SECTION

6

PLANT AND EQUIPMENT, BOARDS, DIODES, WELDING & FUNCTIONAL ZONES

UNIT 1

BUILDING CONSTRUCTION TECHNOLOGY

Pre-Construction Activities

INTRODUCTION

In the building construction industry, plants and equipment usually involve the operation, using and maintaining building and civil construction machinery. The study of plant and equipment in the construction industry will enable you to understand the concept of selecting appropriate type and size of plant and equipment and their effect on time and work output achieved and the job size productivity. The knowledge will also make you aware of the benefits and reasons for using construction plants and equipment on projects.

At the end of this unit, you will be able to:

Identify and state the functions of plants and equipment for construction works.

Key Ideas

- Plants and equipment are machines that play very important roles on construction sites.
- On large construction sites, plants and equipment are used to improve work output.
- Plants and equipment actually minimise waste, reduce costs and minimise down-time.

IDENTIFICATION AND FUNCTIONS OF PLANT AND EQUIPMENT

Tangible assets, such as machinery and vehicles, are referred to as plants while classifying, smaller machinery or anything, which is used to carry out the work at hand as equipment. These assets are mobilised to become an integral part of the contractor's operations and are crucial for the start and completion of the building construction project.

1. Distinguishing Between Plant and Equipment

Plant and **equipment** are both essential components in construction projects, but they serve different purposes and have distinct characteristics. The difference between plant and equipment used in construction works are as follows:

A. Plant

Plant refers to large, often stationary or semi-permanent machinery and facilities used for heavy-duty work on construction sites. These are usually substantial, high-cost assets that are utilised for significant tasks, such as excavation, lifting, and material handling. Plant often stay on-site for extended periods to complete major construction activities.

Examples of Plant

Excavators

When it comes to the clearance activities on the construction site, the most effective way is the employment of heavy machines meant for digging, trenching, and excavation work. These heavy machines are called excavators. As seen in Figure 6.1.1, the excavators are involved in site clearance, subsoil removal, cutting and filling of the site, removal of unwanted materials and digging of trenches for foundations.

Figure 6.1.1: Excavators at the construction sites

Cranes

Some notable scenes at very large construction project sites involve large machinery which are used to lift and move heavy materials vertically and horizontally across the site. The services of these plants on the sites enable the achievement of great progress of construction work as movement of materials vertically and horizontally are very effectively carried out. The illustrations of Figure 6.1.2 show two examples of cranes in use at a large construction site.

Figure 6.1.2: Cranes in use at the construction sites

Concrete Batching Plants

When it comes to working on a large scale, especially involving batching of large volumes of materials for concreting, it is always necessary to engage the services of stationary or mobile units which are used to mix large volumes of concrete for construction projects. It is very convenient to use the concrete batching plants which are very efficient and also effective in obtaining the required quantity of the respective materials and at the same time, ensuring that a thoroughly mixed concrete can be produced. Images in Figure 6.1.3 show the two common types of batching plants for concrete mixing at construction sites.

Figure 6.1.3: Batching plants for concrete mixing

B. Equipment

Equipment refers to smaller, portable tools and devices used to perform specific tasks on construction sites. Equipment is typically more mobile than plant and used for more specialised, hands-on work. Equipment is often task-specific and is used to assist in completing various aspects of construction, such as measurement, fastening, or finishing. Among the illustrations of Figures 6.1.4, 5, 6 & 7 are examples of some equipment used on construction sites.

Examples of Equipment

Power Drills

Whenever the need arise for creating or boring holes in existing concrete works, hand-held devices or power drills are used for drilling holes and driving screws in construction projects. Usually, power drills are employed as the appropriate means of creating a proposed hole instead of chisels or bolster and club or lump hammers. The diagram of Figure 6.1.4 shows the various types and sizes of power drills that are usually employed at construction sites.

Figure 6.1.4: Power drills used at construction sites

Welding Machines

The welding equipment are used to join metal pieces or components by heating and fusing them. The practice of welding on construction sites usually occurs when fabricating iron rods or steel rods for reinforcement of concrete slabs. The diagram of Figure 6.1.5 shows the welding machine and the various set of accessories used at the specific request made.

Figure 6.1.5: Welding machine as a construction equipment

Concrete Mixers

There are two types of concrete mixers in use. They are known as concrete mixers and mobile concrete mixers. The concrete mixers as seen in Figure 6 are portable machines which are used to mix small batches of concrete for localised or for smaller construction works. The mobile concrete mixer in Figure 6.1.7, however, is mounted on a truck purposely designed to mix concrete in a large quantity even while moving. The mobile concrete mixers are very convenient, effective and efficient for very big construction projects. The diagrams of Figures 6.1.6 and 7 show two different types of concrete mixers in use on construction sites.

Figure 6.1.6: Concrete Mixers at site. Figure 6.1.7: Mobile Concrete Mixer

Activity 6.1.1

Join a field trip arranged by the teacher to a construction site and observe differences in functions between plants and equipment in use at the construction site.

Hints:

i. Read thoroughly about plants and equipment used on construction sites.
ii. Make notes on the types of plants and equipment and decide on what to observe.
iii. Take a critical look at the plants and equipment in use on the site and the functions of the various parts.
iv. Ask the personnel there about operational steps involved in operating the plants and equipment.
v. Make a comprehensive note about the differences, functions and parts of plants and equipment for group discussion.

Key Differences Between Plant and Equipment Used in Construction Projects

1. **Size and Scale**: Plant are generally large and perform heavy-duty functions, while equipment is smaller and used for more precise tasks.
2. **Mobility**: Plant is often fixed or difficult to move around, whereas equipment is portable and can be easily transported across the site.
3. **Cost and Lifespan**: Plant is more expensive, with longer lifespans, and is considered as major investments. Equipment, though essential, is generally cheaper and may have shorter service durations.

Plants Likely to be Mobilised into the Inner Perimeter Fence When Building A 3-Storey Block of Flats

When building a 3-storey block of flats, several key items of **plant** would be mobilised to the construction site within the inner perimeter fence to facilitate various construction activities. The following items of plant are likely to be needed:

1. **Excavator**: Used for site clearance, excavation of foundations, trenches, and landscaping. It helps prepare the site for the foundation work.
2. **Tower Crane**: Essential for lifting heavy construction materials (e.g., steel beams, concrete, formwork) to higher levels of the 3-storey building.
3. **Concrete Batching Plant**: A mobile or stationary plant for mixing large quantities of concrete to ensure a consistent supply for foundations, columns, beams, and slabs.
4. **Mobile Crane**: Used for lifting and moving materials around the site, especially when the tower crane is not suitable for certain areas or tasks.
5. **Dump Truck**: Required to transport materials like sand, gravel, and excavated soil to and from the construction site.

Two Items of Plants or Equipment Likely to be Hired Instead of Purchasing at the Stage of Mobilising and Reasons

At the mobilisation stage of a construction project, certain **plant or equipment** are more practical to hire rather than purchase due to cost and frequency of use. Two examples include:

1. Tower Crane (Plant)

- **Reason for Hiring**: Tower cranes are typically only required during the construction phase, particularly for lifting heavy materials to elevated parts of the structure. Since they are expensive to purchase and not needed for the entire duration of a project or for smaller jobs, hiring a tower crane for the specific period that it is needed is more cost-effective.

2. Excavator (Plant)

- **Reason for Hiring**: Excavators are used primarily during the early phases of a construction project, such as site clearance and foundation excavation. Once these activities are completed, the excavator may no longer be needed, making it more economical to hire it for a short-term use rather than investing in its purchase.

Activity 6.1.2

1. Search YouTube and other internet sites and observe the operations of the plant and equipment in use at the site.
2. Prepare a portfolio on the functions of the plant and equipment at the site.
3. Prepare notes on the health and safety measures to be taken when operating plant and equipment.

Brick & Block Laying Tools

1. Spirit level

A **spirit level** is a tool commonly made from either wood or metal, such as aluminum, and features a small tube, called a bubble vial, in its center. This vial is partially filled with a liquid, typically alcohol, which leaves a small air bubble inside. The alcohol is used because it resists freezing and evaporates more slowly than water, ensuring the tool functions well in various conditions.

