

ATSM-2170: ARCHITECTURAL SHEET METAL II

Cuyahoga Community College

Viewing: ATSM-2170 : Architectural Sheet Metal II

Board of Trustees:

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Academic Term:

Fall 2021

Subject Code

ATSM - Applied Ind Tech- Sheetmetal

Course Number:

2170

Title:

Architectural Sheet Metal II

Catalog Description:

Advanced course covering different types of sheet metal roofs, fabrication and installation techniques, and safety concerns related to fall arrest systems and specific personal protective equipment. In addition, composite panels, drainage systems and related conductor heads and commercial skylights with emphasis on purpose and application will be presented and practiced.

Credit Hour(s):

3

Lecture Hour(s):

3

Requisites

Prerequisite and Corequisite

Departmental approval: admission to Sheetmetal Worker's apprenticeship program.

Outcomes

Course Outcome(s):

I. Discuss Architectural Sheet Metal roofs including the related purposes, different types, fabrication, and installation techniques with regards to safety concerns.

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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. List and define the terms related to Architectural Sheet Metal roofs.
 2. Identify the different types of metal roofing.
 3. List the different specialty tools used in metal roof fabrication and describe the use of each.
 4. Describe the various metal seams used and discuss the economics of each.
 5. Differentiate between hand formed and mechanical roll formed panel fabrication.
 6. Identify the different types of flashings and describe the application and profile of each.
 7. List the various installation clips used to secure roof panels to the roof substrate.
 8. Discuss roof safety concerns with respect to ASM roofing, including fall arrest systems and specific personal protection equipment (PPE).
 9. Demonstrate the ability to layout and fabricate Architectural Sheet Metal roofing and flashings.
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Course Outcome(s):

II. Discuss the different types of composite panels used in Architectural Sheet Metal including systems, fabrication, and installation techniques and safety concerns.

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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. List and define the terms related to composite panels.
2. Identify the different types of composite panels and describe the finish and core of each.
3. Differentiate between wet and dry composite systems.
4. Describe the various methods used to cut and fabricate Architectural Composite panels.
5. Interpret construction drawings to establish relative starting points and panel alignment.

Course Outcome(s):

III. Explain the function and design of conductor heads used in roof water removal. Discuss the relationship of roof drain components with each other and fabricate respective units, including conductor heads and scuppers, in accordance 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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. List and define terms related to roof water drainage.
2. Explain the function of a conductor head used in conjunction with roof water drainage.
3. Discuss the best locations for positioning conductor heads and explain why.
4. Describe the function of roof scuppers and discuss different fabrication techniques.
5. Demonstrate the ability to properly fabricate and install conductor heads and scuppers in accordance with accepted industry standards.

Course Outcome(s):

IV. Discuss the applications of various skylights used in the commercial construction industry including different types, installation techniques and safety concerns.

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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. List and define the terms related to skylight applications.
2. Describe the applicable functions of skylights used in construction.
3. List and describe the different types of skylights and explain the application of each.
4. List and describe the safety regulations as prescribed by OSHA for worker safety.
5. Interpret construction drawings to accurately layout, assemble and position skylights on commercial structures.
6. Demonstrate the ability to install commercial skylights using hand and power tools and specialized equipment.

Course Outcome(s):

V. Discuss the principles of handling custom wall panels and wall systems. List the materials used in their manufacturing. Describe the applied coatings, and identify procedures used for installation.

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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. List and define the terms related to custom panels and wall systems.
2. Identify the basic principles of handling custom wall panels.
3. Describe the various styles and materials used to manufacture wall systems.
4. Identify various components related to wall systems including column covers, equipment screens, and specialized treatments.
5. Explain the effect of moisture on custom wall panel finishes.
6. Demonstrate the ability to properly use hand tools, and safely operate power tools and equipment to install custom panels and wall systems in accordance with accepted industry standards.

Course Outcome(s):

VI. Discuss the applications of soldering fabrications, including types of solder and flux/acid selection, and demonstrate the ability to solder architectural sheet metal in accordance 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.

Quantitative Reasoning: Analyze problems, including real-world scenarios, through the application of mathematical and numerical concepts and skills, including the interpretation of data, tables, charts, or graphs.

