ATSM-2150: SHEET METAL: INDUSTRIAL II WELDING

Cuyahoga Community College

Viewing: ATSM-2150 : Sheet Metal: Industrial II Welding

Board of Trustees:
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Academic Term:
Fall 2021

Subject Code
ATSM - Applied Ind Tech- Sheetmetal

Course Number:
2150

Title:
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 a member in good standing of the sheet metal union

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 material/cut list by interpreting structural drawings and calculation of 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 for cutting 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 the 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 t opposition and tack leg assemblies, including pads with holes in accordance with job specifications.
10. Employ checking procedures to ensure proper project dimensions and square intersecting fit.
11. Demonstrate the ability to properly weld the platform assembly using 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 layout a full scale plan view to establish cut sizes and bends of the 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 punch operations.
7. Confirm assembly dimensions and alignments and complete fabrication using welding operations with respect to industry standards.

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 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;
4. 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
    b. Specific welding symbols
        i. Field weld
        ii. Fillet weld
        iii. All around
        iv. Stich weld
        v. 3/16 inside/outside corner
        vi. Plug weld
        vii. Typical
    c. Plans, elevations, sections and details
        i. Plans
            1. Ladder
                a. Bars
                b. Degrees
            2. Grating
                a. Notch locations
                b. Length and width
                c. Spring loaded gate
                d. Band location

3. Welding symbols
4. Cage/ladder dimensions
5. Cage radii
6. Platform location

2. Cut list/bill of materials (structural platform)
   a. Components and materials
      i. Components
         1. Platform
         2. Legs
         3. Supports
         4. Base pads
         5. Plates
      ii. Materials
         1. Type of structural steel
         2. Bar
         3. Angle
         4. Pipe
         5. Flat stock
         6. Grating
            a. Thickness
            b. Length
      iii. Fasteners
         1. Bolts
         2. Nuts
         3. Washers
         4. Clips
         5. Screws
   b. Component lengths
      i. Rails
      ii. Decking
      iii. Supports
   c. Shop notes
      i. Steel grade
         1. A-36
         2. HSS/Grade B
         3. A-53/ pipe / Grade B
      ii. Electrodes:E-70
         1. Tensile strength
         2. Structural grade
      iii. Surface preparation
      iv. Coatings
      v. General information
   d. Calculations/measurements/lengths
      i. Math concepts
         1. Triangulation
         2. Fractional operations
         3. Decimal conversions
         4. Metrics
      ii. Platform measurements
         1. Inside dimension I.D.
         2. Outside dimension O.D.
         3. Material thickness
         4. (O.D.) – material thickness
         5. (I.D.) + material thickness
      iii. Leg length L.L.
         1. Grating thickness “G”
         2. Tube dimensions
         3. Pad thickness
         4. L.L. = A.F.F – (G + tube dimensions + pad thickness)

iv. Intermediate support length = O.D. – 2(tube thickness)
v. Pad hole dimension
1. Bolt diameter
2. Hole centerline

3. 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. 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. ASME American society of mechanical engineers
ii. OSHA Occupational health and safety administration
iii. Manufacturer’s recommendations
iv. PPE

1. Gloves
2. Glasses
3. Hearing protection

v. ANSI American national standards institute

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
h. Assembly
   i. Platform/legs
   ii. Cross member
i. Leg assemblies
   i. Pads
   ii. Positioning
   iii. Mounting pad holes
   iv. Levelling: shims and adjustments
j. Checking procedures
   i. Tools
      1. Level
      2. Tape measure
      3. Square(s)
   ii. Math
      1. Dimensions
      2. Equal diagonals
      3. Pythagorean theorem
k. Welding specifications
   i. Electrode
      1. “70” series
      2. Flux core
      3. MIG
      4. TIG
   ii. Welding symbols
      1. Weld type
         a. Fillet
         b. Butt
         c. Field
         d. Penetration
         e. Staggered
      2. Universally recognized/American Welding Society
   iii. Guidelines
      1. Tolerances
         a. Measurable
         b. Weld size
      2. +/_material thickness
      3. Open/closed root specifications

4. 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
      4. Rolling
         a. Hoop radius
         b. Stretch out dimension
         c. Pinch roll
         d. Bending roll
      5. Hole punch operations
         a. Bolting operations
            i. Ladder base alignment
            ii. Levelling
   ii. Ladder rung placement
   iii. Plug weld
h. Welding operations
   i. Dimension check/confirmation
   ii. Industry standards
      1. MIG
      2. SMAW
      3. 70,000 tensile strength

5. 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
      ii. Scope
         1. Weight capacity
         2. Force location/direction
         3. Stairway
         4. Stairway and handrails
      iii. Stairway

1. Hand rail height 36 inches
2. Centered mid-rail
3. Surfaced components
4. Adequate hand hold
5. Guard rail system
    a. Landings
    b. Unprotected sides/edges

iv. Hand rail
1. Platform height 42 inches
2. Surfaced
3. 70,000 tensile strength

d. Components
i. Riser
ii. Tread
iii. Stringer
iv. Tread connector
v. Connectors
1. Nuts
2. Bolts
3. Washers
vi. Rails
1. Top
2. Mid-rail
3. Risers
vii. Toe kick

e. Bill of materials
i. Stairs
1. Mark numbers
2. Length
    a. Riser
    b. Stringer
3. Treads
    a. Number required
    b. Width
4. Nut/bolt grade
5. Mounting requirements
    a. Hole diameter
    b. Clip length
    c. Welding requirements

ii. Handrail
1. Riser length
2. Vertical height
3. Mid-rail height
4. Lengths
    a. Rail
    b. Riser
5. Weld elbow

f. 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

Resources

International Training Institute: Fairfax, Virginia,. *Industrial Sheet Metal and Welding* . 2007 edition. International Training Institute: Fairfax, Virginia, 2014.

American Welding Society Education Department. *Welding Inspection Technology* . Fifth edition. 2008.

AWS. *AWS D9.1M/D9.12012 AWS D1.1 2015 Sheet Metal Welding Code Book AWS Doral* . current. AWS Doral Florida 33166,

Resources Other

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

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

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