The spirit level is an essential tool in brick masonry and construction, used to determine whether a surface is perfectly horizontal (level) or vertical (plumb). To use it, the spirit level is placed on the surface being checked, and the position of the bubble inside the vial is observed. When the bubble settles exactly in the center of the markings on the tube, it indicates that the

surface is properly leveled or aligned. This precise tool helps ensure accuracy and stability in construction projects.

Figure 6.1.8: Spirit level

2. Trowel

This is a flat, triangular-shaped metal tool with a wooden handle for holding. The ends of a trowel may be pointed, or bull-nosed. A trowel is used to lift and apply the cement mortar in small quantities. It is also used for spreading, shaping, and smoothing mortar when laying bricks or blocks.

Figure 6.1.9: Trowel

3. Line and Pins

Line and pins are simple but effective tools used in bricklaying to ensure straight and aligned courses of bricks. This tool consists of a durable thread or string, with each end attached to a sturdy metal rod shaped like a pin. These rods have pointed ends, allowing them to be easily inserted into the mortar joints at either end of the brickwork.

During use, the pins are securely fixed at both ends of the area where bricks are being laid. The thread is then pulled taut between the two pins to create a straight guideline. This guideline helps bricklayers maintain proper alignment and level across the brick course, ensuring the wall is uniform and aesthetically pleasing. This tool is especially helpful when constructing long sections of walls.

Figure 6.1.10: Line and Pins

4. Wooden Float

A **wooden float** is a bricklaying tool made entirely of wood, designed to assist in the finishing process when laying bricks or blocks. It features a smooth, flat wooden surface on the bottom and a handle securely attached to the top for easy grip and maneuverability.

The wooden float is typically used in addition with a trowel to smooth and level the mortar or plaster applied to brick or block surfaces. By gliding the float over the surface, the tool helps achieve a uniform and even finish, ensuring the mortar or plaster is distributed consistently. It is particularly useful for creating a neat, polished look before the mortar sets, contributing to the overall quality and appearance of the construction.

Figure 6.1.11: Wooden Float

5. Brick Hammer

A **brick hammer** is a specialized tool used in masonry work for two primary purposes: cutting bricks and adjusting their position during construction.

The hammer has two distinct ends: one flat, chisel-like end for cutting or scoring bricks to the desired size or shape, and a blunt, traditional hammerhead on the other end for gently tapping bricks back into alignment if they deviate from the course line.

This dual functionality makes the brick hammer an essential tool for ensuring precision in bricklaying, whether shaping bricks to fit a specific space or maintaining straight and even

courses. Its robust design allows it to handle the tough demands of cutting and positioning bricks effectively.

Figure 6.1.12: Brick Hammer

6. Bolster

A **bolster** is a wide-bladed chisel specifically designed for cutting bricks with precision. Unlike a standard chisel, its cutting edge is broader than the width of a brick, allowing for clean and accurate cuts in a single stroke.

To use a bolster, it is typically paired with a club hammer. The bolster is positioned on the brick where the cut is needed, and the club hammer is used to strike the bolster's flat head, applying enough force to split the brick cleanly along the desired line.

This tool is essential for shaping bricks to fit specific spaces in masonry work, ensuring neat and professional results. Its design makes it particularly effective for tasks requiring precision and uniformity.

Figure 6.1.13: Bolster

7. Builder's Square

A **builder's square** is an L-shaped tool used to ensure perfect right angles at the corners of walls during bricklaying. It is important for achieving accuracy and maintaining the structural integrity of masonry work.

When starting construction, the builder's square is used to position and align the first course of bricks or blocks at a precise 90-degree angle. This ensures the corners are perfectly squared. Once the first course is accurately laid using the builder's square, the remaining layers of bricks are built upon it, maintaining consistent alignment throughout the structure.

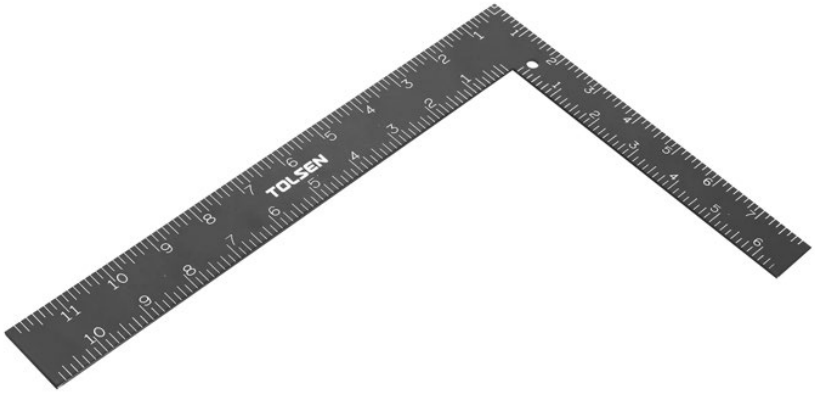

Figure 6.1.14: Builder's Square

8. Tape Measure

A **tape measure** is a flexible measuring tool used in construction to ensure accuracy in dimensions. It consists of a long, retractable strip of metal or plastic marked with standard measurement units, such as inches and centimeters.

In bricklaying and construction, the tape measure is essential for a variety of tasks:

- **Checking thickness**: Ensures that brick or block walls are constructed to the specified width for strength and stability.
- **Measuring length or height**: Confirms that walls and other structures meet the required dimensions.
- **Foundation work**: Helps verify the size of concrete beds and excavated trenches to match the design plans.

By providing precise measurements, the tape measure ensures the construction is accurate, safe, and aligned with project specifications.

Figure 6.1.15: Tape Measure

Activity 6.1.3

1. **Materials Required:**
   - Spirit level
   - Trowel
   - Line and pins
   - Wooden float
   - Brick hammer
   - Bolster
   - Builder's square
   - Tape measure
2. **Group Work:**

   Put yourself into small groups. Each group should get a set of tools listed under the materials.
3. **Task 1: Tool Identification**
   - Each group examines the tools provided.
   - For each tool, the group writes down:
   - Its name
   - A brief description of its appearance
   - Its function
4. **Task 2: Matching Tool to Task**
   - Obtain a set of cards with practical tasks written on them, such as:
   - "Check if the wall is level."
   - "Measure the thickness of a brick wall."
   - "Cut a brick accurately."
   - Groups take turns drawing a card and identifying the correct tool to use for that task.
5. **Task 3: Demonstration**
   - Each group demonstrates how to correctly use one tool in a simulated scenario, such as:
   - Checking the level of a mock brick wall using the spirit level.
   - Cutting a piece of soft material (e.g., foam or cardboard) with the bolster and a mallet.

   After the activity, discuss these questions:

   1. How does the spirit level help ensure accurate construction?

2. Why is it important to use the correct tool for cutting bricks?
3. Which tool would you use to confirm a right angle at the corner of a wall?

Extended Reading

- https://easytoolhire.com/blog/what-is-the-importance-of-construction-equipment/?srsltid=AfmBOooL7lzN3aZQbEGasLqEBCmo_5iIEAigJO1G1QG4fpJfA35XJz0-
- https://vendorfinance.ie/understanding-construction-plant-and-its-crucial-importance-in-the-industry/
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- **Gonzalez, V., & Molenaar, K. R. (2014).** «Optimizing Equipment Utilization in Construction Projects.» *Construction Management and Economics*, 32(1), 1-12.
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- **Khan, M. A., & Memon, A. H. (2016).** «Effective Utilization of Construction Equipment: A Case Study.» *International Journal of Project Management*, 34(5), 837-848.
- **Mansfield, N. R., & Mitchell, J. (2011).** «The Role of Equipment in Construction Project Success.» *Journal of Construction Engineering and Management*, 137(7), 525-532.
- **Zhang, Y., & Li, H. (2018).** «Construction Equipment Management: A Review of Current Practices and Future Directions.» *Journal of Civil Engineering and Management*, 24(6), 467-478.

Review Questions

1. List three items of plant and equipment that the contractor mobilises to site and explain their functions.
2. List two items of plant and equipment that must be mobilised when constructing a 3-storey building and state the function of the plant.
3. Describe three ways and means in which plant and equipment deployed at the site can contribute to good quality work and early completion of the project.

