Industrial Mechanic (Millwright)
Level 1
Industrial Mechanic (Millwright)

Unit: A1 Trade Safety

Level: One

Duration: 20 hours

Theory: 20 hours

Practical: 0 hours

Overview:

This unit of instruction is designed to introduce safety and health requirements and Workplace Hazardous Materials Information System (WHMIS). Compliance with basic safety procedures. Material covered includes:

- Safety and health
- Lock-out procedures
- Personal protective equipment
- Chemical safety
- Tool safety
- Material handling
- Working safely with machinery
- Electrical safety
- Fire safety
- Safe work environments

Objectives and Content:

1. Identify safety and health requirements as they apply with emphasis on the following. 10%
   a. Definition of terms:
      - Accident
      - Hazard
   b. Definition of the four main types of hazards
   c. Definition and identification of various types of accidents
   d. Definition and comparison of the terms:
      - Unsafe act
      - Unsafe condition
   e. Ways in which a company must plan for emergencies
   f. Explanation for prompt accident investigation
   g. Purpose of the Health and Safety Act
   h. Specific rights of employees under the Act
   i. Dangerous work situation and explanation of what should be done

2. Identify and comply with personal protective equipment procedures. 10%
   a. Employer and employee responsibilities as related to personal protective equipment
   b. Work clothing and danger if it fits poorly
   c. Importance of proper glove selection when handling chemicals
   d. Proper fit of a hard hat
   e. Comparison and distinction of everyday eyeglasses, industrial safety glasses and safety goggles
   f. Identification of noise levels at which hearing protection must be worn
   g. Identification of two basic kinds of respirators

3. Define and identify chemical safety fundamentals. 10%
a. Definition of terms:
   • Chemical hazard
   • Physical hazard:
     - Three types of physical hazards
   • Health hazard
     - Four kinds of health hazards
b. Common symptoms of chemical exposure
c. Definition, purpose and objectives of Workplace Hazardous Materials Information System (WHMIS)
d. Health hazard exposure routes
   • Minimum of three
e. First aid procedures to follow when a worker is exposed to hazardous chemicals.
f. Definition and purpose of MSDS sheets

4. Identify tool safety.  
   a. Causes of hand tool accidents
      • Minimum of three
   b. Safety rules to follow when using the following:
      • Screwdriver
      • Wrench
      • Pliers
      • Hammer
      • Chisel
      • Knife
c. Description of proper and improper dress for working with rotating power tools
d. Explanation of the Importance of grounding electric tools.
e. Identification of hazards involved in pneumatic tool use and explanation of how to guard against them
f. Explanation of proper storage and handling of volatile fluids

5. Identify material handling procedures.  
   a. Simple safety procedures and precautions related to material handling
   b. Procedure on how to lift, carry and put down a load
c. Safety principles for working with or around industrial trucks (forklifts, pallet trucks, etc.)
d. Safety rules for working with or around conveyors, slings and hoists
e. How and where to store materials.

6. Identify procedures for working safety with machinery.  
   a. Machinery's point of operation and other pinch points
      • Explanation of why they are dangerous
   b. Different types of mechanical safeguards
      • Explanation of the necessity of their use
c. Definition of term: zero energy state
d. Description of lockout/tagout procedures

7. Identify electrical safety.  
   a. Definition of terms:
      • Electrical current
      • Circuit
      • Potential difference
      • Ampere
      • Watt
      • ohm
      • Volt
   b. Statement of Ohm’s Law
c. Function of each wire in a simple electric circuit and colours used to identify them
d. Three factors that affect the severity of an electric shock
e. Effects of electric current on the human body
f. Three most important points about first aid for shock victims
g. Explanation of how static electricity is generated, why its accumulation can be dangerous and how it may be avoided
h. Explanation of the importance of proper grounding
i. Definition of the term “ground fault” and explanation of ground faults occur
j. Explanation of the purpose and operation of the following devices:
   • GFCI
   • Fuse
   • Circuit breaker
k. Hazardous electrical locations
l. Explanation for the purpose of explosion-proof and intrinsically safe electrical equipment
m. Electrical safety rules to follow in the following areas:
   • Clothing
   • Equipment
   • Water
   • Lockout/tagout

