# Finishing Construction Work

# Level III

## Based on October, 2023, Curriculum Version II

## Module Title: Gypsum Finishing Work

## Module code: EIS FCW3 M08 1023

## Nominal duration: 150 Hour

Prepared by: Ministry of Labor and Skill

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Addis Ababa, Ethiopia

# Contents

**Acknowledgment**

The Ministry of Labor and skill wishes to thank to MOLS experts and TVET trainers who contribute their time and professional experience to the development of this Training module for finishing construction work.

We would like also to express our appreciation to the regional labor and skill bureaus, TVT colleges for their cooperation and technical support of this training module development.

# Acronym

TVT..... Technical vocational educational training

MOLS ..... Ministry of Labor and Skill

LAP .....learning activity performance

PPE .....personal protective equipment

# Introduction to the Module

Gypsum famishing work helps to know the concept of the gypsum finishing work, preparation of the production center, production gypsum board, preparation surface and testing, install and fix of gypsum board and framework and application finishing techniques for gypsum board in finishing construction field. This module cover skill, knowledge and attitude required to Gypsum famishing work.

This module is designed to meet the industry requirement under the finishing construction work occupational standard, particularly for the unit of competency: Gypsum famishing work

**This module covers the units**:

- Introduction of the gypsum finishing work
- Preparation of the production center
- Production gypsum board
- Preparation surface and testing
- Installation and fix of gypsum board and framework
- Application finishing techniques for gypsum board

**Learning Objective of the Module**

- Understanding of the gypsum finishing work
- Prepare of the production center
- Produce gypsum board
- Prepare surface and testing
- Install and fix of gypsum board and framework
- Apply finishing techniques for gypsum board

**Module Instruction**

For effective use these 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

# Unit One: Introduction to Gypsum Finishing Work

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

- Definition of gypsum and its composition
- Properties of Gypsum
- Types of gypsum finishing work
- Safety considerations and regulations

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

- Understanding of the gypsum and its composition
- Describe the Properties of Gypsum
- Identify Types of gypsum finishing work
- Follow Safety considerations and regulations

## 1.1. Definition of gypsum and its composition

Gypsum is a naturally occurring mineral composed of calcium sulfate dihydrate (CaSO4·2H2O). It is a soft and white or grayish mineral that is commonly found in sedimentary rock formations. Gypsum has been used for various purposes for thousands of years, including in construction, agriculture, and industrial applications.

The composition of gypsum consists of calcium sulfate combined with water molecules. Its chemical formula, CaSO4·2H2O, indicates that each calcium sulfate molecule is combined with two water molecules. This composition gives gypsum its unique properties, such as its ability to be easily ground into a fine powder and then rehydrate or set into a solid mass when mixed with water.

When gypsum is heated, it loses its water content and undergoes a process called calcination. The resulting product is called calcined gypsum or "plaster of Paris." Calcined gypsum can be used in various applications, including as a binder in construction materials like plaster, drywall, and cement, as well as in agricultural soil amendments and industrial processes.

Gypsum is known for its fire-resistant properties, as it contains water molecules that are released as steam when exposed to high temperatures, effectively retarding the spread of fire. It is also a good sound insulator and has excellent thermal properties, making it a popular choice in building materials.

In summary, gypsum is a mineral composed of calcium sulfate dihydrate and is widely used in construction, agriculture, and industrial applications due to its unique properties and versatile nature.

## 1.2. Properties of Gypsum

### 1.2.1. Physical Properties of Gypsum

- **Hardness**: Gypsum has a hardness of 2 on the Mohs scale, which means it is a relatively soft mineral and can be easily scratched by a fingernail.
- **Solubility:** Gypsum is moderately soluble in water. When gypsum comes into contact with water, it can dissolve, but its solubility is limited compared to other minerals. This limited solubility is one of the reasons gypsums can be used as a building material, as it does not readily dissolve when exposed to normal environmental conditions.

- **Thermal Properties:** Gypsum has good thermal properties. It is a relatively good insulator and has low thermal conductivity, meaning it does not conduct heat easily. Additionally, gypsum contains water molecules within its crystal structure, and when heated, it releases this water as steam, providing it with fire-resistant properties.

### 1.2.2. Chemical Properties of Gypsum

- **Reaction with Water:** Gypsum exhibits a unique property known as rehydration. When gypsum is mixed with water, it undergoes a chemical reaction and reverts to its original form, calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$). This process is referred to as setting or hardening and results in the formation of a solid material with a specific shape and hardness.
- **Setting Time:** The setting time of gypsum refers to the time it takes for the gypsum plaster or gypsum-based product to harden after mixing with water. Gypsum products have a relatively fast setting time, typically ranging from a few minutes to several hours, depending on the specific product and application. The setting time can be adjusted by altering the formulation and additives used in the gypsum product.

### 1.2.3. Behavior of Gypsum under Different Conditions

- **Moisture Absorption:** Gypsum has a natural affinity for moisture and can readily absorb water vapor from the surrounding environment. This property makes gypsum prone to expansion and contraction in response to changes in humidity levels.
- **Mechanical Strength:** Gypsum exhibits good compressive strength, allowing it to withstand moderate loads. However, it is relatively brittle and has low tensile strength, meaning it is prone to cracking or breaking under tension.
- **Dimensional Stability**: Gypsum has good dimensional stability, meaning it has minimal shrinkage or expansion over time when properly installed and maintained.
- **Durability:** Gypsum is a durable material when protected from continuous exposure to moisture or harsh environmental conditions. However, it can degrade when subjected to prolonged contact with water or high humidity levels.

Understanding the behavior of gypsum under different conditions is crucial for its proper use in construction, where it is commonly used as a building material for interior walls, ceilings, and other applications. Proper installation techniques and consideration of environmental factors are essential to ensure the long-term performance and durability of gypsum-based products.

## 1.3. Gypsum finishing work

Gypsum finishing work refers to the process of applying and finishing gypsum-based materials, such as joint compound, on gypsum boards or drywall surfaces to create a smooth and aesthetically pleasing finish. It involves taping joints, applying joint compound, feathering the compound, sanding the surface, and preparing it for painting or texturing. The goal of gypsum finishing work is to achieve a seamless, uniform, and visually appealing surface on interior walls and ceilings. It is an essential step in the construction or renovation process to create a professional and finished look in residential, commercial, and industrial spaces.

### 1.3.1. Types of gypsum finishing work

There are various types of gypsum finishing work that are commonly used in construction and interior design. Some of the most common types:

a. **Joint Finishing:** Joint finishing, also known as taping and jointing, involves applying joint compound and joint tape to cover and reinforce the joints between gypsum boards or drywall panels. This process ensures smooth and seamless transitions between panels.
b. **Skimming:** Skimming refers to the application of a thin layer of joint compound or gypsum plaster over the entire surface of the gypsum board. It helps to create a smooth and even finish, covering any imperfections or unevenness in the board.
c. **Texturing:** Texturing techniques are used to create decorative patterns or textures on the gypsum surface. This can be achieved using tools, brushes, rollers, or specialized spray equipment. Examples of textured finishes include stippling, swirls, or patterns that add visual interest to the surface.
d. **Veneering:** Veneering involves applying a thin layer of gypsum plaster or veneer plaster over an existing substrate, such as gypsum board or masonry. This technique is used to create a smooth and uniform surface, similar to skim coating, but with a thinner layer of plaster.
e. **Decorative Finishing**: Decorative finishing techniques are employed to create visually appealing and customized finishes on the gypsum surface. This can include techniques like stenciling, faux finishes, or artistic hand-painted designs, allowing for unique and personalized aesthetics.
f. **Sanding and Smoothing:** Sanding is performed to smoothen any rough or uneven areas on the gypsum surface. Sandpaper or sanding tools are used to achieve a uniform finish before priming and painting.

g. **Priming and Painting:** Priming the gypsum surface is important to seal the gypsum and provide a suitable base for paint or other finishes. After priming, the surface can be painted with the desired color or coated with other decorative finishes.

These different types of gypsum finishing work offer a range of options to achieve desired aesthetics and surface quality in construction and renovation projects.

## 1.4. Safety considerations

Safety considerations and regulations play a crucial role in any construction or renovation project involving gypsum or gypsum-related materials. There are some important safety considerations and regulations to keep in mind:

- **Personal Protective Equipment (PPE):** Workers should wear appropriate PPE, such as gloves, safety goggles, masks, and protective clothing, when handling gypsum products. This helps to protect against potential hazards, including skin irritation, eye injuries, and inhalation of dust particles.
- **Dust Control:** Gypsum dust can be generated during cutting, sanding, or other activities, posing a risk of respiratory irritation or allergic reactions. It is important to use dust control measures, such as proper ventilation or dust extraction systems, to minimize airborne dust levels and protect workers' respiratory health.
- **Hazard Identification and Risk Assessment:** Conduct a thorough assessment of the work area to identify potential hazards and assess the associated risks. This includes identifying electrical hazards, working at heights, exposure to harmful substances, and any other potential dangers.
- **Handling and Storage:** Gypsum boards and plaster products should be handled and stored properly to prevent accidents and damage. They should be stacked and stored in a stable manner, away from moisture sources and in designated storage areas.
- **Fire Safety:** Although gypsum itself is fire-resistant, it is important to consider fire safety measures when using gypsum products, especially during installation or renovation. This includes ensuring proper installation of fire-rated gypsum boards and following fire safety codes and regulations.

- **Equipment Safety:** Inspect and maintain all equipment regularly to ensure proper functioning and safety. Follow manufacturer guidelines for the safe operation of machinery and tools, and provide workers with appropriate training on their use.
- **Fall Protection:** Implement fall protection measures, such as guardrails, safety harnesses, and safety nets, when working at heights to prevent falls and protect workers from serious injuries.
- **Electrical Safety:** When working with gypsum boards, electrical fixtures and wiring may be involved. It is essential to follow electrical safety guidelines, such as turning off power sources when working on electrical installations near or within gypsum walls or ceilings.
- **Emergency Preparedness:** Develop and communicate emergency response plans to address potential accidents, injuries, or other emergencies on the job site. This includes having first aid kits readily available and ensuring that workers are trained in basic first aid and CPR.

It is crucial to prioritize safety on construction sites and adhere to relevant safety regulations to protect the health and well-being of workers and occupants of the building. Consulting with local authorities, following manufacturer guidelines, and implementing appropriate safety practices are essential for a safe working environment.

## 1.5. Tool and equipment

Suitably designed tools are essential for high-quality workmanship. Using the right tools for specific jobs can improve efficiency and reduce labor costs. This chapter contains an extensive sampling of tools designed to meet the needs of acoustical, drywall and plaster contractors. Some of the more commonly used hand tools can be found at building material dealers, hardware stores and home centers.

**Spirit Level:** Ensures that steel framing members are level and plumb.

**FIG:1.1.** ***Spirit Level***

**Chalk Line:** A device that holds retractable chalk line and chalk. Also used as plumb bob.

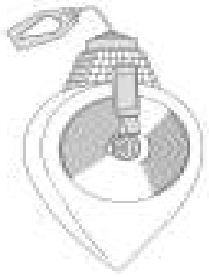

**FIG:1.2.** *Chalk Line*

**String Line:** Strong nylon string that is stretched taut between two distant points, such as midpoints on ceiling grid wall angles, so that additional components can be aligned to the same level plane.

**Water Level:** Useful for ceiling grid installation. Water in transparent hose will be level at two distant points

**FIG:1.3.** *Water Level*

**Laser Alignment Tool:** Utilizes a visible laser beam for all construction alignment jobs. Provides maximum accuracy and speed for laying out partitions and leveling suspended ceiling grids.

**FIG:1.4.** *Laser Alignment Tool*

**Circular Saw:** Cuts wood and steel studs, runners and joists of various gauges with appropriate abrasive metal-cutting blade. Hand held and portable, it ensures easy on-site cutting and trimming. Use a carbide-tipped blade for cutting cement board and gypsum panels.

**FIG:1.5.** *Circular Saw*

**Chop Saw:** Cuts wood and steel framing members with an abrasive metal blade. Its steel base can be placed on a bench, saw horse or floor for fast and efficient gang cutting of members.

**FIG:1.6.** *Chop Saw*

**Band Saw:** Use in cutting wood and steel framing members; a variety of models are available.

**Cut-Off Saw:** Uses an abrasive blade and provides more power than a circular saw. Gas-powered models available

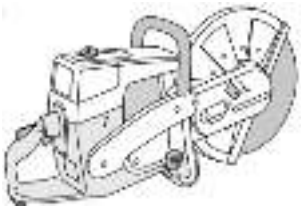

**FIG:1.7.** *Cut-Off Saw*

**Power Fastener Driver:** Drives fasteners into concrete or steel for attachment of framing members. Powder-driven model shown. Also available in air-driven models

**FIG:1.8.** *Power Fastener Driver*

**Lather Nippers**: Used in wire-tie attachment of metal lath, ceiling grid and framing components.

**FIG:1.9.** *Lather Nippers*

**Metal Snips**: Used to cut steel framing components and trims. Several sizes and styles available, including those that make curved cuts

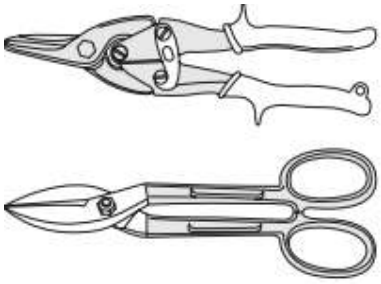

**FIG:1.10.** *Metal Snips*

**Lineman Pliers:** Square-nosed pliers with flat jaws and integral wire cutter. Flat jaws are used for joining wires, such as suspension ceiling tie wires, together by twisting; cutter is used for quickly removing excess.

**FIG:1.11.** *Lineman Pliers*

**Locking Pliers/Clamps:** Holds steel framing and acoustical grid members in place during screw attachment. Adjustable lock mechanism in the grip ensures that clamps hold securely.

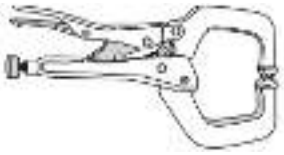

**FIG:1.12.** *Locking Pliers/Clamps*

**Spring Clamps**: Faster and easier to use than locking clamps and excellent for light-duty applications.

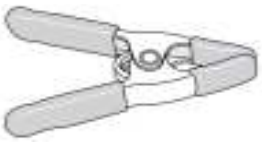

**FIG:1.13.** *Spring Clamps*

**Acoustical Punch Pliers:** Used for punching holes in acoustical ceiling grid main tees for hanger wire attachment or in wall angle to be secured by pop rivets.

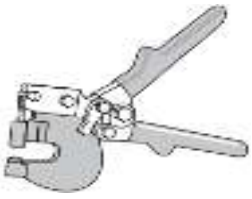

**FIG:1.14.** *Acoustical Punch Pliers*

**Pop Rivet Tool:** Used to flare and secure pop rivets through prepared holes. Useful for securing wall angle to acoustical ceiling grid.

