

ATLB-1090: CUTTING AND BURNING

Cuyahoga Community College

Viewing: ATLB-1090 : Cutting and Burning

Board of Trustees:

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Academic Term:

Fall 2021

Subject Code

ATLB - AIT-Construct/Hazard Material

Course Number:

1090

Title:

Cutting and Burning

Catalog Description:

Covers the purpose of a fire watch assignment during hot work operations including prescribed safety standards and fire suppression equipment and hazards of torch cutting with respect to fire and chemical dangers. In addition, specialty cutting equipment, petrogen: oxygen/gas and plasma arc cutting equipment will be discussed, demonstrated and applied in shop exercises.

Credit Hour(s):

2

Lecture Hour(s):

2

Requisites

Prerequisite and Corequisite

Departmental approval: admission to Laborers' apprenticeship program.

Outcomes

Course Outcome(s):

Explain the purpose of a fire watch during torch cutting and burning operations and discuss the monitoring responsibilities.

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. Discuss the purpose of a fire watch and explain the importance of ensuring the safety of workers and property.
2. List and define the terms related to fire watch duties.
3. Identify the safety standards as prescribed by the Occupational Safety and Health Administration OSHA and explain the importance of safety aspects before, during, and after the cutting procedures.
4. Identify the various fire extinguishers and fire suppression equipment, and materials required during the fire watch.
5. Explain the operation of the fire extinguisher and describe the inspection procedures used for each.
6. Identify the different types of fire that may be encountered and explain the importance of matching the extinguisher to the type of fire.
7. Demonstrate the ability to properly select and operate any fire extinguisher.

Course Outcome(s):

Discuss the hazards related to cutting and burning including fire and chemical related dangers, the various metals and coverings that pose health hazards and basic cutting and burning operations.

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. Identify the different health hazards, including fire potential and chemical reactions that may occur during cutting and burning operations.
2. List the different metal types encountered during cutting and burning operations and discuss the potential related dangers.
3. List the chemical agents related to welding and describe related uses and possible health hazards.
4. Relate to safety data sheets for references for worker safety protection.
5. Describe the Proper Personal Protective Equipment (PPE) required for cutting and burning operations and explain the specific requirements of each.
6. List and describe the components used in cutting and burning operations.
7. Explain the assembly operation of the cutting system.
8. Adjust the respective valves on torches and properly set gauges on respective fuel tanks to establish the neutral flame for cutting.
9. Demonstrate safe use of cutting and burning equipment to perform straight cuts and outside/inside bevels.

Course Outcome(s):

Describe the advantages of the Petrogen oxygen-gas system in the construction industry including system components, set-up, and pressure adjustments and precautions to follow for lighting, setting applications and shut-down.

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 performance of the Petrogen system including cutting speed, cleanliness, and efficiency when used for cutting metal within a range of very thin steel to thicknesses up to fourteen inches.
2. List the components of the oxygen-gas system to explain the differences when compared to standard torch cutting systems.
3. Explain the procedures followed when setting up the oxygen-gas system including pressurizing the tank, tip selection, hose attachment, and torch lighting.
4. List and explain the built-in safety features of the oxygen-gas system.
5. Explain the importance of properly purging the hose before lighting the torch.
6. Demonstrate the ability to set-up the oxygen-gas system and employ safety precautions to cut various metal thicknesses.

Course Outcome(s):

Describe the operation of the plasma arc cutting machine including specific safety concerns, the respective components, efficiency advantages, and cutting 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.

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. Identify the specific health and safety concerns related to plasma arc cutting.
2. Identify the health and safety hazards related to plasma cutting.
3. List and explain the function of the different consumable components of the plasma system.
4. Explain the respective components located on the control panel and discuss the function of each.
5. List the operative sequence of the plasma machine.
6. Discuss the efficiency aspects of cutting with plasma.
7. Demonstrate the ability to cut metal using the plasma arc system.

Methods of Evaluation:

1. Quizzes
2. Tests
3. Class participation
4. Student will be required to demonstrate skill in burning and cutting in accord with current industry standards.

