math concepts to calculate respective platform component lengths.

Course Outcome(s):

Apply the information derived from the bill of materials to layout, cut, assemble, and fabricate the components required for the service platform.

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 tools and equipment required for the platform assembly.
2. Interpret the construction and shop drawings and establish component lengths for the respective structure with respect to calculations.
3. Select the proper band saw blade based on the number of teeth per inch with respect to the material thickness.
4. Adjust the band tension, hydraulic setting, respective fluid levels, and blade width.
5. Apply industry safety standards and wear the proper PPE to safely cut service platform components.
6. Assemble the tube steel components for the platform and maintain square intersections using the fabrication table sides and hand tools used for squaring procedures.
7. Maintain specified dimensions and square intersections using clamping and tacking techniques.
8. Demonstrate the ability to position, square, and tack the assembly to the top section of the platform assembly.
9. Demonstrate the ability to create opposition and tack leg assemblies, including pads with holes, in accordance with job specifications.
10. Employ checking procedures to ensure proper project dimensions and a square intersecting fit.
11. Demonstrate the ability to properly weld the platform assembly using the specified electrode tensile strength in accordance with welding specifications, with reference to welding symbols and guidelines.

Course Outcome(s):

Interpret construction and shop drawings to compute measurements, including cage radius, for layout requirements of the cage and ladder assemblies.

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 define the terms related to the layout and fabrication of the cage and ladder assemblies of industrial access platforms.
 2. List and review the math formulas and concepts used for laying out the components of the industrial access platform.
 3. Refer to drawings to lay out a full-scale plan view to establish cut sizes and bends of large and small diameter hoops.
 4. Refer to drawings to calculate and establish ladder lengths and bend angles.
 5. Cut the components of the ladder and hoop assemblies using an industrial band saw.
 6. Assemble the components of the hoop(s) and ladder assemblies using proper fabrication techniques of fit-up and tack-up, and bending, rolling, and hole punching operations.
 7. Confirm assembly dimensions and alignments, and complete fabrication using welding operations with respect to industry standards.
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Course Outcome(s):

Discuss the layout procedures for the stair stringer and handrails required for industrial access platforms.

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 define terms used in the fabrication of ladders and catwalks.
2. Explain the need for proper layout and fabrication of ladders and stairways as prescribed in the OSHA standards
3. Explain the OSHA standards 1926.2050 and 1926.1060 as it relates to access platforms.
4. Identify the components of ladders, stairways, and catwalks and explain the function of each.
5. Refer to the bill of materials for the cut sizes of respective components.
6. List the tools and equipment used in the fabrication of access platforms.
7. Compute the rise, run, and pitch of the stairways using applied math concepts.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Class participation;

Students will apply welding techniques presented throughout the course to demonstrate welding skills in accordance with industry standards

Course Content Outline:

1. Industrial Fabrication: Construction Drawings and Bill of Materials
 - a. Terminology
 - i. Standard pipe
 - ii. IS bar
 - iii. HSS 2 x 2 x ¼ x 3'-0
 - iv. MC 10 x 84
 - v. Platform
 - vi. Bill of Materials
 - vii. Cut list
 - viii. Closure plate
 - ix. Weld symbols
 - x. Mark nos
 - xi. Plate
 - xii. Bar
 - xiii. Saddle clip
 - xiv. TEK screw
 - xv. Grating
 - xvi. Field bolt
 - xvii. Spring loaded safety gate
 - xviii. Far side stringer
 - xix. Carrier plate
 - xx. Gusset
1. Specific welding symbols
 - a. Field weld
 - b. Fillet weld
 - c. All around
 - d. Stich weld
 - e. 3/16 inside/outside corner
 - f. Plug weld
 - g. Typical
2. Plans, elevations, sections and details