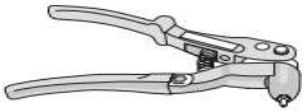

**FIG:1.15.** *Pop Rivet Tool*

**Serrated Knife**: Makes cutting insulation easy

**FIG:1.16.** *Serrated Knife*

**Steel Tape Rule**: Retractable steel tape measure is essential for accurate measurements in preparation for cutting and attaching board.

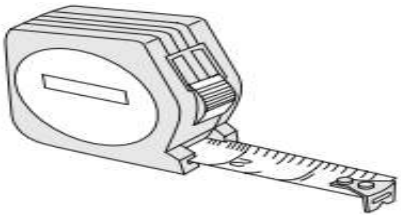

**FIG:1.17.** *Steel Tape Rule*

**T-Square:** it is indispensable for making accurate cuts across the narrow dimension of board products.

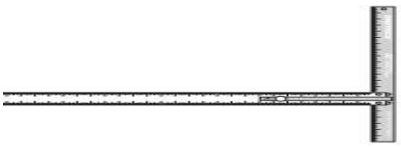

**FIG:1.18.** *T-Square*

**Utility Knife:** The standard knife for cutting board products. Uses replaceable blade; extra blades store in handle

**FIG:1.19.** *Utility Knife*

**Hook-Bill Knife:** Useful for trimming gypsum boards and for odd-shaped cuts. (Also known as linoleum knife.) Carbide-tipped version useful for scoring Durock brand cement board.

**FIG:1.20.** *Hook-Bill Knife*

**Drywall Saw**: Used for cutting gypsum boards quickly and easily. Has short blade and coarse teeth.

**FIG:1.21.** *Drywall Saw*

**Circle Cutter:** Used to cut arcs and circles in gypsum board. Calibrated steel shaft allows accurate cuts up to 40cm diameter

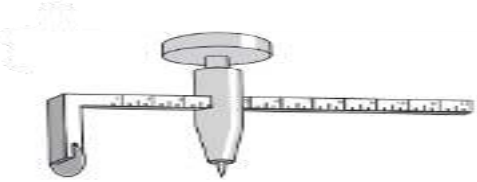

**FIG:1.22.** *Circle Cutter*

**Electric Router**: Used for cutting openings in gypsum panels for electrical boxes, heating ducts and other passageways. Specialty bits are used for cutting cement board or fiber-reinforced gypsum panels

**FIG:1.23.** *Electric Router*

**Tack Claw**: A screwdriver with claw head attached that can be used to remove misapplied fasteners

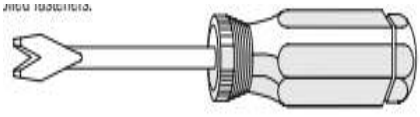

**FIG:1.24.** *Tack Claw*

**Rasp**: Smooths rough-cut edges of gypsum boards quickly and efficiently. Manufactured model features replaceable blade and clean-cut slot to prevent clogging. Job-made model at right consists of metal lath stapled to a wood block

**FIG:1.25.** *Rasp*

**Panel Lift:** Lifts and holds drywall onto ceilings and sidewalls with rollers for easy movement.

**FIG:1.26.** *Panel Lift*

**Drywall Hammer:** Waffle-patterned convex face designed to compress gypsum panel face and leave desired dimple

**FIG:1.27.** *Drywall Hammer*

**Electric Screw Gun**: Drives drywall screws in gypsum board attachment. Special chuck and tip control screw depth to ensure that screw is set at desired depth. Also used for steel-stud framing and acoustical ceilings.

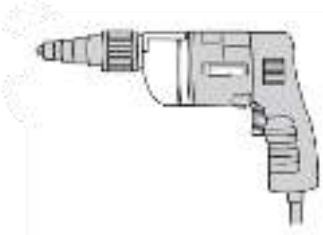

**FIG:1.28.** *Electric Screw Gun*

**Cordless Drill**: Operates with power from battery pack that can be readily recharged

**FIG:1.29.** *Cordless Drill*

**Cartridge-Type Caulking Gun**: Aids uniform application of adhesive. Hand-operated apparatus uses 29-oz. cartridges. Size of caulk bead determined by cut of cartridge nozzle. Smaller version uses 10-oz. cartridges.

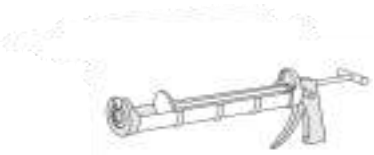

**FIG:1.30.** *Cartridge-Type Caulking Gun*

**Bead Bulk-Type Caulking Gun:** Used for high-volume applications. Cylinder is reloaded from bulk container of adhesive. Trigger mechanism withstands rough usage and offers minimum resistance to large bulk load of adhesive. Gun has 1-qt. capacity

**FIG:1.31.** *Bead Bulk-Type Caulking Gun*

**Loader Pump:** Pump clamps on 5-gal. container to mechanically load bulk-type adhesive hand guns.

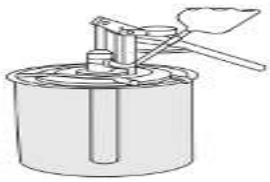

**FIG:1.32.** *Loader Pump*

**Pail Extruder:** Used for high-volume extrusion of adhesives from pails.

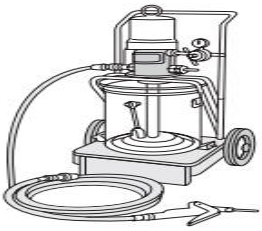

**FIG:1.33.** *Pail Extruder*

**Hand Mixer:** Used for hand mixing joint compounds. Available in several styles. Model with rounded edge is especially effective for scraping material from sides of mixing bucket.

**FIG:1.33.** *Hand Mixer*

**Heavy-Duty Drill:** Use a 1/2″ heavy-duty electric drill operating at a speed of 450–650 rpm for joint compound, 300–600 rpm for textures. Use a 1/2″ electric drill with a no-load rating of 900–1,000 rpm for mixing veneer plasters

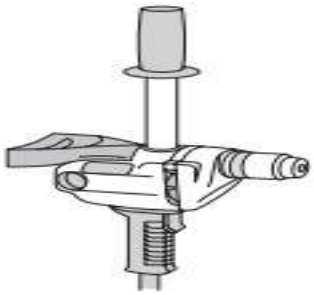

**FIG:1.34.** *Heavy-Duty Drill*

**Veneer Plaster Mixer**: Recommended as the mixer for USG veneer plaster fi nishes, this cage-type paddle provides high-shear action necessary for proper dispersion of plaster ingredients in mixing water and to develop high plasticity in the mix

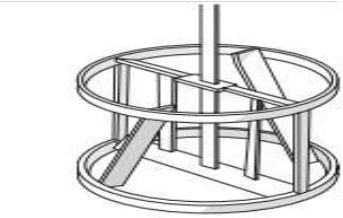

**FIG:1.35.** *Veneer Plaster Mixer*

**Taping Knives**: taping knives designed for taping, fastener spotting, angle taping and finishing.

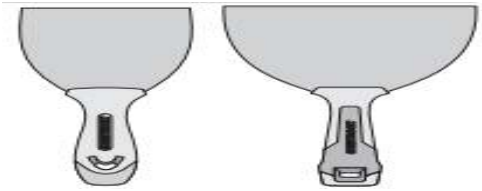

**FIG:1.36.** *Taping Knives*

**Finishing Knives**: 8″ or wider knives designed for finish coating. Drywall finishing knives are available with blade widths from 1″ up to 24″. Offset-handle and long-handle models also available.

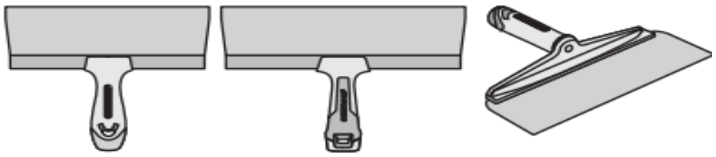

**FIG:1.37.** *Finishing Knives*

**Mud Pan**: Used to carry joint compound. Shaped like a bread pan. Edge of the pan is used for blade cleaning. Available in a wide range of sizes and material composition.

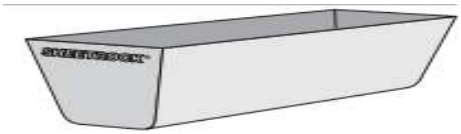

**FIG:1.38.** *Mud Pan*

**Banjo:** Draws paper tape through a compartment filled with joint compound so that both materials are simultaneously applied to joints.

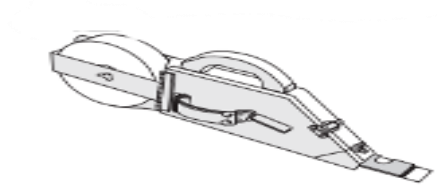

**FIG:1.39.** *Banjo*

**Hand Sander:** Sandpaper attached with end clamps to the base plate. Models include those with wood or aluminum handles.

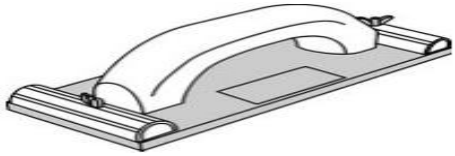

**FIG:1.40.** *Hand Sander*

**Pole Sander**: Enables working large areas with longer strokes and reach.

**FIG:1.41.** *Pole Sander*

**Vacuum Power Sander**: Used for fast and easy sanding of large areas. Vacuum dramatically reduces the number of airborne particles.

**FIG:1.42.** *Vacuum Power Sander*

**Automatic Taper:** Applies a metered amount of compound onto the tape, places the tape on the wall and cuts the tape to length. works for flat joints and corners.

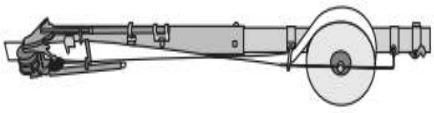

**FIG:1.43.** *Automatic Taper*

**Corner Roller:** Used to embed tape in corner and force excess compound from under tape prior to using the corner applicator head

**FIG:1.44.** *Corner Roller*

**Steel float:** Available in several styles and in lengths from 10″ to 16″. Trowels are the standard tools for veneer plaster and conventional plaster work. Also used by drywall finishers.

**FIG:1.45.** *Steel float*

**Margin Trowel:** A narrow trowel used to touch up small areas and for cleaning tools and equipment.

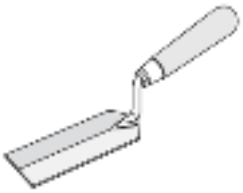

**FIG:1.46.** *Margin Trowel*

**Pointer Trowel:** Pointed trowel enabling finishing of sharp angles.

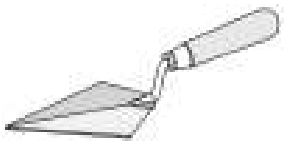

**FIG:1.47.** *Pointer Trowel*

**Angle Trowel**: For interior corner finishing of veneer plaster and drywall jobs

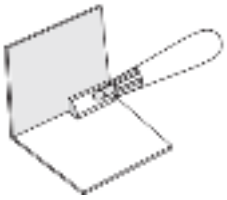

**FIG:1.48.** *Angle Trowel*

**Browning Rod:** Used for leveling base coats of plaster, across grounds or screeds. Also known as a straight edge.

**FIG:1.49.** *Browning Rod*

**Float:** Used for leveling and straightening finish coat or to correct surface irregularities. Also used to produce a sand-finish effect on plaster surfaces. Floats typically are faced with hard rubber (shown) but may also be made of sponge rubber, cork, felt or carpet.

**FIG:1.50.** *Float*

**Blister Brush**: Used to keep the plaster finish wet while finish troweling. This felt-pad brush can also be used for wet sanding joint compound

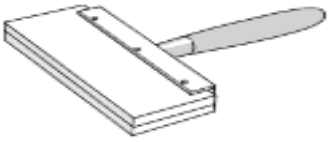

**FIG:1.51.** *Blister Brush*

**Scrub Brush**: Used for cleanup. Residue on tools or containers will affect performance of material.

**FIG:1.52.** *Scrub Brush*

**Stucco Brush**: Used to create a variety of textures from stipple to swirl to splash dash.

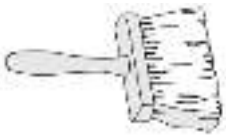

**FIG:1.53.** *Stucco Brush*

**Texture Brush**: Tandem-mounted brushes cover large area to speed texturing job. The texture brush may be attached to a pole for greater reach. Available in many sizes and styles.

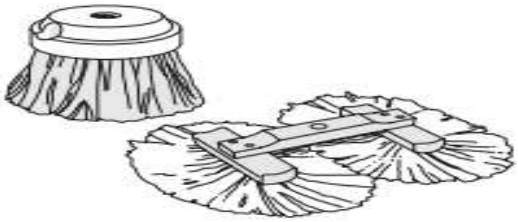

**FIG:1.54.** *Texture Brush*

**Wipe down Blade**: Used for cleaning of walls after application of ceiling texture. Straight wipe down blade is also used to knock down splatters to produce splatter-knockdown surface texture

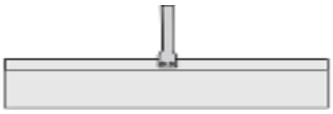

**FIG:1.55.** *Wipe down Blade*

**Airless Spray Equipment**: Specifically designed airless spray pumps deliver paint, joint compound and specialty caulks fast and efficiently. The material is pumped at high pressure with a single piston pump through a high-pressure hose. The high pressure atomizes the material as it leaves the spray tip without the aid of additional air pressure

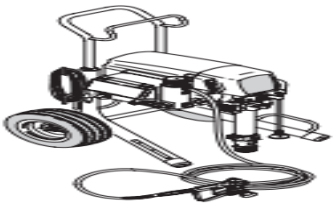

**FIG:1.56.** *Airless Spray Equipment*

**Hoses:** Used to carry material from pump to nozzle. Hoses vary in type and generally have a diameter of 3/4″ to 1″.

**Pole Guns**: Used with any universal spray machine as well as largest of drywall texture machines described earlier in this section. Their length allows any operator to spray moderately high ceilings without scaffolding or stilts. Model shown has electric start-stop control. Also available with air start-stop control

**FIG:1.57.** *Pole Guns*

**Texture Guns:** Professional-type equipment for specific texture applications. Each gun is designed for specific product applications.

**FIG:1.58.** *Texture Guns*

**Gypsum Board Dolly**: Used for efficient transport of gypsum boards around the floors of a building. The load, centered over large side wheels, is easily steered and moved by one worker

**FIG:1.59.** *Gypsum Board Dolly*

**Folding Trestle Horse**: Top surface provides work surface or stand-on work platform. Legs adjust in increments.

**FIG:1.60.** *Folding Trestle Horse*

**Scaffold:** Portable and easy to set up. Wheels lock for safety and security. Wide variety of sizes and types of scaffolds are available to meet job requirements.