Course Content Outline:

1. Fire watch
 - a. Fire watch: Purpose
 - i. Worker safety
 - ii. Property protection
 1. Construction start up
 2. During construction activities
 3. Job termination
 - b. Terminology
 - i. Fire watch
 - ii. Hot work permit evacuation
 - iii. Evacuation
 - iv. Extinguisher
 - v. Fire triangle
 - vi. Fire class
 - vii. Upper flammability
 - viii. Lower flammability
 - ix. Extinguishing agent
 - x. Site specific
 - c. Safety standards
 - i. Site specific protocol
 1. Owner responsibilities
 2. Job specific
 3. Evacuation
 - a. Head count
 - b. Meet up location
 - ii. OSHA
 1. 1926.352
 - a. Responsibilities/requirements
 - b. Duration
 - c. Training
 - d. Response assignment
 - e. Specifics of equipment
 2. Record keeping
 3. Cutting/burning restrictions
- d. Types of extinguisher
 - i. Liquid
 1. Stored pressure water
 - a. Size: 2 and ½ gallon
 - b. Use: class A
 - c. Stream reach: 30'- 40'.
 - d. Discharge time: 1 minute
 - e. Propellant
 - f. Limitations
 2. Aqueous
 - a. Size: 2 and ½ gallon
 - b. Uses: A and B fires
 - c. Stream reach: 30' – 40'.
 - d. Discharge time: one minute
 - e. Limitation: freeze concerns
 - ii. Gas

1. Carbon dioxide
2. Class B fire
3. Characteristics
- iii. Solid
 1. Store pressure: Class B and Class C fires
 2. Cartridge type
 3. Dry powder
- iv. Cartridge
 1. Chemical
 2. Class B and Class C fires
- v. Dry chemical
 1. Sodium bicarbonate
 2. Free flowing
 3. Non toxic
 4. Class B or Class C fires
- vi. ABC multi-purpose
 1. Mildly corrosive
 2. Free flowing water repellent
 3. Non-abrasive
- e. Extinguisher operation and inspection
 - i. Aqueous
 1. Pull safety pin
 2. Aim extinguisher at fire base
 3. Squeeze trigger
 4. Sweep fire
 - ii. Inspection of extinguisher
 1. Inspection notes
 2. Dents, pit marks
 3. Readability of name plate
 4. Seal and tamper indicator
 5. Handle/lever damage
 6. Hose/ nozzle
 7. Fullness
 8. Inspection tag
- f. Fire types and extinguishers
 - i. Fire types
 1. Class A Extinguisher
 - a. Paper
 - b. Wood
 - c. Plastic
 - d. Cloth
 - e. Rubber
 2. Class B/Aqueous Extinguisher
 - a. Flammable liquid
 - b. Oil
 - c. Grease
 - d. Tar
 - e. Paint
 - f. Gases
 3. Class C/ Dry Chemical Extinguisher
 - a. Energized electrical
 - b. Electronic
 4. Class D/Dry Chemical or Carbon Dioxide Extinguisher
 - a. Combustible metals
 - b. Titanium
 - c. Magnesium
 - d. Potassium
 5. Extinguisher: Dry powder, sodium chloride
- g. Fire Extinguisher Operation

- i. Identify fire type
 - ii. Match extinguisher to fire
 - iii. Pin, aim, squeeze and sweep
- 2. Cutting and burning: hazards and application
 - a. Related health hazards
 - i. Inhalation
 - ii. Ingestion
 - iii. Skin absorption
 - iv. Abrasions
 - v. Metal fume fever
 - 1. Inhalation
 - 2. Dust, particles, fumes
 - 3. Thirst, headache, nausea, weakness
 - b. Meta types and hazards
 - i. Cast iron/breathing vapor
 - ii. Stainless steel/carcinogenic vapor
 - iii. Galvanized/flu-like symptoms
 - iv. Lead based/toxic
 - c. Welding: Chemical agents and hazards
 - i. Lead
 - 1. Paints
 - 2. Steel coatings
 - 3. Pipe
 - ii. Zinc
 - 1. Galvanized metals
 - 2. Guardrail
 - 3. Pipe
 - iii. Cadmium
 - 1. Rust preventative
 - 2. Various steels
 - iv. Beryllium
 - 1. Copper
 - 2. Brass
 - 3. Base metals
 - v. Mercury
 - 1. Inhibit foliage growth
 - 2. Metal components
 - vi. Carbon monoxide
 - vii. Health hazards
 - 1. Fatigue
 - 2. Nausea
 - 3. Vomiting
 - 4. Headache
 - 5. Fever
 - d. Safety data sheets
 - i. Chemical research
 - ii. Health hazards
 - iii. General information
 - iv. Corrective actions
 - e. Welding PPE
 - i. Eye protection
 - 1. Tinted lenses
 - 2. Match lens with material
 - ii. Respirator
 - 1. Half face
 - 2. Cartridge
 - 3. Protection factor
 - iii. Leather