UNIT 2

WOODWORK TECHNOLOGY

Material and Artefacts Production Woodwork Industry in Ghana

INTRODUCTION

Manufactured boards from wood and non-wood residues are vital in many industries, providing a sustainable and cost-effective alternative to solid wood. They are commonly used in furniture, construction, and packaging due to their versatility, durability, and use of recycled materials. Understanding their applications underscores their role in promoting resource efficiency and environmental sustainability in modern manufacturing.

At the end of this unit, you will be able to:

Outline the uses of manufactured boards made from wood and non-wood residues.

Key Ideas

- Manufactured boards made from wood and non-wood residues are versatile and widely used across various industries.
- They are commonly used in furniture making as a cost-effective and stable alternative to solid wood.
- In construction, these boards are favored for flooring, wall panels, and cabinetry due to their durability and ease of installation.
- They are used in packaging because they can be produced in large sheets and customised to different sizes and shapes.
- The ability to recycle wood and non-wood residues makes them an eco-friendly choice for sustainable manufacturing practices.

USES OF MANUFACTURED BOARDS MADE FROM WOOD AND NON-WOOD RESIDUES

Considerations when Ordering a Manufactured Board

When ordering a manufactured board, the following areas should be considered:

1. **Interior Work**: Suitable for interior use only, where it will not come into contact with moisture.
2. **Moisture Resistant**: Should be used in situations with limited exposure to the elements.
3. **Weather and Boil Proof**: Highly resistant to the elements, suitable for most exterior applications.

The following are the uses of Manufactured Boards made from Wood and Non-wood residues:

1. **Furniture and Interior Decoration**:
    - Furniture, shelving, moulding, joinery (flush doors)
    - Ship, car, and aeroplane interior decoration
    - Cabinets (kitchen cabinets, wardrobes)
2. **Ceiling Decoration**:
    - Ceiling panels and decorative elements

Figure 6.2.1: Oriented strand board

3. **Wall Paneling and Partitioning**:

- Wall panels and room partitions

Figure 6.2.2: Oriented strand board

4. **Floorwork or Flooring**:

- Flooring solutions

Figure 6.2.3: Oriented strand board in use

5. **Clipboards**

Figure 6.2.4: Oriented strand board

The are many applications of manufactured board across various industries. These include:

- **Furniture Making**:
  - Stable and affordable alternative to solid wood, used for cabinets, tables, and other furniture pieces.
- **Construction**:
  - Favoured for flooring, wall panels, and roofing due to durability and ease of installation.
- **Packaging**:
  - Provides strong, customisable solutions, especially for large or heavy items.
- **Interior Design**:
  - Used for decorative panels, doors, and shelving, offering flexibility in design and finish.

These applications highlight the usefulness of manufactured boards and their contribution to sustainable practices by utilising wood and non-wood residues.

Conclusion

In conclusion, manufactured boards made from wood and non-wood residues are essential in various industries, including furniture making, construction, packaging, and interior design. Their versatility, cost-effectiveness, and use of recycled materials make them valuable and sustainable alternatives to solid wood.

Activity 6.2.1

Scenario:

Your team is tasked with finding innovative applications for manufactured boards made from wood residues in a new product line.

Materials Needed:

- Computers/Tablets with Internet Access
- Paper/Notebooks
- Presentation Software (e.g., PowerPoint, Google Slides).
- Projector/Screen
- Markers/Whiteboard

Activity guidelines:

1. The teacher will form the class into groups of 5
2. Analyse why manufactured boards made from wood residues might be useful in different applications. Consider their properties and benefits.
3. Share insights and ask questions within your group to explore various uses.
4. Research and identify at least two uses for manufactured boards made from wood residues.
5. Use online resources such as articles, videos, and case studies to gather information.
6. Create a presentation or visual board showcasing the identified uses of manufactured boards. Include examples and potential benefits.

Activity 6.2.2

Scenario:

Your team is developing eco-friendly products and needs to identify how manufactured boards made from non-wood residues can be used.

Materials Needed:

- Computers/Tablets with Internet Access
- Paper/Notebooks
- Presentation Software (e.g., PowerPoint, Google Slides)
- Projector/Screen
- Markers/Whiteboard
- Pens/Pencils

Activity guidelines:

1. The teacher will form the class into groups of 5

2. Discuss why manufactured boards made from non-wood residues are valuable and explore their potential applications.
3. Share and debate ideas within your group to understand different uses and benefits.
4. Research and identify at least two uses for manufactured boards made from non-wood residues.
5. Use online resources like articles and videos to gather and analyse information.
6. Create a visual presentation or poster illustrating the identified uses and their benefits.

Activity 6.2.3

Scenario:

Your team is tasked with presenting how manufactured boards from both wood and non-wood residues can be utilised in various applications.

Materials Needed:

- Computers/Tablets with Internet Access
- Paper/Notebooks
- Presentation Software (e.g., PowerPoint, Google Slides).
- Projector/Screen
- Markers/Whiteboard
- Pens/Pencils

Activity guidelines:

1. The teacher will form groups of 5
2. Analyse and discuss why manufactured boards from both types of residues are useful. Consider their benefits and potential applications.
3. Discuss different uses, and clarify any questions to deepen your understanding.
4. Research and identify three uses for manufactured boards made from wood residues, while the other team focuses on non-wood residues.
5. Use online resources such as articles and videos to gather and analyse information.
6. Create a combined presentation or poster showing the three uses for each type of manufactured board. Include visuals and examples.

Extended Reading

- Oriented Strand Board (OSB). APA - The Engineered Wood Association. Retrieved from https://www.apawood.org/oriented-strand-board-osb
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- www.usvintagewood.com
- www.woodworkingnetwork.com
- www.woodworkly.com

Review Questions

1. Your team is developing a new product line. What are three ways you could use manufactured boards made from wood residues in this project?
2. Your company is exploring eco-friendly materials for new products. What are two ways you could use manufactured boards made from non-wood residues?
3. Your team is selecting materials for a budget-friendly project. How is chipboard most commonly used in such projects?
4. What are some common uses of manufactured boards made from wood residues?
5. How can manufactured boards made from non-wood residues be utilised in various applications?
6. What advantages do manufactured boards offer in furniture making and construction?

UNIT 3

ELECTRICAL AND ELECTRONIC TECHNOLOGY

Electronic Devices and Circuits

INTRODUCTION

Testing of the PN junction diode is to find out how the diode conducts and blocks current, and effectively reveal its overall performance or to detect the differences between existing and required conditions of the diode. The testing is done by using various techniques and tools under well-defined procedures. The PN junction rectifier diode is applied in the process of converting alternating current (a. c) voltage into direct current (d. c) voltage denoted as rectification. The operation of two main types of rectifier circuits would be studied in this unit.

At the end of this unit, you will be able to:

Apply the principles of diodes in designing circuits.

Key Ideas

- Testing PN junction diodes.
- Power rectification using PN junction diodes

METHODS OF TESTING A PN JUNCTION DIODE

1. Using Digital Multimeter

The diode test procedure using the multimeter is conducted as follows;

i. **Identify the diode terminals**.
Diodes have two terminals, the anode (+ve) and the cathode (-ve). To identify them; look for the color band, it marks the cathode. The no - band end, indicates the anode.

ii. **Set the multimeter** to diode test mode, (usually indicated by a diode symbol).
The diode setting applies a voltage capable of overcoming the diodes forward voltage drop for most diodes.

iii. Connect Probes:

Insert the black probe into the COM (common) terminal of the multimeter.

Insert the red probe into the VΩ mA terminal.

iv. Test in forward bias.

A diode is forward-biased when the positive (**red**) test lead of the multimeter is on the anode and the negative (**black**) lead is on the cathode**.**

Analysis

i. A good forward-biased diode displays a voltage drop ranging from 0.6 to 0.7 V for Silicon diodes and 0.2 to 0.3 V for Germanium diodes.

