

FINISHING CONSTRUCTION WORKS Level – III

Based on October, 2023 Curriculum Version II



Module Title: - Regular and irregular roofs tile

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ACRONYM

OHS.....	Occupational Health and Safety			
PPE.....	Personal Protective Equipment			
GFCIs.....	Ground Fault Circuit Interrupters.			
PFAS	Personal Fall Arrest Systems			
TPI	Blade Length and Teeth per Inch			
PVC	Polyvinyl Chloride			
UV	Ultraviolet			
EPDM	Ethylene	Propylene	Diene	Monomer

INTRODUCTION TO MODULE

This module covers the knowledge, attitude and skills required to understand the required Installing Tile regular and irregular roofs. The trainees will develop the skill on Installing Tile regular and irregular roofs including Overview of roofs, Prepare roof face, Cut and fix battens, Install tiles and Clean up, Tile roof openings and lay back surfaces and/or facades.

This module covers the units:

- Overview of roofs
- Preparation roof face
- Cut and fix battens
- Install tiles and clean up
- Tile roof openings and lay back surfaces and/or facade

Learning Objective of the Module

At the end of this session, the trainee will able to:

- Overview of roofs
- Prepare roof face
- Cut and fix battens
- Install tiles and Clean up
- Tile roof Openings and lay back surfaces and/or facades

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

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Unit one: Overview of roofs Tile

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Introduction to roof tile
- Work instructions
- OHS policies and signage.
- Tools and equipment
- Materials quantity
- Work materials
- Environmental protection

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Obtain, confirm and apply working instructions
- Follow OHS plans and policies and signage
- Select tools and equipment
- Calculate materials quantity
- Prepare and handle work materials
- Identify environmental protection.

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1.1 Introduction to roof tiles

Roof tiles are one of the most popular and enduring roofing materials used around the world. They have been used for centuries and are known for their durability, aesthetic appeal, and weather resistance. Roof tiles come in various materials, shapes, and sizes, allowing for a wide range of design possibilities.

1.1.1 Types of Roof Tiles:

- **Clay Tiles:** Made from natural clay that is molded and fired at high temperatures, clay tiles are known for their distinctive appearance and longevity. They are available in different profiles, such as flat, curved, or interlocking, and can be glazed or unglazed.
- **Concrete Tiles:** Constructed from a mixture of cement, sand, and water, concrete tiles offer versatility and durability. They can mimic the appearance of clay tiles or other materials, and are available in various shapes and colors.
- **Slate Tiles:** Made from natural slate stone, slate tiles are prized for their elegant appearance, durability, and resistance to fire and weathering. They are available in different sizes and thicknesses, offering a range of installation options.
- **Metal Tiles:** Metal roof tiles, typically made from steel or aluminum, offer durability, lightweight construction, and a modern aesthetic. They are available in various profiles and finishes, including standing seam designs.

1.1.2 Benefits of Roof Tiles:

- **Durability:** Roof tiles are known for their long lifespan, often lasting 50 years or more with proper maintenance. They are resistant to weather elements, including rain, wind, sun, and fire, making them a durable roofing option.
- **Aesthetic Appeal:** Roof tiles can enhance the overall appearance of a building and provide a distinctive look. They come in a variety of shapes, colors, and textures, allowing for customization and architectural creativity.
- **Energy Efficiency:** Some roof tiles, such as clay or concrete tiles, have natural insulating properties that help regulate the temperature inside a building. This can lead to energy savings by reducing the need for heating and cooling.
- **Low Maintenance:** Roof tiles generally require minimal maintenance. They are resistant to rot, insect damage, and decay, reducing the need for frequent repairs or replacement.

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- **Environmentally Friendly:** Many roof tiles are made from natural materials, such as clay or slate, which are sustainable and recyclable. They can contribute to a more eco-friendly building design.

1.1.1 Definition of roofs

A roof is the uppermost covering or structure that forms the top of a building or shelter. It is designed to provide protection from various elements such as rain, snow, sunlight, wind, and extreme temperatures. Roofs serve as a barrier between the interior of a structure and the outside environment, helping to maintain a comfortable and safe living or working space.

They may incorporate features such as chimneys, skylights, vents, and solar panels, depending on the functional and design requirements of the structure.

1.1.2 Types of roofs

Roofs are categorized under Regular and Irregular Roofs.

Regular Roofs are typically have uniform slopes and are easy to construct. Types of regular roofs include: Gable roof, Hip roof, shed roof.

Irregular Roofs are roofs constructed to irregular shaped plans where corners are not right angled and includes:

- | | |
|---------------------------------------|--|
| • Dutch hip | • Mansard |
| • Turrets | • bell cast |
| • Spires | • pyramid |
| • Unequal pitch surfaces and Cape Cod | • Bed and point valleys and steel framed roof trusses. |

Commonly used types of roofs:

Lean to roof:

- It is the simplest form of a pitched roof
- One wall is carried up sufficiently higher than the other to give necessary slope to the roof.

Gable Roof:

- Two sloping sides that meet at a ridge or peak.

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- Triangular shape and provides good water runoff.
- Have different slopes and variations, such as cross-gable roofs and Dutch gable roofs

Hip Roof: A hip roof has slopes on all four sides, which meet at a ridge. The characteristic feature of a hip roof is that it has no vertical ends or gables. Hip roofs are known for their stability and resistance to strong winds.

Mansard Roof: Also known as a French roof, a mansard roof has a double slope on each side, with the lower slope being steeper than the upper one. This design creates additional living space in the attic and is commonly seen in French architectural styles

Flat Roof: As the name suggests, a flat roof is nearly level, with a slight slope to allow water drainage.

Gambrel Roof: It has two distinct slopes on each side, with the lower slope being steeper than the upper one. Gambrel roofs maximize interior space and provide a classic, traditional look.

Shed Roof: A shed roof is a single sloping roof plane that is commonly used for sheds, additions, or extensions. It is a simple and cost-effective design that allows for easy construction and water drainage.

Butterfly Roof: This roof style consists of two roof surfaces that slope inward, creating a V-shape or butterfly-like appearance. Butterfly roofs are known for their unique and modern design, allowing for ample natural light and rainwater collection.

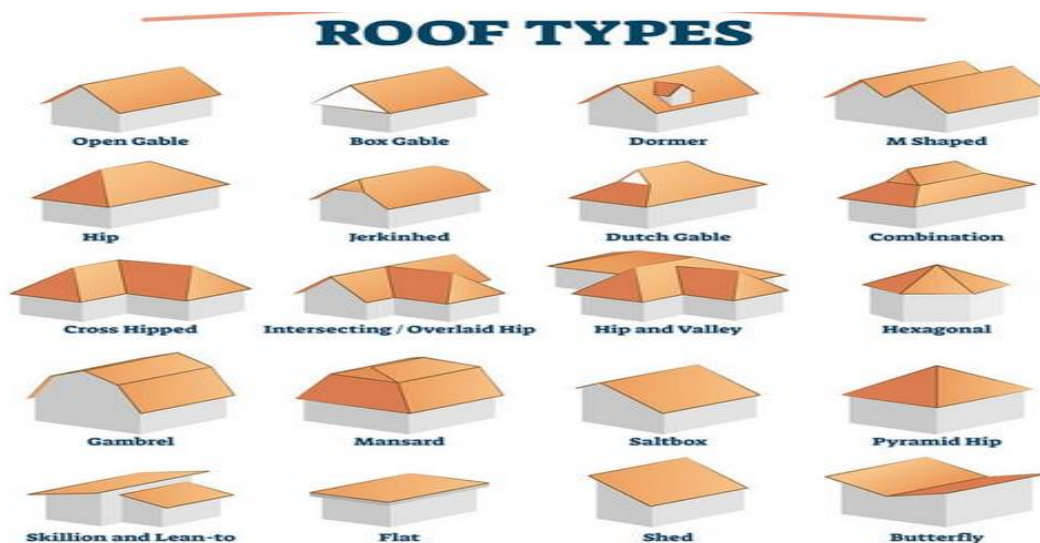


Figure 1-1 Types of roof

1.1.3 Terminologies of roof structures

The common terminologies related to roof structures are:

- **Ridge:** The highest point of a roof where two sloping sides meet.
- **Hip:** The external angle formed by the intersection of two sloping roof surfaces.
- **Valley:** The internal angle formed by the intersection of two sloping roof surfaces.
- **Eave:** The lower edge of a roof that overhangs the walls of a building.
- **Rafter:** A sloping beam that supports the roof covering and transfers the weight of the roof to the walls or other structural elements.
- **Truss:** A framework of beams or bars that provides support and stability to the roof structure.
- **Purlin:** A horizontal beam that provides support for the rafters or roof covering.
- **Fascia:** A horizontal board that covers the ends of the rafters and provides a finished appearance to the eaves.
- **Soffit:** The underside of the eave often enclosed with panels or other materials for aesthetic purposes and to provide ventilation.
- **Roof Decking:** The layer of material, such as plywood or oriented strand board (OSB) that forms the structural base of the roof and supports the roof covering.
- **Roof Sheathing:** The layer of material, such as asphalt shingles, metal panels, or tiles that is installed over the roof decking to provide weather protection.
- **Flashing:** Thin strips or sheets of metal or other materials installed at roof joints, valleys, and other vulnerable areas to prevent water penetration.
- **Ventilation:** The process of allowing air to circulate through the roof structure. Proper ventilation helps regulate temperature, prevent moisture buildup, and extend the lifespan of the roof.

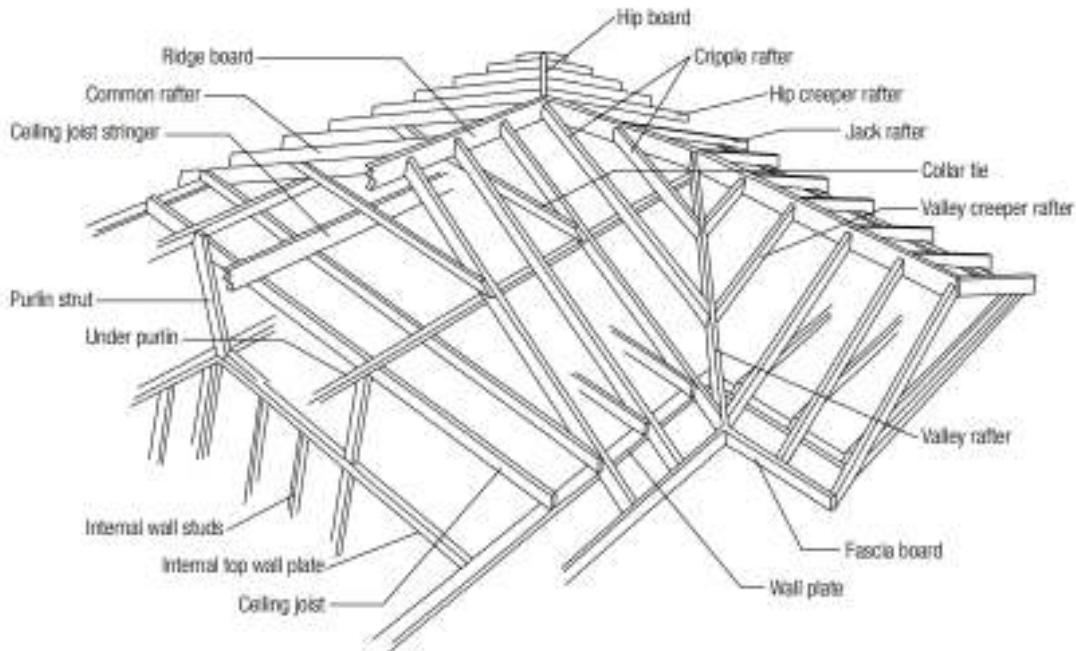


Fig 1-2 Roof Structural Members

1.1.4 Specification and standards

The specifications and standards of roofs can vary depending on factors such as the type of building, climate conditions, local building codes, and architectural design preferences.

General overview of common specifications and standards related to roofs:

- **Roof Pitch:** The roof pitch refers to the slope or angle of the roof. It is usually expressed as a ratio of vertical rise to horizontal run. The roof pitch affects the roof's ability to shed water, resist wind forces, and accommodate certain roofing materials.
- **Roofing Materials:** Common roofing materials include asphalt shingles, metal panels, concrete or clay tiles, wood shakes or shingles, and synthetic materials. The specifications for these materials typically cover aspects such as fire resistance, durability, wind resistance, and weight limitations.
- **Load-Bearing Capacity:** Roofs must be designed to support the weight of the roofing materials, as well as any additional loads such as snow, equipment, or maintenance personnel. Design standards and building codes specify the minimum load-bearing capacity requirements for roofs based on factors like geographic location and expected snowfall or wind loads.

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- **Waterproofing and Drainage:** Specifications may include the use of underlayment materials, flashing details around roof penetrations (e.g., chimneys, vents), and proper installation of gutters, downspouts, and drainage systems.
- **Thermal Insulation:** Energy efficiency is an important consideration for roofs. Standards may specify the minimum thermal resistance (R-value) requirements for roof insulation to help reduce heat transfer through the roof assembly and improve overall energy performance.
- **Ventilation:** Proper roof ventilation is necessary to control moisture buildup, prevent condensation, and maintain a healthy indoor environment. Standards may outline ventilation requirements based on factors such as the size of the attic space, the type of roofing material used, and local climate conditions.
- **Fire Resistance:** Roofs are typically required to meet certain fire resistance standards to minimize the spread of fire from building to building. This can include specifications for the roof covering material, such as its ability to resist ignition, flame spread, and the release of smoke or toxic gases.

1.2 Work instructions

Installing roof tiles requires careful planning and proper execution to ensure a secure and watertight roof. Here are step-by-step work instructions to help guide you through the process:

Note: These instructions provide a general overview, but it's important to consult the manufacturer's guidelines and local building codes for specific requirements.