8. **Identify fire safety.** 10%
   a. Explanation and list of the four elements of the fire pyramid
   b. Recognition and definition of the four classes of fire
   c. Definition of terms:
      • Flashpoint
      • Spontaneous combustion
d. Identification of fire-fighting agents and explanation of how they work and when to use them
e. Explanation of the use of at least two different types of portable fire extinguishers
f. Explanation of fire hose and fire extinguisher maintenance

9. **Identify protecting your health.** 10%
   a. Definition of ergonomics and explanation of how poor ergonomic conditions affect the body
   b. Three actions that a worker can take to protect his/her hearing
   c. Identification and contrast between ionizing and nonionizing radiation
d. Comparison and contrast between personal and background sampling

10. **Identify safe work environment.** 10%
    a. Explanation on the importance of industrial housekeeping
    b. Safety measures related to walkways, stairs and floor openings
    c. Explanation of how to protect the worker and others when working in traffic paths
d. Description of three hazards involved in each of the following and explanation of how to safeguard against them:
   • Working with personal conveyances and people movers
   • Working in confined spaces
e. Calculation of the proper placement of a ladder based on its working length
f. Identification of at least two kinds of scaffolds and provision of at least one safety rule associated with each
g. Symptoms of heatstroke, heat cramps and heat exhaustion
h. Identification of two major safeguards necessary when welding
i. Explanation of how to handle and store cylinders safely
Industrial Mechanic (Millwright)

Unit: A2 Communication

Level: One
Duration: 25 hours
  Theory: 10 hours
  Practical: 15 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and understanding of basic computer knowledge and trade-related communication skills. Material covered includes:
- Basic computer skills
- Describe and identify standards
- Problem solving
- Collaborating
- Communicating

Objectives and Content:

1. Identify basic computer knowledge and skills. 25%

2. Describe and identify standards. 25%
   a. International Organization for Standards (ISO)
      • ISO defined
      • ISO exposure
   b. American National Standards Institute (ANSI)
      • Founded in 1981, a multi-faceted agency that is dedicated to establishing business safety standards and guidelines
      • Official US standards body offers news and other information from the Information Infrastructure
   c. Quality control
   d. Standards

3. Describe problem solving skills. 25%

4. Describe collaborating skills. 25%
Industrial Mechanic (Millwright)

Unit: B1 Measurement and Measuring Devices
Level: One
Duration: 30 hours
   Theory:  10 hours
   Practical: 20 hours

Overview:

This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and understanding of basic measurement. Material covered includes:
- Basic measurement
- The measuring devices as to:
  - External measuring devices
  - Internal measurement
  - Angular measurement
  - Comparative measurement
  - Metric and imperial measurement
- Safety practices and quality assurance

Objectives and Content:  

<table>
<thead>
<tr>
<th>Percent of</th>
<th>Unit Mark (%)</th>
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<tbody>
<tr>
<td>1. Identify measuring tools in the imperial and metric systems.</td>
<td>20%</td>
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<tr>
<td>a. Comparison and direct reading measuring tools</td>
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<tr>
<td>b. Fractional, decimal, and metric steel rules</td>
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<tr>
<td>c. Calipers</td>
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<td>d. Micrometers</td>
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<td>e. Vernier calipers</td>
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<td>f. Protractors</td>
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<td>g. Dial indicators</td>
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<td>h. Vernier height gauges</td>
<td></td>
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<tr>
<td>i. Surface plates</td>
<td></td>
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<td>j. Squares</td>
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<td>k. Small hole gauges</td>
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<td>l. Telescoping gauges</td>
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<td>m. Dial bore gauges</td>
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<td>n. Gauge blocks</td>
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<tr>
<td>o. Universal bevel protractors</td>
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<td>p. Plug, ring and snap gauges</td>
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<td>q. Optical flats (measuring for “flatness”)</td>
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<tr>
<td>2. Describe the principles of operation that apply to precision measuring tools.</td>
<td>20%</td>
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<tr>
<td>a. Principles of the inch and metric micrometer</td>
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<td>b. Discrimination of inch and metric micrometers</td>
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<td>c. Parts of the micrometer</td>
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<td>d. Inside, outside and depth micrometers</td>
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<tr>
<td>e. Vernier micrometer</td>
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<td>f. Adjusting micrometers</td>
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</tbody>
</table>
g. Specialty micrometers
h. Vernier calipers
i. Parts of the vernier caliper
j. Store and maintain measuring tools:
   Calibration of precision measuring tools

3. **Store and maintain measuring tools.** 60%

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Industrial Mechanic (Millwright)

Unit: B2 Layout

Level: One
Duration: 20 hours
Theory: 5 hours
Practical: 15 hours

Overview:

This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and understanding of general procedures and surface preparation used in layout operations. Material covered includes: Safety practices.