Figure 6.3.1: Diode being tested in forward-bias mode using digital multimeter

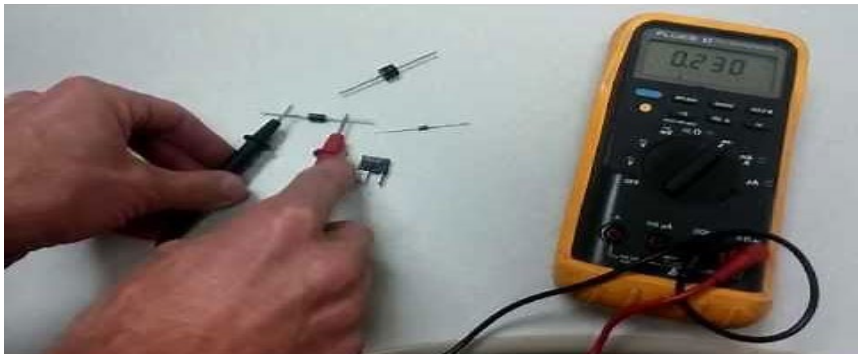

Figure 6.3.2: *A technician using a multimeter to test a diode.*

2. Reverse Bias Test

The reverse- bias diode test procedure is conducted as follows;

i. **Identify** the diode terminals again.

ii. Set the multimeter to diode test mode.

iii. **Connect Probes:**

Insert the black probe into the COM (common) terminal.

Insert the red probe into the VΩmA terminal.

iv. Test the diode in reverse bias.

Connect the positive (**red**) test lead of the multimeter to the cathode and the negative (**black**) lead to the anode of the diode**.**

The digital multimeter displays OL when a good diode is reverse biased.

The OL reading indicates the diode is functioning as an open switch.

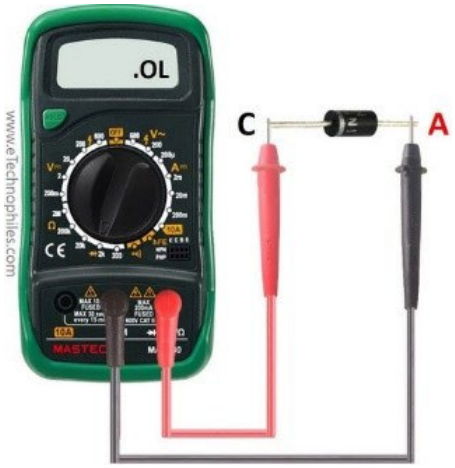

Figure 6.3.3: A a diode being tested in reverse-bias using the diode mode in a digital multimeter

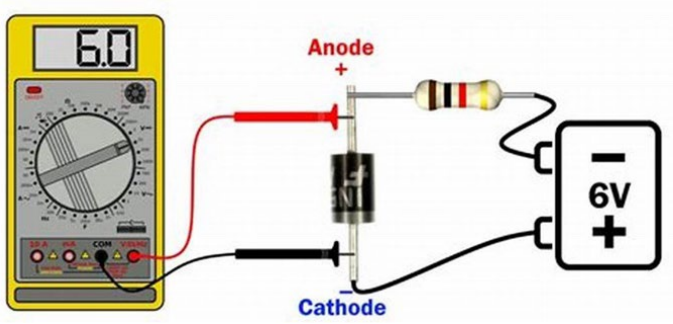

Figure 6.3.4: A diode connected in the reversed bias mode.

The voltmeter measures the voltage across it

3. Using a Test Circuit

i. **Build** a test circuit by connecting a resistor in series with the diode, a voltage source and a multimeter.

ii**. Connect Probes**:

Insert the black probe into the COM (common) terminal of the multimeter.

Insert the red probe into the VΩ mA terminal.

iii. Set the multimeter to a suitable d.c current range (mA).

iv. Connect the multimeter probes into the test circuit in series with the diode and ***NOT*** across it.

iv. Apply a small forward voltage from a (voltage source) or battery and record the current flowing through the diode.

A good diode should conduct current 2mA or (0 - 1 A) in only the forward direction for a rectifying diode.

It does not conduct in the other reverse direction

If a diode conducts in both directions or does not conduct in either direction, it is likely faulty.

Figure 6.3.5: A multimeter connected as a milliammeter or (Ammeter) to measure current in a test circuit

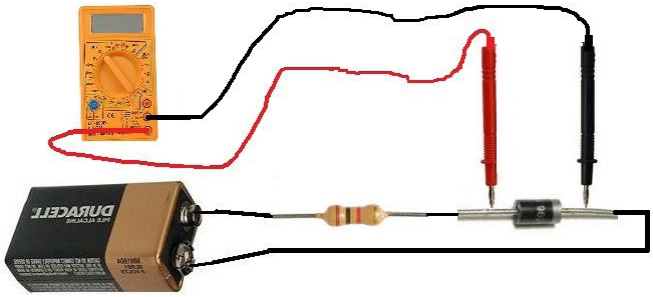

Figure 6.3.6: A diode connected in the forward bias mode.

The voltmeter measures the voltage across it

4. Using A Digital Oscilloscope

An oscilloscope is an important measuring tool that offers a graphical representation of electrical signals. It gives a real-time, visual demonstration of how the diode conducts and blocks current, and effectively reveals its overall health and performance.

The Step-by-Step Procedure of Testing Diodes with a digital Oscilloscope is as follows;

i. ***Setup:***

Turn ON the oscilloscope and allow it a few minutes to warm up for stable readings.

ii. ***Probe connection***:

Connect the probe to the oscilloscope and use the probe's alligator or hook clip to attach it to the diode's anode and cathode.

iii. ***Settings:***

Set the oscilloscope to display a d.c voltage scale that covers the diode's expected forward and reverse bias voltages (-1 to +1).

iv. ***Signal injection:***

Apply a sinusoidal or square wave input to the diode, ensuring that the amplitude and frequency are appropriate for the diode.

A high-frequency input signal can sometimes make a faulty diode appear functional—so always cross-verify with DC tests.

Typical oscilloscope readings:

A healthy diode will show a waveform, indicating proper function in both forward and reverse bias conditions.

In forward bias, the waveform should be clipped above the diode's forward voltage.

In reverse bias, a flat line or a slight ripple indicates good health.