- a. Plans
 - i. Ladder
 - 1. Bars
 - 2. Degrees
 - ii. Grating
 - 1. Notch locations
 - 2. Length and width
 - 3. Spring loaded gate
 - 4. Band location
 - iii. Welding symbols
 - iv. Cage/ladder dimensions
 - v. Cage radii
 - vi. Platform location
- 1. Cut list/bill of materials (structural platform)
 - a. Components and materials
 - i. Components
 - 1. Platform
 - 2. Legs
 - 3. Supports
 - 4. Base pads
 - 5. Plates
- 1. Materials
 - a. Type of structural steel
 - b. Bar
 - c. Angle
 - d. Pipe
 - e. Flat stock
 - f. Grating
 - i. Thickness
 - ii. Length
- 2. Fasteners
 - a. Bolts
 - b. Nuts
 - c. Washers
 - d. Clips
 - e. Screws
- 3. Component lengths
 - a. Rails
 - b. Decking
 - c. Supports
- 4. Shop notes
 - a. Steel grade
 - i. A-36
 - ii. HSS/Grade B
 - iii. A-53/ pipe / Grade B
 - b. Electrodes:E-70
 - i. Tensile strength
 - ii. Structural grade
 - c. Surface preparation
 - d. Coatings
 - e. General information
- 5. Calculations/measurements/lengths
 - a. Math concepts
 - i. Triangulation
 - ii. Fractional operations
 - iii. Decimal conversions
 - iv. Metrics
 - b. Platform measurements

- i. Inside dimension I.D.
 - ii. Outside dimension O.D.
 - iii. Material thickness
 - iv. (O.D.) – material thickness
 - v. (I.D.) + material thickness
 - c. Leg length L.L.
 - i. Grating thickness “G”
 - ii. Tube dimensions
 - iii. Pad thickness
 - iv. $L.L. = A.F.F - (G + \text{tube dimensions} + \text{pad thickness})$
 - d. Intermediate support length = $O.D. - 2(\text{tube thickness})$
 - e. Pad hole dimension
 - i. Bolt diameter
 - ii. Hole centerline
1. Bill of materials
- a. Tools and equipment/platform assembly
 - i. Tools
 - 1. Square
 - a. Framing
 - b. Combination
 - c. Magnetic triangle
 - 2. Clamps
 - a. Locking
 - b. C clamp
 - c. Vice grip
 - 3. Tape measure
 - ii. Equipment
 - 1. Fabrication table
 - 2. Jig and fixture
 - 3. Grinder
 - 4. Welder: multi process
 - 5. Cut off wheel
 - 6. Extension cords
 - 7. Wet saw
 - b. Component lengths
 - i. Construction drawing
 - 1. Plan
 - 2. Elevations
 - 3. Structural
 - ii. Shop drawings
 - 1. Computer-Aided Drawing (CAD)
 - 2. Field
 - iii. Lengths/calculations
 - c. Band saw blade
 - i. Thin/less than or equal to 12 gauge: 14 teeth /inch
 - ii. Heavy/ greater or equal to than 12 gauge—3/4 inch plate:7-11 teeth /inch
 - d. Band saw adjustments
 - i. Tension
 - 1. Maintain cutting property
 - 2. Over tension: blade failure
 - 3. Under tension: slip, bind
 - ii. Hydraulic setting
 - 1. Blade travel speed
 - 2. Zero thru 10
 - 3. Material thickness based
 - iii. Fluid level
 - 1. Cutting
 - 2. Cools blade
 - iv. Blade width