Safety Precautions:

- Wear appropriate personal protective equipment (PPE) such as non-slip shoes, gloves, safety glasses, and a hard hat.
- Use stable ladders or scaffolding with proper fall protection systems.
- Take necessary precautions to prevent accidents and ensure personal safety.

Surface Preparation:

- Ensure the roof structure is sound and able to support the weight of the roof tiles.
- Repair any existing damage or leaks before proceeding.
- Clean the roof surface of debris, dirt, and loose materials.

Underlayment Installation:

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- Install an appropriate underlayment or waterproofing membrane according to the manufacturer's instructions.
- Ensure proper overlap and secure attachment of the underlayment to the roof structure.
- Follow any specific requirements for the type of roof tiles being installed.

Tile Layout and Marking:

- Plan the layout of the roof tiles, considering the roof slope, architectural features, and aesthetic preferences.
- Use chalk lines or guides to mark the layout on the roof surface.
- Ensure proper alignment and spacing between the tiles.

Tile Installation:

- Start at the lower edge of the roof and work your way up.
- Apply a layer of mortar or adhesive on the back of each roof tile, following the manufacturer's instructions for the specific type of tile being used.
- Position the tile on the marked layout, aligning it properly.
- Press the tile firmly into place, ensuring a secure bond with the mortar or adhesive.
- Use a rubber mallet or similar tool to tap the tile gently into position, helping it adhere to the surface.

Fastening:

- Depending on the type of roof tile and local building codes, additional fastening methods may be required.
- Follow the manufacturer's guidelines and local regulations for proper fastening, such as using nails, clips, screws, or other specialized fasteners.
- Ensure the fasteners are properly secured and do not compromise the integrity of the roof or the tiles.

Tile Cutting and Fitting:

- Measure and mark tiles accurately before cutting them to fit around roof edges, vents, chimneys, or other protrusions.
- Use a tile cutter, tile saw, or other appropriate tools to achieve clean and precise cuts.
- Ensure proper fit and alignment of the cut tiles.

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Ridge and Hip Tiles:

- Install ridge and hip tiles at the intersections of roof slopes according to the manufacturer's instructions.
- Secure them in place using appropriate techniques and fasteners.
- Ensure proper alignment and a watertight seal at these critical areas.

Flashing and Sealing:

- Install flashing materials around roof penetrations, such as chimneys, vents, or skylights, to prevent water infiltration.
- Follow proper flashing techniques and materials based on your specific roofing system and local building codes.
- Seal any gaps or joints between tiles using appropriate sealants or caulking where necessary.

Regular Maintenance:

- Periodically inspect the roof tiles for any damage, cracks, or loose tiles.
- Replace or repair any damaged tiles promptly to maintain the integrity of the roof.
- Clean the roof surface as needed to remove debris, moss, or algae growth.

1.3 OHS policies and signage.

1.3.1 Emergency procedures

The general emergency procedures to consider for roof works are:

- **Risk Assessment:** Identify potential hazards, such as fragile roof areas, electrical wires, or nearby equipment, and develop a plan to mitigate those risks.
- **Safety Equipment:** Ensure that all workers involved in roof works have the necessary personal protective equipment (PPE), including hard hats, safety harnesses, non-slip footwear, and fall protection gear. Make sure the equipment is in good condition and properly fitted.
- **Communication:** Establish a clear communication system among workers on the roof and with ground personnel. This can include the use of two-way radios, hand signals, or designated communication points to relay important information or raise alarms in case of emergencies.

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- **Emergency Exits:** Workers should be familiar with the location of these exits and the quickest routes to reach them.
- **Fall Protection:** Implement fall protection measures, such as guardrails, safety nets, or personal fall arrest systems, to prevent falls from heights.
- **Rescue Procedures:** Establish a rescue plan and train workers on emergency procedures in the event of a fall or injury.
- **Weather Monitoring:** Keep a close eye on weather conditions during roof works. Strong winds, lightning storms, or heavy rain can pose significant risks. Have a designated safety officer responsible for monitoring weather updates and making decisions regarding work stoppage or evacuation if conditions become hazardous.
- **Emergency Contacts:** Maintain a list of emergency contact numbers, including local emergency services, medical facilities, and relevant project managers or supervisors.
- **Regular Training:** Provide regular training sessions for workers involved in roof works to review safety procedures, emergency protocols, and the proper use of equipment.

1.3.2 Lifting devices

Lifting devices can be useful for transporting materials, equipment, or workers to elevated areas safely and efficiently.

There are some common lifting devices used for roof work:

- Cranes
- Hoists
- Elevators/Lifts
- Material Lifts
- Scaffolding

1.3.3 Hazardous materials and substances

Roof work may involve the use or encounter of various hazardous materials and substances. It's essential to be aware of these hazards and take appropriate safety precautions.

The common hazardous materials and substances associated with roof work are:

- Asbestos
- Lead
- Chemicals and Solvents
- Hazardous Roofing Materials

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- Biological Hazards
- Roofing Dust and Particles

1.3.4 First aid

When it comes to first aid for roof work, it's important to prioritize safety and take precautions to prevent accidents and injuries. The general guidelines for first aid in case of an incident while working on a roof:

- Assess the situation
- Call for help
- Control bleeding
- Stabilize fractures and sprains
- Treat burns
- Eye injuries
- Heat-related illnesses

1.3.5 Personal protective equipment (PPE)

When performing roof work, it's crucial to prioritize safety and protect yourself from potential hazards.

The essential personal protective equipment (PPE) items commonly recommended for roof work are:

- Hard Hat
- Safety Harness and Lifeline
- Non-Slip Boots
- Eye Protection
- Gloves
- Respiratory Protection
- Protective Clothing
- Fall Protection Equipment

1.3.6 Safe operating procedures

Safe operating procedures are crucial for roof work to minimize the risk of accidents and injuries.

The general guidelines for safe operating procedures when working on a roof are:

- Risk Assessment
- Training and Competence
- Personal Protective Equipment (PPE)
- Fall Protection
- Ladder Safety
- Roof Access and Egress
- Weather Conditions
- Tool and Equipment Safety
- Communication
- Emergency Preparedness

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1.3.7 Earth leakage boxes

The earth leakage boxes or ground fault circuit interrupters (GFCIs) used in electrical systems during roof work. GFCIs are safety devices designed to protect against electrical shock hazards. They are commonly used in areas where there is a risk of electrical faults or moisture, such as on roofs. There are a few considerations:

- Portable GFCIs
- Permanent GFCIs
- Compliance with Electrical Codes
- Regular Testing and Maintenance

1.3.8 Power cables

When it comes to power cables for roof work, it's important to prioritize safety and use cables that are suitable for the conditions and electrical requirements of the task at hand. The considerations for power cables during roof work are:

- Outdoor-Rated Cables
- Heavy-Duty Construction
- Length and Gauge
- Grounding
- Extension Cords
- Cord Management
- Regular Inspection

1.3.9 Surrounding structures

When conducting roof work, it's essential to consider the safety of surrounding structures to prevent accidents, damage, or disturbances. The key factors to consider:

- Adjacent Buildings
- Utilities and Services
- Noise and Vibration
- Protection of Surfaces
- Access and Egress
- Communication with Occupants
- Compliance with Regulations

1.3.10 Traffic control

When conducting roof tile work that may impact traffic, it's important to prioritize safety and implement appropriate traffic control measures. The considerations for traffic control during roof tile work:

- Traffic Assessment
- Signage and Barricades
- Warning Lights and Flags
- Traffic Cones and Barriers

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- Road Closures or Lane Diversion
- Communication with Local Authorities
- Flaggers and Traffic Controllers
- Ongoing Monitoring

1.3.11 working at height

Working at heights during roof work requires careful planning, proper safety measures, and adherence to relevant regulations. There are some considerations for working at heights during roof work:

- Risk Assessment
- Weather Conditions
- Fall Protection Systems
- Tools and Equipment
- Training and Competency
- Emergency Preparedness
- Safe Access and Egress
- Regular Inspections and Maintenance
- Roof Stability and Structural Integrity

1.3.12 working safely on roofs

Working safely on roofs is crucial to prevent accidents and ensure the well-being of workers. Here are some important tips to consider for safe roof work:

- Risk Assessment
- Weather Considerations
- Proper Training and Competency
- Roof Stability and Inspections
- Use of Personal Protective Equipment (PPE)
- Communication and Supervision
- Safe Access and Egress
- Work in Teams
- Secure the Work Area
- Emergency Preparedness

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1.4 Tools and equipment

1.4.1 Tools

When performing roof work, using the right tools and equipment is essential for efficiency, productivity, and, most importantly, safety. The common tools and equipment used in roof work:

Hand Tools:

- Hammer
- Utility Knife
- Pry Bar
- Roofing Nailer
- Roofing Trowel
- Chalk Line

Power Tools:

- Circular Saw
- Roofing Cutter
- Roofing Heat Gun
- Power Drill
- Air Compressor

Ladders and Scaffolding:

- Extension Ladders
- Roofing Brackets

1.4.2 Equipment

A. Fire fighting equipment

When performing roof work, it's important to consider the potential risks of fire and have appropriate fire-fighting equipment available as a safety precaution. There are some key points to consider regarding the use of fire-fighting equipment during roof work:

- Fire Risk Assessment
- Fire Extinguishers
- Fire Blankets
- Fire Hoses and Water Supply
- Emergency Communication
- Fire Safety Training
- Fire Safety Plan
- Emergency Respons

B. Safety Equipment:

- Fall Protection Equipment
- Personal Protective Equipment (PPE)

C. Air compressors and hoses

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This compressed air is stored in a tank and can be released through hoses attached to the compressor for clearing debris.



Figure 1.3 Air compressor

D. Bedding frames

In traditional slate or tile roofing, bedding frames are wooden or metal frames used as a guide or template for laying the roofing material. They help ensure proper alignment, spacing, and pitch of the individual slates or tiles during installation.

There's how bedding frames are typically used in roof work:

- Construction
- Layout
- Removal
- Installation

E. Blower

A blower is a versatile tool that can be used for various tasks in roof work. The common uses of blowers in roof work:

- Debris Removal
- Cleaning Gutters
- Drying Surfaces
- Ventilation

When using blowers for roof work, it's important to keep the following in mind:

- Safety
- Power Source
- Consider Surroundings

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- Operator Skill



Figure 1.4 Blowers for roof clearing

F. Buckets

Buckets are versatile tools commonly used in roof work for carrying and transporting materials, tools, and other items. Some ways buckets are used in roof work are:

- Material Transport
- Debris Removal
- Tool Storage
- Water Storage

When using buckets for roof work, consider the following:

- Proper Lifting Techniques
- Bucket Material
- Safety
- Bucket Size and Capacity

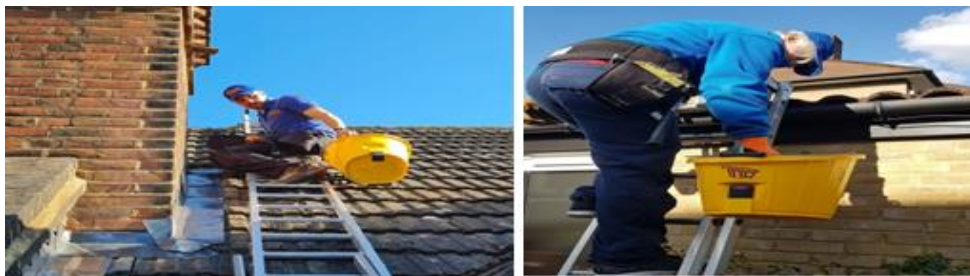


Figure 1.5 Buckets for roof work

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G. Calculators

Calculators are valuable tools for various aspects of roof work, helping with measurements, estimating materials, and performing calculations. The types of calculators commonly used in roof work are:

- Basic Calculator
- Roofing Calculator
- Angle Calculators
- Cost Calculators
- Unit Conversion Calculators



Figure 1.6 Calculators for roof work

H. Chalk lines

Chalk lines are commonly used in roof work as a tool for marking straight lines and reference points on the roof surface. They help ensure accurate alignment and guide the installation of roofing materials.

There's how chalk lines are typically used in roof work:

- Marking Layout
- Finding Reference Points
- Measuring and Cutting

There are some tips for using chalk lines effectively in roof work:

- **Chalk Line Selection:** Choose a chalk line with a durable and high-quality string. Look for a chalk line that is resistant to moisture and has a reliable locking mechanism to prevent the line from retracting unintentionally.

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- **Chalk Color:** Consider the visibility of the chalk against the roof surface. Opt for a contrasting chalk color that is easily visible, especially in different lighting conditions or against dark roofing materials.
- **Preparing the Surface:** Ensure that the roof surface is clean and dry before snapping the chalk line. Clear away any debris or loose materials that could interfere with the line's accuracy.
- **Tension and Snapping:** When snapping the chalk line, hold the line taut and apply sufficient tension. This helps ensure a straight and clear line. Hold the line firmly in place, lift it slightly, and release it to create a clean and visible line of chalk.
- **Accuracy Check:** Double-check the alignment of the chalk line before proceeding with the installation of roofing materials. This helps ensure that the lines are straight and properly aligned.

By using chalk lines effectively, you can enhance the accuracy and efficiency of your roof work, resulting in a professional-looking installation.



Figure 1.7 Chalk lines for roof work

I. Chisels

Chisels are versatile tools that can be useful for certain roof work tasks, particularly when working with specific roofing materials or performing repairs. The ways chisels can be used in roof work:

- Removing Adhesives or Sealants
- Cutting or Trimming Roofing Material
- Notching or Shaping Flashing
- Removing Old or Damaged Roofing Material

When using chisels for roof work, keep the following considerations in mind:

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- Chisel Selection
- Safety
- Precision and Control
- Sharpness
- Technique

It's important to note that chisels may not be suitable or necessary for all roof work tasks. The specific use of chisels in roof work will depend on the type of roofing material, the nature of the project, and individual preferences or techniques employed by roofing professionals.