**FIG:1.61.** *Scaffold*

# Self-check 1.1

**Part 1: Choose the best answer**

1. Which of the following is the primary component of gypsum?
   a) Calcium carbonate
   b) Calcium sulfate
   c) Calcium oxide
   d) Calcium chloride
2. Gypsum board is commonly used for:
   a) Insulation purposes
   b) Structural support
   c) Fire-resistant applications
   d) Waterproofing
3. The most common type of gypsum board used for finishing walls and ceilings is:
   a) Green board
   b) Blue board
   c) White board
   d) Fire-resistant board
4. Gypsum finishing work involves:
   a) Installing gypsum boards on walls and ceilings
   b) Applying joint compound and tape to seams and corners
   c) Sanding and smoothing the surface
   d) All of the above
5. Which of the following is a common tool used for gypsum finishing work?
   a) Trowel
   b) Hammer
   c) Screwdriver
   d) Paintbrush

**Part II: Write true if the statement is correct and write false if the statement is incorrect**

1. Gypsum is a naturally occurring mineral.
2. Gypsum boards are resistant to moisture.

3. Gypsum finishing work is typically done before painting or wallpapering.
4. Gypsum finishing work requires the use of safety equipment such as goggles and gloves.

**Part II: Give Short Answer for the following question:**

1. What are some properties of gypsum that make it suitable for finishing work?
2. What are some safety considerations when working with gypsum?
3. Name two types of gypsum finishing work techniques.

## Unit Two: Preparation of the Production Center

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

- Production area setup for gypsum board
- Organizing tools and equipment
- Ventilation in the production room

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

- Set up production area for gypsum board
- Organize tools and equipment
- Prepare ventilation in the production room

## 2.1. Production Area Setup for Gypsum Board

Setting up a production area for gypsum board manufacturing requires careful planning and consideration of various factors. Here are some key steps involved in the process:

- **Planning the Layout**: Begin by assessing the available space and determining the optimal layout for the production area. Consider factors such as the size and shape of the space, access to utilities (electricity, water, etc.), and any specific requirements or restrictions.
- **Equipment Placement:** Identify the necessary equipment for gypsum board manufacturing, such as mixers, forming machines, drying ovens, cutting machines, and packaging equipment. Determine the most efficient and logical placement of the equipment within the production area to facilitate smooth material flow and workflow.
- **Workflow Design**: Design the workflow by considering the sequential steps involved in gypsum board manufacturing. This includes material preparation, mixing, forming, drying, cutting, finishing, and packaging. Ensure that the workflow is logical and minimizes unnecessary movement or transportation of materials or products.
- **Material Flow Management**: Efficient management of material flow is crucial for smooth operations. Determine the entry and exit points for raw materials, intermediate products, and finished gypsum boards. Plan the placement of storage areas for raw materials, such as gypsum, additives, and paper liners. Also, consider the flow of waste or byproducts for proper disposal or recycling.

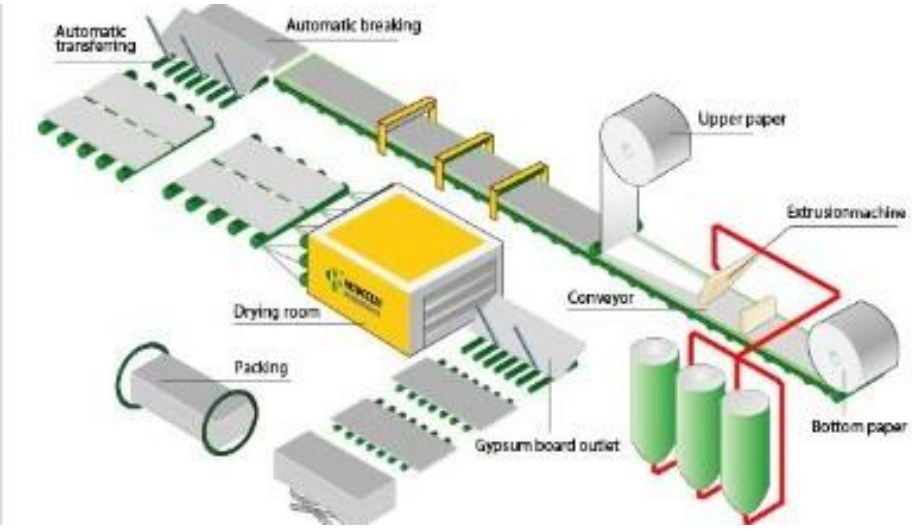


**Fig** 2.1 Workflow

- **Safety Considerations**: Integrate safety considerations into the production area setup. Ensure that there is adequate space for workers to maneuver safely around equipment and machinery. Install safety measures such as safety barriers, emergency stop buttons, and signage. Provide proper ventilation systems to control dust and fumes generated during the manufacturing process.
- **Ergonomics and Accessibility**: Consider ergonomics and accessibility for workers when designing the layout. Ensure that workstations and equipment are positioned at appropriate heights and angles to minimize strain or injuries. Provide clear pathways and sufficient space for workers to move around comfortably.

## 2.2. Organizing tools and equipment

Organizing tools and equipment in a systematic and efficient manner is essential for a well-functioning work environment. There some points highlighting the importance, benefits, and storage/layout considerations for proper tool and equipment organization:

### 2.2.1. Importance of Proper Tool and Equipment Organization:

**Time Efficiency**: Organized tools and equipment save time by reducing the need to search for specific items. When tools are readily accessible and properly stored, workers can quickly locate and retrieve what they need, increasing overall productivity.

**Safety**: Proper organization reduces the risk of accidents and injuries. Tools that are organized and stored correctly are less likely to cause accidents due to mishandling or improper storage. Workers can easily identify and safely use the tools they need, minimizing the chance of accidents.

**Asset Protection**: Organizing tools and equipment helps protect them from damage or loss. Proper storage prevents tools from being misplaced, damaged, or exposed to elements that could cause deterioration. This extends the lifespan of the tools, reducing replacement costs.

**Fig** 2.2 Organizing tools and equipment

### 2.2.2. Benefits of Organized Tools and Equipment

There are numerous benefits to organizing tools and equipment in a systematic and efficient manner. Some key advantages:

- **Time Efficiency:** Organized tools and equipment save time by reducing the need to search for specific items. When tools are properly stored and labeled, workers can quickly locate and retrieve the tools they need for a particular task. This reduces downtime and allows for more productive work.
- **Improved Productivity:** An organized workspace promotes efficiency and productivity. When tools and equipment are arranged in a logical and accessible manner, workers can easily find what they need, leading to smoother workflows and streamlined processes. This enables workers to complete tasks more efficiently and effectively.
- **Enhanced Safety:** Properly organized tools and equipment contribute to a safer work environment. When items are stored in designated locations, there is less risk of tripping or falling over tools left on the floor. Additionally, workers can quickly identify and safely use the tools they need, reducing the chance of accidents or injuries.
- **Asset Protection:** Organizing tools and equipment helps protect them from damage or loss. When tools are stored in a specific location, they are less likely to be misplaced or damaged.

Proper storage also prevents tools from being exposed to harsh environmental conditions or unintentional mishandling, extending their lifespan and reducing the need for frequent replacements.

- **Improved Inventory Management:** Organized tools and equipment facilitate better inventory management. When items are properly labeled and stored, it is easier to keep track of what tools are available and their condition. This allows for more accurate inventory control, reducing the risk of running out of essential tools or overstocking unnecessary items.
- **Time and Cost Savings:** The time saved by having organized tools and equipment directly translates into cost savings. When workers can quickly find the tools they need, there is less time wasted searching or waiting for equipment to become available. This increased efficiency can lead to higher productivity levels and ultimately improve the bottom line.
- **Professionalism and Image:** An organized workspace reflects professionalism and attention to detail. When tools and equipment are neatly arranged, it creates a positive impression on clients, visitors, and employees. It conveys a sense of professionalism, efficiency, and a commitment to quality workmanship.
- **Reduced Stress and Frustration:** A cluttered and disorganized workspace can lead to stress and frustration for workers. It can be mentally and physically taxing to navigate through a chaotic environment. By contrast, an organized workspace promotes a sense of order and reduces stress levels, allowing workers to focus on their tasks with a clearer mindset.

In summary, the benefits of organizing tools and equipment include time efficiency, improved productivity, enhanced safety, asset protection, better inventory management, cost savings, a professional image, and reduced stress. By creating an organized work environment, businesses can optimize their operations and create a more productive and efficient workplace.

### 2.2.3. Tool and Equipment Storage and Layout

Tool and equipment storage and layout refer to the systematic arrangement and organization of tools and equipment in a designated area. It involves creating a structured and efficient system for storing, accessing, and maintaining various tools and equipment used in a specific setting, such as a workshop, construction site, or manufacturing facility.

Tool and equipment storage and layout typically involve the following considerations:

- **Storage Solutions:** Select appropriate storage solutions based on the type, size, and quantity of tools and equipment. Common storage options include cabinets, shelves, drawers, pegboards, toolboxes, and specialized tool racks or hangers.
- **Categorization and Grouping:** Categorize tools and equipment based on their function, size, or frequency of use. Group similar items together to facilitate easy identification and retrieval. This can be done by creating separate sections or compartments within storage units.
- **Accessibility and Ergonomics:** Arrange tools and equipment in a way that ensures easy access and minimizes physical strain for users. Frequently used items should be placed within reach, while less frequently used ones can be stored in less accessible areas. Consider ergonomic principles when determining the height and layout of storage solutions to promote safe and comfortable handling.
- **Labeling and Identification:** Clearly label storage areas or containers to indicate the contents and make it easy to locate specific tools or equipment. Utilize visual cues, such as color-coded labels or tags, to enhance identification and organization.
- **Visual Management:** Use visual indicators, such as outlines or silhouettes, to show where tools and equipment should be stored. This helps ensure items are returned to their designated places after use, maintaining organization and making it visually evident when something is missing or misplaced**.**
- **Security and Safety:** Implement measures to protect valuable tools and equipment from theft or unauthorized access. This may include using lockable storage units or implementing access control systems. Additionally, consider safety measures such as storing sharp or hazardous tools separately or using protective covers or sheaths.
- **Maintenance and Inspection:** Establish a regular maintenance and inspection schedule for tools and equipment. This includes cleaning, lubrication, and periodic checks to ensure they are in good working condition. Designate a separate area or system for tools that require repair or maintenance.
- **Flexibility and Adaptability:** Design the storage and layout system to be flexible and adaptable to changing needs. Consider future growth, new tool acquisitions, or modifications in the workflow, and ensure that the storage system can accommodate these changes.

Overall, an efficient tool and equipment storage and layout system ensures that tools and equipment are well-organized, easily accessible, and properly maintained, contributing to improved productivity, safety, and efficiency in the workplace.

## 2.3. Ventilation in the production room

Ventilation is a critical aspect of any production room, including areas where gypsum board manufacturing takes place. Proper ventilation helps maintain a safe and comfortable working environment by controlling air quality, temperature, and humidity. Here are some important considerations for ventilation in a production room:

- **Air Quality Control:** Effective ventilation helps remove dust, fumes, and airborne particles generated during the manufacturing process. Gypsum board production can generate fine dust, so it's crucial to provide adequate ventilation to prevent the accumulation of airborne particulates. This helps protect the health and well-being of workers and ensures product quality.
- **Temperature Regulation:** Ventilation can aid in regulating the temperature within the production room. Gypsum board manufacturing often involves heat-intensive processes such as drying or curing. Proper ventilation can help dissipate excess heat, preventing the production area from becoming excessively hot. It also helps create a comfortable working environment for employees.
- **Humidity Management:** Maintaining appropriate levels of humidity is essential in gypsum board manufacturing. Excessive humidity can affect the drying process and quality of the boards. Proper ventilation helps remove excess moisture from the production room, ensuring optimal conditions for gypsum board formation and drying.
- **Ventilation System Design:** The design of the ventilation system should consider the specific requirements of the production room. Factors such as room size, equipment layout, and production processes will influence the ventilation system design. It may involve a combination of natural ventilation (windows, doors) and mechanical ventilation systems (exhaust fans, air conditioning) to achieve the desired airflow and air exchange rates.
- **Local Exhaust Ventilation:** Local exhaust ventilation systems can be beneficial in areas where specific equipment or processes generate high levels of dust, fumes, or emissions.

These systems capture and remove contaminants at their source, preventing their dispersion into the surrounding air. Local exhaust ventilation can be particularly useful for controlling dust generation during gypsum grinding or cutting processes.

- **Air Filtration:** In addition to ventilation, incorporating air filtration systems can further enhance air quality by removing fine particles, allergens, or contaminants. Depending on the specific needs and regulations, air filtration systems such as high-efficiency particulate air (HEPA) filters or electrostatic precipitators can be installed to capture and filter airborne particles effectively.
- **Compliance with Regulations:** It is crucial to comply with local regulations and industry standards regarding ventilation in the production room. These regulations may specify requirements for air exchange rates, permissible dust levels, or emission control. Ensure that the ventilation system design meets or exceeds these requirements to maintain a safe and compliant working environment.

Proper ventilation in the production room is essential for the health and safety of workers, product quality, and overall operational efficiency. Consulting with ventilation experts or engineers can help ensure that the ventilation system is appropriately designed and meets the specific needs of your gypsum board manufacturing facility.

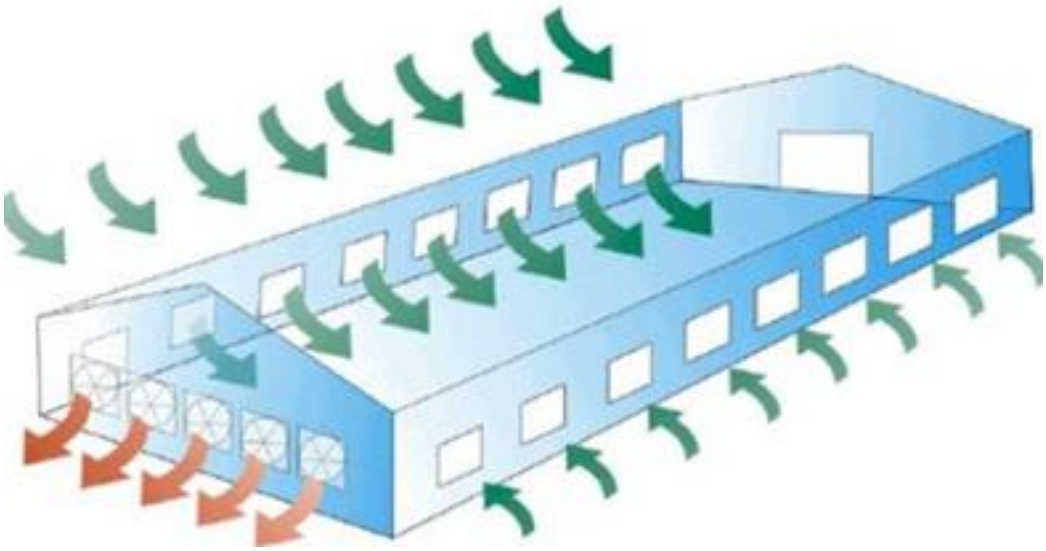

**Fig** 2.3. Ventilation in the production room

# Self-check 2.1

**Part 1: Choose the best answer**

1. Production area setup for gypsum board:
   a) The production area should have adequate lighting.
   b) The production area should be kept at high humidity levels.
   c) The production area should be located near a source of open flame.
2. Organizing tools and equipment:
   a) Tools and equipment should be stored haphazardly in the production area.
   b) Tools and equipment should be properly labeled for easy identification.
   c) Tools and equipment should be shared among workers without any organization.
3. Ventilation in the production room:
   a) Adequate ventilation is not necessary in the production room.
   b) Ventilation helps in removing airborne dust and fumes.
   c) Ventilation can increase the risk of fire hazards.