Objectives and Content:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Percent of Unit Mark (%)</th>
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</thead>
<tbody>
<tr>
<td>1. Select the appropriate layout tools needed to perform a layout for a specific job.</td>
<td>20%</td>
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<tr>
<td>a. Layout solutions/sprays</td>
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<td>b. Layout tables</td>
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<tr>
<td>c. Surface plates</td>
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<td>d. Scribers</td>
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<tr>
<td>e. Combination sets</td>
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<td>f. Hermaphrodite calipers</td>
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<td>g. Dividers</td>
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<td>h. Trammels</td>
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<tr>
<td>i. Prick and centre punches</td>
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<tr>
<td>j. Angle plates</td>
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<tr>
<td>k. Parallels</td>
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<td>l. V-blocks</td>
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<tr>
<td>m. Surface gauges</td>
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<td>n. Handbooks, tables and charts</td>
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<tr>
<td>2. Lay out straight and irregular profile lines.</td>
<td>20%</td>
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<tr>
<td>3. Identify reasons for and describe safety precautions regarding layout procedures and related equipment.</td>
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<td>4. Identify and describe use of layout tools and related equipment.</td>
<td>8%</td>
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<td>5. Describe layout procedures and purpose of layout procedures.</td>
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<td>6. Describe maintenance and storage procedures for layout tools and related equipment.</td>
<td>8%</td>
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<td>7. Demonstrate the use of the following devices.</td>
<td>18%</td>
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<tr>
<td>a. Angle plate</td>
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<td>b. Vernier height gauge</td>
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<td>c. Scriber</td>
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<td>d. Straight edges</td>
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<tr>
<td>e. Hammers</td>
<td></td>
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<tr>
<td>f. &quot;V&quot;-blocks</td>
<td></td>
</tr>
</tbody>
</table>
g. Hermaphrodite calipers  
h. Surface gauges  
i. Clamps  
j. Combination square  
k. Centre punch  
l. Parallels  
m. Dividers  
n. Surface plate  
o. Templates  
p. Prick punch  
q. Protractors  
r. Trammels  
s. Layout fluids and coatings

8. **Store and maintain layout tools.**  
a. Sharpening of layout tools
Industrial Mechanic (Millwright)

Unit: B3 Non-cutting Hand Tools

Level: One
Duration: 10 hours
  Theory: 5 hours
  Practical: 5 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and skills necessary to use and care for common non-cutting hand tools in a safe, efficient and responsible manner. Material covered includes:
- Safety practices in the use and care of hand tools
- Identification of hand tools
- Operation and maintenance

Objectives and Content:

1. Identify non-cutting hand tools.  
   a. Open end, box end, adjustable wrenches and combination wrenches
   b. Pliers and their uses
   c. Screwdrivers and their uses
   d. Ratchets, sockets and power bars
   e. Allen wrenches (metric and imperial) (Hex head)
   f. Torque wrenches and torque multipliers:
      • Hydraulic and mechanical
   g. Hammers
   h. Vises
   i. Clamps
   j. Drift Punches
   k. Number and Letter Stamps
   l. Pipe wrenches and their uses

2. Describe torque and its importance.  
   a. Definition of torque
   b. Purposes
   c. Torque wrench types
   d. Torque charts
   e. Torque wrench adjustment
   f. Torque wrench accuracy

Percent of Objectives and Content: Unit Mark (%)

1. Identify non-cutting hand tools. 50%
   a. Open end, box end, adjustable wrenches and combination wrenches
   b. Pliers and their uses
   c. Screwdrivers and their uses
   d. Ratchets, sockets and power bars
   e. Allen wrenches (metric and imperial) (Hex head)
   f. Torque wrenches and torque multipliers:
      • Hydraulic and mechanical
   g. Hammers
   h. Vises
   i. Clamps
   j. Drift Punches
   k. Number and Letter Stamps
   l. Pipe wrenches and their uses

2. Describe torque and its importance. 50%
   a. Definition of torque
   b. Purposes
   c. Torque wrench types
   d. Torque charts
   e. Torque wrench adjustment
   f. Torque wrench accuracy

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Industrial Mechanic (Millwright)