Figure 1.8 Chisels for roof work

J. Concrete mixers

Concrete mixers are not typically used for roof work, as roofs are usually not made of concrete. However, there are instances where concrete mixers may be utilized in roof-related projects that involve concrete elements or structures.

The few scenarios where concrete mixers could be used in roof work:

- Concrete Roof Decks
- Structural Elements
- Roof Repairs or Additions

When using a concrete mixer for roof-related projects, it's important to consider the following:

- Mixer Selection
- Safety
- Accessibility
- Mixing Consistency
- Cleanup and Waste Disposal

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Figure 1.9 Concrete mixers for roof work

K. Elevators

When it comes to roof tile work, elevators are not typically used for the installation or repair of roof tiles. Roof tiles are usually installed manually, and workers access the roof using ladders, scaffolding, or other means of safe access.

Some specialized tools and equipment that are commonly used for roof tile work are:

- Roof Tile Hoists
- Tile Carriers
- Tile Cutters
- Roof Brackets and Support Systems
- Safety Equipment

Always follow local regulations, manufacturer guidelines, and industry best practices when working on roofs or using specialized equipment for roof tile installations.



Figure 1.10 Elevators for roof work

L. Fall safety devices

When working on roof tile installations, using appropriate fall safety devices is crucial to protect workers from falls and ensure their safety.

The commonly used fall safety devices for roof tile work:

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- Ladder Safety
- Roof Anchors
- Guardrails
- Safety Nets
- Roofing Brackets and Scaffolding
- Personal Fall Arrest Systems (PFAS)

It's important to note that fall safety devices should be selected based on the specific requirements of the roof tile work, the height of the roof, and local safety regulations. Additionally, workers should receive proper training on the correct use of fall safety equipment and follow all safety guidelines and best practices.



Figure 1.10 fall safety devices for roof work

M. Gutter protectors

Gutter protectors, also known as gutter guards or gutter covers, are devices designed to prevent debris from entering and clogging gutters. While they are not directly related to roof tile work, they can be installed on roofs with gutters to help maintain proper drainage and prevent gutter blockages. The common types of gutter protectors:

- Mesh Screens
- Gutter Brushes
- Foam Inserts
- Reverse Curve Systems
- Perforated Screens

When considering gutter protectors for your roof, it's important to keep the following points in mind:

- Compatibility
- Maintenance
- Installation

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- Climate Considerations
- Compatibility with Roof Tiles



Figure 1.11 Gutter protectors

N. Hammers

Hammers are commonly used tools in roof tile work for various tasks such as tile installation, repairs, and adjustments. Here are some types of hammers that are commonly used in roof tile work:

- Roofing Hammer
- Claw Hammer
- Rubber Mallet
- Tiling Hammer
- Brick Hammer

When selecting a hammer for roof tile work, consider the following factors:

- Size and Weight
- Material
- Face Type
- Quality



Figure 1.12 Hammers for roof work

O. Hand saws

When working with roof tiles, hand saws can be useful for cutting or shaping tiles to fit specific areas or to make adjustments during installation or repairs. The types of hand saws commonly used in roof tile work:

- Tile Saw
- Coping Saw
- Jab Saw
- Backsaw
- Hack Saw

When choosing a hand saw for roof tile work, consider the following factors:

- Blade Type
- Blade Length and Teeth per Inch (TPI)
- Handle Comfort
- Safety Considerations

It's important to note that different roof tile materials have varying hardness and brittleness. Some tile types may require specialized cutting tools or techniques to avoid cracking or damaging the tiles. Consult with roofing professionals or tile manufacturers for specific recommendations based on the type of roof tiles you are working with.



Figure 1.13 Hand saws for roof work

P. High-pressure water cleaners

High-pressure water cleaners, also known as pressure washers, can be a useful tool for certain roof work tasks. They utilize a powerful stream of water to remove dirt, debris, moss, algae, and other contaminants from various surfaces, including roofs. Some considerations when using high-pressure water cleaners for roof work:

- Pressure Washer Types
- Pressure and Nozzles

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- Cleaning Solutions
- Surface Compatibility
- Safety Precaution



Figure 1.14 pressures water cleaner for roof work

Q. Ladders

When it comes to roof tile work, having a suitable ladder is essential for safe and efficient access to the roof. Some considerations when selecting a ladder for roof tile work:

- Ladder Type
- Height and Reach
- Weight Capacity
- Material
- Stability and Safety Features
- Portability and Storage
- Safety Considerations
- Regulations and Standards

It's important to note that roof work can be hazardous, and if you are uncomfortable or lack the necessary experience, it is advisable to seek professional assistance. Roofing professionals have the expertise and equipment to safely access and work on roofs.



Figure 1.15 Ladders for roof work

R. Measuring tapes

Measuring tapes and rules are essential tools for accurate measurements during roof tile work. They help ensure precise cuts, proper alignment, and correct placement of tiles.

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Some considerations when selecting measuring tapes and rules for roof tile work:

- Length
- Units of Measurement
- Durability
- Blade Width
- Blade Locking Mechanism
- Ease of Reading
- Measuring Rules
- Additional Features

Accurate measurements are essential for achieving a professional and aesthetically pleasing roof tile installation. Always double-check your measurements and take your time to ensure accuracy before making any cuts or adjustments.



Figure 1.16 Measuring tapes for roof work

S. Nail bags

For nail bags specifically designed for roof work, you'll want to consider a tool belt or pouch that is durable, has ample storage space, and offers convenient access to your nails or fasteners.

There are a few options to consider:

- Roofing Tool Belt
- Magnetic Nail Pouch
- Suspender Systems
- Apron-style Nail Bags

When selecting a nail bag for roof work, ensure that it meets your specific requirements in terms of storage capacity, durability, and comfort. It's also a good idea to read reviews and check for recommendations from other professionals in the roofing industry to find the best option for your needs.

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Figure 1.17 Nail bags for roof work

T. Signage

Signage refers to any visual graphics or display that conveys information, communicates messages, or provides directions to people. It is a broad term that encompasses various types of visual communication tools, including signs, symbols, graphics, and displays.

When it comes to signage for roof tile works, there are a few key considerations to keep in mind. The signage should effectively communicate important information to ensure safety and provide necessary guidance.

There are some common types of signage that may be useful for roof tile works:

- Warning Signs
- Safety Instructions
- Directional Signs
- Restricted Area Signs
- Emergency Information

Ensure that all signage is prominently displayed, easily readable, and properly maintained. Consider using weather-resistant materials to withstand outdoor conditions. Additionally, local regulations and safety standards may provide specific requirements for signage in construction areas, so it's important to consult relevant guidelines and regulations in your area when designing and installing signage for roof tile works.



Figure 1.18 Signage for roof work

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1.5 Roof materials

1.5.1 Types of roofing materials

Roofing materials are the materials used to construct and cover the roof of a building. They are designed to provide protection against weather elements such as rain, snow, sunlight, and wind. Various roofing materials are available, each with its own advantages and characteristics.

There are several types of materials commonly used for roofing, each with its own characteristics, advantages, and considerations. There are some of the most popular roofing materials:

- Asphalt Shingles
 - Metal Roofing
 - Clay or Concrete Tiles
 - Wood Shingles or Shakes
 - Slate
 - Synthetic Roofing Materials
- **Asphalt Shingles:** Asphalt shingles are one of the most widely used roofing materials due to their affordability, durability, and ease of installation. They are available in various colors and styles and can effectively protect against different weather conditions.
 - **Metal Roofing:** Metal roofs, such as steel, aluminum, or copper, are known for their longevity, durability, and resistance to fire, rot, and insects. Metal roofs can be expensive upfront but provide excellent long-term value due to their low maintenance and energy efficiency.
 - **Clay or Concrete Tiles:** Clay or concrete tiles are popular in areas with a Mediterranean or Spanish architectural style. They offer excellent durability, fire resistance, and aesthetic appeal. However, they can be heavy, requiring proper structural support, and installation can be more complex and costly.
 - **Wood Shingles or Shakes:** Wood shingles or shakes provide a natural and rustic look to roofs. Cedar, redwood, or other types of wood are commonly used. Wood roofs require regular maintenance to prevent rot, moss, or insect infestation and may have limitations in fire-prone areas.
 - **Slate:** Slate is a natural stone material that offers exceptional longevity and an elegant appearance. It is highly durable and fire-resistant. However, slate is a heavy material that

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requires a strong roof structure to support its weight. It can also be more expensive and may require specialized installation.

- **Synthetic Roofing Materials:** There are synthetic roofing materials available that mimic the look of natural materials like slate or wood shakes. These materials are often more affordable, lightweight, and easier to install while offering similar aesthetics and durability.

When selecting a roofing material, consider factors such as your budget, climate, architectural style, durability, maintenance requirements, and local building codes. Tiles may classify by interlocking and non-interlocking.

- **Interlocking Tiles:** Interlocking roof tiles are designed to fit together seamlessly, creating a watertight roof surface. These tiles have special features that allow them to interlock with adjacent tiles, providing added stability and protection against water infiltration. Interlocking tiles are commonly made of materials like concrete, clay, or metal. They are relatively easy to install and offer excellent weather resistance. The interlocking design also helps distribute the weight evenly across the roof, enhancing the overall structural integrity.
- **Non-Interlocking Tiles:** Non-interlocking roof tiles are individual tiles that are not designed to interlock with one another. Instead, they are often installed with overlapping patterns, where each tile covers part of the one beneath it. Non-interlocking tiles can be made of materials like clay, concrete, slate, or synthetic materials. They are available in various shapes and profiles, offering a wide range of aesthetic options. Non-interlocking tiles require proper installation techniques, such as using appropriate underlayment and fastening methods, to ensure they provide effective weather protection.



Figure 1.19 Types of roofing materials

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1.5.2 Pointing material

A. Mortar

When it comes to roof work, various types of mortars can be used for different applications. Mortar is a mixture of cement, sand, and water that is commonly used in construction for bonding and sealing purposes.

There are a few types of mortars commonly used in roof work:

- **Cement Mortar:** Cement mortar is a widely used mortar in roof work. It consists of Portland cement, sand, and water. Cement mortar provides good strength and durability, making it suitable for applications such as bedding roof tiles or slates.
- **Lime Mortar:** It is made from lime putty or hydrated lime, sand, and water. Lime mortar offers flexibility and breathability, which can be advantageous for certain types of roofing materials. It allows for some movement and can accommodate the natural expansion and contraction of materials, reducing the risk of cracking.
- **Polymer-Modified Mortar:** Polymer-modified mortars are mortars that have been enhanced with polymer additives. These additives improve the mortar's properties, such as flexibility, adhesion, and water resistance. Polymer-modified mortars are commonly used in roof work where additional flexibility and durability are required, such as in areas prone to movement or where there may be thermal expansion and contraction.
- **Roof Tile Adhesive:** Roof tile adhesive is a specialized mortar designed specifically for adhering roof tiles or slates to the roof surface. Roof tile adhesives are typically polymer-modified and formulated to provide strong adhesion, flexibility, and weather resistance.

The choice of mortar depends on factors such as the type of roofing material, climate conditions, and the specific requirements of the project.



Figure 1.20 Pointing for roof work

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B. Flexible pointing material

Flexible pointing materials are commonly used in roof work to seal gaps and joints between roofing materials, such as tiles, slates, or shingles, while allowing for some movement and flexibility. These materials are designed to accommodate the expansion, contraction, and slight shifting of the roof components due to temperature changes or structural settling.

There are a few examples of flexible pointing materials used in roof work:

- **Polymeric Sealants:** Polymeric sealants, often based on silicone or polyurethane, are widely used for flexible pointing in roofing applications. These sealants offer excellent flexibility, adhesion, and weather resistance. They can withstand a wide range of temperatures and UV exposure without cracking or deteriorating.
- **Acrylic Sealants:** Acrylic sealants are another flexible pointing option for roofs. They are synthetic sealants that offer good flexibility, durability, and weather resistance. Acrylic sealants are available in a range of formulations and can be tinted or painted to match the roof color.
- **Butyl Rubber Sealants:** Butyl rubber sealants are highly flexible and particularly suitable for sealing joints and gaps in roofs. They provide excellent adhesion and elongation properties, allowing for movement without compromising the seal. Butyl rubber sealants have good resistance to UV radiation, moisture, and temperature fluctuations.
- **Modified Bitumen Sealants:** Modified bitumen sealants are commonly used in flat or low-slope roofs. They are made of bitumen modified with synthetic polymers, which enhance their flexibility and durability. Modified bitumen sealants can tolerate minor roof movement and provide a reliable, long-lasting seal.

When selecting a flexible pointing material for your roof, consider factors such as the type of roofing material, climate conditions, and the specific requirements of the project.



Figure 1.21 Flexible pointing materials for roof tiles

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C. Flashings

Flashings are essential components in roof work that help to prevent water penetration and protect vulnerable areas of the roof from moisture damage. They are typically made of metal, such as aluminum, copper, or galvanized steel, although other materials like PVC or rubber may also be used. Flashings are installed in areas where the roof intersects with other structures or where there are joints, transitions, or penetrations.