**Part II: Write true if the statement is correct and writes false if the statement is incorrect**:

1. The production area for gypsum board should be kept at low humidity levels.
2. Organizing tools and equipment is not necessary for efficient production.
3. Adequate ventilation in the production room is important for worker safety.
4. Ventilation can help control the temperature in the production room.

**Part II: Give Short Answer for the following question:**

1. Why is adequate lighting important in the production area for gypsum board?
2. How can organizing tools and equipment benefit the production process?
3. What are some potential risks associated with poor ventilation in the production room?

## Unit Three: Producing Gypsum Board

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

- Material Quantities
- Materials for Gypsum Board Production
- Gypsum Mold
- Mixing materials for gypsum board
- Gypsum board production procedure

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

- Calculating material quantities
- Identify materials for gypsum board production
- Preparing Molds based on gypsum board patterns
- Mixing materials for gypsum board
- Produce of gypsum board

## 3.1. Material quantity

To calculate the material quantities for gypsum board production, you will need to consider the specific dimensions of the boards and the desired production volume. Here's a step-by-step guide on how to calculate the material requirements:

1. **Determine the board dimensions:** Start by determining the dimensions of the gypsum boards you intend to produce. This includes the length, width, and thickness of the boards. For example, let's assume you want to produce gypsum boards that are 8 feet (96 inches) long, 4 feet (48 inches) wide, and 0.5 inches thick.
2. **Calculate the board area:** Calculate the area of each gypsum board by multiplying the length by the width. In our example, the board area would be 96 inches x 48 inches = 4,608 square inches.
3. **Determine the gypsum-to-paper ratio:** Decide on the gypsum-to-paper ratio, which refers to the thickness of the gypsum core compared to the thickness of the paper facing on each side of the board. This ratio can vary depending on the specific product requirements. Let's assume a gypsum-to-paper ratio of 1:1, meaning the gypsum core is 0.25 inches thick, and each paper facing is 0.125 inches thick.
4. **Calculate the gypsum quantity:** Multiply the board area by the gypsum core thickness to determine the quantity of gypsum needed for each board. In our example, the gypsum quantity per board would be 1.20m x 2.40m= 2.88 Meter square x 0.095 meter = 0.274 cubic meters.
5. **Calculate the paper quantity:** Multiply the board area by the paper facing thickness to determine the quantity of paper needed for each board. Since there are two paper facings, multiply by 2. In our example, the paper quantity per board would be 2.88 Meter square x 2 = 5.76 Meter square.
6. **Determine the production volume:** Determine the desired production volume, which refers to the number of gypsum boards you plan to produce. For instance, let's assume you want to produce 1,000 gypsum boards.

7. **Multiply the material quantities by the production volume:** Multiply the gypsum and paper quantities calculated in steps 4 and 5 by the production volume to obtain the total material quantities needed. In our example, if we want to produce 1,000 boards, the total gypsum quantity would be 0.274 cubic meters x 1,000 = 270 cubic meters, and the total paper quantity would be 5.76 Meter square x 1,000 = 5760-meter square.

Remember to consider any additional materials, such as water, additives, or packaging, and factor those into your calculations as well.

It's important to note that these calculations are simplified examples, and the actual material quantities may vary based on the specific production process, board specifications, and other factors.

**Example:** Calculating the material quantities for gypsum board production. In this example, we will assume the following specifications:

- **Board dimensions:**
  - Length: 1.20m
  - Width: 2.40m
  - Thickness of gypsum core: 0.95 centimetre or 0.095meter
  - Thickness of each paper facing: 0.95 centimetre or 0.095meter
- **Production volume:**
  - Desired production volume: 10,000 gypsum boards
  - Now, let's calculate the material quantities step by step:
- **Calculate the board area:**
  - Board area = Length x Width
  - Board area = 1.20m x 2.40m = 2.88 Meter square
- **Determine the gypsum core volume per board:**
  - Gypsum core volume per board = Board area x Thickness of gypsum core
  - Gypsum core volume per board = 2.88 Meter square x 0.095 meter = 0.274 cubic meters.
- **Determine the paper facing area per board:**
  - Paper facing area per board = 2 x (Length x Width)
  - Paper facing area per board = 2 x (1.20m x 2.40m) = 5.76 Meter square
- **Determine the paper quantity per board:**

- Paper quantity per board = Paper facing area per board x Thickness of each paper facing
- Paper quantity per board = 2.88 Meter square x 0.095 Meter square = 0.274 cubic meters.

- **Multiply the material quantities by the production volume:**
  - Total gypsum quantity = Gypsum core volume per board x Production volume
  - Total gypsum quantity = 0.274 cubic meters 10,000 = 2740 cubic meters
  - Total paper quantity = Paper quantity per board x Production volume
  - Total paper quantity = 6.034 cubic meters x 10,000 = 60340 cubic meters

These calculations give you the estimated material quantities for gypsum board production based on the specified dimensions and production volume.

## 3.2. Materials for Gypsum Board Production

Materials for gypsum board production are the components and substances required to manufacture gypsum boards, which are widely used in construction for interior walls and ceilings. The specific materials used can vary depending on the manufacturing process and product specifications.

General overview of the main materials involved:

- **Gypsum:** Gypsum is the primary ingredient in gypsum board production. It is a naturally occurring mineral composed of calcium sulfate dihydrate ($CaSO_4 \cdot 2H_2O$). Gypsum provides the core material for the board, offering fire resistance and sound insulation properties.
- **Fiber:** In the context of gypsum board production, "fiber" refers to fibrous materials that can be added to the gypsum board mixture to enhance its properties. Fibers are commonly used in specific types of gypsum board, such as fiberglass-faced or glass mat gypsum boards, where they provide additional strength, durability, and resistance to cracking. There are different types of fibers that can be used in gypsum board production, including:
  - **Fiberglass:** Fiberglass fibers are thin and flexible strands made from glass. They are commonly used in fiberglass-faced gypsum boards, where a layer of fiberglass is used as the facing material. The fiberglass fibers add strength to the board, improve its impact resistance, and enhance its moisture resistance.

Fig3.1.fiber glass

- **Cellulose:** Cellulose fibers are derived from plant-based materials, typically wood or recycled paper. They are commonly used as reinforcing fibers in gypsum boards. Cellulose fibers improve the board's strength, reduce shrinkage and cracking, and provide better dimensional stability.
- **Synthetic Fibers:** Synthetic fibers, such as polypropylene or nylon fibers, can also be used in gypsum board production. These fibers are added to the gypsum mixture to enhance the board's strength, impact resistance, and crack resistance.
- **Mineral Fiber:** Traditionally, natural fibers have been used in all cultures for making utilitarian products. Different parts of the plant are used. Fibers can be extracted from the bark (banana, jute, hemp, ramie), stem (banana, palm, bamboo), leaf, husk (coir), seeds (cotton), and grass Even before the arrival of man-made fibers, manufacturers could create hundreds of different kinds of fabrics, differing mainly by fiber content, weight, style of weave, or sheen. Here are just a few of these historic fabrics, along with the natural fiber from which they were originally made (nearly all can be made now with other fibers, either natural or synthetic). Natural fibers have traditionally been used in all cultures of the world to meet basic requirements of building material (gypsum production).

**Fig.**3.2. Mineral Fiber

- **Starch:** Starch is used as a binder in gypsum board production. It helps bind the gypsum particles together during the manufacturing process and contributes to the strength and integrity of the final product.
- **Water:** Water is essential for the hydration and setting of gypsum. It is mixed with the gypsum and other additives to form a slurry or paste that is spread onto the facing material and allowed to harden.
- **Additives:** Various additives may be incorporated into the gypsum board production process to modify specific properties or improve performance. These additives can include accelerators, retarders, foam agents, dispersants, and other chemical compounds. They are used to control the setting time, improve workability, enhance fire resistance, reduce shrinkage, or achieve other desired characteristics.

## 3.3. Gypsum Mold

A gypsum mold, also known as a plaster mold, is a type of mold used in various casting and molding processes. It is made from gypsum plaster, a versatile material that can be easily shaped and provides excellent detail reproduction. Gypsum molds are commonly used in art, design, and industrial applications to create replicas, sculptures, ceramics, and architectural elements.

Gypsum molds offer several advantages over other mold-making materials. They are relatively inexpensive, readily available, and easy to work with. Gypsum plaster is a fine powder that, when mixed with water, forms a paste that can be poured or brushed onto a model or pattern. Once the gypsum plaster sets and hardens, it creates a rigid mold that accurately captures the shape and details of the original object.

One of the key benefits of gypsum molds is their ability to produce intricate and highly detailed castings. The fine texture of gypsum plaster allows for precise reproduction of surface textures, intricate designs, and subtle features. This makes gypsum molds particularly useful in applications where capturing fine details is crucial, such as in sculpture, jewellery making, and architectural restoration.

Gypsum molds are also known for their durability and stability. Once the gypsum plaster has fully cured, it forms a strong and stable mold that can withstand the casting process. Gypsum molds can be used multiple times, making them cost-effective for producing multiple replicas or castings.

Another advantage of gypsum molds is their compatibility with a wide range of casting materials. They can be used with various casting materials such as plaster, concrete, resins, and even molten metals, allowing for versatility in the casting process.

It's worth noting that gypsum molds do have some limitations. They are not suitable for high-temperature applications, as gypsum plaster can break down or degrade when exposed to extreme heat. Additionally, gypsum molds may not be as durable as molds made from materials like silicone or urethane, and they may require occasional maintenance and repair.

In summary, gypsum molds are widely used in casting and molding processes due to their ease of use, detail reproduction capabilities, and compatibility with various casting materials. Whether you're a sculptor, artist, designer, or hobbyist, gypsum molds can provide a reliable and cost-effective solution for creating high-quality reproductions and castings.

### 3.3.1. Importance of gypsum board Mold

The importance of gypsum board molds lies in their role in the production of gypsum boards, which are widely used in the construction industry for interior wall and ceiling applications. The key reasons why gypsum board molds are important:

- **Consistent Quality:** Gypsum board molds ensure consistent quality in the production of gypsum boards. The molds are designed to create precise dimensions, smooth surfaces, and uniform thickness, resulting in gypsum boards that meet industry standards and specifications. Consistent quality is essential for the structural integrity, aesthetics, and performance of gypsum boards.
- **Efficient Production:** Gypsum board molds enable efficient and high-volume production of gypsum boards. Once the molds are created, they can be used repeatedly to produce a large number of gypsum boards. This allows for streamlined manufacturing processes, increased productivity, and shorter lead times for supplying gypsum boards to construction projects.
- **Customization and Design Flexibility:** Gypsum board molds provide flexibility in design and customization. They can be designed to produce gypsum boards in various sizes, shapes, and edge details to meet specific project requirements. This allows architects, designers, and contractors to create unique and visually appealing interior spaces with gypsum boards.

- **Cost-Effective Production:** Gypsum board molds contribute to cost-effective production. The molds allow for efficient material usage by precisely controlling the amount of gypsum plaster needed for each board. This helps minimize material waste and reduces production costs. Additionally, the ability to produce gypsum boards in high volumes with consistent quality helps optimize manufacturing efficiency and lowers overall production expenses.
- **Speed of Construction**: Gypsum board molds facilitate the rapid installation of gypsum boards, leading to faster construction timelines. The availability of standardized gypsum board molds allows for efficient board production and quick assembly on-site. This can help accelerate construction projects, providing time and cost savings.
- **Sustainability:** Gypsum board molds contribute to sustainable construction practices. Gypsum boards are recyclable and have a low environmental impact. Molds enable efficient production processes, reducing energy consumption and waste generation. Additionally, the use of gypsum boards in construction projects can contribute to improved indoor air quality and enhanced fire resistance.

In summary, gypsum board molds are crucial for the efficient, high-quality, and cost-effective production of gypsum boards. They enable customization, design flexibility, and rapid construction, while also supporting sustainable construction practices.

### 3.3.2. Types of gypsum board Molds

There are various types of gypsum board molds used in the production of gypsum boards. The specific type of mold used depends on the desired characteristics of the gypsum board and the manufacturing process. some common types of gypsum board molds:

- **Flat Mold:** Flat molds are the most basic type of gypsum board molds. They are used to produce standard flat gypsum boards with smooth surfaces and uniform thickness. Flat molds can be designed to create gypsum boards of different sizes and thicknesses, ranging from standard wallboards to thinner ceiling panels.
- **Tapered Edge Mold:** Tapered edge molds are used to create gypsum boards with tapered edges. These molds are designed to produce gypsum boards that have tapered edges on the long sides, allowing for seamless jointing and a smoother finished appearance. Tapered edge

gypsum boards are commonly used for wall and ceiling applications where a seamless finish is desired.

- **Beveled Edge Mold:** Beveled edge molds are similar to tapered edge molds but produce gypsum boards with beveled edges instead of tapered edges. Beveled edge gypsum boards have a chamfered edge along the long sides, adding a decorative detail to the board. They are often used for aesthetic purposes in applications such as wainscoting or architectural features.
- **Mold for Textured or Patterned Surfaces:** In addition to flat molds, there are molds specifically designed to create gypsum boards with textured or patterned surfaces. These molds can have various designs and textures, such as stucco, embossed patterns, or simulated wood grains. Textured or patterned gypsum boards are used to add visual interest and decorative effects to interior walls and ceilings.
- **Specialty Molds:** Specialty molds are designed for specific gypsum board applications that require unique shapes or features. For example, there are molds for creating gypsum board arches, curves, or domes used in architectural designs. These specialty molds allow for the production of gypsum boards with non-standard shapes or customized features.

Local markets may offer aluminium and glass molds for gypsum board production, depending on the availability of such materials and the preferences of manufacturers in a particular region. Here's some information on aluminium and glass molds for gypsum board:

- **Aluminium Molds**
  - **Aluminum Frame Mold:** This type of mold consists of an aluminum frame that holds the gypsum plaster mixture in place while it sets and hardens. Aluminum frame molds are durable, lightweight, and resistant to corrosion, making them suitable for long-term use in gypsum board production.
  - **Aluminum Edge Mold:** Aluminum edge molds are used to create gypsum boards with specific edge profiles or details. These molds are designed to shape and finish the edges of the gypsum boards, providing a clean and precise appearance.
  - **Aluminum Texture Mold:** Texture molds made from aluminum can be used to create gypsum boards with textured or patterned surfaces. These molds are designed with specific patterns or textures, which are transferred onto the surface of the gypsum board during the production process.