Unit: B4 Cutting Hand Tools
Level: One
Duration: 15 hours
  Theory: 5 hours
  Practical: 10 hours

Overview:

This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and skills necessary to use and care for common cutting hand tools, drills, taps, reamers in a safe, efficient and responsible manner. Material covered includes:
  - Identification of cutting hand tools
  - Safety practices in the use and care of cutting hand tools

Objectives and Content:

1. Identify cutting tools. 30%
   a. Hacksaws - blade selection
   b. Files – Types
   c. Chisels
   d. Scrapers
   e. Snips
   f. Shears (hand)
   g. Pliers (cutting)
   h. Twist drills
   i. Taps and Dies
   j. Reamers
   k. Broaches
   l. Stud extractors
   m. Abrasive cloths
   n. Countersinks

2. Describe the different parts of a twist drill and their purpose. 10%
   a. Shanks (straight and tapered)
   b. Body
      • Flutes, margins, lands and cutting lips
   c. Point
      • Cutting edge, heel, body clearance and chisel edge

3. Calculate the tap drill size using the formula. 10%
   a. Purpose of the proper tap drill size
   b. Tap drill formulas for imperial and metric sizes
   c. Tap drill charts

4. Describe the different taps in a set and the purpose of each. 10%
   a. Taper, plug and bottoming taps
   b. Tap extractors
   c. Tap handles
   d. Tapping procedures
5. **Describe procedures to sharpen a twist drill for various materials:**  
   a. Drill point characteristics  
   b. Drill point angles for various materials  
   c. Cutting lip length  
   d. Web thickness  
   e. Clearance angles  
   f. Chisel point  
   g. Grinding procedures  
   h. Web thinning  
   i. Drill point angle measurement  
   j. Problems caused by improperly sharpened drills  
   k. Cutting speeds for drills, various materials, etc. (different angles to be sharpened for different materials)

6. **Describe the different types of threading dies.**  
   a. Purpose of dies  
   b. Solid die  
   c. Adjustable dies  
   d. Die stocks  
   e. Threading procedures

7. **Describe the different types of hand and machine reamers and describe their purpose.**  
   a. Purpose of reaming  
   b. Solid hand reamer  
   c. Expansion hand reamer  
   d. Adjustable hand reamer  
   e. Taper reamers  
   f. Straight and helical fluted reamers  
   g. Rose reamers  
   h. Shell reamers

8. **Describe different types of drill bits and their purpose.**  
   a. Straight and tapered shank twist drills  
   b. High helix drills  
   c. Core drills  
   d. Oil hole drills  
   e. Straight fluted drills  
   f. Deep hole drills  
   g. Spade drills  
   h. Step drills  
   i. Hole saws

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Industrial Mechanic (Millwright)

Unit: B5 Fasteners

Level: One
Duration: 10 hours
Theory: 5 hours
Practical: 5 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and skills necessary to install fasteners in a safe and efficient manner. Material covered includes:
- Installation of fasteners
- Different tools used to install fasteners

Objectives and Content:

1. Describe the types, sizes, classification and uses of threaded and non-threaded fastening devices. 25%
   a. Purposes of threads
   b. Screw thread terms and systems
   c. Thread designation
   d. Thread series (various)
   e. Thread size
   f. Thread measurement
   g. Right and left hand threads
   h. Nuts, bolts, cap screws and machine screws
   i. Multiple threads
   j. Keys
   k. Keyways
   l. Splines
   m. Class of fit
   n. Flat washers
   o. Lock washer styles and application
   p. Lock nuts

2. Select the proper fastening device for use in metal, wood and concrete. 50%
   a. Wood screw classification
   b. Sheet metal screws
   c. Self drilling screws
   d. Rivets
   e. Taper pins
   f. Cotter pins
   g. Dowel pins
   h. Shear pins
   i. Spring pins
   j. Clevis pins
   k. Spring locking pins
   l. Toggle bolt styles
   m. Expansion shields
   n. Concrete anchor types
3. **Identify the grade of cap screws and nuts.** 25%
   a. Classification methods for fasteners
   b. Tensile strength
   c. Grade markings

4. **Describe the installation procedure for various fastening devices.** 25%
   a. Threaded and non-threaded fasteners
   b. Rotary hammer use
   c. Pop rivet installation
   d. Thread inserts
   e. Broken stud removal methods
   f. Preloading fasteners
   g. Lock wires
   h. Resins