Objective(s):

1. Explain the importance of solder applications to seal joints and fabrications.
2. List and explain the various types of solder with respect to base material.
3. Explain the importance of proper flux/acid and solder selection with respect to different base metal types.
4. Demonstrate the ability to apply sealants and solder, including tool selection and technique, to architectural sheet metal safely.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Class participation
4. Assessed on ability to set up, layout, fabricate and install architectural sheet metal in accordance with current industry standards.

Course Content Outline:

1. Architectural Sheet Metal Roofs: Purpose, fabrication, and installation
 - a. Terminology
 - i. Seam
 - ii. Metal roofing
 - iii. Pitch
 - iv. Square footage
 - v. Roll formed
 - vi. Substrate
 - vii. Underlayment
 - viii. Clips
 - ix. Starter
 - x. Ridge
 - xi. Hip
 - xii. Valley
 - xiii. J channel
 - xiv. Gutter
 - xv. Flashing
 - xvi. Incorporated seam
 - xvii. Double lock

- xviii. U panel
- xix. Hairpin
- xx. Expansion
- xxi. Contraction
- b. Types of metal roofing
 - i. Standing seam
 - 1. Double lock
 - a. Labor intensive
 - b. High quality
 - c. Durable
 - d. Original
 - 2. T Panel
 - a. Ease of installation
 - b. Economical
 - 3. Dutch lap
 - a. Single piece design
 - b. Incorporated seam
 - 4. U panel/hairpin
 - a. Two piece design
 - b. Requires maintenance
 - ii. Batten seam
 - 1. Aesthetics
 - 2. Restoration work
 - 3. Infrequently used
 - iii. Flat seam
 - 1. Vertical application
 - 2. Horizontal application
 - 3. Solder compatible
 - 4. Water tight
 - iv. Bermuda
 - v. Miscellaneous
 - 1. Slate
 - 2. Spanish tile
- c. Specialty tools
 - i. Seamer
 - 1. Hand
 - 2. Electric
 - 3. Folds metal seam
 - ii. Framing square: Layout
 - iii. Bar folder: Folds hook and creates closure
 - iv. Roll former
 - 1. Custom seams
 - 2. Panel fabrication
 - v. Tongs: Clip folder
 - vi. Aviation snips: Simple cuts and notches
 - vii. Electric shear
 - 1. Double cut
 - 2. Unisheer
 - 3. Nibber
 - viii. Crimper: Form metal to radius
 - ix. Stretcher: Converse framing
- d. Hand form versus roll form
 - i. Hand form
 - 1. Limitation of brake
 - 2. Labor intensive
 - ii. Roll form
 - 1. Efficient
 - 2. Multiple styles of fabrication
 - 3. Consistent

4. Extensive lengths
 5. Cost effective
 6. Creates radius panels
- e. Flashing types
- i. Counter
 1. Wall-base
 2. Reglet profile
 3. Surface
 - ii. Thru wall
 1. Masonry
 2. Under copings
 3. Sill
 4. Custom profile
 - iii. Chimney
 1. Apron
 2. Step
 3. Cricket
 4. Saddle
 5. Angle bend
 - iv. Valley
 1. Open-“W”
 2. Closed-“V”
 3. Roof angle profile
 - v. Hip/ridge
 1. Open hem
 2. Floating
 3. Mechanically fastened
- f. Installation clips
- i. Double seam
 - ii. Batten
 - iii. T panel
 - iv. U panel
 - v. Floating
- g. Safety
- i. Fall arrest systems
 1. Lanyard
 2. Rope grab
 3. Rail
 4. Leading edge
 - ii. PPE
 1. Harness
 2. Retractable lanyard
 3. Gloves
 4. Safety glasses
- h. Layout and fabrication
- i. Layout
 1. Panel
 - a. Width
 - b. Length
 2. Pattern
 3. Tools
 - a. Tape measure
 - b. Scratch awl
 - c. Combination square
 - d. Framing square
 - e. Hand brake
 - ii. Fabrication