- **Glass Molds:** Glass plates can be used as molds for smaller-scale gypsum board production. The glass plates provide a smooth and flat surface for pouring and shaping the gypsum plaster mixture. They are easy to clean and reuse.

**Fig 3.3.** Glass Mold

It's important to note that the availability of aluminum and glass molds for gypsum board production can vary depending on the local market and the specific manufacturing practices in your area. It would be best to contact local manufacturers or suppliers who specialize in gypsum board production to inquire about the availability of aluminum and glass molds in your region.

## 3.4. Mixing materials for gypsum board

Mixing materials for gypsum board refers to the process of combining the necessary components to create the gypsum slurry or paste used in the manufacturing of gypsum boards. The mixing process involves carefully measuring and blending the materials in specific proportions to ensure the desired properties and characteristics of the final gypsum board product.

The main materials involved in mixing for gypsum board production are:

- **Gypsum:** Gypsum is the primary ingredient and the core material of gypsum boards. It is a naturally occurring mineral composed of calcium sulfate dihydrate. Gypsum powder is mixed with other additives and water to form a paste or slurry.
- **Additives:** Various additives are incorporated into the gypsum mixture to modify and enhance specific properties of the gypsum board. These additives can include retarders, accelerators, water reducers, and fiber reinforcement. Retarders slow down the setting time of the gypsum,

accelerators speed it up, water reducers control the water content, and fiber reinforcement enhances strength and impact resistance.

- **Water:** Water is an essential component in mixing materials for gypsum board. It is added to the gypsum powder and additives to form a workable slurry or paste. The water activates the setting process of the gypsum, causing it to harden and form a solid board.
- **Oil:** it is a liquid that is made up of organic molecules and it helps to prevent sticking of the newly formed billet shell in the mold. Near the mold tube meniscus, the oil decomposes, pyrolysis, to form a gas cushion, which prevents the strand shell from sticking to the mold walls. Mold lube oil is used in most billet casters rather than powders because of cost and other practical considerations.
- **Pigment:** A pigment is a colored substance that is completely or nearly insoluble in water.

## 3.5. Gypsum board Production procedure

### I. Gypsum board (drywall or plasterboard) Production procedure

The production of gypsum board, also known as drywall or plasterboard, involves several steps. Detailed procedure for the production of gypsum board:

a. **Raw Material Preparation:** In the production of gypsum board, the material preparation involves obtaining and processing the necessary raw materials to create the gypsum slurry or paste used in the manufacturing process. The raw materials for gypsum board production like: Gypsum, Fiber, Water and additives.

**b. Mixing and Forming**

- **Mixing:** The powdered gypsum is mixed with water in a mixing machine to form a slurry or paste. The water-to-gypsum ratio is carefully controlled to ensure the appropriate consistency.
- **Additives:** Various additives may be incorporated at this stage, depending on the desired properties of the gypsum board. Common additives include accelerators, retarders, water reducers, and fiber reinforcement. These additives are mixed into the slurry to enhance specific characteristics such as setting time, workability, strength, and fire resistance.
- **Forming:** The gypsum slurry is poured onto a continuous moving sheet of facing material, typically made of paper. Another layer of facing material is applied on top, forming a

sandwich-like structure with the gypsum slurry in between. The facing material acts as a cover on both sides of the gypsum core.

**c. Drying and Setting**

- **Drying:** The continuous sheet of gypsum slurry and facing material moves through a drying chamber. Heat is applied to remove excess moisture from the gypsum core, allowing it to solidify and strengthen. This process may involve the use of hot air or radiant heat.
- **Setting:** As the gypsum core dries, it undergoes a chemical reaction called hydration. This reaction causes the gypsum to harden and set, transforming it into a solid board. The setting time can be influenced by the additives used in the slurry.

**d. Shaping and Cutting**

- **Shaping:** Once the gypsum board has set and dried, it can be shaped into specific dimensions. This can involve cutting the continuous sheet into individual board lengths or shaping it into specialized profiles for specific applications.
- **Cutting**: The shaped gypsum boards are cut to the desired lengths using automated cutting machines or saws. Precision cutting ensures uniformity and accuracy in the final product.

**e. Edge Finishing**

- **Edge Treatment:** The cut gypsum boards may undergo edge finishing to create smooth and uniform edges. This can involve trimming, bevelling, or tapering the edges using specialized equipment. Edge treatment helps facilitate installation and provides a professional appearance.

**f. Quality Control**

- Inspection and Testing: Throughout the production process, quality control checks are performed to ensure the gypsum boards meet the required standards. Inspections may include dimensions, strength, moisture content, and other properties. Sample boards may also be subjected to various tests to verify compliance with specifications.

**g. Packaging and Distribution**

- **Packaging:** Once the gypsum boards pass the quality control tests, they are packaged in bundles or stacks. The boards are typically wrapped in protective materials, such as plastic or paper, and labelled for identification.
- **Distribution:** The packaged gypsum boards are prepared for distribution to construction sites, retailers, or other customers.

It's important to note that the specific production procedure can vary among manufacturers, and they may employ different technologies or variations to achieve specific board characteristics or meet regional standards.

## II. Gypsum board (fiber board) Production procedure

The method of producing Fiber gypsum board comprising the steps of mixing in a preliminary mixing step predetermined amounts of Fibers and water respectively, to form a mixture of wetted, loose fibers; mixing in a mixing step the wetted fibers with a predetermined amount of dry calcined gypsum; premixing an accelerator with one of the components of dry calcined gypsum, fiber and water; promptly laying the mixed composition into a mat; immediately degassing the mat in a first compression step, adding a predetermined amount of water onto the resultant mat; and immediately compressing the mat to form a board composed of bonded fibers and gypsum.

This process may be used to produce a homogeneous board which is preferably a gypsum board reinforced by fiber, such as paper fiber, wherein several layers of board forming materials are placed on each other before the board is fully formed, pressed, and dried and wherein each of the layers is identical in composition. Schafer et al specifically describes the formation of a three-layer board wherein the central, core layer has a composition which differs from the composition of the outer layers.

Specific method of forming gypsum boards using an aluminum and glass mold. While there are different approaches to forming gypsum boards, the traditional method involves the use of continuous forming machines rather than molds. However, I can provide you with a general step-by-step process based on the description you provided:

a. **Preparation of Mixed Gypsum:** Prepare the gypsum slurry or paste by mixing gypsum powder with water according to the manufacturer's recommended ratio. The mixture should have the proper consistency for forming.
b. **Adding Mixed Gypsum in Mold:** Place the aluminum and glass mold in position for casting the gypsum board. Pour the prepared mixed gypsum into the mold, ensuring that it spreads evenly and fills the desired thickness of the board.

Fig:3.4. Mixed Gypsum in Mold

c. **Spreading the Fiber of First Layer:** After pouring the mixed gypsum in the mold, immediately spread a layer of fiber on top of it. The fiber reinforcement helps improve the strength and durability of the gypsum board. The fiber used is typically glass fiber or cellulose fiber, which is evenly distributed over the surface of the gypsum layer.

Fig:3.5. Spreading the Fiber of First Layer

d. **Adding Mixed Gypsum:** Once the fiber layer is in place, add another layer of the mixed gypsum on top, covering the fiber reinforcement. Ensure that the second layer of mixed gypsum is spread evenly and fills the mold to the desired thickness.

Fig:3.6. Spreading the Fiber of First Layer

e. **Consolidation and Levelling:** After adding the second layer of mixed gypsum, use appropriate tools or equipment to consolidate and level the gypsum mixture in the mold. This step helps remove air bubbles, ensure uniform density, and achieve a smooth surface finish.

f. **Setting and Curing:** Allow the gypsum board to set and cure in the mold for a specific period of time. The setting time depends on the gypsum formulation and ambient conditions. During this stage, the gypsum undergoes a chemical reaction, known as hydration, which transforms it into a solid board.

g. **Demoulding:** Once the gypsum board has sufficiently set and cured, carefully remove it from the aluminum and glass mold. The demoulded gypsum board should retain its shape and have a solid, hardened structure. It's worth noting that the specific details and variations in the forming process may differ depending on the manufacturing equipment, techniques, and the desired characteristics of the gypsum board.

**Fig:**3.7. Demoulding Fiber gypsum board

## Self-check 3.1

**Part 1: Choose the best answer**

1. Which one of the following is correct to Material Quantities
   a. Material quantities for gypsum board production are typically measured in kilograms.
   b. Material quantities for gypsum board production are typically measured in liters.
   c. Material quantities for gypsum board production are typically measured in square meters.
2. Which one of the following is correct to Materials for Gypsum Board Production:
   a. Gypsum board production requires gypsum, paper facing, and additives.
   b. Gypsum board production requires cement, wood fibers, and steel.
   c. Gypsum board production requires plastic, glass fibers, and aluminum.
3. one of the following is correct to Gypsum Mold:
   a. A gypsum mold is used to shape gypsum boards during production.
   b. A gypsum mold is used to create decorative patterns on finished gypsum boards.
   c. A gypsum mold is not required in the production of gypsum boards.
4. One of the following is correct to Mixing materials for gypsum board:
   a. Gypsum, water, and additives are mixed together to create a slurry for gypsum board production.
   b. Gypsum boards are produced by simply compressing dry gypsum powder.
   c. Mixing materials is not necessary for gypsum board production.

**Part II: Write true if the statement is correct and write false if the statement is incorrect**

1. Gypsum boards are primarily made from cement.
2. Gypsum boards are commonly faced with paper.
3. Gypsum boards can be shaped using a gypsum mold.
4. The production of gypsum boards does not involve any drying process.

**Part III: Give Short Answer for the following question:**

1. What are some additives used in the production of gypsum boards?
2. How does the drying process contribute to the production of gypsum boards?

3. What are some finishing techniques used in gypsum board production?

## Operation sheet 3.1: production gypsum board

Purpose: To know the production gypsum board

**Equipment Tools and Materials:**

- gypsum
- fiber
- oil
- glass
- trowel
- bucket
- mixing tool

**Instruction:** when produce follow the steps. For this operation you have given 10 day each data

**Steps in doing the task of Gypsum board**

1. Planning the job based of the design
2. Collect the materials
3. Prepare Mold and fibre.
4. Mixing the gypsum
5. Casting: To casting step by step:
    a. First add the mixed gypsum in Mold.
    b. Second spreading the fibre of first layer
    c. Finally add mixed gypsum
6. After casting remove surpluses gypsum and sticked gypsum.
7. Wating gypsum board until drying approximately 15minute
8. Off the gypsum bord from Mold (Glass or aluminium)
9. Properly store the board.

**Quality Criteria:** performing of all the activities according to the procedures

## LAP Test: Practical Demonstration

| LAP Test | Practical Demonstration |
|---|---|

Name: _____ Date: _____

Time started: _____ Time finished: _____

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 10 days for each task.

**Task 1:** Produce of gypsum work

**Task 2:** Install gypsum board on wall

**Task 3:** Install gypsum board on celling

## Unit Four: Surface Preparation and Testing

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

- Introduction to surface preparation
- Surface preparation techniques
- Testing the strength and quality of gypsum board and framing

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

- Understand the Importance of surface preparation for gypsum board and frames
- Identify surface preparation techniques
- Understand and identify testing the strength and quality of gypsum board and framing

## 4.1. Introduction to surface preparation

Surface preparation refers to the process of preparing a material or substrate before applying a coating, finish, adhesive, or any other treatment. It involves a series of steps aimed at cleaning, repairing, and optimizing the surface to ensure proper adhesion, durability, and a high-quality result. Surface preparation is essential to remove contaminants, imperfections, and irregularities that may hinder the performance or appearance of the applied material or treatment.

The specific techniques and methods involved in surface preparation may vary depending on the type of material, the desired outcome, and the specific application. Common surface preparation procedures include cleaning, sanding, grinding, priming, filling, leveling, and applying sealants or coatings. These steps help create a smooth, clean, and properly conditioned surface that promotes optimal adhesion, improves the appearance, and enhances the longevity of subsequent treatments or finishes.

Surface preparation is crucial in various industries and applications, including painting, coating, flooring, construction, automotive, aerospace, and manufacturing. It ensures that the surface is free from contaminants, such as dirt, dust, grease, oil, rust, or old coatings, which can compromise the adhesion and performance of the applied material. Proper surface preparation helps achieve a uniform and durable finish, enhances the effectiveness of treatments and coatings, and contributes to the overall quality and longevity of the final product or structure.

### 4.1.1. Importance of surface preparation

Surface preparation is crucial for gypsum board and frames to ensure proper adhesion, durability, and a high-quality finish. It involves a series of steps to clean, repair, and prime the surfaces before installation or finishing. The importance of surface preparation for gypsum board and frames can be summarized as follows:

- **Adhesion**: Proper surface preparation promotes better adhesion of joint compounds, adhesives, and coatings to the gypsum board and frames. It helps prevent delamination, cracking, or peeling of the finishes, ensuring long-lasting performance.
- **Smooth Finish:** Surface preparation techniques help create a smooth and even surface by eliminating imperfections such as bumps, ridges, or depressions. This allows for a seamless installation and a professional-looking finish.

- **Moisture Resistance:** Gypsum board and frames are susceptible to moisture damage. Adequate surface preparation, including sealing and priming, helps enhance the moisture resistance of these materials, reducing the risk of mold, mildew, and structural damage.
- **Durability:** By preparing the surface properly, you can improve the overall durability of gypsum board and frames. This includes addressing any structural weaknesses, reinforcing joints, and ensuring proper fastening to minimize the risk of sagging or failure over time.

## 4.2. Surface Preparation Techniques

Surface preparation techniques are essential in various industries and applications to ensure that surfaces are properly cleaned, repaired, and optimized before applying coatings, finishes, adhesives, or other treatments. Here are some commonly used surface preparation techniques:

A. **Cleaning:** Cleaning is a fundamental surface preparation technique that involves removing dirt, dust, debris, contaminants, or unwanted substances from a surface. Proper cleaning is crucial to ensure the effectiveness and longevity of subsequent treatments, coatings, or finishes.
   - **Dry Cleaning:** Use brooms, brushes, or vacuums to remove loose debris, dust, or dirt from the surface.
   - **Wet Cleaning:** Use water, detergents, or solvents to remove contaminants like grease, oil, or stubborn dirt.
   - **Pressure Washing:** Utilize high-pressure water jets to clean surfaces, especially for removing tough stains or coatings.