5. **Describe the procedure to torque fastening devices to specifications.** 25%
   a. Definition and purpose of torque
   b. Torque wrenches
   c. Torque multipliers
   d. Torque charts
   e. Wet and dry torque
   f. Proper sequence
Industrial Mechanic (Millwright)

Unit: B6 Metallurgy

Level: One
Duration: 14 hours
Theory: 14 hours
Practical: 0 hours

Overview:

This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and skills necessary to understand the properties, composition, classification, and uses of ferrous and non-ferrous metals, and heat treatment terminology and practices. Material covered includes:
- Safety practices
- Terminology relating to metallurgy
- Properties of metals

Objectives and Content:

1. Identify and describe the various properties of metals. 20%
   a. Chemical, physical and mechanical properties
   b. Brittleness, ductility, elasticity, hardness, malleability, tensile strength and toughness

2. Identify the classification of steel and describe the numbering system for steel. 20%
   a. Hot rolled and cold rolled steel
   b. Alloy steels
   c. Plain, medium and high carbon steels
   d. Identifying steel using the SAE and ANSI classification systems

3. Define heat treatment terms. 20%
   a. Definition of heat treatment
   b. Lowest and lower critical temperature
   c. Critical range
   d. Hardening
   e. Tempering
   f. Annealing
   g. Normalizing
   h. Case hardening
   i. Induction hardening
   j. Flame hardening

4. Describe the properties and uses of various non-ferrous metals. 20%
   a. Definition of non-ferrous metals
   b. Aluminum
   c. Copper and copper base alloys
   d. Lead and lead based alloys
   e. Tin and tin alloys
   f. Zinc
   g. Leaded bronzes
   h. Babbitt
5. Describe terms and describe methods and procedures used in hardness testing. 10%
   a. Definition of hardness
   b. Rockwell Hardness Tester
   c. Brinell Hardness Tester

6. Identify structural steel shapes and how they are sized. 10%
   a. Angle iron
   b. Flat bar
   c. Channel
   d. I beam
   e. H beam
   f. Structural tubing
Industrial Mechanic (Millwright)

Unit: C1 Read and Interpret Drawings I
Level: One
Duration: 30 hours
Theory: 10 hours
Practical: 20 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) Apprentice with the knowledge and skills necessary to execute basic sketching and extract basic information from a blueprint. This unit also provides the apprentice with the knowledge and skills necessary to use blueprints dealing with various aspects of machinery assembly and its installation. Material covered includes:

- Freehand sketches
- Basic blueprint terminology
- Basic blueprint principles
- Assembly procedures for equipment and its component

Objectives and Content:

1. Identify principles of basic blueprint reading and the components involved. 4%
   a. Visualization
   b. Interpretation of the print

2. Develop freehand sketches. 2%
   a. Drawing production
   b. Accepted sketching methods
   c. Drawing to scale
   d. Proportion in sketching

3. Describe orthographic projection. 2%
   a. Definition of orthographic projection
   b. Projection and selection of views
   c. Rules of procedure for the visualization of objects
   d. Identification of lines and surfaces
   e. Matching views
   f. Sketching orthographic views

4. Describe the use of different lines. 2%
   a. Visible
   b. Hidden
   c. Section
   d. Centre
   e. Dimension
   f. Extension
   g. Cutting plane
   h. Break
   i. Phantom lines

5. Identify basic machining symbols used on blueprints. 5%
6. **Describe the methods of dimensioning.**
   a. Size and location dimensions
   b. Dimension and extension lines
   c. Placement dimensions

7. **Read drawings to extract relevant information.**
   a. Basis for interpreting drawings
   b. Sectional views
   c. Tolerances and allowances
   d. Removed and revolved sections
   e. Inclined surfaces
   f. Circular features

8. **Interpret equipment assembly blueprints to determine the assembly procedures for equipment components.**
   a. Purpose of detailed drawings
   b. Purpose of assembly drawings:
      - Sub-assembly, working assembly, diagram assembly, installation assembly and exploded pictorial assembly drawings
   c. Identify terms used in dimensioning
   d. Identifying various types of dimensions
   e. Identifying gearing
   f. Identifying splines and serrations
   g. Recognizing basic weld and welding symbols

9. **Use equipment assembly blueprints to determine the assembly procedures for equipment components.**

10. **Identify various views and their arrangement.**
    a. Auxiliary views
    b. Sectional views
    c. Full, half, offset, aligned, broken out, revolved, removed, partial and outlined sections