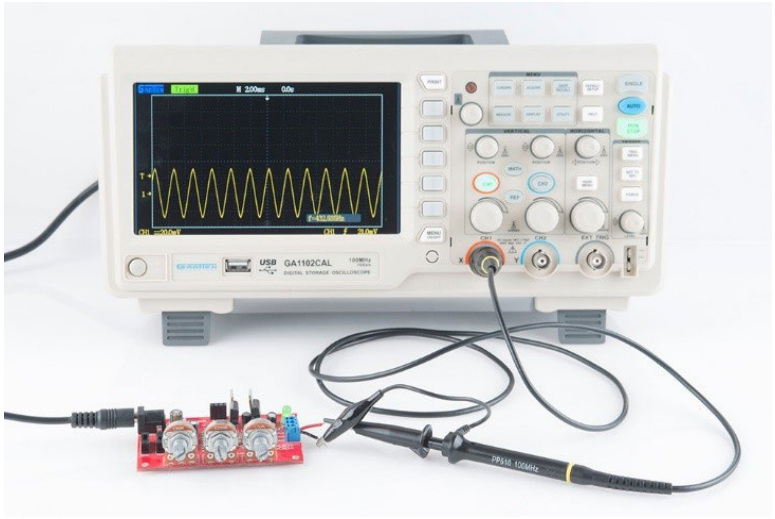

Figure 6.3.7: A waveform on the scope prior to testing the diode

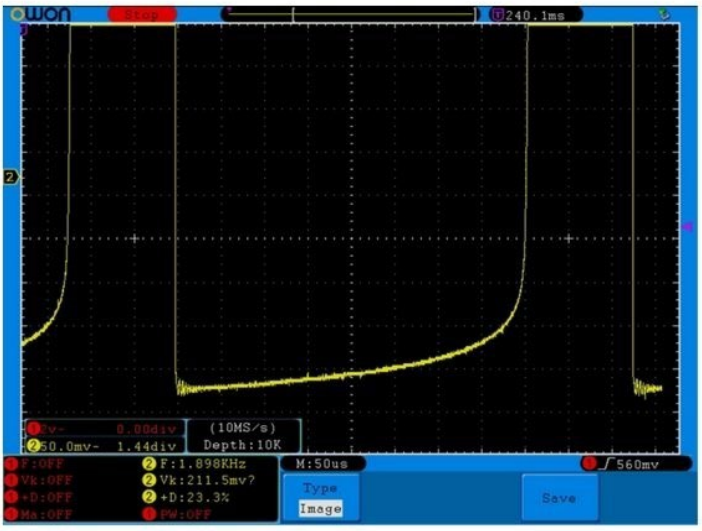

Figure 6.3.8: The output waveform of forward-biased diode on an oscilloscope

Activity 6.3.1

1. Describe the procedure of testing a diode using a Multimeter. .
   i. Assemble the following, PN junction diode, a digital multimeter
   ii. identify the polarity of the diode.
   iii. Set the digital multimeter to the diode test mode.
   iv. Connect the diode in forward bias (red lead of multimeter to the anode and black lead to the cathode).
   v. Record the value displayed on the multimeter.
   vi. From the reading obtained, state whether the diode is made of Silicon or Germanium.
2. What indications would you expect to see on the Multimeter when performing a diode continuity test on a functional diode?
   i. What is meant by continuity test?
   ii. State what continuity test is meant to achieve.
   iii. State the expected display for continuity test on the multimeter for a good diode.
   iv. Is there continuity in both directions?
   v. What suggests that a diode is good?
3. Explain the principle behind forward voltage testing of diodes.
   i. What is the forward voltage of a diode?
   ii. What is the importance of the forward voltage of a diode?
   iii. List other procedures that can be used to test a functional diode.
   iv. List the methods that test for voltage drop.
   v. Which diode test can tell the type of diode on test?
4. Describe a practical method to measure the forward voltage of a diode using a Digital Multimeter.
   i. Assemble the following Apparatus: Digital multimeter, PN junction diode.
   ii. Identify the polarity of the diode.
   iii. Set the digital multimeter to the diode test mode.
   iv. Connect the diode in forward bias (red lead of multimeter to the anode and black lead to the cathode).
   v. Record the value of voltage displayed on the multimeter.
   vi. State the importance of the forward voltage of a diode.
   vii. Declare the other name for the forward voltage (V_F) of a diode.

Rectification Process

1. Half-wave rectification:

In this process, only one diode and a half -cycle of the input wave is used.

During the positive half-cycle of the input a.c voltage,

i. the diode is forward- biased, conducts and current flows,
ii. voltage drops across the load, R_L,
iii. the output voltage display is a pulsating d.c wave
v. the ripple frequency is equal to that of the input voltage frequency (50 Hertz).

During the negative input half-cycle,

i. the diode is reverse biased, does not conduct, and only leakage current flows.
ii. there is no voltage drop across the load, R_L and
v. the negative input half-cycle is suppressed.

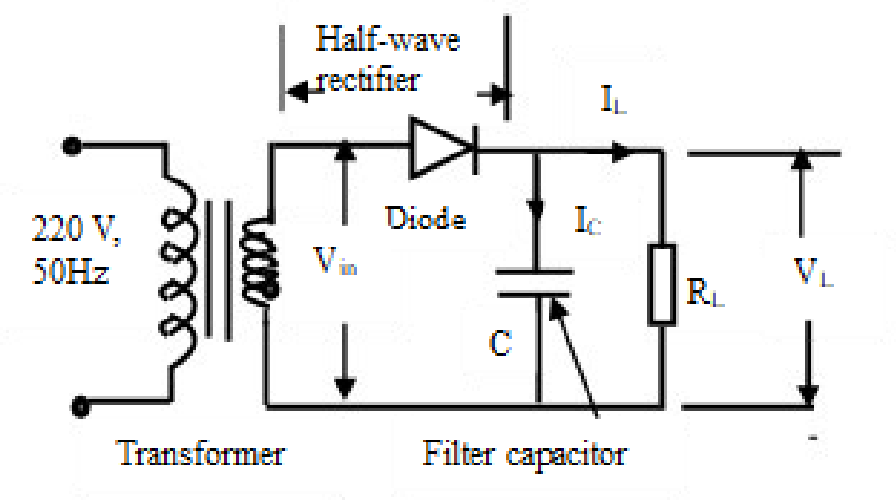

Figure 6.3.9: Circuit diagram of a half-wave rectifier

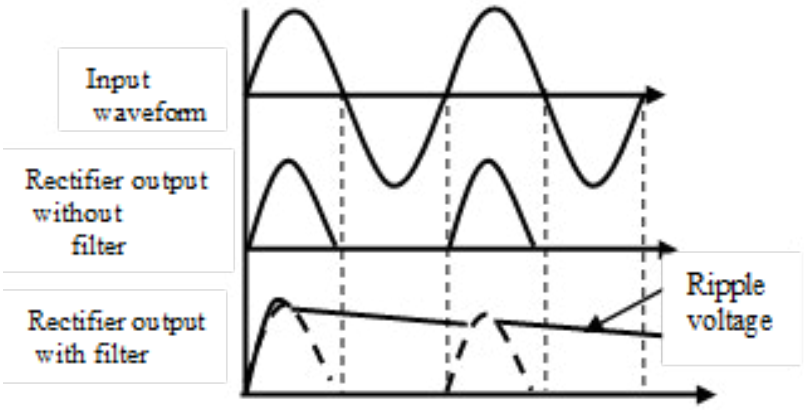

Figure 6.3.10: Input and output waveform diagrams of a half-wave rectifier

2. Full–wave rectification (bridge arrangement)

In this process, both half-cycles of the input are utilized with the help of four discrete diodes, two of the diodes working alternatively.

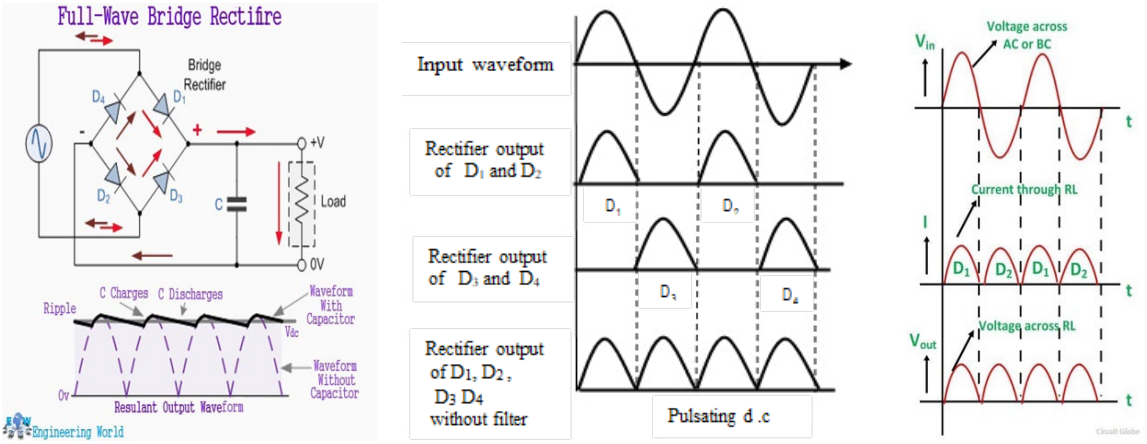

Fig. 6.3.11: Rectification process.

Operation

In one half-cycle diodes D_1 and D_2 are forward biased, conduct, and voltage V_o appears across R_L.

On the other half of the same cycle, diodes D_3 and D_4 are forward biased, conduct and produce output voltage V_o appears across R_L .

Current keeps on flowing through R_L in both cycles.

Filter action

A circuit which converts a pulsating output from a rectifier into a very steady d.c level is known as filter.

The filter action depends for its operation on the property of capacitor, C to charge up (store energy) during conducting half-cycle and to discharge (deliver energy) during the non-conducting half-cycle.

When connected across the pulsating d.c voltage, it tends to smoothen out or filter out the pulsations.

The capacitor C does not have sufficient time to discharge appreciably so it maintains a sufficiently large voltage across the R_L.