1. Exposure
2. Minimum: material size
3. Maximum: material size
- e. Safety standards
 - i. American Society of Mechanical Engineers (ASME)
 - ii. Occupational Health and Safety Administration (OSHA)
 - iii. Manufacturer's recommendations
 - iv. Personal Protective Equipment (PPE)
 1. Gloves
 2. Glasses
 3. Hearing protection
 - v. American National Standards Institute (ANSI)
- f. Platform assembly
 - i. Square intersection
 1. Squaring tool
 2. Diagonal checks
 3. Pythagorean theorem
 - ii. Fit up
 - iii. Tack up
- g. Proper dimensions
 - i. Per drawings
 - ii. Tool application
 - iii. Tack-up/fit-up
1. Assembly
 - a. Platform/legs
 - b. Cross member
2. Leg assemblies
 - a. Pads
 - b. Positioning
 - c. Mounting pad holes
 - d. Levelling: shims and adjustments
3. Checking procedures
 - a. Tools
 - i. Level
 - ii. Tape measure
 - iii. Square(s)
 - b. Math
 - i. Dimensions
 - ii. Equal diagonals
 - iii. Pythagorean theorem
4. Welding specifications
 - a. Electrode
 - i. "70" series
 - ii. Flux core
 - iii. MIG
 - iv. TIG
 - b. Welding symbols
 - i. Weld type
 1. Fillet
 2. Butt
 3. Field
 4. Penetration
 5. Staggered
 - ii. Universally recognized/American Welding Society
 - c. Guidelines
 - i. Tolerances
 1. Measurable
 2. Weld size

- ii. +/-material thickness
 - iii. Open/closed root specifications
1. Cage and ladder
- a. Terminology
 - i. Cage
 - ii. Ladder
 - iii. Mounting clip
 - iv. Cage stringer
 - v. Ladder rungs
 - vi. Ladder riser
 - vii. Bend angle
 - viii. Hoop: large/small
 - ix. "Roll"
 - x. "Punch"
 - xi. Stretch-out
 - xii. Arc length
 - b. Math concepts
 - i. Basic
 - 1. Addition
 - 2. Subtraction
 - 3. Multiplication
 - 4. Division
 - ii. Geometry
 - 1. Angular
 - 2. Pythagorean theorem
 - 3. Arc length/stretch-out
 - c. Hoop layout
 - i. Drawings
 - 1. Plan views
 - 2. Shop drawings
 - 3. Field notes
 - ii. Math concepts
 - 1. Arc length, large
 - 2. Arc length, small
 - 3. Equation variables
 - a. Diameter
 - b. Radii
 - c. Material thickness
 - d. Mean diameter
 - 4. Dimensions
 - a. Bend angle
 - b. Angle hypotenuse
 - c. Line lengths
 - d. Cage stringer layout
 - i. Hoop template/plan view
 - ii. Centerline of hoop diameter
 - iii. Stringer locations
 - 1. Angle of centerline
 - 2. angle from 1st stringer (s)
 - iv. safety standards (OSHA Platform)
 - 1. 1910.27(d)
 - 2. OSHA Fixed Ladder Fall Protection
 - e. Ladder length and bend angle
 - i. Platform height + cage and handrail height
 - ii. Bend angle
 - 1. Relationship to hoop size and ladder width
 - 2. Varies per specifications
 - iii. Rung height per OSHA standard
 - f. Component cutting

- i. Industrial band saw
 - 1. Hydraulic speed control
 - 2. Component sizes
 - a. Specifications
 - b. Bill of Materials
 - c. Full scale layout
- ii. PPE
 - 1. Eye protection
 - 2. Gloves
 - 3. Hearing
- g. Component assembly
 - i. Fabrication techniques
 - 1. Fit up
 - a. Clamp/secure
 - b. Dimension check
 - 2. Tack up
 - a. Component stabilization
 - b. Square assembly
 - 3. Bending
 - a. Press brake
 - b. Bottom die width = 8 x material thickness
 - c. Hoop(s) configuration
- 1. Rolling
 - a. Hoop radius
 - b. Stretch out dimension
 - c. Pinch roll
 - d. Bending roll
- 2. Hole punch operations
 - a. Bolting operations
 - i. Ladder base alignment
 - ii. Levelling
- 3. Ladder rung placement
- 4. Plug weld
- 5. Welding operations
 - a. Dimension check/confirmation
 - b. Industry standards
 - i. MIG
 - ii. SMAW
 - iii. 70,000 tensile strength
- 1. Access platforms
 - a. Terminology
 - i. Rise
 - ii. Run
 - iii. Pitch
 - iv. Handrail
 - v. Toe kick
 - vi. Riser
 - vii. Mid rail
 - viii. Top rail
 - ix. MAG drill
 - b. Safety concerns
 - i. Fall protection
 - ii. Side load capacity
 - iii. Accident prevention
 - iv. Lost work time
 - v. Fatalities
 - c. OSHA Standards