There are some common types of flashings used in roof work:

- **Drip Edge Flashing:** Drip edge flashing is installed along the edges of the roof, such as the eaves and rakes, to direct water away from the underlying structure. It helps prevent water from seeping under the roof covering and causing damage to the fascia, soffit, or decking.
- **Valley Flashing:** Valley flashing is used in roof valleys, where two roof slopes meet. It is installed to create a watertight channel that directs water down the valley and away from the roof system. Valley flashings are typically made of metal and can be custom-formed to fit the specific roof slope and design.
- **Step Flashing:** Step flashing is used to seal the junction between the roofing material and vertical surfaces, such as chimneys, walls, or dormers. It consists of individual metal pieces that are layered with each course of roofing material, creating a step-like pattern. Step flashing ensures a watertight transition and prevents water from entering through the gaps.
- **Chimney Flashing:** Chimney flashing is specifically designed to seal the area where the chimney meets the roof. It typically includes a combination of base flashing, step flashing, and counter flashing. The base flashing is integrated into the roof covering, while the step flashing and counter flashing are layered around the chimney to create a waterproof seal.
- **Vent Pipe Flashing:** Vent pipe flashing is used to seal around vent pipes or other protrusions through the roof. It typically consists of a rubber or neoprene boot that fits tightly around the pipe and is secured to the roof. Vent pipe flashing prevents water from entering around the pipe and ensures a watertight seal.
- **Eave Flashing:** Eave flashing, also known as eave drip or eave apron, is installed along the lower edge of the roof, where the eaves overhang. It provides additional protection against water infiltration and helps to direct water away from the fascia and soffit area.

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The selection and installation of flashings depend on factors such as the type of roof, climate conditions, and specific design requirements.



Figure 1.22 Application of flashing for roof

D. Sarking materials

Sarking materials, also known as roof sarking or roof underlayment, are products used in roofing construction to provide an additional layer of protection and insulation beneath the roof covering. Sarking is typically installed on the external side of the roof frame, directly on top of the roof trusses or rafters, before the roof covering, such as tiles or metal sheets, is installed.

The primary functions of sarking materials are:

- **Waterproofing:** Sarking acts as a barrier against water ingress, preventing moisture from penetrating the roof structure and entering the building.
- **Thermal Insulation:** Sarking materials can provide an additional layer of insulation, reducing heat transfer between the roof and the interior of the building. This can help improve energy efficiency and reduce heating or cooling costs.
- **Condensation Control:** It allows water vapor to escape while preventing it from reaching the insulation or other vulnerable components, which could lead to damage or reduced performance.

Common materials used for sarking include:

- Foil-faced reflective insulation
- Bituminous or synthetic underlays
- Breathable membranes



Figure 1.22 Application of sarking materials for roof

E. Timber and metal battens

Timber and metal battens are commonly used in roof construction to provide support and secure the roof covering material. Timber and metal battens are commonly used in roof construction to provide a stable base for various roofing materials. Both materials have their own advantages and considerations.

There's some information about timber and metal battens for roof work:

Timber Battens:

- **Material:** Timber battens are typically made from treated softwood, such as pine or spruce. The timber is often pressure-treated to enhance its durability and resistance to rot, insects, and decay.
- **Installation:** Timber battens are usually fixed horizontally across the roof rafters, and their spacing depends on the type of roofing material being used. The battens provide a nailing surface for the roof covering.
- **Advantages:**
 - Cost-effective
 - Easy to work with
 - Insulation
- **Considerations:**
 - Maintenance: Timber battens require periodic maintenance, such as painting or staining, to protect against moisture and UV damage.
 - Vulnerability: Wood can be susceptible to rot, decay, and insect infestation if not properly treated and maintained.

- **Weight:** Timber battens are heavier compared to metal battens, which may affect the overall load on the roof structure.

Metal Battens:

- **Material:** Metal battens are typically made of galvanized steel or aluminum, which provides durability and resistance to corrosion.
- **Installation:** They are fixed using appropriate fasteners, such as screws or nails, depending on the specific roofing system.

Advantages:

- **Durability:** Metal battens are resistant to rot, decay, and insect damage. They can withstand harsh weather conditions and have a longer lifespan compared to timber battens.
- **Lightweight:** Metal battens are lighter in weight, which can be beneficial in certain roof applications and reduce the overall load on the roof structure.
- **Low maintenance:** Metal battens generally require minimal maintenance, especially when made from materials with high corrosion resistance.

Considerations:

- **Cost:** Metal battens are often more expensive than timber battens due to the higher material and manufacturing costs.
- **Thermal conductivity:** Metal is a good conductor of heat, which means that metal battens may transfer heat more readily compared to timber battens. This factor should be considered when it comes to thermal insulation.

The choice between timber and metal battens for roof work depends on factors such as cost, desired lifespan, maintenance requirements, and the specific roofing materials being used.

F. Quality requirements

When it comes to roof work, there are several important quality requirements that should be considered. These requirements help ensure that the roof installation or repair is done correctly and that the roof will provide long-lasting protection for the building. Here are some key quality requirements for roof work:

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- Proper Installation
- Structural Integrity
- Weather proofing
- Adequate Ventilation
- Energy Efficiency
- Aesthetics
- Compliance with Building Codes and Regulations
- Warranty and Guarantees

1.6 Material preparation and handling

Proper material preparation and handling are crucial for the success of any roof work project. Whether you are installing a new roof or carrying out repairs, following best practices for material preparation and handling helps ensure the quality and longevity of the roof.

There are some important considerations:

- **Material Selection:** Choose roofing materials that are suitable for your specific project, taking into account factors such as climate, building codes, and aesthetic preferences.
- **Order Sufficient Materials:** Calculate the required quantity of roofing materials accurately to avoid delays or insufficient supply during the project. Ordering extra materials to account for waste, cuts, and future repairs is recommended.
- **Storage and Protection:** Store roofing materials properly to prevent damage from exposure to the elements. Materials such as shingles or tiles should be stored in a dry, well-ventilated area, protected from moisture, direct sunlight, and extreme temperatures.
- **Material Inspection:** Before installation, inspect all roofing materials for defects, damage, or inconsistencies. This includes checking for broken or cracked tiles, warped shingles, or any other issues that could affect the performance or appearance of the roof. Defective materials should be replaced or repaired before installation.
- **Handling Safety:** Roofing materials can be heavy and awkward to handle, so it's important to prioritize safety during material handling. Use proper lifting techniques, such as using a team lift or mechanical aids, to prevent strain or injuries. Wear appropriate personal protective

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equipment (PPE), such as gloves, safety glasses, and sturdy footwear, to protect against cuts, falls, or other hazards.

- **Roof Access and Delivery:** Ensure that there is safe and clear access to the roof for material delivery.
- **Material Placement:** This includes following the recommended installation patterns, overlaps, and fastening methods. Adhere to any specific requirements for ventilation, flashing, or underlayment as specified by the manufacturer or building code.
- **Waste Management:** Dispose of any waste materials properly and responsibly. Keep the work area clean and organized to prevent accidents and ensure efficient workflow.
- **Weather Considerations:** Consider weather conditions during material preparation and handling. Avoid working with roofing materials during extreme weather conditions such as heavy rain, strong winds, or freezing temperatures, as these can compromise the quality of the installation and pose safety risks.

By following these guidelines for material preparation and handling, you can help ensure a smooth and successful roofing project while maintaining the integrity and performance of the roof.



Figure 1.23 Handling of roof materials

1.7 Materials quantity (Estimation)

Calculating the quantity of materials required for a roof work project involves several factors, including the size and shape of the roof, the type of roofing materials being used, and any specific design considerations. There are some steps to help you estimate the quantity of materials needed:

- Measure the Roof
- Determine Material Coverage
- Consider Roof Slope or Pitch
- Calculate Material Quantity

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- Account for Waste
- Additional Materials

Remember, these steps provide a general guideline for estimating material quantities.

Estimating

This guide has been compiled to estimate concrete roof tile quantities. To use this guide one should acquaint oneself with the roofing terminology used in the concrete roof tile industry. Reference should also be made to the definitions of building terms and of roof forms which can be found in table below.

- Eaves length
- Roof span
- Rafter span
- Rafter length
- Roof plan area
- Roof area to slope
- Roof pitch
- The head lap
- Roofline on the plan
- Gutter overhang
- Tile pitch
- Batten centers
- Ridge length
- Hip and Valley length

Note: the length of the hip or valley cannot be measured off the plan and must always be calculated.

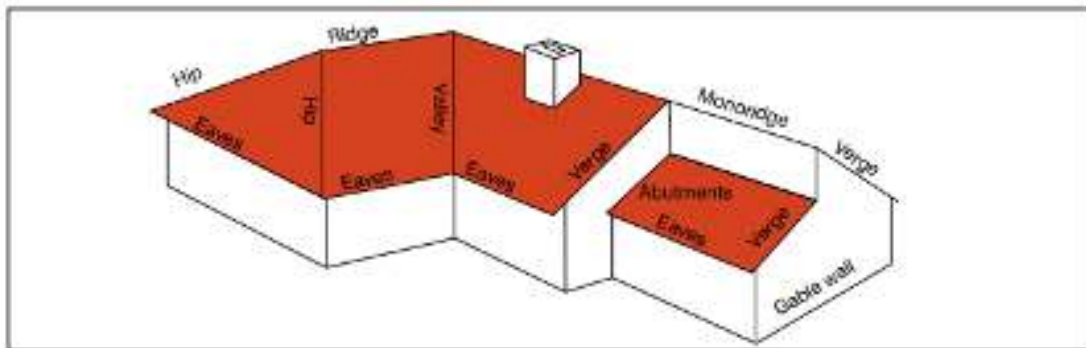


Figure 1.24 Roof terminology

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Figure 1.25 Plan and section of roof

Calculating roof tile quantities

The two methods of calculating roof tile quantities are:

- a) Eaves length/rafter length method
- b) Roof area method

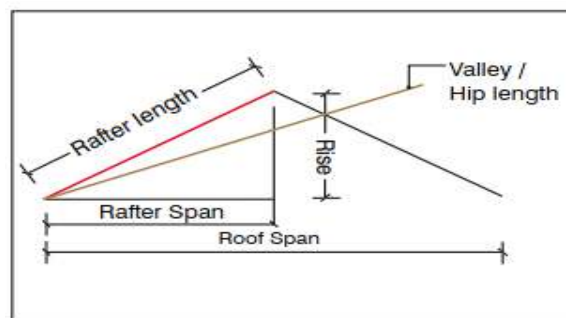
To calculate the number of tiles required it is necessary to have working drawings showing lengths of eaves, rafters and roof pitch.

To calculate the rafter length at a given pitch, multiply the rafter span (including the eaves overhang) by the appropriate rafter constant. Refer to Table 9

Rafter length = rafter span x rafter constant.

To calculate the valley or hip length multiply the rafter span by the appropriate valley/hip constant.

Valley/hip rafter length = rafter span x valley/hip constant.



a) Eaves length/rafter length method

This is an accurate method and is recommended when calculating quantities of tiles required.




Using Table 10 Column 4 read off the number of tiles required along the length of the eaves.

Round up to the nearest full tile.

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- Using Table 10 read off the number of courses required on the rafter length at the relevant tile head lap. Round up to the nearest full tile.
- Multiply the number of tiles along the eaves by the number of courses on the rafter length for each roof area. Add the totals together.
- Add 2% of total for wastage.

Table 9: Roof rafter constant multipliers

Roof pitch	Rafter	Valley/Hip <small>For calculations in between use the preceding higher constant.</small>			Rise
		 90° Valleys	 120°	 150°	
17.5°	1.048	1.450	1.187	1.082	0.315
18°	1.051	1.451	1.200	1.095	0.325
19°	1.058	1.456	1.205	1.091	0.344
20°	1.064	1.460	1.211	1.097	0.364
21°	1.071	1.465	1.217	1.104	0.384
22°	1.079	1.471	1.224	1.111	0.404
22.5°	1.082	1.473	1.227	1.115	0.411
23°	1.085	1.475	1.230	1.118	0.424
24°	1.095	1.482	1.238	1.127	0.445
25°	1.103	1.486	1.246	1.135	0.466
26°	1.113	1.488	1.254	1.144	0.488
27°	1.122	1.503	1.263	1.154	0.510
27.5°	1.127	1.506	1.267	1.159	0.521
28°	1.133	1.511	1.272	1.164	0.532
29°	1.143	1.519	1.281	1.174	0.554
30°	1.155	1.528	1.291	1.185	0.577
31°	1.167	1.537	1.302	1.197	0.601
32°	1.179	1.546	1.313	1.208	0.625
32.5°	1.185	1.551	1.319	1.215	0.637
33°	1.192	1.556	1.325	1.220	0.649
34°	1.208	1.567	1.338	1.236	0.675
35°	1.221	1.578	1.351	1.254	0.70
35°	1.235	1.590	1.365	1.265	0.727

37,5°	1,260	1,309	1,367	1,268	0,767
38°	1,269	1,318	1,394	1,297	0,781
39°	1,287	1,330	1,411	1,314	0,810
40°	1,305	1,344	1,428	1,332	0,839
41°	1,325	1,360	1,445	1,351	0,868
42°	1,346	1,377	1,464	1,372	0,900
42,5°	1,356	1,385	1,474	1,382	0,916
43°	1,367	1,395	1,484	1,393	0,933
44°	1,390	1,712	1,506	1,415	0,966
45°	1,414	1,732	1,528	1,439	1,000
46°	1,440	1,753	1,552	1,464	1,036
47°	1,466	1,775	1,567	1,490	1,072
47,5°	1,480	1,785	1,589	1,504	1,091
48°	1,494	1,798	1,609	1,518	1,111
49°	1,524	1,823	1,630	1,547	1,150
50°	1,556	1,850	1,660	1,579	1,192
51°	1,589	1,877	1,69	1,611	1,235
52°	1,624	1,907	1,724	1,645	1,280
52,5°	1,648	1,923	1,741	1,664	1,303
53°	1,662	1,940	1,759	1,683	1,327
54°	1,701	1,973	1,797	1,722	1,376
55°	1,743	1,009	1,837	1,764	1,426
56°	1,786	2,049	1,880	1,808	1,483
57°	1,836	2,091	1,925	1,853	1,540
57,5°	1,861	2,113	1,949	1,880	1,570
58°	1,887	2,135	1,973	1,905	1,600
59°	1,942	2,164	2,026	1,960	1,664
60°	2,000	2,238	2,082	2,018	1,732

Table 10: Tile cover – rafter / eaves

Number of tiles Nominal size of tiles 420 x 330mm	Rafter		Eaves
	Roof pitch		Nominal cover on eaves length m
	17,5° – 25° 100mm head lap 320mm batten centres m	26° and above 75mm head lap 345mm batten centres m	
1	0,380	0,380	0,332
2	0,690	0,709	0,633
3	1,000	1,050	0,934
4	1,320	1,395	1,235
5	1,640	1,740	1,536
6	1,960	2,085	1,837
7	2,280	2,430	2,138
8	2,600	2,775	2,439
9	2,920	3,120	2,740
10	3,240	3,465	3,041
11	3,560	3,810	3,342
12	3,880	4,155	3,643
13	4,200	4,500	3,944
14	4,520	4,845	4,245
15	4,840	5,190	4,546
16	5,160	5,535	4,847
17	5,480	5,880	5,148
18	5,800	6,225	5,449

19	6,120	6,570	5,750
20	6,440	6,915	6,051
21	6,760	7,260	6,352
22	7,080	7,605	6,653
23	7,400	7,950	6,954
24	7,720	8,295	7,255
25	8,040	8,640	7,556
26	8,360	8,985	7,857
27	8,680	9,330	8,158
28	9,000	9,675	8,459
29	9,320	10,020	8,760
30	9,640	10,365	9,061
31	9,960	10,710	9,362
32	10,280	11,055	9,663
33	10,600	11,400	9,964
34	10,920	11,745	10,265
35	11,240	12,090	10,566
36	11,560	12,435	10,867
37	11,880	12,780	11,168
38	12,200	13,125	11,469
39	12,520	13,470	11,770
40	12,840	13,815	12,071

b) Roof area method

Reduce the roof plan to basic areas.