Activity 6.3.2

i. Use the multism software to simulate the half-wave and full-wave rectifier circuits.

ii. State the difference between half-wave and the full-wave rectifier output waveforms.
iii. Which type of rectifier circuit produces higher voltage?
iv. State which type of rectifier circuit is commonly used for most applications.
v. State the reason why the Half-wave rectifier circuit is hardly used in practice.
vi. Enumerate three applications of the bridge rectifier circuit.

Activity 6.3.3

Use the following components to construct a bridge rectifier.

i. One transformer 240 V / 12 V
i. Four 1N4001 diodes
ii. One electrolytic capacitor, 100 μF
iii. One 10 KΩ variable resistor.
iv. One breadboard.
v. Connecting wires.
vi. Connect the output of the circuit to an oscilloscope,
vii. Observe the following:
    α. Waveform of the circuit without the capacitor.
    β. Waveform of the circuit with the capacitor connected in place.

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- https://www.keysight.com › used › how-do-you-test-diode
- https://www.quora.com › What-is-the-significance-of-the...
- https://www.wikihow.com › Test-Continuity-with-a-Multi...

Review Questions

1. What does a good diode's forward voltage reading indicate?
2. What does a bad diode's reading typically show?
3. What is the significance of the depletion region in a diode and how does it affect its operation?
4. What are the potential reasons for obtaining inaccurate readings when testing a diode, and how can errors be minimised in the testing process?
5. a. How does a full-wave rectifier differ from a half-wave rectifier?
   b. What are the advantages of using a full-wave rectifier?
6. How would you set up an oscilloscope to test for a diode and what would you expect to observe?
7. Discuss the voltage drop method for testing a diode

UNIT 4

METAL TECHNOLOGY

Welding Technology

INTRODUCTION

Welding is a crucial process in the fabrication and repair of metal structures, with several methods available for different applications. Among these, gas welding and electric arc welding are two of the most common techniques.

Gas welding primarily uses a combination of fuel gases and oxygen to produce a flame hot enough to melt the metal at the welding point. On the other hand, electric arc welding uses an electrical current to create an arc between an electrode and the metal, generating enough heat to melt and fuse the material.

When comparing these two methods, it is essential to weigh their advantages and disadvantages based on factors such as efficiency, cost, skill level, and suitability for specific applications. Understanding these differences helps in selecting the most appropriate welding method for a given task.

At the end of this unit, you will be able to:

Compare the advantages and disadvantages of gas and electric arc welding.

Key Ideas

- Understanding the advantages and disadvantages of gas welding and electric arc welding is for several reasons, especially for welders, engineers, or anyone involved in metal fabrication or construction.
- When comparing gas welding (oxy-acetylene) and electric arc welding, several advantages and disadvantages of each can be identified based on the application, efficiency, cost, and safety.
- Understanding the advantages and disadvantages of both methods ensures that you can optirmise quality, safety, and efficiency in your work.

ADVANTAGES AND DISADVANTAGES OF GAS WELDING

Gas welding offers versatility and portability, but it may not provide the same strength and speed as arc welding. It is ideal for thin metal work and requires relatively simple equipment, yet it can be slower and less efficient for industrial-scale work.

Advantages and Disadvantages of Electric Arc Welding

Electric arc welding, by contrast, is highly efficient for thicker metals and large -scale production. It creates stronger welds faster, but it requires more advanced equipment and often higher skills level. It can also be less for delicate or thin materials.

Each method has its strengths and limitations, making it essential to evaluate the requirement of the job to choose the right technique in welding.

This unit presents a set of advantages and disadvantages of gas welding and electric arc welding, which are the two common methods used in the welding industry.

Table 6.4.1: Comparing the Advantages and Disadvantages of Gas and Electric Arc Welding

S/N	WELDING TECHNIQUE	ADVANTAGES	DISADVANTAGES
1	**GAS WELDING**	**1. Portability:** Gas welding tools and equipment are more portable since they do not require external power sources, making them useful in remote or field settings. **2. Cost:** Generally, gas welding setups can be cheaper in terms of initial equipment cost. Gas welding equipment is often less expensive than electric arc welding machines, making it a more economical option for some applications.	**1. Slower process:** Gas welding is generally slower than electric arc welding leading to longer project times for larger welds. **2. Heat control:** It can create a wide heat-affected zone, which may weaken the surrounding materials or cause warping in thin materials.

		3. Versatility: Gas welding can be used for cutting, heating, and welding, offering greater flexibility for various metalworking tasks. It can be used on a wide range of metals and alloys, including ferrous and non-ferrous metals. **4. Control:** It allows slower heating and better control over the weld pool, making it ideal for welding thin or delicate metals like aluminum. It provides good control over the heat input, allowing for precise welding on thin materials without causing excessive distortion. **5. Ease of use:** Gas welding is easier to control for beginners because of its relatively slower process. 1.https://www.xometry.com/resources/sheet/what-is-gas-welding/ 2. https://fractory.com/gas-welding-explained/ 3. https://scienceinfo.com/gas-welding-types-procedure-importance-advantages/ 4. https://m.help-repair.info/machinery_and_equipment/advantages_and_disadvantages_of_gas_welding	**3. Skill dependent/requirements:** Gas welding requires a higher level of skill and experience to achieve quality welds, especially on challenging materials or joint conFigurations. High skill is needed for precise, quality welds, and poorly trained welders might have trouble maintaining consistency. **4. Safety hazards and concerns**: Gas welding involves handling flammable gases and open flames, posing a higher risk of fire hazards compared to some electric arc welding processes**.** Handling and storing flammable gases (acetylene and oxygen) create a higher fire or explosion risk. **5. Lower productivity**: Gas welding typically has a slower welding speed compared to electric arc welding processes, which can lead to reduced productivity on large-scale projects. **6. Limited thickness:** Gas welding may not be suitable for welding thick materials or heavy structural components due to its lower heat input capabilities. 1. https://fractory.com/gas-welding-explained/ 2. https://boyicnc.com/2024/03/09/gas-welding-techniques-types-applications-advantages/ 3.https://interestingengineering.com/innovation/gas-welding-basics-advantages-disadvantages-and-applications

2	**ELECTRIC ARC WELDING**	**1. Efficiency:** Electric arc welding is faster and more efficient for heavy-duty and large -scale welding jobs. **2. Strong welds:** It produces stronger welds with better penetration, making it ideal for thick and heavy materials. **3. Versatility:** Various arc welding techniques (MIG, TIG, Stick) allow for specialised applications depending on material type and thickness **4. Portability:** The apparatus required for electric arc welding is very simple and portable. **5. Precision:** TIG welding, in particular, provides excellent precision for high-quality work and is preferred for intricate jobs. **6. Cleaner process:** Less risk of oxidation as compared to gas welding due to the presence of sheading gases (e.g. MIG welding).	**1. Initial/Equipment costs:** Electric arc welding equipment, especially advanced machines like TIG/MIG welders or robotic welding systems, can be more expensive than gas welding equipment. **2. Portability:** Requires a constant power source, which limits its portability, especially in outdoor or remote areas without electricity. **3. Complex setup:** Some arc welding methods, like MIG or TIG, require more complicated setups and maintenance. **4. Safety hazards:** Electric arc welding poses risks such as electrical shock, exposure to intense UV radiation, and eye injuries (arc flash), requiring additional protective equipment. **5. Limited use on thin materials:** Some forms of arc welding (e.g. stick) can struggle with thin or delicate metals, leading to frequent burn-throughs. **6. Power requirement:** Electric arc welding machines require a stable power supply, which may limit their use in remote or off-grid locations.