- i. Standard
 - 1. 1926.2050
 - 2. 1926.1060
- 1. Scope
 - a. Weight capacity
 - b. Force location/direction
 - c. Stairway
 - d. Stairway and handrails
- 2. Stairway
 - a. Hand rail height 36 inches
 - b. Centered mid-rail
 - c. Surfaced components
 - d. Adequate hand hold
 - e. Guard rail system
 - i. Landings
 - ii. Unprotected sides/edges
- 3. Hand rail
 - a. Platform height 42 inches
 - b. Surfaced
 - c. 70,000 tensile strength
- 4. Components
 - a. Riser
 - b. Tread
 - c. Stringer
 - d. Tread connector
 - e. Connectors
 - i. Nuts
 - ii. Bolts
 - iii. Washers
 - f. Rails
 - i. Top
 - ii. Mid-rail
 - iii. Risers
 - g. Toe kick
- 5. Bill of materials
 - a. Stairs
 - i. Mark numbers
 - ii. Length
 - 1. Riser
 - 2. Stringer
 - iii. Treads
 - 1. Number required
 - 2. Width
 - iv. Nut/bolt grade
 - v. Mounting requirements
 - 1. Hole diameter
 - 2. Clip length
 - 3. Welding requirements
 - b. Handrail
 - i. Riser length
 - ii. Vertical height
 - iii. Mid-rail height
 - iv. Lengths
 - 1. Rail
 - 2. Riser
 - v. Weld elbow
- 6. Tools and equipment/platform assembly

- a. Tools
 - i. Square
 - 1. Framing
 - 2. Combination
 - 3. Magnetic triangle
 - ii. Clamps
 - 1. Locking
 - 2. C clamp
 - 3. Vice grip
 - iii. Tape measure
- b. Equipment
 - i. Fabrication table
 - ii. Jig and fixture
 - iii. Grinder
 - iv. Welder: multi process
 - v. Cut off wheel
 - vi. Extension cords
 - vii. Wet saw

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](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	Course orientation, safety standards, PPE, and shop procedures
Week 2	Construction drawings: plans, elevations, sections, and details
Week 3	Welding symbols and fabrication terminology
Week 4	Bill of materials and cut list development
Week 5	Applied math for industrial fabrication (dimensions and calculations)
Week 6	Structural platform components and materials
Week 7	Band saw operation and material cutting techniques
Week 8	Platform layout, fit-up, and squaring procedures
Week 9	Platform assembly and welding processes
Week 10	Cage and ladder terminology and OSHA requirements
Week 11	Cage layout: radii, hoop stretch out, and full-scale layout
Week 12	Ladder fabrication and assembly techniques
Week 13	Stairways and handrails: terminology and OSHA standards
Week 14	Stair stringer layout, rise/run calculations, and fabrication
Week 15	Final assembly, dimension checks, and welding completion
Week 16	Project review, inspection, and final 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

International Training Institute. *Industrial Sheet Metal and Welding*. Falls Church, VA: International Training Institute, <https://www.sheetmetal-iti.org/>

American Welding Society Certification and Education Department. *Welding Inspection Technology*. Miami, FL: American Welding Society, <https://www.aws.org/>

American Welding Society Certification and Education Department. *Sheet Metal Welding Code Book*. Miami, FL: American Welding Society, <https://www.aws.org/>

Additional Resources for the Instructor

http://www.weldersuniverse.com/welding_symbols.html

http://www.metallicfusion.com/symbols_and_definitions.htm

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