B. **Abrasive Techniques:** Abrasive techniques are surface preparation methods that involve the use of abrasive materials to remove coatings, roughen surfaces, or smooth imperfections. These techniques are commonly used in various industries, such as construction, automotive, metalworking, and manufacturing. Here are some common abrasive techniques:
   - **Sanding:** Sanding is the process of using sandpaper or abrasive pads to remove surface layers, smooth rough areas, or prepare surfaces for painting, staining, or finishing. It is typically performed by hand using sanding blocks or with power tools such as orbital sanders or belt sanders. Different grits of sandpaper are used depending on the desired level of abrasion and smoothing required. Coarse grits are used for heavy material removal, while finer grits are used for finer finishing.

- **Grinding**: Grinding involves using abrasive wheels or discs on power tools to remove material, shape surfaces, or achieve a desired finish. It is commonly used in metalworking, concrete preparation, and woodworking.

  Grinding can be performed using angle grinders, bench grinders, or specialized grinding machines with different types of abrasive wheels, such as grinding discs, grinding stones, or grinding belts.
- **Shot Blasting:** Shot blasting is a method where abrasive particles, such as steel shot or grit, are propelled at high velocity onto the surface using compressed air or centrifugal force. It is effective for removing coatings, rust, scale, or surface contaminants from metal surfaces. Shot blasting machines can be used for large-scale projects, while handheld shot blasting equipment is available for smaller areas or localized treatments.
- **Abrasive Blasting:** Abrasive blasting, also known as sandblasting, involves using compressed air to propel abrasive media, such as sand, garnet, or aluminum oxide, onto the surface to remove coatings, rust, corrosion, or contaminants. It is widely used in surface preparation for metal, concrete, or masonry surfaces. Abrasive blasting can be performed using various types of blasting equipment, including sandblasters, bead blasters, or water blasters.
- **Wire Brushing**: Wire brushing utilizes brushes with wire bristles to remove loose rust, scale, or coatings from surfaces. It is commonly used for smaller-scale projects, hand tools, or areas where power tools may not be suitable. Wire brushes are available in different sizes, shapes, and bristle materials to accommodate various surface materials and cleaning requirements.

**C. Chemical Techniques:** Chemical techniques are surface preparation methods that involve the use of specialized chemicals or solutions to clean, etch, remove contaminants, or prepare surfaces for further treatment. These techniques are commonly used in industries such as manufacturing, construction, automotive, and electronics. Here are some common chemical techniques:

- **Degreasing:** Degreasing is the process of removing grease, oil, lubricants, or other hydrocarbon-based contaminants from surfaces. Solvent-based degreasers or detergent solutions are used to dissolve and remove the grease or oil. Degreasing is important for ensuring proper adhesion of coatings, paints, or adhesives to the surface.

- **Etching:** Etching involves using acidic or alkaline solutions to chemically treat the surface, creating a roughened or textured profile. Acid etching is commonly used on concrete, metal, or glass surfaces to improve adhesion for coatings or to create decorative patterns. Alkaline etching is used on aluminum surfaces to prepare them for anodizing or other surface treatments.
- **Rust Removal:** Rust removal techniques aim to eliminate rust and corrosion from metal surfaces. Chemical rust removers or rust converters are applied to the surface to dissolve or convert the rust into a more stable form. These products typically contain acids or chelating agents that react with the rust, facilitating its removal.
- **Surface Activation:** Surface activation is a chemical technique used to modify the surface properties of materials to enhance adhesion or bonding. Surface activation methods include the use of primers, adhesion promoters, or plasma treatment to increase surface energy and improve bonding characteristics.
- **Paint Stripping:** Chemical paint stripping involves using paint strippers or paint removal solutions to dissolve and remove paint or coatings from surfaces. Paint strippers contain chemicals that break down the paint, allowing it to be scraped or washed off. Different types of paint strippers are available, including solvent-based, caustic-based, or bio-based formulations, depending on the type of paint and surface being stripped.
- **Surface Passivation**: Passivation is a chemical technique used to create a protective layer on metal surfaces to prevent corrosion. Passivation solutions typically contain acids or chemicals that remove impurities from the surface and promote the formation of a passive oxide layer.
- **Cleaning and Surface Preparation Solutions:** Various cleaning and surface preparation solutions are available for specific applications, such as removing adhesives, preparing surfaces for bonding, or removing contaminants. These solutions may include solvent cleaners, alkaline cleaners, acid cleaners, or specialized formulations tailored to specific surface materials or contaminants.

## 4.3. Testing the strength and quality of gypsum board and framing

Testing the strength and quality of gypsum board and framing is essential to ensure the structural integrity and performance of building systems. The importance of testing for strength and quality assessment:

- **Safety:** Testing helps ensure that gypsum board can withstand the expected loads and forces, reducing the risk of structural failure or collapse.
- **Performance:** Testing assesses the mechanical properties of gypsum board to determine its suitability for specific applications, such as load-bearing walls or fire-resistant assemblies.

The key aspects of testing these components:

A. **Gypsum Board Testing:** Gypsum board testing is performed to assess the strength, quality, and performance characteristics of gypsum boards used in construction. Some key aspects of gypsum board testing:

- **Flexural Strength Test:** Measures the board's ability to resist bending or flexing without breaking. A sample of gypsum board is subjected to a gradually increasing load in a controlled manner. The flexural strength is determined by measuring the maximum load the board can withstand before failure.

  The flexural strength test is commonly performed to determine the strength and resistance of materials, including gypsum board, to bending or flexural forces. Here is a general outline of the procedure for conducting a flexural strength test for gypsum board:

  - **Sample Preparation:** Cut rectangular samples from the gypsum board according to the required dimensions. The typical size for gypsum board samples is around 300 mm long and 50 mm wide, with a thickness of about 12.5 mm.
  - **Conditioning:** Condition the samples by allowing them to acclimate to the testing environment for a specified period, typically 24 hours, at a controlled temperature and humidity. This step ensures that the samples reach equilibrium moisture content.
  - **Test Setup:** Place the sample horizontally on two supports, commonly referred to as the "third-point loading" configuration. The supports should be spaced apart at a specific distance, typically 250 mm, with the sample centered on them.
  - **Loading:** Apply a force to the center of the sample using a loading device, such as a mechanical or hydraulic testing machine. The force is typically applied at a constant rate or as per the applicable standard.
  - **Deflection Measurement:** Measure the deflection or deformation of the sample as the load is applied. This can be done using displacement transducers, dial gauges, or similar measuring devices positioned near the center of the sample.

- **Load and Deflection Recording:** Record the applied load and corresponding deflection values at regular intervals or until the sample fails. Plotting a load-deflection curve can provide valuable information about the material's behavior.
- **Calculation of Flexural Strength:** Once the test is completed, calculate the flexural strength of the gypsum board using the recorded data. The flexural strength is typically expressed in terms of the maximum load sustained by the sample at failure or the modulus of rupture.

To calculate the flexural strength of gypsum board, you need to determine the maximum load sustained by the sample at failure and use that information in the appropriate formula. Here's how you can calculate the flexural strength:

- ✓ Measure the maximum load: During the flexural strength test, record the maximum load sustained by the gypsum board sample before it fails. This value is often denoted as P_max.
- ✓ Calculate the moment of inertia: The moment of inertia (I) of the gypsum board sample can be determined based on its geometry. For a rectangular cross-section, the moment of inertia can be calculated using the formula:

$$I = (b * h^3) / 12$$

where:

I is the moment of inertia

b is the width of the sample

h is the thickness of the sample

Calculate the flexural strength: The flexural strength (σ) of the gypsum board can be calculated using the formula:

$$\sigma = (3 * P_{max} * L) / (2 * b * h^2)$$

where:

σ is the flexural strength

P_max is the maximum load sustained by the sample

L is the span length between the supports

b is the width of the sample

h is the thickness of the sample

It's important to note that specific testing procedures and requirements may vary depending on the applicable standards or specifications.

**Example**: calculation of flexural strength for a gypsum board sample. Assuming we have a gypsum board sample with the following dimensions:

Width (b): 50 mm

Thickness (h): 12.5 mm

Span length (L): 250 mm

Maximum load sustained (P_max): 500 N

First, let's calculate the moment of inertia (I) using the formula:

$$I = (b * h^3) / 12$$

Plugging in the values:

$$I = (50 * (12.5^3)) / 12$$

$$I \approx 8,789 \text{ mm}^4$$

Next, we can calculate the flexural strength (σ) using the formula:

$$\sigma = (3 * P_{max} * L) / (2 * b * h^2)$$

Plugging in the values:

$$\sigma = (3 * 500 * 250) / (2 * 50 * (12.5^2))$$

$$\sigma \approx 2000 \text{ N/mm}^2$$

So, the flexural strength of the gypsum board sample is approximately 2000 N/mm^2.

Remember, this is just an example calculation. The actual values and results may vary depending on the specific dimensions and properties of the gypsum board sample, as well as the testing conditions and standards used.

- **Nail Pull Resistance Test**: Evaluates the board's ability to securely hold fasteners, such as nails or screws. A sample of gypsum board is fastened to a rigid backing, and the force required to pull out the fastener is measured. This test provides an indication of the board's ability to hold fasteners under typical construction conditions.
- **Impact Resistance Test:** Assesses the board's ability to withstand impacts without significant damage. A weighted pendulum or falling object is used to strike the board's surface, and the resulting damage or deformation is evaluated. This test helps determine the board's resistance to accidental impacts.

- **Moisture Resistance and Dimensional Stability Testing:** Tests the board's ability to resist moisture absorption and dimensional changes in high humidity or water exposure conditions. Involves subjecting samples to controlled moisture conditions and measuring changes in weight, thickness, or other relevant properties. This testing is crucial to ensure the board's performance and durability in moisture-prone environments.

**B. Framing Testing:** Framing testing is conducted to assess the strength, quality, and performance of framing components used in construction, such as studs, beams, joists, and connections. Some key aspects of framing testing:

- **Load-Bearing Capacity Tests:** Evaluates the load-bearing capacity of framing members, such as studs, beams, or joists. Involves applying controlled loads to the framing system and measuring deflections or other performance indicators. This testing helps determine the maximum load the framing can support without failure.
- **Quality Assessment of Connections:** Ensures that connections between framing members, including fasteners, brackets, or connectors, are secure and reliable. Visual inspection and testing methods, such as pull-out or shear tests, may be used to assess the strength and quality of connections.
- **Structural Integrity Assessment:** Involves inspecting the overall structural integrity of the framing system, including checking for proper alignment, bracing, and overall stability.
- **Deflection Testing:** Measures the deflection or deformation of framing members when subjected to load. Helps evaluate the stiffness and structural behavior of the framing system. Deflection gauges, strain gauges, or displacement sensors may be used to measure deflection.
- **Vibration Testing**: Assesses the dynamic response and vibration characteristics of the framing system. Involves subjecting the framing members to controlled vibration sources or harmonic loading and measuring their response. This testing is particularly important for structures subjected to dynamic loads or vibrations, such as bridges or floors.

Testing the strength and quality of gypsum board is important to ensure that it meets the required standards and specifications for its intended use. Gypsum board, also known as drywall or plasterboard, is widely used in construction for interior walls, ceilings, and partitions.

# Self-check 4.1

**Part 1: Choose the best answer**

1. Why is surface preparation important before installing gypsum board?
   a. To ensure proper adhesion of the gypsum board
   b. To increase the strength of the gypsum board
   c. To reduce the weight of the gypsum board
   d. To improve the sound insulation properties of the gypsum board
2. Which of the following is a common surface preparation technique for gypsum board?
   a. Sanding the surface
   b. Applying primer
   c. Cleaning the surface
   d. All of the above
3. Which of the following tools is commonly used for surface preparation?
   a. Paint roller
   b. Paintbrush
   c. Sandpaper
   d. Screwdriver
4. What is the purpose of testing the strength and quality of gypsum board and framing?
   a. To ensure structural stability
   b. To determine the fire resistance rating
   c. To assess the sound insulation properties
   d. To check for water resistance
5. Which of the following factors can affect the strength and quality of gypsum board and framing?
   a. Moisture exposure
   b. Improper installation
   c. Age and deterioration
   d. All of the above

**Part II: Write true if the statement is correct and write false if the statement is incorrect**

1. Surface preparation is only necessary for exterior applications of gypsum board.

2. Sanding the surface helps to remove imperfections and create a smooth finish.

3. Testing the strength of gypsum board is not required for residential construction.

4. Water exposure does not affect the strength and quality of gypsum board.

**Part III: Give Short Answer for the following question:**

1. Name two surface preparation techniques for gypsum board.

2. How can you test the strength of gypsum board?

3. What are some potential issues to look for when testing the quality of framing?

# Unit Five: Installation and Fixing of Gypsum Board and Framework

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

- Concept of Installation and Fixing of Gypsum Board and Framework
- Types of Gypsum Board Systems
- Installation Techniques for Gypsum Board

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

- Understand the of installation and fixing of gypsum board and framework
- Identify types of gypsum board systems
- Apply Installation techniques for gypsum board

## 5.1. Installation and Fixing of Gypsum Board and Framework

### 5.1.1. Introduction

The installation and fixing of gypsum board and framework are fundamental processes in the construction industry, commonly used for interior walls, ceilings, and partitions. Gypsum board, also known as drywall or plasterboard, is a lightweight and versatile building material made of a gypsum core sandwiched between paper facings. The framework, usually made of wood or metal studs, serves as the structural support for the gypsum board.

### 5.1.2. Importance of proper installation

Proper installation of gypsum board and framework is of utmost importance for several reasons:

- **Structural Integrity:** The correct installation of the framework provides the necessary structural support for the gypsum board. This ensures that the walls, ceilings, or partitions constructed with gypsum boards are stable, strong, and capable of withstanding intended loads and stresses.
- **Safety:** Incorrect installation can compromise the safety of the structure. Properly installed gypsum boards and framework reduce the risk of failures, collapses, or accidents, ensuring the well-being and safety of occupants.
- **Aesthetics:** Proper installation contributes to the overall appearance and aesthetics of the finished space. When gypsum boards are correctly aligned, secured, and finished, it results in smooth, seamless surfaces that provide a visually appealing and professional finish.
- **Sound Insulation:** Gypsum board installations can contribute to sound insulation within a building. Properly installed gypsum boards, along with appropriate insulation materials, help reduce sound transmission between rooms, creating a more comfortable and private environment.
- **Fire Resistance:** Gypsum boards are known for their fire-resistant properties. However, proper installation is crucial to maintain the fire resistance rating of the system. Correctly installed gypsum boards, including sealing joints and penetrations, help prevent the spread of fire and provide valuable time for evacuation and firefighting.
- **Moisture Control:** Proper installation techniques, such as sealing joints and using moisture-resistant gypsum boards in appropriate areas, help protect against moisture intrusion. This is

particularly important in areas prone to high humidity or moisture, such as bathrooms or kitchens, to prevent mold growth, deterioration, and structural damage.