		7. High productivity and speed: Electric arc welding processes, such as shielded metal arc welding (SMAW) and gas metal arc welding (GMAW), offer higher welding speeds and increased productivity, making them suitable for large-scale fabrication projects. **8. Automation:** Some electric arc welding processes, like robotic welding, can be fully automated, improving efficiency and consistency in welding operations. **9. Penetration and temperature:** Electric arc welding processes provide deeper weld penetration compared to gas welding, making them suitable for welding thick materials. The electric arc welding gives superior temperature at the point of welding. **10**. **Electricity supply**: Electric arc welding can work on both AC and DC supply. **11. Cost of installation:** It is inexpensive to install some arc welding equipment. **Websites:** 1.https://arcweldingservices.co.uk/advantages-disadvantages-arc-welding/ 2.https://expressmetalindustries.com.au/what-is-arc-welding-advantages-and-disadvantages/ 3. https://www.theweldingmaster.com/top-8-advantages-of-arc-welding/ 4. https://www.eeeguide.com/advantages-and-disadvantages-of-arc-welding/	**7**. **Welding fume and spatter:** Electric arc welding processes can produce welding fumes and spatter, requiring proper ventilation and safety measures to protect welders and surrounding areas. **Websites:** 1.https://www.wasatchsteel.com/advantages-disadvantages-arc-welding/?__cf_chl_tk=5cgfNdWiQp6.zvluwzC-UAidMaQa_hTHdyiByOS-CeU7o-1725901031-0.0.1.1-4884 2.https://www.choongngaiengineering.com/what-is-arc-welding-advantages-and-disadvantages 3. https://transfotopix.com/en/what-are-the-disadvantages-of-electric-arc-welding/

Conclusions

This unit covered the advantages and disadvantages of gas and electric arc welding. This knowledge is essential for beginners in metalwork technology. You are required to explain and appreciate the advantages and disadvantages of gas and electric arc welding. I Studying the advantages and disadvantages of gas welding and electric arc welding will equip you with valuable knowledge, skills and competencies that are essential for success and practice in the welding industry, engineering professions and other technical fields that rely on welding practitioners.

Gas welding is more portable, flexible, and cost-effective for thin materials and general -purpose work, but it is slower and can weaken surrounding materials.

Electric arc welding is faster, more efficient, and better suited for heavy-duty applications and precision work, but it requires a power source and can be expensive to set up.

Gas welding and electric arc welding are two common methods used in the welding industry, each with its own set of advantages and disadvantages.

Activity 6.4.1

Field Trips: The teacher will organise field trips to welding workshops, fabrication facilities, or industrial sites where you can observe welding processes in action. You are encouraged to ask questions and interact with welders and technicians to deepen your understanding.

Organising a field trip to a welding workshop, fabrication facility, or industrial site requires careful planning and coordination to ensure experience in educational, safe, and engaging.

Working with your Career Technology teacher follow the step -by-step guide on how to successfully organise such trips:

1. **Defining your objectives**
    - **Educational goals**: Clarify what you want to gain from the experience (e.g., understanding welding process, exposure to real-world applications, safety procedures).
    - **Target group:** Identify the age group, number of participants, and level of knowledge you have about welding and fabrication.
2. **Selecting the Right Facility**
    - **Research potential locations**: Find welding workshops, fabrication facilities, or industrial sites that are open to visitors or offer educational tours. Look for facilities with trained professionals who can explain processes in a clear and engaging way.

- **Contact facilities**: Call or email the site to inquire about field trip possibilities. Ensure they can accommodate your group size and that their operations align with your educational goals.

3. **Planning Logistics**
   - **Date and Time:** Coordinate with the teacher and facility/factory to set a suitable date and time. Avoid busy production periods, as it might limit what you can observe.
   - **Transportation:** Arrange for transportation, considering the location of the facility and making sure all participants have clear instructions on where and where to meet.
   - **Permission and Waivers**: Obtain permission slip from parents\guardians. Also, they may have to sign liability waivers as many industrial sites require them.
4. **Observing Safety Precautions**
   - **Understand Site Safety Requirements**: Confirm the safety measures in the place at the workshop/factory. Ask if personal protective equipment (PPE) like helmets, safety glasses, and gloves are needed or if they will be provided.
   - **Pre-trip Safety Briefing**: Hold a session beforehand to discuss safety rules and importance of following the industry's /factory's instructions.
   - **Supervision:** Ensure that there are enough supervisors or chaperones to manage the class and address any safety issues.
5. **Coordinating With the Facility/Industry**
   - **Pre-arrange the visit/tour**: Work with the teacher/industry/facility to create a structured tour. Identify key areas or processes to observe, such as cutting, welding, quality control, or testing.
   - **Demonstration:** Request demonstrations of key welding techniques (MIG, TIG, arc welding etc.) and other fabrication processes.
   - **Guide or Speaker:** Arrange for a guide or expert to explain each process, answer questions, and provide insight into industry practices.
6. **Preparing Yourself**
   - **Pre-Trip Lessons**: Before the field trip, your teacher will take you through the basic welding concepts, safety procedures, and the type of processes you will observe. This will help you better understand what you will see during the visit.
   - **Prepare Questions**: Your Career Technology teacher will help you prepare questions in advance. This will ensure greater engagement and deepen your understanding.
7. **On-Site Experience**

- **Observe and Take Notes:** You are encouraged to observe processes, take notes, and ask questions during the visit.
- **Hands-on opportunities (if possible):** Some industry/facility may allow you to try welding under supervision. Ensure this is pre-approved, and all safety protocols are followed.
- **Photos and documentation:** If allowed, take photos or videos to document the trip for future reference or classroom discussions.

8. **Post trip activities**
   - **Debriefing session:** After the trip, your Career Technology Teacher will hold a debrief session where you will discuss your observations, reflect on what you learned and share feedback.
   - **Assignments:** Perform a follow-up activity such as reports, presentations, or research on the welding techniques observed.
   - **Thank you note**: Your Career Technology Teacher will teach you how to prepare and send a formal thank you note or email to the industry/facility for hosting the visit.
9. **Review and improve:**
   - **Evaluate the trip**: Gather feedback from your colleagues, supervisors and the facility to assess how well the trip met its educational objectives. Use this information to improve future trips.

Conclusion

By following the above steps, you can work with others to organise an effective, engaging and educational field trip to welding workshops, fabrication facilities or industrial sites.

Extended Readings

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Review Questions

1. In a table form, describe four advantages and disadvantages each for gas welding and electric arc welding.
2. Explain why you would choose electric arc welding instead of gas welding to carry out a given project.
3. Explain why gas welding is the best option for specific industrial applications.
4. Explain why gas welding is the best option for joining non-reactive metals such as aluminium and chromium.
5. Analyse two advantages of gas welding over electric arc welding and explain how these advantages contribute to its suitability for specific welding applications.
6. Evaluate two advantages and two disadvantages of gas welding compared to electric arc welding and justify your evaluation with examples from industry applications.

UNIT 5

BUILDING CONSTRUCTION TECHNOLOGY

Pre-Construction Activities

INTRODUCTION

This lesson on the specific locations of temporal structures, services, welfare facilities will help you to understand how the various offices and other spaces are provided on construction sites during projects. The temporal structures serve as the main offices for all personnel on site to ensure effective monitoring and supervising. As a space for storing the construction materials, the temporal structures assist in securing the materials and preventing theft on the construction sites.

At the end of this unit, you will be able to:

Explain the specific locations of temporal structures, services, welfare facilities and equipment at the new construction site to ensure order, safety, progress of work and security.

Key Ideas

- Temporal structures provide covered space to protect tools and materials from theft.
- Temporal structures also refer to a tent, canopy, sun shade structures install on construction sites to provide services until the desired permanent structure is completed.

THE MAJOR FACILITIES THAT THE CONTRACTOR PROVIDES SPACE FOR DURING SITE PLANNING

Medical and welfare facilities: medical and grocery stores are required on construction sites to provide adequate welfare for workers.

- **Water facilities**: Water is a basic necessity for the construction site. Drinking water supply to construction site is very necessary for effective management of the workers need.
- **Fitting room:** There is the need for an enclosed apartment for keeping workers items, for changing clothing and space for drying wet clothing.
- **Electricity:** In order to properly equip the construction site, it is necessary to have a reliable source of electricity. Light is needed for the site offices and for workers welfare.
- **Offices for personnel:** These are the specifically designed spaces to accommodate the various site personnel.