1. Jacket
2. Gloves
- iv. Hard hat
- v. Ear protection
- vi. Foot wear
- f. Cutting and burning equipment
 - i. Cutting
 1. Torch
 - a. Regulator
 - b. Hose
 - c. Tip
 2. Tank
 - a. Oxygen
 - b. Acetylene
 - c. Propane
 3. Plasma
 4. Petrogen
 - ii. Burning
 1. Torch system
 2. Specialized equipment
- g. Cutting, burning equipment assembly
 - i. Tank preparation
 1. Purge tank
 2. Valve positioning
 - ii. Regulator
 1. Fuel
 2. Oxygen
 - iii. Hose attachment
 1. Regulator
 2. Torch
 - iv. Pressure
 1. Material thickness
 2. Tip selection
 - v. System checks
 1. Leaks
 - a. Soapy water
 - b. Pressure test
 2. Loose connections
 3. Crimped hoses
- h. Neutral flame
 - i. Correct fuel mix
 - ii. Flame
 1. Color
 2. Size
 3. Sound
- i. Application
 - i. Equipment set-up
 1. Assembly
 2. Regulator adjustment
 3. Flame profile
 - ii. Straight cut
 1. Torch angle
 2. Tip distance
 3. Rate of speed/travel
 4. Direction: push
 - iii. Bevel
 1. Inside
 - a. 45 degree
 - b. Tension relief
 2. Outside

- a. Sufficient angle
 - b. Travel speed
 - c. Direction
 - d. Tip distance
- 3. Oxygen-gas cutting
 - a. Performance
 - i. Cutting speed
 - 1. 4" shaft-30 seconds
 - 2. 6" shaft-90 seconds
 - 3. 12" shaft-3 minutes
 - 4. Hole punch/10" shaft-1 minute
 - ii. Work efficiency
 - 1. Movement freedom
 - 2. Positioning
 - 3. Less sparking
 - 4. No backlash
 - iii. Cut layers
 - 1. Cutting through gaps
 - 2. Wire rope
 - iv. Long coupling distance
 - v. Non grinding
 - vi. Contaminated steel surface
 - 1. Oxidizing flame
 - 2. Blows steel clear
 - vii. Flame extinguishing resistant
 - 1. Water
 - 2. Mud
 - 3. Dirt
 - 4. Underwater cutting
 - b. Components
 - i. Fuel tank
 - 1. Hand pump
 - 2. Pressure gauge
 - 3. Gasoline
 - ii. Hoses
 - 1. Oxygen
 - 2. Gasoline
 - iii. Torch
 - 1. Needle valve
 - 2. Cutting lever
 - 3. Tips
 - a. Shroud
 - b. Fluted internal
 - c. 1 thru 1e
 - iv. Oxygen tank
 - 1. Cylinder valve
 - 2. Valve protection cap
 - v. Bottle cart
 - 1. Wheels
 - 2. Securing device
 - a. Chain
 - b. Cable
 - c. Bars
 - vi. Differences
 - 1. Fuel
 - 2. Non regulated
 - 3. Single cart
 - 4. Non connected hoses
 - c. System set-up