- **Energy Efficiency:** A properly installed gypsum board system, along with insulation materials, can contribute to energy efficiency by improving thermal insulation and reducing heat transfer. This helps create a more comfortable indoor environment and can lead to energy savings.
- **Longevity and Durability:** Correct installation techniques, such as proper fastening, joint treatment, and finishing, enhance the durability and longevity of gypsum board installations. This reduces the likelihood of premature wear, cracking, or damage, ensuring that the system maintains its integrity over time.

Proper installation practices for gypsum board and framework not only ensure the functionality and performance of the system but also contribute to the overall quality and value of the construction project.

## 5.2. Types of gypsum board systems

There are different types of gypsum board systems available, each designed to meet specific applications and requirements. Here is an overview of some common gypsum board systems:

- **Wallboard:** Wallboard, also known as regular gypsum board or drywall, is the most common type used for interior walls in residential and commercial buildings. It consists of a gypsum core sandwiched between paper facings. Wallboard is available in various thicknesses and sizes to accommodate different wall heights and construction requirements.

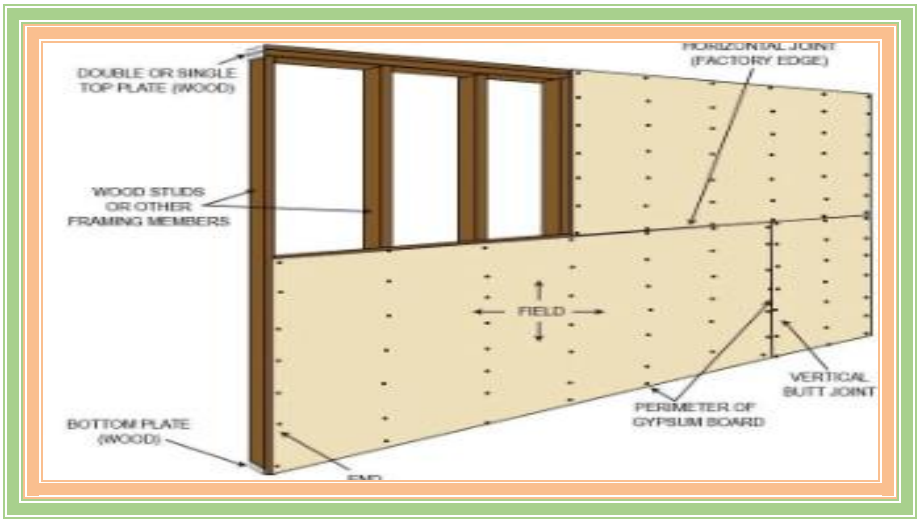


**Fig.**5.1. Wallboard

- **Ceiling Board:** Ceiling board, also referred to as gypsum ceiling tile or gypsum board ceiling, is specifically designed for use on ceilings. It is lightweight and has enhanced sag resistance to withstand the weight of the board itself. Ceiling boards come in different sizes, edge details, and surface patterns to achieve various aesthetic and acoustic requirements.

**Fig.**5.2. Ceiling Board

- **Shaft wall System:** Shaft wall systems are designed for enclosing vertical shafts, such as elevator shafts, stairwells, and utility chases. They consist of specialized gypsum panels, metal studs, and tracks that provide fire resistance and structural stability. Shaft wall systems are engineered to meet specific fire-rated requirements and are typically installed in multi-story buildings.
- **Partition Wall System:** Area separation wall systems, also known as party walls, are used to create fire-rated separation between individual units or townhouses in residential buildings. They consist of multiple layers of gypsum boards with a steel stud frame and insulation in between, providing high fire resistance and sound insulation.

**Fig.**5.3. Partition Wall System

- **Soundproof Wall System:** Soundproof wall systems are designed to reduce sound transmission between rooms or spaces. They typically incorporate multiple layers of gypsum boards, specialized insulation, and resilient channels or sound isolation clips for decoupling the wall from the structural frame. Soundproof wall systems are commonly used in recording studios, theaters, hotels, and other spaces where sound control is crucial.
- **Moisture-Resistant System:** Moisture-resistant gypsum board systems are used in areas with high humidity or moisture, such as bathrooms, kitchens, and laundry rooms. These systems have enhanced water and mold resistance properties, often achieved through the use of moisture-resistant gypsum boards, moisture barriers, and appropriate joint treatment materials.
- **Fire-Resistant System:** Fire-resistant gypsum board systems provide increased fire protection and are designed to slow down the spread of fire. They come in different fire-rated types, such as Type X or Type C, which have specific fire-resistance properties and are used in assemblies requiring fire-rated walls, ceilings, or shaft enclosures.

**Applications and Specific Requirements for Each System:**

The applications and specific requirements for each gypsum board system vary based on their intended use. There are some common applications and requirements:

- **Wallboard:** Used for interior walls in residential and commercial buildings. The specific requirements depend on factors such as fire resistance, sound insulation, and moisture resistance, based on the location within the building.

- **Ceiling Board:** Designed for use on ceilings to achieve an aesthetically pleasing finish and provide acoustic control. Requirements may include sag resistance, fire resistance, sound absorption, and accessibility for maintenance.
- **Shaft wall System:** Installed in vertical shafts, such as elevator shafts and stairwells. These systems must meet specific fire rating requirements to ensure the safety and compartmentalization of the building.
- **Area Separation Wall System:** Used to create fire-rated separation between individual units or townhouses. These systems must meet strict fire resistance and sound insulation requirements to ensure the safety and privacy of occupants.
- **Soundproof Wall System:** Designed to reduce sound transmission between rooms or spaces. These systems require specialized construction techniques and materials to achieve the desired level of sound control.
- **Moisture-Resistant System:** Suitable for areas exposed to moisture or high humidity, such as bathrooms and kitchens. These systems incorporate moisture-resistant gypsum boards, vapor barriers, and appropriate joint treatment to prevent moisture damage and mold growth.
- **Fire-Resistant System:** Used in assemblies requiring fire-rated walls, ceilings, or shaft enclosures. These systems provide increased fire protection and must meet specific fire-resistance ratings based on the building codes and regulations.

It's important to consult the manufacturer's guidelines, local building codes, and project specifications to ensure the selection and installation of the appropriate gypsum board system for a specific application. Professional contractors or specialists in gypsum board installations can provide expertise in determining the suitable system and meeting the specific requirements of a project.

## 5.3. Installation techniques for gypsum board

### 5.3.1. Installation techniques for gypsum board (plaster board)

Proper installation techniques are crucial for achieving a high-quality and durable gypsum board installation. Some key installation techniques for gypsum board:

1. **Measuring and Layout:**
   - Begin by accurately measuring the area where the gypsum board will be installed and plan the layout accordingly. Consider openings, corners, and fixtures in the layout.

- Use a chalk line or a straight edge to mark guidelines on the framing or substrate to ensure accurate placement of the gypsum boards.

2. **Framing:** Install the framework, such as wooden or metal studs, according to the desired spacing and layout. Ensure proper alignment and secure attachment of the framework members. Ensure that the framing is plumb, level, and straight to provide a solid foundation for the gypsum board installation. Framing is an essential step in the installation of gypsum board. Detailed explanation of the framing process:

- **Planning and Layout**
  - Determine the desired layout of the gypsum board walls or ceiling.
  - Mark the locations of walls, partitions, openings (such as doors and windows), and other structural elements according to the building plans or design specifications.
  - Consider factors like load-bearing requirements, architectural design, and local building codes when determining the spacing and layout of the framing members.
- **Selecting Framing Materials**
  - Choose the appropriate framing material based on the project requirements, such as wooden studs or metal studs.
  - Wooden studs are commonly used for residential construction, while metal studs are preferred for commercial and non-load-bearing applications.
  - Ensure the selected framing material meets the required strength, dimensions, and fire-rating specifications.
- **Marking and Cutting**
  - Measure and mark the desired locations of the framing members on the floor or ceiling.
  - Use a chalk line or laser level to create straight and accurate reference lines for aligning the framing.
  - Cut the framing members, such as wooden studs or metal tracks, to the appropriate lengths using a saw or shears.
- **Installation of Wooden Studs**
  - Position the wooden studs vertically along the marked lines, ensuring they are plumb (vertical) and straight.

- Secure the studs to the floor and ceiling using appropriate fasteners, such as nails or screws, at regular intervals.
- Space the studs according to the specific requirements, typically 16 inches on center or 24 inches but this may vary based on local building codes and load-bearing considerations.
- Install additional studs around openings, corners, and edges to provide structural support.

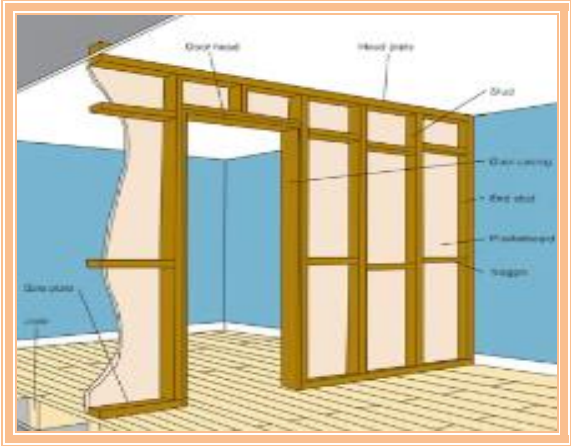

**Fig.**5.4. (a) Wooden Studs for wall

**Fig.**5.4. (b) Wooden Studs for ceiling

- Installation of Metal Studs
  - Attach the metal tracks horizontally to the floor and ceiling using appropriate fasteners, such as screws or anchors.
  - Position the metal studs vertically into the tracks, ensuring they align with the marked lines and are plumb.
  - Secure the metal studs to the tracks using screws or clips designed for metal framing.
  - Space the studs according to the specific requirements, typically 16 inches OC or 24 inches OC, but refer to the manufacturer's guidelines and local building codes for precise spacing recommendations.
  - Install additional studs around openings, corners, and edges as needed.

**Fig.**5.5. (a) Metal Studs for wall

**Fig.**5.5. (b) Metal Studs for ceiling

- **Bracing and Blocking**
  - Install bracing or blocking between the framing members as required to provide additional support, stability, and attachment points for the gypsum boards.
  - Bracing may include horizontal or diagonal members that strengthen the framework and prevent twisting or shifting.
  - Blocking refers to additional framing elements placed within the wall cavities to provide support for fixtures, attachments, or to facilitate the installation of electrical or plumbing components.

Proper framing is crucial for the structural integrity and stability of the gypsum board installation. Following building codes, plans, and industry best practices will help ensure a solid and secure framework for the gypsum board installation.

3. **Positioning the gypsum boards**: Positioning the gypsum boards is an important step in the installation process. Guide on how to properly position gypsum boards:
   - Preparation
     - Ensure that the framing or substrate is clean, level, and ready for the gypsum board installation.
     - Remove any obstructions or debris from the surface where the gypsum boards will be placed.
   - Layout and Markings

- Refer to the project plans or design specifications to determine the layout of the gypsum boards.
- Use a measuring tape, level, and chalk line to mark the locations where the edges of the gypsum boards will be positioned.
- Take into account any openings, such as doors or windows, and plan the layout accordingly.

- Handling the Gypsum Boards
  - Gypsum boards can be heavy and fragile, so handle them with care.
  - Use proper lifting techniques or assistance when moving larger or heavier boards.
  - Avoid bending or flexing the boards, as this can cause damage or cracking.
- Aligning the Edges
  - Lift the gypsum board into position against the framing or substrate.
  - Align the edges of the gypsum board with the layout lines or markings you made earlier.
  - Ensure that the board is positioned correctly, with the front-facing side of the gypsum board facing outward.
- Checking for Level and Plumb
  - Use a level to check if the gypsum board is plumb (vertical) and level horizontally.
  - Adjust the positioning as needed to achieve a level and plumb installation.
  - Pay attention to any specific requirements or design considerations, such as sloped ceilings or angled walls.
- Butt Joints and End-to-Edge Placement
  - Butt joints occur where two gypsum boards meet without overlapping.
  - Position the boards closely together, ensuring a tight and even seam along the joint.
  - For end-to-edge placement, where the gypsum board ends meet the edge of another board, ensure a snug fit with no gaps.
- Maintaining Consistent Gaps
  - Leave a small gap, usually around 1/8 to 1/4 inch, between gypsum boards and adjacent surfaces, such as walls, ceilings, or floors.

- These gaps allow for expansion and contraction of the gypsum board and provide space for joint treatment.

- Temporary Support
  - If needed, use temporary supports, such as braces or T-shaped wooden or metal props, to hold the gypsum boards in place during installation.
  - This can be especially helpful for larger or heavier boards or when working on ceilings.

By carefully positioning the gypsum boards and ensuring that they are level, plumb, and properly aligned, you'll create a solid foundation for the rest of the installation process. Taking the time to accurately position the boards will result in a professional and aesthetically pleasing finished product.

4. **Fastening:** Fastening is a critical step in the installation of gypsum board. It involves securing the gypsum boards to the framing or substrate using appropriate fasteners. Here's a guide on fastening gypsum board:
   - Selecting Fasteners
     - Choose the appropriate fasteners based on the type of framing and the specific requirements of the project.
     - For wooden framing, use drywall screws or nails. Drywall screws are commonly preferred due to their stronger hold and resistance to popping out.
     - For metal framing, use self-drilling screws designed for attaching gypsum board to metal studs or tracks. These screws have a sharp point that can penetrate the metal easily.
   - Fastener Spacing and Placement
     - Follow the manufacturer's guidelines and local building codes for the recommended fastener spacing and placement.
     - Typically, fasteners are placed every 7 to 12 inches along the edges of the gypsum boards and every 12 to 16 inches in the field.
     - Leave a gap of about 3/8 inch between the fasteners and the edges or corners of the gypsum board to prevent cracking.
   - Attaching Gypsum Board to Wooden Framing
     - Position the gypsum board against the framing, ensuring proper alignment and fit.
     - Drive drywall screws or nails into the gypsum board and through the paper facing, penetrating into the wooden framing members.

- Use a screw gun or drill with a screwdriver bit for screws, or a hammer or nail gun for nails.
- Drive the screws or nails slightly below the surface of the gypsum board without breaking the paper facing. This allows for proper finishing of the joints.

- Attaching Gypsum Board to Metal Framing
  - Position the gypsum board against the metal studs or tracks, ensuring proper alignment and fit.
  - Use self-drilling screws designed for metal framing to attach the gypsum board to the metal members.
  - Drive the screws into the gypsum board and through the metal, allowing the screw to self-drill and tap into the metal.
  - Make sure the screws are flush with the surface of the gypsum board, but avoid over-tightening, as it may damage the board.
- Fastening at Corners and Edges
  - Pay special attention to fastening at corners and edges, as these areas are prone to cracking and damage.
  - Place additional fasteners near corners and edges to provide extra support and prevent sagging or separation.
  - For edge fastening, ensure the fasteners are positioned within the field of the gypsum board and not too close to the edge to avoid edge cracking.
- Fastening Multiple Layers of Gypsum Board:
  - If multiple layers of gypsum board are required, stagger the joints between the layers for added strength and stability.
  - Fasten the subsequent layers to the underlying layer, ensuring the joints are properly aligned and supported.
  - Proper fastening of gypsum board is crucial for a secure and durable installation. Following the recommended spacing, using the correct fasteners, and applying the appropriate amount of pressure during attachment will help ensure the gypsum board remains firmly in place.