- **Rest area**: Rest rooms are needed for site workers, contractors, and site managers, which should be well equipped with tables and seating for a sufficient number of people. It should have decent space for visitors to the site.
- **Toilet /Washing rooms:** Construction site workers need to have access to functioning toilet which must flush, be lockable have sinks with hot and cold running water. Equally decent washrooms should be provided at construction site for all workers convenience.
- **Store rooms:** At the construction sites, adequate and sizeable rooms are to be provided to protect and sustained the quality of the various materials supplied for construction projects.
- **Waste management area**: There is the need for a space for disposal of waste or discarded materials at the construction sites. Such space could also be used as deposit for recycling or for disposing of dangerous materials.
- **Canteen**: Workers at the construction site need a place to res and eat meals. Since construction work is physically demanding, a decent food canteen should be adequately provided and protected from the outside climate which may not be favourable.

THE USEFULNESS OF THE SECURITY CHECKPOINT AT THE ENTRANCE OF THE INNER PERIMETER FENCING

A security checkpoint at the entrance of the inner perimeter fencing is a critical feature on construction sites, especially for projects like building a 3-storey block of flats. Its usefulness can be explained as follows:

Access Control

The most effective way of ensuring security at the site involves the provision of checkpoint at the main entrance to serves as the primary point for controlling access to the construction site. This helps to ensure that only authorised personnel, such as workers, contractors, suppliers, and visitors, can enter the construction site. This prevents unauthorised individuals from gaining access, reducing the risk of theft, vandalism, or trespassing.

Protection of Materials and Equipment

Since construction sites are used to house valuable materials (e.g., steel, cement, tools) and expensive equipment (e.g., cranes, excavators), the presence of a security checkpoint becomes very necessary. This provision to a great extend prevents theft and ensures that all items leaving or entering the site closely are accounted for. It also acts as a safeguard against the loss of materials and equipment, which sometimes lead to financial setbacks.

Safety and Compliance

The security checkpoint can be used for monitoring the use of personal protective equipment (PPE) by workers and visitors entering the site, ensuring compliance with safety regulations. Security personnel can check to ensure that all individuals are properly equipped, thereby promoting a safer working environment and reducing the likelihood of accidents or injuries.

Record Keeping and Monitoring

The Security personnel stationed at the checkpoint can maintain a log of everyone entering and leaving the site. This provides a clear record of site activities, which is useful for both security and administrative purposes. In case of any incident or emergency, these records can be reviewed to track movements on the site.

Emergency Response

In the event of an emergency, such as a fire or accident, the security checkpoint can serve as a coordination point. Security staff can assist with directing emergency services, managing evacuations, and ensuring that unauthorised individuals do not interfere with emergency response efforts.

Visitor Management

The checkpoint helps to manage visitors, such as suppliers, clients, or inspectors, by verifying their identity and purpose before granting access. This ensures that visitors are properly escorted and their presence on-site is documented, preventing disruptions or security risks.

THE RELEVANCE OF WORKSHOPS AS REGARDS EARLY COMPLETION OF PROJECTS

Prefabrication of Components

The workshops on construction sites do allow the production of building parts, like doors, windows, or steel frames, before they are needed on the site. These parts are made ahead of time and installed quickly, thereby saving the time on the project.

Less Work on the Construction Site

When doing some work in the workshop like, cutting wood or welding steel, less work needs to be done on the construction site. This reduces delays and speeds up the construction process.

Better Quality and Fewer Mistakes

In the workshop on construction sites, works are done more carefully because conditions are controlled. This leads to better quality of work, fewer mistakes, and less time to fix problems later on.

Faster Work Progress

As construction is progressing on-site, workshops can prepare parts of timber components at the same time. In this way, construction work continues smoothly without waiting for materials, thereby speeding up the project.

Skilled Workers

Workshops ensure that workers are train in specific tasks, like making furniture or assembling electrical panels. This means work is done faster because the workers are highly skilled.

No Delays Due to Weather

As workshops are indoors, so work continues even when it's raining or too hot outside. This in effect prevents delays caused by bad weather.

Organised Material Handling

Workshops usually have enough space to store materials and tools in an organised way. This arrangement makes it easy for workers to find what they need, thereby speeding up work and reducing delays.

Saving Time and Money

The usage of workshops enable projects to save time, money, and enhances work more efficiently, make fewer mistakes, and avoid wasting materials.

FUNCTIONAL AND BUFFER SPACES THAT ARE PROVIDED FOR WITHIN THE WELFARE ZONE AND THEIR RELATION TO THE CONSTRUCTION SITE

Functional and buffer spaces are important in construction projects because they provide safety, organisation, and efficiency around the work zone. The following are reasons why buffer spaces should be left around the functional spaces in the work zone:

Functional spaces

These are spaces located for specific facilities necessary for the well-being of workers or personnel on construction sites. Among such functional facilities within the welfare zone are:

- Administration,
- Visitors' car park,
- workshops,
- canteen,
- washrooms,
- restrooms,
- clinic/first aid post,
- workshops,
- security post,
- changing rooms,
- warehouses,
- store rooms etc.

Buffer space

The buffer space is a crucial safety feature of a construction work zone work zone. It serves to separate traffic flow from the work area or potentially hazardous area and provides safe area recovery space for an errant vehicle. In practice, buffer spaces are usually provided around all functional spaces or work zones to ensure that there I adequate safety on the whole construction area or zone.

It is therefore important that all functional spaces or temporal structures on construction sites are safety assured with provision of buffer spaces around them. The ideas of functional space provision and buffer space provision are closely related to ensure good security, safety and well organised construction site environment.

Buffer spaces create a safe distance between workers, equipment, and potential hazards, such as falling debris or moving machinery. This reduces the risk of accidents and injuries on the construction site.

- **Room for Equipment and Movement**

  Large machinery like excavators, cranes, and trucks need space to move and operate. Buffer zones give the necessary room for these machines to maneuver without interfering with workers or other equipment.
- **Material Storage**

  Buffer spaces allow for the temporary storage of materials (such as bricks, steel, or concrete) near the work area. This makes it easier for workers to access materials quickly without cluttering the actual work zone.
- **Prevention of Damage**

  By keeping a buffer space, nearby structures, utilities, and landscaping are protected from accidental damage. This is especially important in areas close to roads, sidewalks, or existing buildings.
- **Emergency Access**

  Buffer zones ensure that there is always a clear path for emergency vehicles or workers to access the site in case of an accident or urgent situation. This makes it easier to provide help quickly to any functional space on the site.
- **Improved Workflow**

  A buffer space keeps the functional work zone organised and less crowded. This improves the overall workflow because workers have enough room to move and complete tasks without getting in each other's way.

Activity 6.5.1

1. Go on a field trip arranged by the teacher to the construction site to e ask the personnel on the usefulness of the security check point at the entrance of the inner perimeter of the site.
2. Attend a seminar presentation by an expert on the relevance of workshops in relation to early project completion.

3. Use the internet to find out why buffer spaces should be left around the work zone.
4. Prepare a personal report on security and buffer space relevance for group discussion.

References

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Glossary

- **Cabinetry**: The craft of making cabinets and storage units, where manufactured boards are commonly used for their affordability and workability.
- **Construction**: The industry involved in building structures, where manufactured boards are used for flooring, wall panels, and cabinetry due to their durability and ease of use.
- **Eco-Friendly**: Practices or products that are not harmful to the environment, such as using manufactured boards made from recycled wood and non-wood residues.
- **Furniture Making**: The process of designing and constructing furniture, often using manufactured boards for their cost-effectiveness and stability.
- **Non-Wood Residues**: Organic materials other than wood, like agricultural fibres (e.g., straw, bamboo), used in the production of manufactured boards.
- **Packaging**: The industry focused on enclosing products for distribution, storage, and sale, often using manufactured boards to create durable and customisable packaging solutions.
- **Sustainable Manufacturing**: Production processes that minimise waste and environmental impact, often incorporating materials like manufactured boards made from recycled residues.
- **Wood Residues**: By-products from wood processing, such as sawdust, wood chips, and shavings, used in making manufactured boards.

Review Questions

1. List the major facilities that the contractor provides space for during site planning and relate them to activities that the contractor performs during the construction period.
2. List functional spaces that are provided for within the welfare zone relate their usefulness to the constructional projects.
3. Describe the facilities and functional spaces that must be provided to enhance security at site.

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