1. Seam form
 - a. Male seam
 - b. Female seam
2. Hand brake
3. Bar folder
 - a. Hook
 - b. Closure
- iii. Flashings
 1. Measure and mark
 2. Profile
 3. Size
 4. Angles
 5. Hand brake
2. Composite panels
 - a. Terminology
 - i. Level
 - ii. Plumb
 - iii. Vertical
 - iv. Router
 - v. Rain screen systems
 - vi. Wet system
 - vii. Glazed end panel
 - viii. Composite panel
 - ix. Core
 - x. Thermal
 - xi. Conductivity
 - xii. Backer rod
 - xiii. Spline
 - xiv. Extrusion
 - xv. Starting point
 - b. Panel types: core and finish
 - i. Type
 1. Metallic composite
 2. Corrugated plastic
 - ii. Core
 1. Polyethylene
 2. Polyurethane
 3. Fire retardant
 4. Wood
 5. Corrugated
 - iii. Finish
 1. Painted aluminum
 2. Brushed
 3. Stainless
 4. Zinc
 5. Copper
 - iv. Application
 1. Exterior cladding
 2. Interior cladding
 3. Soffit treatment
 4. Columns
 5. Canopy
 6. Signage
 7. Partitions
 8. Kiosks
 - c. Wet versus dry systems
 - i. Wet
 1. Waterproofed
 2. Requires caulking

- 3. Clip fastened
- 4. Economical
- 5. Time efficient
- ii. Dry
 - 1. Spline installed
 - 2. Extrusions
 - 3. Extruded clips
 - 4. Rigid
 - 5. Not waterproofed
 - 6. Waterproofed substrate
 - 7. Glazed/window
- d. Cutting and fabricating
 - i. Cutting
 - 1. Panel saw
 - 2. Portable electric saw
 - 3. Jig saw
 - 4. Sheer
 - 5. Aviation snips
 - 6. Computer Numerical Control CNC
 - ii. Fabrication
 - 1. Router
 - 2. Folded returns
 - 3. Corner clips
 - 4. Applied extrusions
 - 5. Stiffeners installed
 - 6. Critical accuracy
- e. Construction drawings
 - i. Starting point
 - 1. Window frame
 - a. Frame alignment
 - b. Vertical alignment
 - 2. Doors
 - 3. Corners
 - ii. Panel size
 - iii. Building dimensions
 - iv. Panel orientation
 - v. Panel number
 - vi. Special considerations
 - vii. Drawing sheets
 - 1. Elevation
 - 2. Plans
 - 3. Details
 - 4. Sections
 - viii. Panel alignment
 - 1. Panel-window frame
 - 2. Sills –headers
 - 3. Corners
 - 4. Joint spacing
- 3. Conductor head: Function and Design
 - a. Terms
 - i. Conductor head
 - ii. Scupper
 - iii. Outlet
 - iv. Hook seam
 - v. Pitch
 - vi. Bead
 - vii. Elbows: A and B
 - viii. Overflow opening

- ix. Gravel stop
- x. Sump pan
- xi. Flange
- xii. Roof water
- b. Function
 - i. Increased roof water drainage
 - ii. Building protection
 - iii. Discharge roof water into downspouts
 - iv. Decorative
- c. Design
 - i. Top opening depth equals two-thirds width
 - ii. Tapered
 - iii. Open top
 - iv. Screened opening
 - v. Ice expansion allowance
- d. Conductor head locations
 - i. Aesthetics
 - ii. Long downspout runs
 - iii. One-third from gutter elevation
 - iv. Special design/architect preference
- e. Roof scuppers
 - i. Function
 - 1. Discharges roof water through parapet
 - 2. Overflow: roof water
 - 3. Directs water into conductor
 - ii. Fabrication
 - 1. 16oz. copper minimum
 - 2. Open
 - 3. Closed
 - 4. Through gravel stop
 - 5. Custom design
 - 6. Overflow
- f. Installation
 - i. Tools
 - 1. Aviation snips
 - 2. Drill motor
 - 3. Soldering iron
 - ii. Fasteners
 - 1. Concrete inserts
 - 2. Screw with washers
 - 3. Solder
 - 4. Hook seam
 - iii. Water tight
 - iv. Hangers
- 4. Skylights
 - a. Terminology
 - i. Pressure bac
 - ii. Laminated
 - iii. Glass cups
 - iv. Backer rod
 - v. Caulking
 - vi. Square
 - vii. Gasket
 - viii. Curb
 - ix. Sill
 - x. Rafter
 - xi. Cross bar
 - xii. Operable