11. **Describe steel specifications found on the blueprints.**
    a. ANSI and ASME methods of identifying steel by code

12. **Use equipment assembly blueprints to determine the assembly procedures for equipment components.**
    60%

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Industrial Mechanic (Millwright)

Unit: D1 Drilling Machines

Level: One
Duration: 16 hours
    Theory: 6 hours
    Practical: 10 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to use pneumatic and electric power tools. Material covered includes:
- Identification of power tools
- Safety practices and care of power tools
- Maintenance of power tools

Objectives and Content:

1. Select the proper power tool for a specific task.
   a. Proper tool selection based on job requirements
   b. Drill types and classification
   c. Portable grinders and grinding wheel types and classification
   d. Power screwdriver classification, and clutch mechanisms
   e. Circular saw classification
   f. Reciprocating saw classification
   g. Pipe threading machines and their uses
   
2. Identify the safe operation of power tools.
   a. Safe practices for the operation of shears, nibblers, drills circular and reciprocating saws, power screwdrivers, grinders and impact tools
   b. Current flow through electric tools
   c. Over current protection and double insulated tools
   
3. Inspect and maintain power tools.
   a. Operating principles of various electrical and pneumatic tools
   b. Proper methods of lubricating pneumatic tools
   c. Power cord inspection
   d. Air line inspection
   e. Designated operating pressure
   f. Pressure loss in lines
   g. Filters, regulators and lubricators

Percent of Objectives and Content: Unit Mark (%)

1. Select the proper power tool for a specific task. 25%
   a. Proper tool selection based on job requirements
   b. Drill types and classification
   c. Portable grinders and grinding wheel types and classification
   d. Power screwdriver classification, and clutch mechanisms
   e. Circular saw classification
   f. Reciprocating saw classification
   g. Pipe threading machines and their uses

2. Identify the safe operation of power tools. 50%
   a. Safe practices for the operation of shears, nibblers, drills circular and reciprocating saws, power screwdrivers, grinders and impact tools
   b. Current flow through electric tools
   c. Over current protection and double insulated tools

3. Inspect and maintain power tools. 25%
   a. Operating principles of various electrical and pneumatic tools
   b. Proper methods of lubricating pneumatic tools
   c. Power cord inspection
   d. Air line inspection
   e. Designated operating pressure
   f. Pressure loss in lines
   g. Filters, regulators and lubricators

***
## Industrial Mechanic (Millwright)

**Unit:** D2 Power Metal Saws  
**Level:** One  
**Duration:** 10 hours  
Theory: 5 hours  
Practical: 5 hours

### Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to use and care for power metal saws in a safe, efficient and responsible manner. Material covered includes:

- Safety practices and care of power tools
- Horizontal and vertical band saws
- Reciprocating saws
- Abrasive wheel cut off saws
- Equipment and accessories for power metal saws

### Objectives and Content:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
<th>Percent of Unit Mark (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Demonstrate procedures to cut metal with a band saw.</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>a. Methods of cutting off material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Saw types and operation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Speeds and feeds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Contour saw operations</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Select the proper band saw blade for a specific task.</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>a. Saw blade classification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Speeds and feeds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Blade pattern</td>
<td></td>
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<tr>
<td></td>
<td>e. Pitch</td>
<td></td>
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<td></td>
<td>f. Tooth form</td>
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<td></td>
<td>g. Width and gauge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>h. Blade length calculations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. Blade installation</td>
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<tr>
<td>3.</td>
<td>Identify procedures to weld band saw blades.</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>a. Blade preparation</td>
<td></td>
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<tr>
<td></td>
<td>b. Machine settings</td>
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<td></td>
<td>c. Annealing</td>
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<tr>
<td>4.</td>
<td>Demonstrate procedures to cut metal with a reciprocating saw.</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>a. Blade classification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Blade installation</td>
<td></td>
</tr>
</tbody>
</table>
5. Demonstrate procedures to cut metal with an abrasive wheel cut off saw.  
   a. Theory of operation  
   b. Wheel selection  
   c. Safety hazards  

6. Describe maintenance procedures for power metal saws.  
   a. Lubrication methods  
   b. Coolant systems
Industrial Mechanic (Millwright)

Unit: D3 Pedestal Grinders

Level: One
Duration: 20 hours
Theory: 10 hours
Practical: 10 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to use and care for pedestal grinders in a safe, efficient and responsible manner. Material covered includes:

- Safety practices and care of pedestal grinders
- Types of pedestal grinders, grinding wheels and accessories

Objectives and Content:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Percent of Unit Mark (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select the proper type of wheel to grind a specific metal from wheel identification codes.</td>
<td>25%</td>
</tr>
<tr>
<td>a. Theory of operation of pedestal grinders</td>
<td></td>
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<tr>
<td>b. Abrasive types</td>
<td></td>
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<tr>
<td>c. Bonds</td>
<td></td>
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<tr>
<td>d. Coarse and fine wheels</td>
<td></td>
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<tr>
<td>e. Hard and soft wheels</td>
<td></td>
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<tr>
<td>f. Mounted grinding wheels</td>
<td></td>
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<tr>
<td>g. Rotary files and burrs</td>
<td></td>
</tr>
<tr>
<td>2. Change and dress wheels on a pedestal grinder.</td>
<td>25%</td>
</tr>
<tr>
<td>a. Safe dismantling procedures</td>
<td></td>
</tr>
<tr>
<td>b. Blotters and flanges and their purpose</td>
<td></td>
</tr>
<tr>
<td>c. Ring test</td>
<td></td>
</tr>
<tr>
<td>d. Safe operating speeds for wheels</td>
<td></td>
</tr>
<tr>
<td>e. Dressing tools and their purpose</td>
<td></td>
</tr>
<tr>
<td>f. Adjustment of tool rest</td>
<td></td>
</tr>
<tr>
<td>3. Explain the code systems found on grinding wheels.</td>
<td>25%</td>
</tr>
<tr>
<td>4. Describe the techniques used to sharpen different tools.</td>
<td>25%</td>
</tr>
<tr>
<td>a. Techniques for grinding chisels, lathe tools, twist drills and punches</td>
<td></td>
</tr>
</tbody>
</table>

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Industrial Mechanic (Millwright)

Unit: D4 Metal Lathe

Level: One
Duration: 30 hours
  Theory: 15 hours
  Practical: 15 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to perform work safely and perform metal lathe operations. Material covered includes:
  - Safety practices and care of metal lathes
  - Parts and accessories
  - Speed and feed
  - Turning, facing, boring, threading

Objectives and Content:

1. Describe procedures to perform basic lathe functions such as turning, facing, boring, and threading.  
   a. Lathe size and capacity  
   b. Lathe parts, accessories and their function:  
      • Bed  
      • Head stock  
      • Spindle  
      • Feed reverse lever  
      • Quick change gear box  
      • Lead screw and feed rod controls  
      • Carriage  
      • Saddle  
      • Cross-slide and compound rest  
      • Apron handweel, automatic feed lever and feed change lever  
      • Tailstocks  
      • Tailstocks clamp lever, spindle and spindle lock, offsetting screw and centre  
      • Work holding devices:  
        • Spindle nose types  
        • Lathe centres  
        • 3 jaw, 4 jaw, collett, magnetic chucks, face plates and lathe dogs  
        • Mounting chucks  
        • Mounting jaws in chucks  
        • Mounting work in chucks  
        • - Truing work in a 4 jaw chuck with a dial indicator  
        • Steady rest and follower rests  
      • Cutting tool holders:  
        • Left and right hand offset tool holders  
        • Parting tool holders  
        • Boring bars
Standard toolpost
Quick change tool holders

- Cutting tools:
  - Sharpening of cutting tools
  - Importance of centre height
  - Types of cutting tools:
    - Carbide
    - Ceramic
    - H.S.S.

- Mounting, removing and aligning lathe centres
- Facing and machining between centres and in chucks
  - Facing to accurate length
  - Rough and finish cut
  - Turning to a shoulder
  - Filing and polishing in a lathe
  - Knurling and form turning
  - Cutting off work in a chuck
  - Drilling, boring, reaming and tapping on the lathe
  - Coolants and lubricants
  - Skin safety: Dermatitis

2. **Calculate correct speeds and feeds.** 25%
   a. Definition of speeds and feeds for lathes and various metals
   b. Formulas for speeds and feeds and depth of cut
   c. Shear pins and slip clutches
   d. Graduated micrometer collars

3. **Calculate thread depths and perform thread cutting operations.** 25%
   a. Thread cutting on the lathe:
      - Terminology
      - Thread forms
      - Fits and classifications
      - Thread pitch and depth of cut calculations
      - Thread chasing dial
      - Set up procedures for thread cutting
      - Thread cutting operations
        - Resetting a threading tool
        - Thread measurement
        - Multiple threads