- i. Pressurization
 - 1. Hand pump
 - 2. Fuel delivery
 - 3. Air purging
- ii. Tip selection
 - 1. Material thickness
 - 2. Required speed
 - 3. Tip distance
- iii. Hose attachment
 - 1. Quick connect
 - a. Torch
 - b. Fuel
 - 2. Oxygen/threaded connect
- iv. Torch lighting
 - 1. Pressure setting
 - a. Fuel
 - b. Oxygen
 - 2. Valve opening
 - a. Gas
 - b. Droplets
 - c. Oxygen valve opening/mist
 - 3. Tip positioning
 - a. Avoid striker
 - b. Work piece location
 - 4. Striker light
 - 5. Flame adjustment
 - a. Fuel low
 - b. Oxygen low
- d. Oxygen-gas operation
 - i. Site preparation
 - 1. Remove flammables
 - 2. Remove combustibles
 - 3. Shield stationary items
 - ii. Secure bottles and cart
 - iii. Oxygen regulator attachment
 - iv. Pressurize gasoline tank
 - v. Hose connections
 - vi. Purge
 - vii. Torch, tip attachment
 - viii. Pressure settings
 - ix. Light torch and commence
 - x. Safety
 - 1. PPE
 - 2. Spark/heat protection
 - 3. Secure area
 - 4. Fire watch
 - 5. Respirator protection
 - 6. Ventilation
 - 7. OSHA subpart J
 - xi. Oxygen
- 4. Plasma arc cutting machine
 - a. Health and safety hazards
 - i. Health
 - 1. Burns
 - 2. Respiratory
 - 3. Ingestion
 - ii. Safety hazards
 - 1. Electrical
 - 2. Eye injury

- a. Dust
 - b. Sparks
 - c. Ultraviolet rays
- 3. Heat/temperature
- b. Consumable components
 - i. Swirl ring
 - 1. Plasma gas swirl
 - 2. Tip/electrode gap
 - ii. Electrode
 - iii. Tip
 - iv. Retaining clip
 - v. Shields
- c. Control panel components
 - i. Gas pressure gauge
 - 1. Gas/air pressure
 - 2. Pounds per square inch
 - ii. Gas/air pressure control: specific cutting application
 - iii. Output: ampere selection
 - iv. Trouble lights/problems
 - 1. Temperature
 - 2. Pressure
 - 3. Tip
 - v. Power light
 - vi. Ready light: safety shut down systems
 - vii. Pilot arc switch
 - viii. Torch connection receptacle
- d. Operative sequence
 - i. Installation and connection of equipment
 - ii. PPE
 - iii. Checks:
 - 1. Torch tips
 - 2. Electrode
 - 3. Retaining clip
 - iv. Pressure check
 - 1. Gas
 - 2. Air
 - v. Control settings
 - vi. Power source
 - vii. Operation
- e. Efficiency aspects
 - i. Versatility
 - ii. Cutting speed
 - iii. No pre heating
 - iv. Minimum heat affected zone
 - v. Reduced metal warping
 - vi. Fume reduction
- f. Plasma arc cutting
 - i. Machine set up /grounding
 - ii. Inspections
 - iii. Torch handling
 - iv. PPE
 - v. Secure materials
 - vi. Push/drag cut direction
 - vii. Rate of speed
 - viii. Grounding continuity

Resources

NA TrainingPomfret CT 06259. "Fire Watch ". current. LIUNA Training and Education Fund 37 Deerfield Road, Pomfret CT 06259, 2018.

Gosse, Jonathan F. *Welding Skills Book*. 5th ed. American Technical Publishers, Orland, IL, Copyright 2015.

Matasovic, John. *Universal Pipe-Fitters' Layout Guide*. Fifth Edition. Universal Welding Supply Co., New Lenox, IL, Copyright 1955.

Ludwig, Oswald. *Metal Work: Technology and Practice*. Third Edition. McKnight & McKnight Publishing, Bloomington, IL, Copyright 1955.

Resources Other

<https://nptel.ac.in/courses/107103012/module6/lec1.pdf> ([https://www.google.com/url/?sa=t&rct=j&q=&esrc=s&source=web&cd=19&cad=rja&uact=8&ved=2ahUKewjK2MSx0YbfAhXus1kKHWRiDEIQFjASegQIABAC&url=https%3A%2F%2Fnptel.ac.in%2Fcourses%2F107103012%2Fmodule6%2Flec1.pdf&usg=AOvVaw1CbNr4zAelR64TTPkQtR8_](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=19&cad=rja&uact=8&ved=2ahUKewjK2MSx0YbfAhXus1kKHWRiDEIQFjASegQIABAC&url=https%3A%2F%2Fnptel.ac.in%2Fcourses%2F107103012%2Fmodule6%2Flec1.pdf&usg=AOvVaw1CbNr4zAelR64TTPkQtR8_))

<https://www.instructables.com/id/How-to-Weld--MIG-Welding>

<https://www.britannica.com/technology/welding>

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