- Calculate each roof area on plan by multiplying eaves length of each roof area by the roof span.
- Total area of roof to be tiled = sum of various areas on plan x constant for the appropriate roof pitch. Refer to Table9
- If the roof has different pitches for the various areas, then each area should be calculated separately.
- As this roof area method is only approximate add 5% for wastage
- Valleys and hips: extra tiles for cutting.
Length of hips and valleys = number of hips/valleys x rafter span x hip/valley constant.
Refer to Table 9
Extra tiles for hips = length of hips x 3.
Extra tiles for valleys = length of valleys x 4.
- Add 2% for wastage. Round up to nearest 10.
- Ridge tile quantity for ridges and hips.

Total ridge/hip tiles required = length of ridge/hip x number of ridge/ hip tiles/m.

Refer to manufacturer if in doubt

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Add one ridge tile per length of ridge. Add one ridge tile per hip for mitring at ridge/ hip junction.

- Add 5% for wastage.
- Verge. For each verge allow one rake verge tile for each course of tiling and one extra verge tile for mitring at the apex.
- Add 5% for wastage.

1.8 Environmental protection

Environmental protection refers to the practice of preserving, conserving, and safeguarding the natural environment and its resources from degradation, pollution, or exploitation. It involves taking proactive measures to prevent or mitigate harm to ecosystems, biodiversity, air, water, soil, and other natural elements.

When it comes to roof work, there are several ways to promote environmental protection.

There are some specific measures you can take:

- Sustainable Roofing Materials
- Proper Waste Management
- Energy Efficiency
- Rainwater Harvesting
- Green Roofing and Biodiversity
- Minimize Disruption to Wildlife
- Reduce Noise and Air Pollution
- Compliance with Environmental Regulation

1.8.1 Waste management

Proper waste management of roof tiles is important to minimize environmental impact and ensure responsible disposal. Here are some guidelines for managing roof tile waste:

Reuse or Salvage:

- If the roof tiles being removed are still in good condition, consider reusing or salvaging them.
- Tiles that are undamaged and can be safely removed can be reused for other projects or donated to organizations or individuals in need of roofing materials.

Recycling:

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- Check if there are recycling facilities or programs in your area that accept roof tiles for recycling.
- Roof tiles are typically made of materials such as clay, concrete, or terracotta, which can often be recycled and used in the production of new tiles or other construction materials.
- Contact local recycling centers or waste management facilities to inquire about their acceptance of roof tiles and the specific recycling process.

Landfill Disposal:

- If reuse or recycling options are not available, roof tiles may need to be disposed of in a landfill.
- However, it's important to check local regulations regarding the disposal of roof tiles in landfills, as some areas may have restrictions or require specific handling procedures.
- Contact your local waste management authority or landfill facility for guidance on proper disposal methods and any specific requirements.

Separate and Handle Carefully:

- During the removal and handling of roof tiles, take precautions to prevent breakage or damage, as this can increase waste and make recycling or reuse more difficult.
- Separate different types of roof tiles (e.g., clay, concrete) to facilitate proper recycling or disposal.

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Self-Check 1

Name..... ID..... Date.....

Part I: True or False question

I. Instruction: Say true if the statement is correct and false if the statement is incorrect.

1. Tile roofs are not suitable for areas with extreme weather conditions.
2. Tile roofs are lightweight compared to other roofing materials.
3. Tile roofs provide good insulation and energy efficiency.
4. Tile roofs are resistant to fire and insects.
5. Do roof tiles require more maintenance compared to other types of roofing?

Part II: Matching

Instruction: Match the following characteristics with their corresponding type

- | <u>A</u> | <u>B</u> |
|---|---------------------------------------|
| 1 Material options include clay and concrete. | A. Material options. |
| 2 High durability and long lifespan. | B. Durability. |
| 3 Requires regular maintenance. | C. Maintenance requirements. |
| 4 Provides insulation and energy efficiency. | D. Insulation and energy efficiency.. |
| 5 Resistant to fire and insects | E. Resistance properties. |

Part III: Short Answer Questions

1. What are the different types of roof tiles?
2. Can roof tiles be used on flat roofs?
3. What maintenance do roof tiles require?
4. What are some common signs of damage or displacement in roof tiles?
5. What are the advantages of using tile roofs compared to other types of roofs?

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Unit Two: Preparation of roof face

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Installing fall roofing work.
- Elevator for roof
- Roof surface and roof tile structure.
- Setting out roof surface.
- Roof tiles load

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Install fall roofing work.
- Assemble and operating elevator.
- Check roof surface and roof tile structure.
- Mark setting out roof surface.
- Support and distribute load roof tiles

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2.1 Installing fall roofing work.

Fall roofing work refers to roofing projects that are specifically carried out during the autumn season. Fall is a popular time for roofing work due to its generally favourable weather conditions, such as cooler temperatures and lower humidity compared to summer. The more stable weather during fall provides an optimal environment for roof installations, repairs, or maintenance.

Fall roofing work can include various tasks, such as:

- Roof Inspections
- Roof Repairs
- Roof Replacements
- Roof Preparations for winter
- Gutter Maintenance

There are some key aspects to consider for fall roofing work installation:

- Weather Conditions
- Scheduling and Timing
- Leaf and Debris Management
- Roof Inspection
- Roof Preparation
- Material Selection
- Safety Measures
- Professional Installation

2.2 Elevator for roof

Roof elevators are commonly used in construction, maintenance, and repair work on rooftops. They provide a safe and efficient means of transporting workers, tools, materials, and equipment to and from the roof level, eliminating the need for ladders or scaffolding.

There's a general overview of the process:

Planning and Design:

- Determine the purpose and capacity requirements of the elevator.
- Assess the building's structural integrity and suitability for installing an elevator.
- Obtain necessary permits and comply with local building codes and regulations.
- Develop an elevator system design, including floor layout, shaft dimensions, and electrical requirements.

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Procuring Equipment and Materials:

- Purchase or order elevator components from a reputable manufacturer or supplier.
- Ensure that all components meet safety standards and are compatible with each other.

Preparing the Shaft:

- Construct or prepare the elevator shaft according to the design specifications.
- Install necessary structural supports, guide rails, and brackets.
- Ensure the shaft is properly ventilated and insulated.

Installing Components:

- Assemble the elevator car, including the platform, walls, doors, and control panel.
- Install the drive system, which may include a motor, pulleys, and cables or hydraulic systems.
- Position and secure the guide rails within the shaft.
- Connect the electrical wiring, safety devices, and control systems.

Safety Testing and Inspections:

- Conduct thorough safety tests to ensure proper functioning of all components.
- Test emergency systems such as power failure backup, emergency lighting, and communication devices.
- Schedule inspections by relevant regulatory authorities to ensure compliance with safety standards.

Final Adjustments and Commissioning:

- Fine-tune the elevator's performance, including speed, leveling, and door operation.
- Conduct load tests to determine the elevator's maximum capacity.
- Obtain necessary certifications and documentation for compliance.

Ongoing Maintenance and Operation:

- Establish a maintenance schedule to inspect and service the elevator regularly.
- Train building staff or designated personnel on safe elevator operation and emergency procedures.

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- Monitor the elevator's performance, address any malfunctions promptly, and keep records of maintenance and repairs.



Figure 2.1 Elevator for roof

2.3 Roof surface and roof tile structure

The structure of a roof and the type of roof tiles used can vary depending on the architectural style, climate, and specific building requirements. However, here's a general overview of roof surface and roof tile structures:

Roof Tile Structure:

- **Roof Tiles:** Roof tiles are the outermost layer of the roof and provide protection from weather elements. They can be made from various materials, including clay, concrete, slate, metal, or composite materials.
- **Underlayment:** A layer of underlayment, such as roofing felt or synthetic underlayment, is typically installed over the roof deck before the roof tiles. It acts as a secondary barrier against water infiltration.
- **Flashing:** Flashing is used around roof penetrations, such as chimneys, skylights, or vents, to prevent water from seeping into the roof structure. It is typically made of metal, such as aluminum or galvanized steel.
- **Ridge Tiles and Hip Tiles:** Ridge tiles are installed along the peak of the roof, while hip tiles are placed along the roof's hips or sloping edges. They provide a finished look and help protect the roof's vulnerable areas.
- **Fasteners:** Roof tiles are secured to the roof deck using nails, screws, or clips, depending on the specific tile material and design. The fasteners are typically concealed beneath overlapping tiles to maintain a cohesive appearance.

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To check the condition of the roof surface and roof tile structure, you can follow these steps:

Visual Inspection:

- Safely access the roof using a ladder or other approved means of access.
- Walk carefully on the roof surface, paying attention to any potential hazards or weak areas.
- Inspect the roof surface for signs of damage, such as cracks, missing tiles, or loose materials.
- Look for areas where the underlayment or insulation may be exposed or damaged.
- Check for any signs of water stains or leaks on the underside of the roof deck.

Roof Tile Examination:

- Inspect each individual roof tile for cracks, chips, or other signs of damage.
- Check for any loose or displaced tiles that may need to be repositioned or replaced.
- Look for signs of wear or deterioration, such as fading or disintegration of the tile surface.
- Examine the flashing around roof penetrations to ensure it is intact and properly sealed.
- Check the condition of ridge tiles and hip tiles, making sure they are securely in place.

Addressing Issues:

- If you notice any minor damage or loose tiles, consider repairing or replacing them promptly to prevent further issues.
- For significant damage or extensive wear, it may be necessary to consult with a roofing professional for a thorough assessment and recommended repairs or replacements.
- If you observe signs of water damage or leaks, it's important to address the underlying cause and repair any compromised areas to prevent further water intrusion and potential structural damage.

2.4 Setting out roof surface

Setting out the roof surface involves establishing the layout and dimensions of the roof components, such as rafters, battens, and tiles, based on the design and specifications. Here's a general guideline for setting out the roof surface:

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Gather Information:

- Obtain the architectural drawings, roof plans, and specifications for the project.
- Review the design to understand the roof's shape, slope, and any special features or requirements.

Determine Roof Pitch and Layout:

- Identify the roof pitch or slope, which is typically expressed as a ratio (e.g., 1:4, 1:6) or angle (e.g., 20 degrees, 30 degrees).
- Calculate the size and spacing of the roof rafters based on the pitch and span of the roof.
- Determine the position and dimensions of any valleys, hips, ridges, or other structural elements based on the design.

Marking Rafter Positions:

- Measure and mark the positions of the roof rafters on the wall plates or ridge beam according to the calculated spacing.
- Use a chalk line or straightedge to draw lines along the top plates or ridge beam to indicate the positions of the rafters.

Installing Battens:

- Determine the size and spacing of the battens or purlins that will support the roof tiles.
- Mark the positions of the battens on the rafters or trusses, ensuring they are evenly spaced and aligned.
- Install the battens, securing them to the rafters or trusses using appropriate fixing methods, such as nails or screws.

Roof Tile Placement:

- Determine the specific tile layout and pattern based on the design and type of roof tiles being used.
- Start laying the tiles from the eaves or bottom edge of the roof, ensuring they are aligned and properly interlocked or overlapped.
- Continue installing the tiles row by row, working your way up towards the ridge or top of the roof.

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- Trim or cut tiles as necessary to fit around roof penetrations, valleys, or other obstacles.

Check Alignment and Adjustments:

- Regularly check the alignment, levelness, and straightness of the roof surface as you progress.
- Make any necessary adjustments or corrections to ensure a uniform and visually appealing roof surface.

It's important to note that the specific steps and techniques for setting out the roof surface may vary depending on the roofing system, materials used, and regional practices. It's recommended to consult the project's design documents and seek guidance from experienced roofing professionals to ensure accurate and precise roof surface setting out.

2.5 Roof tiles load

The load on roof tiles refers to the forces and weights that the tiles are designed to support without compromising the structural integrity of the roof. The load on roof tiles can be categorized into two main types: dead load and live load.