- xiii. Heat treated
- xiv. Tempered
- xv. Safety glass
- xvi. Air space
- xvii. Weep hole
- xviii. Condensate
- xix. Wet seal
- b. Skylights: functions
 - i. Energy efficiency
 - ii. Aesthetics
 - iii. Natural light
 - iv. Air movement
 - v. Roof scuttle
- c. Skylight component
 - i. Curb
 - 1. Square
 - 2. Level
 - 3. Mounting frame
 - ii. Sill
 - 1. Lowest framework member
 - 2. Rafter attachment
 - 3. Pre-punched
 - 4. Weep hole
 - iii. Rafter
 - 1. Extended aluminum
 - 2. Main structure member
 - 3. Commons, jacks, and hips
 - 4. Pre-drilled
 - iv. Cross-bar
 - 1. Supports glass
 - 2. Retainer
 - 3. Pre-punched
 - v. Beauty cap
 - vi. Cladding/flashing
 - vii. Glass unit
 - 1. Tempered
 - 2. Heat strengthened
 - 3. Fiberglass
- d. Skylight type
 - i. Glass
 - 1. Aesthetics
 - 2. Light allowance
 - ii. Fiberglass
 - 1. Economical
 - 2. Ease of installation
 - iii. Acrylic
 - 1. Light weight
 - 2. Time effective
 - 3. Basic function
 - iv. Specialty skylight
 - 1. Ceiling grid mount
 - 2. Size transitions
 - 3. Versatile
 - 4. Application
 - a. Storage areas
 - b. Offices
 - 5. Solar tubes
- e. Safety regulations

- i. Guardrails
 - ii. Fall protection
 - 1. Nets
 - 2. Fixed cover
 - 3. Catch platform
 - iii. Training
 - f. Construction drawings
 - i. Roof plan
 - 1. Location
 - 2. Size
 - 3. Orientation
 - ii. Assembly layout
 - 1. Pre-assembly instructions
 - 2. Attachment points
 - iii. Positioning
 - 1. Roof plan
 - 2. Slope
 - 3. Reflector orientation
 - iv. Details
 - 1. Clip and cross bar
 - 2. Curb attachment
 - 3. Sill alignment
 - v. Sections
 - 1. Rafter location
 - 2. Clip orientation
 - 3. Fasteners
 - 4. Weatherization retainers
 - 5. Caulking locations
 - g. Installation
 - i. Tools
 - 1. Hand
 - 2. Power
 - ii. Equipment
 - 1. Glass cup
 - 2. Cup machine
 - 3. Lifting
 - 4. Roof cart
 - iii. Drawing interpretation
 - iv. Component inventory
 - v. Sub-assembly
 - vi. Layout dimension verification
 - vii. flashing/sill installation
 - viii. Rafter placement/crossbar
 - ix. Glass panel installation
 - x. Retainer/caulk
 - xi. Wet seal
 - xii. Decorative covers
 - 5. Wall Systems
 - a. Terminology
 - i. Custom panel
 - ii. Wall system
 - iii. Abrasive blade
 - iv. Nibbler
 - v. Double cut
 - vi. Shear
 - vii. Oil canning
 - viii. Expansion/contraction
 - ix. Oxidation
 - x. Smiles

- xi. Shrapnel
- xii. Sill
- xiii. Pre-engineered
- xiv. Honeycomb
- xv. Rain screen
- b. Handling principles
 - i. Adequate personnel
 - ii. Avoid moisture conditions
 - iii. Cutting precautions
 - 1. Avoid abrasive blades
 - 2. Overheating
 - 3. Cut side on top
 - 4. Remove steel shavings
 - 5. Avoid using graphite pencils
 - a. Rust
 - b. Corrosion
- c. Wall systems: styles and materials
 - i. Styles
 - 1. Standing seams
 - 2. Flat seams
 - 3. Battened
 - 4. Specialties
 - 5. Abstract
 - 6. Composite
 - 7. Gasket
 - 8. Vertically oriented
 - ii. Materials
 - 1. Aluminum
 - 2. Stainless steel
 - 3. Copper
 - 4. Zinc
 - 5. Monel
 - 6. Lead coated
 - 7. Porcelain clad
 - 8. Alucobond
 - 9. Pre-engineered
- d. Components
 - i. Column cover
 - 1. Appearance enhancement
 - 2. Multiple sections
 - 3. Minimum exposed fasteners
 - ii. Cover guards
 - 1. Typically stainless steel
 - 2. Direct attachment
 - 3. 18 gauge minimum
 - 4. Fasteners or adhesives
 - 5. Radius formed
 - iii. Interior wall lining
 - 1. Decorate and protect
 - 2. Food service
 - 3. Copper, stainless steel, or aluminum
 - iv. Coping
 - 1. Thermal expansion
 - 2. Surface protection
 - 3. Material durability
 - v. Fire curtains
 - 1. Hot gas protection
 - 2. Fire resistant material
 - vi. Equipment screen