4. **Describe procedures to turn a taper.** 25%
   a. Types of tapers
   b. Taper calculations
   c. Taper turning methods
      - Tailstock offset, taper attachments and compound rest method

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Industrial Mechanic (Millwright)

Unit: D5 Milling Machines

Level: One
Duration: 10 hours
- Theory: 4 hours
- Practical: 6 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to set up, operate milling machines for basic milling operations and comply with safety procedures. Material covered includes:
- Safety practices and care of milling machines
- Setup of equipment
- Calculation of speeds and feeds
- Information on cutters

Objectives and Content:  

<table>
<thead>
<tr>
<th>Percent of Unit Mark (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.  Identify safety hazards involved in operating a milling machine.</td>
</tr>
<tr>
<td>2.  Calculate correct speeds and feeds.</td>
</tr>
<tr>
<td>a. Horizontal and vertical milling machines</td>
</tr>
<tr>
<td>b. Knee and column mills</td>
</tr>
<tr>
<td>c. Parts of the milling machine</td>
</tr>
<tr>
<td>d. Milling machine attachments</td>
</tr>
<tr>
<td>• Vertical milling attachment</td>
</tr>
<tr>
<td>• Slotting attachment</td>
</tr>
<tr>
<td>• Arbors, collets and adapters</td>
</tr>
<tr>
<td>• Vises</td>
</tr>
<tr>
<td>3.  Perform calculations involved in using a milling machine.</td>
</tr>
<tr>
<td>a. Definition of speed and feeds</td>
</tr>
<tr>
<td>b. Calculations for feed, speed and depth of cut</td>
</tr>
<tr>
<td>c. Keyseat depth of calculations</td>
</tr>
<tr>
<td>4.  Describe set-up procedures.</td>
</tr>
<tr>
<td>a. Direction of feed</td>
</tr>
<tr>
<td>• Climb and conventional milling</td>
</tr>
<tr>
<td>5.  Select proper cutters to perform specific tasks.</td>
</tr>
<tr>
<td>a. Plain mill cutters</td>
</tr>
<tr>
<td>b. Face mill cutters</td>
</tr>
<tr>
<td>c. End mills</td>
</tr>
<tr>
<td>d. Woodruff keyseat cutter</td>
</tr>
<tr>
<td>e. Flycutters</td>
</tr>
<tr>
<td>6.  Describe the procedures for centring cutters on shafts.</td>
</tr>
</tbody>
</table>
Industrial Mechanic (Millwright)

Unit: E1 Welding I

Level: One
Duration: 20 hours
Theory: 6 hours
Practical: 14 hours

Overview:
This unit of instruction is designed to provide the Industrial Mechanic (Millwright) apprentice with the knowledge and skills necessary to properly use oxy-fuel equipment in brazing, soldering, welding and cutting operations and comply with safety procedures. Material covered includes:
- Safety around oxy-fuel equipment
- Oxy-fuel equipment, components and accessories

Objectives and Content:

1. **Describe the purpose of various safety devices and the precautions to follow when using oxy-fuel equipment.** 10%
   a. Safety
   - Transportation of oxy-fuel equipment
   - Handling and storage
   - Operating pressure
   b. Regulators and gauges (single stage and two stage)
   c. Fusible plugs
   d. Flashback arresters
   e. Properties of oxygen and fuel

2. **Describe proper procedures to set up oxy-fuel equipment.** 10%
   a. Regulator installation
   b. Left and right hand threads
   - Hazards of oil or grease in contact with oxygen
   c. Different gases
   d. Securing cylinders
   e. Proper order of operations when opening cylinder valves
   f. Proper regulator adjustment

3. **Select the proper tips for various cutting and welding jobs on different metals.** 30%
   a. Numbering system for tips
   b. Heating tips

4. **Use oxy-fuel equipment to perform basic burning operations.** 30%
   a. Safety hazards present when using oxy-fuel equipment
   b. Check torch valves and regulator pressure screws
   c. Open cylinder valves and adjust regulator pressures
   d. Checking for leaks
   e. Torch lighting procedures
   f. Types of oxy-acetylene flames and their purpose
   - Proper torch use

5. **Describe oxy-acetylene cutting techniques.** 10%

6. **Describe procedures for cutting metal with oxy-fuel equipment.** 10%