Dead Load: The dead load refers to the permanent weight of the roofing materials themselves and any fixed components, such as the roof structure, underlayment, battens, and the tiles themselves. It also includes any additional layers or materials, such as insulation or vapor barriers. The dead load is a constant load that the roof must support at all times.

Live Load: The live load refers to temporary or variable loads that can act on the roof, such as snow, wind, and people or equipment that may be present during maintenance or construction activities. Live loads are not constant and can vary depending on the specific circumstances. For example, the live load due to snow accumulation will vary with the amount of snowfall in a particular area.

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Self-Check 2	Written test
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Name..... ID..... Date.....

Part I: True or False question

I. Instruction: Say true if the statement is correct and false if the statement is incorrect.

1. Before installing roof tiles, it is necessary to ensure that the roof face is clean, free from debris, and properly prepared.
2. The preparation of the roof face includes applying a layer of underlayment to provide additional weather protection and insulation.
3. The preparation of the roof face involves installing the roof tiles directly on the bare roof deck without any additional layers or materials.

Part II: Matching

Instruction: Match the numbers (1, 2, 3, and 4) with the corresponding letters (A, B, C, D).

- | | |
|---|---|
| <u>A</u> | <u>B</u> |
| 1 Removal of existing roof materials | A. Ensures a clean and stable base for new roof tiles, allowing for proper inspection and identification of underlying issues. |
| 2 Inspection and repair of the roof deck | B. Provides an additional barrier against moisture and enhances the overall performance of the roof system. |
| 3 Application of underlayment | C. Seals and protects vulnerable areas, such as roof edges and penetrations, from water intrusion. |

Part III: Short Answer Questions

1. Why is it important to clean the roof face before installing new roof materials?
2. What is the purpose of applying underlayment during the preparation of the roof face?
3. Why are flashings and edge trims installed during the preparation of the roof face?
4. What are some common materials used for underlayment in roof preparation?
5. What is the purpose of repairing the roof deck during the preparation process?

Unit Three: Cut and fix battens

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Measure and cut battens.
- Fixing battens.
- Alignment and fixing of battens.

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Measure and cut battens.
- Apply and conform fixing battens.
- Check alignment and fix work.

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3.1 Measure and cut battens

There are detailed instructions and guidelines for measuring and cutting battens for your roof work:

Gather the Necessary Tools:

- Measuring tape or ruler
- Pencil or marker
- Handsaw, circular saw, or miter saw (based on your preference and the precision required)
- Protractor or angle gauge (if angled cuts are necessary)
- Safety equipment (safety glasses, work gloves, etc.)

Determine Batten Size:

- Consider the type of roofing material, recommended batten spacing, and local building codes to determine the appropriate batten size.
- Common batten sizes range between 1x2 inches (25x50mm) and 1x4 inches (25x100mm), but this can vary based on your specific project.

Measure Rafter Spacing:

- Measure the distance between the rafters or roof trusses where the battens will be installed.
- Measure each section individually, as the spacing may vary.
- Use a measuring tape or ruler to get accurate measurements.

Mark the Batten Material:

- Transfer the measurements onto the batten material.
- Use a pencil or marker to mark the desired length on the battens.
- Make sure the marks are straight, clear, and easily visible.

Cut the Battens:

- Place the batten material securely on a stable surface, such as a workbench or sawhorses.
- Using a handsaw, circular saw, or miter saw, carefully cut along the marked lines to achieve the desired lengths.
- Follow proper safety precautions, such as wearing safety glasses and work gloves, and ensure the material is firmly secured during cutting.

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Cut Angles (if necessary):

- If your roof has a pitch or slope that requires angled cuts on the battens, measure and mark the angles on the batten material using a protractor or angle gauge.
- Use a miter saw or handsaw to make the angled cuts accurately.
- Double-check the angle measurements to ensure proper fit and alignment.

Test Fit and Adjust:

- After cutting the battens, perform a test fit by placing them between the rafters or roof trusses.
- Ensure the battens fit properly and lie flat on the roof surface.
- Make any necessary adjustments to the length or angles if required.

Install the Battens:

- Once the battens are cut to the correct size and angle, secure them onto the rafters or roof trusses according to the recommended spacing guidelines.
- Use appropriate fasteners, such as nails or screws, to attach the battens securely.

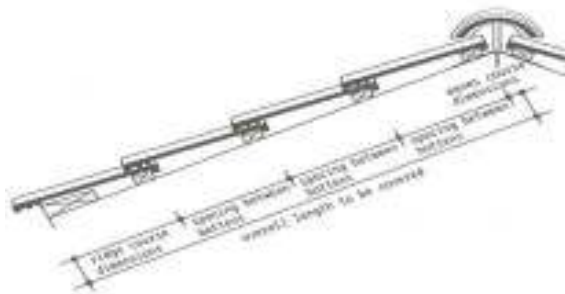


Fig 3.1 Roof Batten Cross-section

3.2 Fixing battens

Fixing battens involves securing them to the roof structure to provide a stable base for the installation of roofing materials.

There are the steps for fixing battens:

Prepare the Work Area:

- Ensure you have a safe and stable working platform, such as scaffolding or a sturdy ladder, to access the roof.

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- Put on appropriate safety gear, including gloves and safety glasses.

Identify the Batten Placement:

- Refer to the roofing plans or guidelines to determine the spacing and layout of the battens.
- Mark the positions of the battens on the roof surface using chalk lines or a measuring tape.

Attach the Battens:

- Start at one end of the roof and position the first batten according to the marked layout.
- Use appropriate fasteners, such as roofing nails or screws, to secure the batten to the roof structure.
- Drive the fasteners through the batten and into the rafters or roof trusses beneath.
- Repeat this process for each batten, ensuring they are aligned with the marked positions and spaced correctly.

Check for Level and Alignment:

- Use a spirit level to check that the battens are level horizontally.
- Adjust the battens as necessary by adding shims or making slight modifications to ensure they are level.
- Also, check that the battens are straight and aligned with the roof's edge or other reference points.

Continue the Batten Installation:

- Work your way across the roof, installing additional battens according to the marked layout and spacing.
- Ensure each batten is securely fixed to the roof structure, maintaining levelness and alignment.

Trim Battens as Needed:

- If any battens extend beyond the roof's edge, use a saw to trim them to the desired length.
- Ensure the cut ends are clean and smooth.

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Final Check and Adjustments:

- Once all battens are installed, double-check their levelness, alignment, and spacing.
- Make any necessary adjustments or corrections to ensure a consistent and stable base for the roofing material installation.



Fig 3.2 Battens Fixing

3.3 Alignment and fixing of battens

Aligning and fixing battens properly is crucial to ensure a stable and even base for the roofing materials.

There are the **steps** for aligning and fixing battens:

Prepare the Work Area:

- Ensure you have a safe and stable working platform, such as scaffolding or a sturdy ladder, to access the roof.
- Put on appropriate safety gear, including gloves and safety glasses.

Determine Batten Placement:

- Refer to the roofing plans or guidelines to determine the layout and spacing of the battens.
- Mark the positions of the battens on the roof surface using chalk lines or a measuring tape.

Establish the Reference Line:

- Start at one end of the roof and establish a horizontal reference line using a chalk line or a long, straight batten.
- This reference line will serve as a guide for aligning the battens.

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Align the First Batten:

- Position the first batten along the reference line, ensuring that it is parallel to the eaves or roof edge.
- Use a spirit level to check that the batten is level horizontally.

Secure the First Batten:

- Once the first batten is properly aligned, secure it to the roof structure using appropriate fasteners, such as roofing nails or screws.
- Drive the fasteners through the batten and into the rafters or roof trusses beneath.
- Space the fasteners according to the manufacturer's guidelines or local building codes.

Align and Fix Subsequent Battens:

- Use the first batten as a guide to align and fix the subsequent battens.
- Position each batten parallel to the reference line and adjacent to the previous batten.
- Check the alignment and levelness of each batten using a spirit level before securing it in place.

Check for Vertical Alignment:

- Use a plumb bob or a spirit level to verify that the battens are vertically aligned.
- This ensures that the battens are perpendicular to the roof surface and will provide a straight and even base for the roofing materials.

Continue Aligning and Fixing Battens:

- Work your way across the roof, aligning and fixing battens according to the marked layout and spacing.
- Double-check the alignment, levelness, and verticality of each batten as you go along.

Trim Battens as Needed:

- If any battens extend beyond the roof's edge, use a saw to trim them to the desired length.
- Ensure the cut ends are clean and smooth.

Final Check and Adjustments:

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- Once all battens are installed, conduct a thorough inspection to ensure they are properly aligned and securely fixed.
- Make any necessary adjustments or corrections to ensure a consistent and stable base for the roofing material installation.

Proper alignment and fixing of battens are essential for the structural integrity and longevity of the roof. If you're unsure or inexperienced, it's recommended to consult with a professional roofer to ensure correct installation and adherence to safety standards.

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Self-Check 3

Name..... ID..... Date.....

Part I: True or False question

I. Instruction: Say true if the statement is correct and false if the statement is incorrect.

1. Cut and fix battens are typically used after the installation of roof tiles.
2. Cut and fix battens are used to provide ventilation and airflow under the roof tiles.
3. Cut and fix battens are used to provide additional insulation to the roof.
4. Cut and fix battens are used to create a level and even surface for the installation of roof tiles.

Part II: Matching

Instruction: Match the numbers (1, 2, and 3) with the corresponding letters (A, B, C).

1	Provides support and alignment for the installation of roof tiles.	A. Supports the proper alignment and attachment of the roof tiles.
2	Creates ventilation and airflow under the roof tiles	B. Facilitates ventilation and airflow, preventing moisture buildup.
3	Helps to ensure a level and even surface for the roof covering	C. Creates a level and even surface for the roof covering.

Part III: Short Answer Questions

1. What is the purpose of cut and fix battens in roofing?
2. What are the benefits of using cut and fix battens in roofing?
3. What is the purpose of creating a level surface with cut and fix battens?
4. Are cut and fix battens necessary for all types of roofing materials?
5. Do cut and fix battens provide any additional benefits besides support and alignment?

Unit Four: Install Roof tiles and clean up

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Load and support tiles to roof
- Cut, spread, install and secure roof tiles.
- Roof, hip and ridge tiles alignment.
- Pointing of roof, valley, hips, ridges tiles
- Clear roof, guttering, downpipes and work area
- Storing methods of tools, equipment and materials

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Load and support tiles to roof
- Cut, spread, install and secure roof tiles.
- Bed and maintain roof, hip and ridge tiles alignment.
- Point of roof, valley, hips, ridges tiles
- Clear roof, guttering, downpipes and work area
- Store methods of tools, equipment and materials

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4.1 Load and support tiles to roof

"Load tiles to roof" generally refers to the process of physically placing or transferring roof tiles onto the roof surface in preparation for installation. Loading tiles to the roof involves the careful handling, positioning, and securing of the tiles to ensure they are properly aligned and supported.

The process typically involves taking the tiles from the ground or a staging area and safely transferring them to the roof. This can be done manually by carrying individual tiles or by using mechanical lifting equipment such as a tile hoist or crane. The tiles are then positioned and arranged in the desired pattern or layout on the roof surface.

General guidance on loading and supporting tiles for a roof. However, please note that working with roofs can be dangerous, and it's important to consult with a professional and follow local building codes and safety guidelines.

There are some steps to consider:

Assess the roof structure

- Before loading any tiles onto the roof, it's important to evaluate the condition and strength of the roof structure. Ensure that it is capable of supporting the weight of the tiles.

Gather the necessary equipment

- You'll need appropriate safety equipment, such as a hard hat, gloves, and non-slip footwear. Additionally, you may require scaffolding or a sturdy ladder to access the roof safely.

Prepare the roof surface

- Ensure that the roof surface is clean and free from any debris. Repair any damaged areas or leaks before proceeding.

Install tile supports

- Depending on the type of roof tiles you're using, you may need to install tile supports or battens. These are typically long, narrow pieces of wood or metal that provide a framework for the tiles to sit on.

They help distribute the weight and maintain proper alignment.

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- Start loading the tiles
- Distribute the weight evenly
- Secure the tiles
- Work in sections
- Take safety precautions

This is a general guideline, and the specific steps may vary based on the type of roof tiles and your local building codes.



Fig 4.1 Loading tiles to roof

4.2 Cut, spread or install and secure roof tiles

4.2.1 Cutting roof tiles

Cutting roof tiles may be necessary to fit them around edges, corners, or other obstacles on the roof.

There are the general steps for cutting roof tiles:

- **Safety precautions:** Before you start cutting tiles, make sure you are wearing appropriate safety gear, including gloves and safety glasses. Tile cutting can produce sharp edges and debris, so take necessary precautions to protect yourself.
- **Measure and mark:** Measure the area of the tile that needs to be cut to fit the desired shape or size. Use a measuring tape or a straightedge to mark the cutting line on the tile's surface. Ensure that your measurements are accurate to achieve a precise fit.
- **Choose a cutting method:** There are several methods you can use to cut roof tiles, depending on the type of tile and the tools available:
 - Tile cutter
 - Wet saw
 - Angle grinder

- **Make the cut:** Once you have chosen the appropriate cutting method, carefully follow the marked cutting line. Apply steady pressure and let the tool do the work, ensuring a smooth and controlled cut. Take your time and avoid rushing to maintain accuracy.
- **Finishing touches:** After the cut is made, inspect the tile for any rough or sharp edges. Use a tile file or sandpaper to smooth out any imperfections and create a clean edge.

C. Cutting Techniques

There are several cutting techniques that can be used for roof tiles, depending on the type of tile and the desired cut.