1. Ground or rooftop installation
2. Custom fabricated, anodized, painted
3. Panel, trim, flashing
- e. Panel finishes and moisture
 - i. Environmental
 1. Sunlight and moisture
 - a. Staining
 - b. Oxidation
 2. Moisture
 - a. Trapped: staining
 - b. Protective wrap bond
 - c. Corrosion and rust
 - ii. Handling
 1. Scratches
 2. Dings and dents
- f. Installation
 - i. Establish proper installation order
 - ii. Plumb and square
 - iii. Required sealants
 - iv. Fasteners
 - v. Layout
 1. Wall length
 2. Centering point
 - vi. Specialty tools/equipment
 1. Well wheel
 2. Nibbler
 3. Double cuts
 4. Sheers
 5. Vice grip
 - vii. Safety
 1. Rigging
 2. Lifts/scaffolds
 3. PPE
 4. Fall protection
 5. Overhead protection
6. Soldering
 - a. Solder applications
 - i. Joint sealing
 - ii. Fabrications
 - iii. Importance
 1. Sealer vs. fastener
 2. Solder ability /primary metals
 - iv. Selection
 - v. Material selection
 - vi. Tools
 1. Iron
 2. Hot box
 - b. Solder types
 - i. 50/50
 1. Tin and lead
 2. Flow-ability
 3. Melting point: 420 degrees F
 4. User friendly
 - ii. 60/40
 1. 60% tin/stronger
 2. Lower melting point
 3. Application
 - a. Low slope
 - b. Flow-ability
 - iii. 40/60

1. Strength
2. High melting point
- iv. 95/5
 1. 95% tin/high melting point
 2. Antimony
 3. Application
 - a. Tanks
 - b. Vessels
- c. Flux/acid
 - i. Types
 1. Corrosive—copper, stainless
 2. Non-corrosive—copper, stainless
 3. Muriatic acid—galvanized, copper, stainless
 4. Zinc chloride—brass, copper, lead, stainless, tin plate, galvanized, turn plate
 5. Ammonium chloride—brass, copper, lead, stainless, tin plate, galvanized, turn plate
- d. Application
 - i. Tool selection
 1. Portable
 2. Electrical
 3. Site location
 4. Iron
 - ii. Technique
 1. Material selection
 2. High slope
 3. Solder matrix
 4. Vertical
 5. Horizontal
 6. Sweat
 7. Cap soldering
 8. Heat application
 9. Joint cleaning
 - a. Before
 - b. After
 10. Joint cooling
 11. Travel speed

Resources

International Training Institute for the Sheet Metal and Air Conditioning Industry. *Architectural Sheet Metal*. First Edition. International Training Institute 601 North Fairfax Street, suite 240. Alexandria, Virginia 22314, Copyright 2006.

Sheet Metal and Air Conditioning Contractor's National Association. *Architectural Sheet Metal Manual*. 6th Edition. Sheet Metal and Air Conditioning Contractor's National Association, Inc. 4201 Lafayette Center Drive Chantilly, VA 20151-1209, Copyright 2003.

International Training Institute for the Sheet Metal and Air Conditioning Industry. *Soldering in the Sheet Metal Industry*. First edition. International Training Institute 601 North Fairfax Street, suite 240 Alexandria, Virginia 22314, Copyright 2007.

Resources Other

1. www.wilsonshaw.com (<http://www.wilsonshaw.com>)
2. www.supersky.com (<http://www.supersky.com>)
3. www.alucobondusa.com (<http://www.alucobondusa.com>)
4. www.centria.com (<http://www.centria.com>)
5. www.sheetmetal-iti.org (<http://www.sheetmetal-iti.org>)
6. [www.smacna.org](http://catalog.tri-c.edu/www.smacna.org) (<http://catalog.tri-c.edu/www.smacna.org>)

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