There are some common techniques:

- **Wet Tile Saw:** A wet tile saw is a popular tool for cutting roof tiles. It uses a diamond-coated blade that is cooled with water to prevent overheating. Wet tile saws are effective for straight cuts and can be adjusted for different angles and depths.
- **Angle Grinder:** An angle grinder with a diamond blade can also be used to cut roof tiles. This handheld tool allows for precise and controlled cuts. However, it requires some skill and caution to ensure a straight cut.
- **Score and Snap:** This technique is commonly used for clay or concrete tiles. A straight line is scored on the surface of the tile using a tile cutter or a tile scorer. Once the line is scored, the tile can be snapped along the scored line. This method is best suited for straight cuts and may not work well for complex shapes or angles
- **Tile Nippers:** Tile nippers are used to make small cuts or adjustments to roof tiles. They have sharp jaws that can nibble away at the tile to create the desired shape or size. Tile nippers are commonly used for trimming or fitting tiles around obstacles like vents or pipes.
- **Tile Cutter:** A manual tile cutter can be used for straight cuts on thinner roof tiles. The tile is placed in the cutter, and a scoring wheel is rolled along the desired cutting line. Once the tile is scored, the lever of the cutter is pressed down to snap the tile along the scored line.

Additionally, make sure to take proper safety precautions, such as wearing protective goggles and gloves, when working with cutting tools.

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Fig 4.2 Roof tile cutting

D. Spreading (installing) roof tiles

The spreading of roof tiles refers to the installation process of arranging and fixing roof tiles on a roof surface. Roof tiles are commonly used in residential and commercial buildings to provide weather protection and aesthetic appeal to the structure.

There are the general steps involved in spreading roof tiles:

- Preparation
- Underlayment
- Starting point
- Tile layout
- Fastening
- Overlapping
- Ridge and hip tiles
- Finishing touches

E. Secure roof tiles

Securing roof tiles refers to the process of properly fastening or fixing individual tiles to the roof structure in order to ensure they remain in place and provide a watertight barrier. Roof tiles are typically made of materials such as clay, concrete, metal, or slate, and they are arranged in an overlapping pattern to create a protective covering for the roof. Securing roof tiles is an essential step in ensuring a durable and weatherproof roof.

Methods used to secure roof tiles:

- Nailing
- Screwing
- Adhesive
- Interlocking Systems
- Clipping or Hooking

It's important to note that the specific method of securing roof tiles may vary depending on the type of tile, local building codes, and manufacturer recommendations.

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Fig 4.3 Securing tiles to roof

4.3 Roof, hip and ridge tiles alignment.

Roof tile alignment is the process of positioning and arranging roof tiles in a uniform and orderly manner during installation. It involves ensuring that the tiles are properly aligned both horizontally and vertically to create a visually appealing and structurally sound roof covering.

- Layout and Planning
- Chalk lines or Guides
- Horizontal Alignment
- Vertical Alignment
- Overlapping and Interlocking
- Trim and Cut Tiles

Techniques to help you align roof tiles effectively:

- **String Line or Chalk Line:** One of the most common techniques for aligning roof tiles is using a string line or chalk line. Start by attaching one end of the string or chalk line at a fixed point along the bottom edge of the roof. Then, stretch it taut along the length of the roof, making sure it is level. This line will serve as a reference guide for aligning the tiles horizontally and vertically. Use the line to visually check if the tiles are aligned accurately.
- **Roofing Guide Boards:** Guide boards can be used as physical guides to ensure consistent alignment of roof tiles. These boards are fixed horizontally or vertically along the roof at predetermined intervals. They act as a reference point for placing the tiles, allowing for precise alignment. Use a level to ensure the guide boards are straight and parallel to the desired alignment. As you install the tiles, position them against the guide boards to maintain alignment.
- **Tile Spacers:** Tile spacers are small plastic or rubber devices that can be placed between tiles to ensure consistent spacing and alignment. They come in various sizes and shapes to accommodate different tile designs. By inserting spacers between tiles,

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you can achieve uniform gaps and alignment throughout the roof. Once the tiles are in place, the spacers can be removed.

- **Manufacturer's Alignment Guides:** Some roof tile manufacturers provide alignment guides or markings on the tiles themselves. These guides can be in the form of notches, grooves, or other indicators that help align the tiles properly. Follow the manufacturer's instructions and align the tiles according to these guides to ensure accurate placement.
- **Visual Inspection:** Regularly step back and visually inspect the alignment of the roof tiles as you progress with the installation. This will help you identify any misalignments or deviations from the desired pattern. Make adjustments as needed to ensure consistent alignment and a visually pleasing result.

Remember, the specific techniques used for aligning roof tiles may vary depending on the type of tile and the manufacturer's recommendations. Additionally, professional installation or consultation may be necessary for complex or specialized roofing systems.



Fig 4.4 Tiles alignment to roof

4.4 Pointing of roof, valley, hips, ridges tiles

Pointing of roof tiles refers to the process of filling the gaps or joints between individual roof tiles with a specialized mortar or sealant material. The purpose of pointing is to provide a weatherproof barrier, enhance the structural integrity of the roof, and improve the overall aesthetic appearance.

When roof tiles are installed, there are naturally occurring gaps or spaces between them. These gaps can allow water, debris, and pests to penetrate the roof structure if left unsealed. Pointing fills these gaps, creating a tight and secure seal between the tiles. It helps to prevent water infiltration, reduce the risk of leaks, and maintain the longevity of the roof.

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The pointing material used for roof tiles is typically a specialized mortar or sealant. The choice of pointing material depends on the type of roof tiles, the climate conditions, and the desired appearance.

Common pointing materials include:

- Cement Mortar
- Polymer-Based Sealants
- Colored Pointing Compounds

The process of pointing typically involves the following steps:

- **Cleaning:** Before pointing, the roof tiles and joints should be thoroughly cleaned to remove any dirt, debris, or loose material. This ensures proper adhesion of the pointing material.
- **Application:** The pointing material is applied into the gaps or joints between the roof tiles using a pointing tool, such as a pointing trowel or a caulking gun. The material is pressed firmly into the gaps, ensuring complete coverage.
- **Finishing:** Once the pointing material is applied, it is often smoothed or tooled to create a neat and uniform finish. This can be done using a pointing trowel or a specialized tool designed for shaping and finishing the pointing material.

Techniques used for pointing roof tiles are:

- **Tuck Pointing:** Tuck pointing is a technique used for pointing roof tiles with cement mortar. It involves applying a base layer of mortar into the gaps between the tiles using a pointing trowel or a mortar bag. After allowing the mortar to partially set, a second layer of mortar, often tinted to match the color of the tiles, is applied on top. The second layer is shaped and tooled to create a neat and flush finish. Tuck pointing is commonly used with clay or concrete roof tiles.
- **Caulking or Sealant Application:** For pointing roof tiles with polymer-based sealants or caulking, the process typically involves using a caulking gun to apply the sealant directly into the gaps between the tiles. The sealant is dispensed along the joint, ensuring complete coverage. After application, the sealant can be smoothed and shaped using a pointing trowel or a specialized tool designed for sealant finishing. This technique is

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often used for roof tiles with minimal movement or in areas with high exposure to moisture.

- **Finishing and Tooling:** Once the pointing material is applied, it is important to finish and tool the joints to create a neat and uniform appearance. This can be done using a pointing trowel, a jointing tool, or a specialized tool designed for shaping and finishing the pointing material. The tool is used to smooth and shape the pointing material, ensuring it is flush with the surface of the tiles and creating a cohesive finish.
- **Cleaning and Maintenance:** After the pointing material has been applied and tooled, it is important to clean any excess material off the surface of the tiles. This can be done using a damp cloth or sponge. It is also recommended to regularly inspect and maintain the pointing over time. If any cracks or deterioration occur, it is advisable to repair or re-point the affected areas to maintain the integrity and functionality of the roof.



Fig 4.5 Pointing roof tiles

4.5 Clear roof, guttering, downpipes and work area

Clearing waste and surplus material from the roof, guttering, and downpipes is crucial for maintaining the functionality and longevity of these components.

Clearing roof tile work typically involves removing and disposing of old or damaged roof tiles and replacing them with new ones. Here are the general steps involved in clearing roof tile work:

There's a step-by-step guide to help you with the process:

- Safety precautions
- Roof debris removal
- Gutter cleaning
- Downpipe clearance
- Inspect and repair
- Proper waste disposal

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Regular maintenance of the roof, gutters, and downpipes is essential to prevent water damage and maintain the integrity of your home. It's recommended to perform these tasks at least twice a year, ideally in the spring and fall seasons, or more frequently if your property is surrounded by trees or experiences heavy rainfall. If you're uncomfortable or unable to perform the task yourself, consider hiring a professional roofing or gutter cleaning service to ensure the job is done safely and effectively.



Fig 4.6 Clearing of roof

4.6 Storing methods of tools, equipment and materials

When it comes to storing tools, equipment, and materials for roof tile work, it's important to prioritize accessibility, organization, and protection from environmental factors. Here are some specific guidelines for storing items related to roof tile work:

Tools:

- **Hand Tools:** Hang hand tools such as hammers, trowels, snips, and tile cutters on a peg board or tool rack. This will keep them easily accessible and prevent them from getting damaged or lost.
- **Power Tools:** Store power tools like tile saws, drills, and nail guns in their original cases or sturdy toolboxes. Make sure they are protected from dust and moisture.
- **Safety Equipment:** Keep safety equipment like goggles, gloves, and safety harnesses in a designated area near the tools for quick and easy access.

Equipment:

- **Ladders:** Store ladders in an upright position, secured against a wall or rack. Make sure they are stored in a dry area to prevent rust or deterioration.

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- **Scaffolding:** If using scaffolding, disassemble it and store the components in a designated area. Keep the frames, planks, and accessories organized for easy reassembly when needed.
- **Roofing Carts or Dollies:** If you have carts or dollies for transporting materials on the roof, store them in a covered area to protect them from the elements.

Materials:

- **Roof Tiles:** Store roof tiles in a covered area, such as a warehouse or storage shed, to protect them from moisture and potential damage. Stack them on pallets or racks to keep them organized and easily accessible.
- **Underlayment and Flashing:** Keep rolls of underlayment and flashing materials in a dry area, away from direct sunlight. Store them upright to prevent bending or warping.
- **Adhesives and Sealants:** Store adhesives, sealants, and other chemicals in a cool, dry place, following the manufacturer's recommendations. Keep them tightly sealed and away from sources of heat or open flames.

General Tips:

- Clearly label containers, shelves, or racks to identify different types of roof tiles, tools, and materials.
- Keep an inventory of your tools and materials to ensure you have an adequate supply and to facilitate reordering when necessary.
- Regularly inspect and maintain your tools and equipment to ensure they are in proper working condition.
- Train your team on proper handling and storage procedures to maintain safety and efficiency.



Fig 4.7 Storing of roof tiles

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Self-Check 4

Name..... ID..... Date.....

Part I: True or False question

I. Instruction: Say true if the statement is correct and false if the statement is incorrect.

1. Roof tiles should be installed starting from the bottom of the roof and working upwards.
2. It is necessary to install a waterproof underlayment beneath roof tiles to provide an additional layer of protection against water penetration.
3. Flashing is used around roof penetrations, such as chimneys or vents, to prevent water leaks at these vulnerable areas.
4. Roof tiles should overlap each other to provide proper water drainage and prevent leaks.

Part II: Matching

Instruction: Match the following roof tile installation techniques with their corresponding descriptions:

<u>A</u>	<u>B</u>
1 Interlocking Tiles	A. Roof tiles that fit together by interlocking mechanisms, providing enhanced stability and resistance against wind uplift.
2 Overlapping Tiles	B. Roof tiles that are installed by overlapping each other, creating a layered pattern.
3 Dry Fix System	C. A method of installing roof tiles without the use of mortar, relying on mechanical fixings and weatherproofing accessories.
4 Mortar Bedding	D. The traditional method of installing roof tiles using a mortar mix to secure the tiles in place.

Part III: Short Answer Questions

1. What are the common methods used to secure roof tiles to the roof structure?
2. What are the key considerations when planning the layout of roof tiles?
3. What are some common tools used for cutting roof tiles to size?
4. What is the role of flashing in roof tile installation?

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Operation sheet-1

Operation Title:

- Install roof tiles

Purpose:

- To provide a protective and durable covering for the roof of a building.

Precautions:

- Requirement of tools and materials
- OHS requirement (Safety)
- Practice active listening.
- Fall Protection
- Proper Ladder Usage
- Structural Inspection
- Weather Conditions

Tools and materials

- | Tools | Materials |
|---------------------|-------------------------------|
| • Roofing Hammer | • Roof Tiles |
| • Roofing Nailer | • Underlayment |
| • Tape Measure | • Roofing Adhesive |
| • Chalk Line | • Roofing Nails or Clips |
| • Tile Cutter | • Flashing |
| • Roof Tile Spacers | • Ridge and Hip Tiles |
| • Roofing Trowel | • Roofing Cement or Mortar |
| • Roofing Knife | • Weatherproofing Accessories |
| • Roofing Pliers | |

- Safety Equipment

Procedure:-

1. Preparation
2. Layout and Alignment
3. Installation of the First Row
4. Installation of Subsequent Rows
5. Cutting and Fitting
6. Installation of Ridge and Hip Tiles
7. Finishing Touches and Inspections

Quality criteria: At the end of this operation customer satisfaction and improvement of the Work progress.

- Check the Alignment and Levelness according to drawing and specification.
- Verify that the roof tiles have been properly overlapped and interlocked to allow for effective water shedding.
- Confirm that the roof tiles are securely attached to the roof deck.
- Inspect the installation of flashing around roof penetrations, valleys, and other vulnerable areas.
- Evaluate the overall appearance of the roof tile installation.

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Lab Test

Name: -----

Date: -----

Time started: -----

Time Finished: -----

Time Allowed: 3 hours

Instruction: For this operation you have given 3 hours for each task and you are expected to finish in the given time.

Task 1: Cut and fix battens for roof

Task 2: Install tiles on the roof after task 1 finished

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Unit Five: Tile roof openings and lay back surfaces

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Soakers and flashings around roof openings.
- Weather proofing around openings.
- Tiles to steep and vertical surfaces

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, the trainee will be able to:

- Prepare and check soakers and flashings for roof openings.
- Apply weather proofing around roof openings.
- Spread and fix tiles to steep and vertical surfaces.

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5.1 Soakers and flashings around roof openings

Roof openings and lay back surfaces play important roles in the construction and maintenance of roofs. Let's explore these concepts further:

- **Soakers:** Soakers are used to create a watertight seal between the roof covering and a vertical abutment, such as a wall or chimney. Soakers are usually made from lead or a synthetic material like EPDM rubber.
- **Roof Openings:** Roof openings are areas where structures penetrate through the roof surface. Common examples of roof openings include chimneys, vents, skylights, dormers, and other types of protrusions. These openings serve various purposes, such as providing ventilation, accommodating plumbing or electrical systems, or allowing natural light into the building.
- **Lay Back Surfaces:** Lay back surfaces are the angled or sloped areas surrounding roof openings. They are designed to facilitate proper water drainage and prevent water infiltration. The angle of the lay back surfaces allows rainwater to flow away from the openings, minimizing the risk of leaks and water damage.
- **Flashing:** Flashing is an integral part of the lay back surfaces around roof openings. It involves the installation of waterproof materials, typically metal, to create a barrier between the roof covering (such as tiles) and the roof opening. Flashing helps redirect water away from vulnerable areas, ensuring a watertight seal.

When it comes to roof openings, such as chimneys, skylights, or vents, soakers and flashings play a crucial role in preventing water leaks and ensuring proper waterproofing.

There are some common materials used for soakers and flashings:

- **Lead:** Lead flashing has been traditionally used for centuries due to its durability and malleability. It can be shaped easily to fit around roof openings and provides excellent waterproofing. However, lead is becoming less common due to environmental concerns.
- **Aluminum:** Aluminum flashing is lightweight, corrosion-resistant, and relatively easy to work with. It is a popular choice for soakers and flashings, especially in residential applications. Aluminum flashing is available in various thicknesses and can be painted to match the roof color.

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- **Copper:** Copper is another long-lasting and corrosion-resistant material that is often used for soakers and flashings. It has an attractive appearance that develops a natural patina over time. Copper flashing is commonly used in high-end or historical buildings.
- **Stainless Steel:** Stainless steel flashing offers excellent durability and resistance to corrosion. It is a robust material suitable for various weather conditions. Stainless steel flashing is commonly used in commercial and industrial applications.
- **EPDM (Ethylene Propylene Diene Monomer):** EPDM rubber flashing is a synthetic material known for its excellent weather resistance and flexibility. It is often used for flashing around irregularly shaped roof penetrations. EPDM flashing is available in rolls or pre-formed shapes.
- **PVC (Polyvinyl Chloride):** PVC flashing is a plastic material that offers good resistance to weathering and UV rays. It is easy to install and suitable for low-slope roofs. PVC flashing is available in various widths and thicknesses.

It's important to note that the choice of flashing material may depend on factors such as the roof type, climate conditions, local building codes, and personal preferences. Consulting with a roofing professional or following manufacturer guidelines is recommended to ensure the appropriate material is selected for your specific roof opening.

Types of Flashing for Roof Openings:

- **Step Flashing:** Step flashing is commonly used around chimneys, dormers, and sidewalls. It consists of individually layered metal pieces that are integrated with the roofing material, providing a stepped appearance. Step flashing directs water away from the opening and prevents it from seeping into the roof structure.
- **Vent Pipe Flashing:** Vent pipe flashing is specifically designed for vent pipes that protrude through the roof. It forms a tight seal around the pipe, preventing water infiltration. Vent pipe flashings often include a rubber or metal boot that fits over the pipe and a base flashing that integrates with the surrounding roofing material.
- **Skylight Flashing:** Skylights require specialized flashing kits to ensure proper installation and water resistance. These kits typically include components such as base flashings, step flashings, and apron flashings, which create a watertight seal around the skylight frame. To check and prepare soakers and flashings for tile roof work, there are some steps to follow:

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- **Assess the Roof Opening:** Examine the specific roof opening, such as a chimney, vent, or skylight. Take note of its dimensions, shape, and any unique features that may impact the flashing installation.
- **Choose the Right Flashing Material:** Select a flashing material suitable for tile roof work. Common options include metal flashings (such as aluminum or copper) or synthetic materials like PVC or rubber. Ensure that the chosen material is compatible with your tile roofing system.
- **Measure and Cut Flashing Pieces:** Take accurate measurements of the roof opening and the surrounding area where the flashing will be installed. Use these measurements to cut the flashing material into appropriately sized pieces. The flashing should extend beyond the edges of the opening to provide adequate coverage.
- **Install Step Flashing:** Step flashing is commonly used for tile roofs. Each step flashing piece should fit between the individual tiles, extending up the sides of the roof opening. Install the step flashing in an interwoven pattern, ensuring a secure fit and proper water shedding.
- **Secure Counter flashing:** Counter flashing is typically used in conjunction with step flashing to provide additional protection and create a watertight seal. It is often embedded into the mortar joints or vertical surfaces of the roof opening. Ensure that the counter flashing overlaps the step flashing and integrates well with the surrounding tiles.
- **Apply Roofing Cement:** Use roofing cement or an appropriate adhesive to secure the flashing in place. Apply the cement or adhesive to the underside of the flashing and press it firmly against the roof surface and tiles. This helps create a strong bond and prevents water intrusion.
- **Check for Proper Alignment and Angles:** Verify that the flashing is properly aligned with the roof opening and that the lay back surfaces have the correct angles for water shedding. Ensure that the flashing fits snugly against the opening and that there are no gaps or areas where water could accumulate.
- **Conduct Water Tests:** After installation, perform water tests to check for any leaks. Spray water from a hose onto the roof opening and observe if any water penetrates the flashing or shows signs of leakage. Address any issues promptly, making necessary adjustments or repairs to ensure a watertight seal.

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Fig 5.1 Openings on roofs

5.2 Weather proofing around openings.

Weatherproofing is the process of protecting a building or structure from the elements to prevent damage, energy loss, and maintain a comfortable interior environment. It involves taking measures to prevent water infiltration, air leaks, and heat transfer.

There are some general weatherproofing techniques:

- **Insulation:** Proper insulation helps to regulate temperature and reduce heat loss or gain. Insulate walls, attics, and crawl spaces using materials such as fiberglass, cellulose, or spray foam insulation. Insulate pipes to prevent freezing.
- **Seal air leaks:** Identify and seal air leaks around windows, doors, electrical outlets, and pipes. Use caulk, weather stripping, or foam sealants to seal gaps and cracks. Pay attention to areas where different materials meet, such as corners, joints, and transitions.

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- **Window and door weather stripping:** Install weather stripping around windows and doors to create a tight seal when closed. Weather stripping materials include adhesive-backed foam tape, V-strip, or door sweeps. Replace worn-out weather stripping as needed.
- **Caulking:** Apply caulk around windows, doors, and other openings to seal gaps and prevent water and air infiltration. Use silicone or latex caulk appropriate for the specific application. Remove old caulk before applying new caulk.
- **Roof maintenance:** Regularly inspect and maintain the roof to prevent water leaks. Repair damaged or missing shingles, flashing, and seals. Clear debris from gutters and downspouts to ensure proper drainage.
- **Exterior siding and sealing:** Check the exterior walls for cracks, gaps, or deteriorated siding. Repair or replace damaged siding and seal any gaps or joints using weather-resistant sealants.
- **Proper drainage:** Ensure that water is directed away from the building. Maintain functional gutters and downspouts, and ensure they are clear of debris. Grade the landscape to promote water runoff and prevent pooling near the foundation.
- **Ventilation:** Proper ventilation helps control moisture levels and prevents condensation and mold growth. Install and maintain exhaust fans in bathrooms, kitchens, and laundry rooms. Ensure attic ventilation to prevent moisture buildup.
- **Storm doors and windows:** Install storm doors and windows for an additional layer of protection against wind, rain, and drafts. Storm doors provide an extra barrier and help reduce air infiltration.
- **Regular maintenance:** Conduct regular inspections of the building's exterior, including walls, roof, and openings. Repair any damaged or deteriorated elements promptly to maintain the effectiveness of weatherproofing.

Weatherproofing requirements may vary depending on the climate conditions in your area.

There are the steps to apply weatherproofing around roof openings:

- Clean the area
- Inspect the flashing
- Measure and cut the flashing
- Install the base flashing
- Apply roofing sealant
- Install the counter flashing
- Inspect and maintain
- Seal the joints

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Fig 5.2 Application of weather proofing around roof openings

5.3 Tiles to steep and vertical surfaces.

There are step-by-step procedures to help you spread and fix roof tiles on steep and vertical surfaces:

- **Safety Precautions:** Prioritize safety by wearing appropriate personal protective equipment (PPE), including non-slip shoes, a safety harness, and a hard hat. Use stable ladders or scaffolding with proper fall protection systems.
- **Surface Preparation:** Ensure the roof surface is clean, free from debris, and structurally sound. Repair any damaged areas or leaks before proceeding. Install underlayment or waterproofing membranes as needed for added protection.
- **Tile Selection:** Choose roof tiles suitable for steep and vertical installations. Common options include clay tiles, concrete tiles, or metal tiles. Consider their weight, durability, and weather resistance based on your specific climate and requirements.
- **Layout and Marking:** Plan the layout of the tiles in advance, considering the roof slope and any architectural features. Use chalk lines or guides to mark the layout on the roof surface, ensuring proper alignment and spacing.
- **Mortar Mixing:** Follow the manufacturer's instructions to mix the mortar to the correct consistency. Typically, this involves combining the mortar mix with water in a bucket until it forms a workable paste.
- **Spreading Mortar:** Using a trowel, spread a thin, even layer of mortar onto the back of each tile. Ensure complete coverage, especially along the edges and corners. Apply enough mortar to create a secure bond, but avoid excessive thickness that may cause the tile to sit too high.

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- **Placing and Fixing Tiles:** Carefully position the tile onto the roof surface, aligning it with the marked layout. Press the tile firmly into the mortar, ensuring a secure bond. Use a rubber mallet or similar tool to tap the tile gently into place, helping it adhere to the mortar.
- **Additional Fastening:** Depending on the type of roof tile and local building codes, additional fastening methods may be required. This can include using nails, clips, screws, or other specialized fasteners. Follow the manufacturer's guidelines and local regulations for proper fastening.
- **Grouting (if applicable):** If the type of roof tiles you're using requires grouting, follow the manufacturer's instructions for mixing and applying the grout. Fill the gaps between the tiles using a grout float, ensuring a smooth and even finish. Wipe off excess grout with a damp sponge or cloth.
- **Finishing and Flashing:** Install appropriate flashing materials around roof penetrations, such as chimneys, vents, or skylights, to prevent water infiltration. Follow proper flashing techniques and materials based on your specific roofing system and local building codes.
- **Regular Maintenance:** Periodically inspect the roof tiles for any damage, cracks, or loose tiles. Replace or repair any damaged tiles promptly to maintain the integrity of the roof.

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Self-Check 5	Written test
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Name..... ID..... Date.....

Part I: True or False question

I. Instruction: Say true if the statement is correct and false if the statement is incorrect.

1. Layback refers to the inclination or angle at which the tile roof extends beyond the vertical wall.
2. A chimney opening in a tile roof accommodates the installation of a skylight.
3. Ventilation openings in a tile roof provide airflow and help prevent moisture buildup.
4. Access openings in a tile roof are created to allow for maintenance or repair purposes.
5. Skylight openings in a tile roof are designed to provide access to the attic or roof space.

Part II: Matching

Instruction: Match the following terms with their corresponding definitions.

- | | |
|-----------------------|--|
| 1 Layback | A. An opening in the tile roof that allows for the installation of a skylight. |
| 2 Chimney opening | B. The inclination or angle at which the tile roof extends beyond the vertical wall. |
| 3 Ventilation opening | C. An opening in the tile roof that accommodates a chimney or flue pipe. |
| 4 Skylight opening | D. An opening in the tile roof that provides ventilation for the attic or roof space. |
| 5 Access opening | E. An opening in the tile roof that allows access for maintenance or repair purposes. |

Part III: Short Answer Questions

1. What is layback in the context of a tile roof?
2. What is the purpose of a chimney opening in a tile roof?
3. How do ventilation openings contribute to a tile roof?
4. Why is access openings created in a tile roof?
5. What is the purpose of a skylight opening in a tile roof?

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Reference

1. Building construction, part 1 by Getachew Yimer
2. Building construction by Dr. B.C.Punmia
3. Building construction by Sushil Kumar
4. Text book of Building construction by Abebe Dinku
5. Building construction principles and practices the motive series
6. <https://www.google.com/search?q=Overview%20of%20roofs%20tile>
7. <https://www.google.com/search?q=Tools%20and%20equipment%20for%20roof%20tiles>
8. <https://www.google.com/search?q=Work%20material%20preparation%20and%20handli%20ng%20for%20tile%20roof>
9. <https://www.google.com/search?q=Environmental%20protection%20for%20tile%20roof>
10. <https://www.google.com/search?q=Materials%20quantity%20estimation%20for%20tile%20roof>
11. <https://www.google.com/search?q=Preparation%20of%20roof%20face%20for%20tile%20Roof>
12. <https://www.google.com/search?q=Installing%20fall%20tile%20roofing%20work>
13. <https://www.google.com/search?q=Elevator%20for%20tile%20roof>
14. <https://www.google.com/search?q=Cut%20and%20fix%20battens>
15. <https://www.google.com/search?q=Tile%20roof%20openings%20and%20lay%20back%20surfa>

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