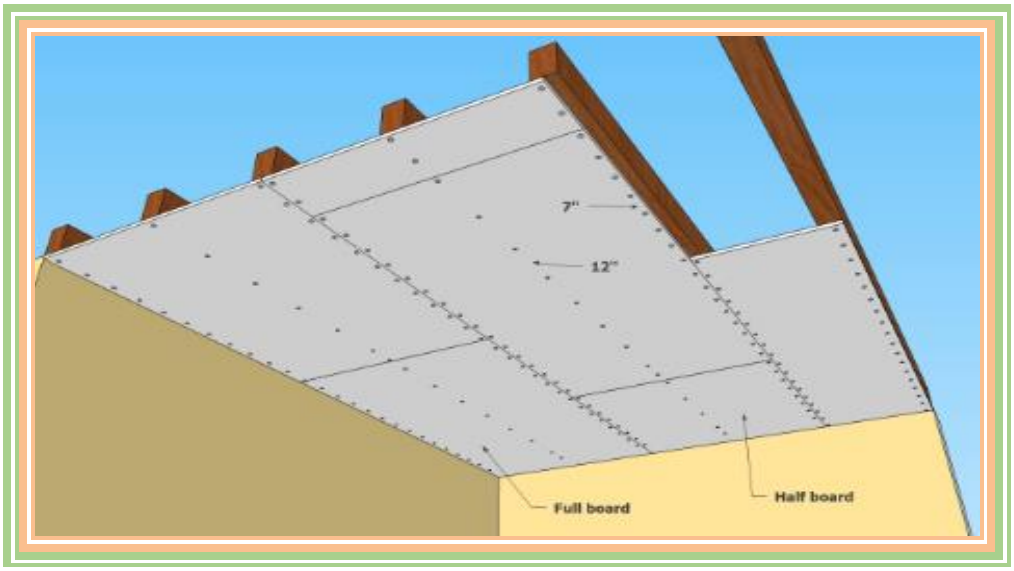


**Fig** 5.6. Positioning the gypsum boards and fastener

**5. Joint Treatment**

- Apply joint tape over the joints between gypsum boards. Use a joint compound or mud to cover the tape and fill in screw or nail indentations.
- Embed the tape in a layer of joint compound using a joint knife or trowel. Smooth out the compound and remove any excess.
- Apply multiple layers of joint compound, feathering the edges outward with each layer to create a smooth and seamless surface.
- Allow each layer of joint compound to dry before applying the next layer. Sand the dried compound between layers for a smooth finish.

**Fig** 5.7. Joint Treatment

**6. Corner Treatment**

- Install metal or vinyl corner beads on external corners to reinforce and protect them. Secure the corner beads using nails or screws.
- Apply joint compound to the corner beads, embedding them in the compound. Feather out the compound to create a smooth transition between the corner and the gypsum board.

### 5.3.2. Installation techniques for gypsum board (fiber gypsum board)

The steps for installing gypsum board on a ceiling are as follows:

a. **Read and interpret the interior design drawing**: Familiarize yourself with the design plans and specifications for the ceiling installation. Understand the dimensions, locations of fixtures, and any special requirements.

b. **Collect materials:** Gather all the necessary materials for the installation, including gypsum boards, screws, joint compound, joint tape, corner beads, and any other accessories or tools required for the job.

c. **Set out the ceiling:** Use a laser level or a hose level to establish the desired level of the ceiling. Depending on the depth of the ceiling and any openings or fixtures, mark the level using reference points. Create a straight line using a chalk line to serve as a guide for the installation.

d. **Set the straight edge and tie:** Attach a straight edge, such as a long piece of lumber, along the marked line. Secure it in place using screws or nails. This straight edge will act as a guide for installing the gypsum boards in a straight and level manner.

e. **Place gypsum boards on the straight edge:** Position the gypsum boards on the straight edge, aligning them with the marked line. Ensure that the boards fit tightly against each other without any gaps. Use screws to secure the boards to the ceiling joists or furring strips.

Fig 5.7. Place gypsum boards on the straight edge

f. **Hang the gypsum boards:** Use fiber and mixed gypsum to hang the gypsum boards. Apply the adhesive or compound to the backside of the boards, following the manufacturer's instructions. Lift the boards into place and press them firmly against the ceiling, ensuring they are aligned properly.

Fig 5.8. Hang the gypsum boards

g. **Fill the joints and taping:** Apply joint compound to the joints between the gypsum boards. Embed joint tape into the compound, covering the joints completely. Use a taping knife to smooth out the compound and remove any excess. Allow the compound to dry according to the manufacturer's instructions.

h. **Veneer plaster:** Once the joint compound is dry, you can apply a veneer plaster to the gypsum board surface. This step helps to create a smooth and finished appearance. Follow the instructions provided by the plaster manufacturer for mixing and applying the veneer plaster.

Fig 5.9. Veneer plaster

i.

## Self-check 5.1

**Part 1: Choose the best answer**

1. What is the purpose of gypsum board systems?
   a. To provide structural support
   b. To enhance sound insulation
   c. To improve fire resistance
   d. All of the above
2. Which of the following is a type of gypsum board system?
   a. Suspended ceiling grid system
   b. Metal stud framing system
   c. Shaft wall system
   d. All of the above
3. Which installation technique is commonly used for attaching gypsum boards to the framework?
   a. Screw attachment
   b. Nail attachment
   c. Adhesive attachment
   d. All of the above
4. When installing gypsum board, it is important to:
   a. Ensure proper alignment and leveling
   b. Use the correct type and length of screws
   c. Apply joint compound and tape to seams and corners
   d. All of the above
5. Which factor should be considered when choosing the thickness of gypsum board?
   a. Fire resistance requirements
   b. Sound insulation requirements
   c. Structural support requirements
   d. All of the above

**Part II: Write true if the statement is correct and write false if the statement is incorrect**

1. Gypsum board systems are only used for interior applications. True/False

2. Adhesive attachment is the most common technique for installing gypsum boards. True/False
3. Gypsum board systems can provide thermal insulation. True/False
4. The thickness of gypsum board does not affect its fire resistance rating. True/False

**Part III: Give Short Answer for the following question:**

1. Name two types of gypsum board systems.
2. What are the advantages of using adhesive attachment for gypsum board installation?
3. What are some safety considerations when applying installation techniques for gypsum board?

# Operation sheet 5.1: Installing framing

Purpose: To know the installing of framing on a ceiling and wall

**Equipment Tools and Materials:**

- Meter
- Cutter
- Lather level
- Chock line
- Straight edge
- trowel
- bucket
- mixing tool etc.… see in the units

**Instruction:** when fixing follow the steps. For this operation you have given 5 day each data

**Steps in doing the task installing framing on a ceiling**

1. Measure the dimensions of the ceiling and plan the layout for the framing.
2. Locate the ceiling joists using a stud finder or by tapping on the ceiling to listen for solid areas.
3. Cut the framing material, such as wooden joists or metal furring channels, to the appropriate lengths based on your measurements.
4. Attach the first piece of framing to the ceiling by aligning it with the marked position of the first ceiling joist.
5. Continue installing the remaining pieces of framing, spacing them according to your planned layout.
6. If installing furring channels, make sure they are properly aligned and spaced.
7. Double-check the alignment and levelness of the installed framing.
8. Once the framing is installed, you can proceed with installing plasterboard or other ceiling materials according to the specific instructions for that material.

**Quality Criteria:** performing of all the activities according to the report writing procedures

# Operation sheet 5.2: Install Gypsum Board on Celling

Purpose: To know the application gypsum board on a celling

**Equipment Tools and Materials:**

- Meter
- Cutter
- Lather level
- Chock line
- Straight edge
- trowel
- bucket
- mixing tool etc.… see in the unit two.

**Instruction:** when fixing follow the steps. For this operation you have given 10 day each data

**Steps in doing the task of install Gypsum board on a celling,**

1. Read and interpret drawing (interior design)
2. Collect materials
3. Set out the celling by using leaser levelling or hose level
    a. Depending the depth of the celling and opening mark the level
    b. Make a line by using chock line
4. Set the straight edge and tie
5. Put gypsum board on the straight edge
6. Hung the gypsum board by fiber and mixed gypsum
7. Fill the joint and taping
8. Veneer plaster.

**Quality Criteria:** performing of all the activities according to the procedures

# Operation sheet 5.3: Install Gypsum Board on wall

Purpose: To know the application gypsum board on a wall

**Equipment Tools and Materials:**

- Meter
- Cutter
- Lather level
- Chock line
- Straight edge
- trowel
- bucket
- mixing tool etc.… see in the unit two.

**Instruction:** when fixing follow the steps. For this operation you have given 10 day each data

**Steps in doing the task of install Gypsum board on a wall.**

1. Preparation
2. Marking and Layout
3. Cutting Gypsum Boards
4. Installation
5. Taping and Finishing
6. Finishing Touches

**Quality Criteria:** performing of all the activities according to the procedures

# LAP Test:

**LAP Test: Practical Demonstration**

Name: _____ Date: _____

Time started: _____ Time finished: _____

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 10 days for each task.

**Task 1:** Installing framing

**Task 2:** install gypsum board on wall

**Task 3:** install gypsum board on celling

# Unit Six: Finishing Techniques for Gypsum Board

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

- Concept finishing techniques for gypsum board
- Common Finishing techniques

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

- Understanding of finishing techniques for gypsum board
- Apply and identify common finishing techniques

## 6.1. Concept of Finishing Techniques for Gypsum Board

### 6.1.1. Introduction

Finishing techniques are a crucial part of the installation process for gypsum board surfaces. They enhance the appearance, durability, and functionality of the finished walls or ceilings. Proper finishing ensures that the gypsum board surfaces are smooth, seamless, and ready for final decorative treatments.

### 6.1.2. Importance of Proper Finishing for Gypsum Board Surfaces

The importance of proper finishing for gypsum board surfaces:

A. **Aesthetics**: Finishing techniques play a significant role in enhancing the visual appeal of gypsum board surfaces. They help create a smooth and seamless appearance by concealing joints, screws, and other imperfections. A well-finished gypsum board surface provides a clean and professional look that enhances the overall aesthetics of the space.

B. **Durability**: Finishing techniques, such as applying joint compound, tape, and skim coating, reinforce the gypsum board joints and create a sturdy surface. They help prevent cracks, gaps, and other potential damages, ensuring the long-term durability of the gypsum board installation.

C. **Surface Preparation:** Proper finishing techniques involve leveling, filling, and smoothing the gypsum board surface. This prepares the surface for the application of final finishes, such as paint or wallpaper, ensuring optimal adhesion and a uniform appearance.

D. **Seamlessness**: Finishing techniques aim to create seamless transitions between gypsum board panels, ensuring that joints and other connections are virtually invisible. This seamless integration contributes to a cohesive and polished look, particularly in large areas or rooms with extensive gypsum board installations.

E. **Substrate Protection:** Finishing techniques, including priming, provide a protective layer over the gypsum board surface. Primers seal the porous surface of the gypsum board, preventing excessive moisture absorption and improving the adhesion of final finishes. This protection contributes to the longevity and performance of the gypsum board installation.

F. **Customization:** Finishing techniques offer opportunities for customization and design creativity. Texturing, such as knockdown or stippling, can be applied to create unique visual effects and add depth to the gypsum board surface. Paint, wallpaper, or other decorative finishes can be applied on top of the properly finished gypsum board, allowing for endless design possibilities.

Proper finishing techniques for gypsum board surfaces are essential to achieve a high-quality, visually appealing, and long-lasting installation. They contribute to the overall aesthetics, durability, and functionality of the gypsum board surfaces, making them an integral part of any construction or remodeling project.

## 6.2. Common Finishing Techniques

Common finishing techniques in gypsum work refer to the methods and processes used to achieve smooth, polished, and visually appealing surfaces on gypsum-based materials such as gypsum board or plaster. These techniques are employed to prepare the gypsum surface for painting, wallpaper application, or as a final decorative finish. There are common finishing techniques in gypsum work:

A. **Joint Finishing:** typically refers to the process of completing or refining the final stages of a joint in construction or woodworking. It involves applying joint compound or filler to smooth out the surface and create a seamless finish. In the context of construction, joint finishing is commonly associated with drywall installation. After the drywall sheets are hung and secured to the wall or ceiling framing, the joints between the sheets are covered with joint compound. This compound is spread over the joints using a taping knife, and additional layers may be applied to achieve a smooth and even surface.

- **Joint Compound:** Joint compound, also known as drywall mud, is applied to the joints between gypsum boards to create a seamless appearance. It is spread over the joints with a trowel or putty knife, and then smoothed and feathered out to blend with the surrounding surface.
- **Joint Tape:** Joint tape is embedded in the joint compound to reinforce the joints and prevent cracking. It is applied over the joints before applying the joint compound.

B. **Skim Coating:** Skim coating involves applying a thin layer of joint compound across the entire gypsum board surface. It helps to create a smooth and uniform finish by filling in minor imperfections, seams, and nail/screw indentations. The compound is spread evenly using a trowel or wide putty knife, and then sanded after drying.

**Fig** 5.8. Skim coating

C. **Texture Application:** Texture can be applied to gypsum board surfaces to add visual interest and hide imperfections. When it comes to gypsum work, texture application refers to the process of adding texture to gypsum surfaces, such as walls or ceilings, using various techniques and materials. Texture application can be used to create visual interest, hide imperfections, or achieve a specific decorative effect. Some common methods of texture application for gypsum work:

- **Trowel Texturing**: Trowel texturing involves using a trowel or a similar tool to apply joint compound or specialized texture mixtures to the gypsum surface. The texture material is spread and manipulated with the trowel to create desired patterns or textures. Trowel texturing can be used to achieve techniques like skip trowel, knockdown, or swirl textures.

**Fig** 5.9. Trowel texturing

- **Spraying:** Spraying is a technique where texture material is applied using a spray gun or texture sprayer. The texture material, such as joint compound or specialized texture mixtures, is mixed to the desired consistency and sprayed onto the gypsum surface. This method is often

used for textures like orange peel or popcorn, where the texture material is atomized and then settles on the surface.

To apply spraying for a textured finish on a gypsum surface, follow these general steps:

- **Surface Preparation:** Ensure that the gypsum surface is clean, dry, and free from any dust, debris, or contaminants. Repair any cracks, holes, or imperfections on the surface and allow them to dry.
- **Texture Material Selection:** Choose the appropriate texture material for the desired texture finish. This can include joint compound, texture mixtures, or other specialized texture products available in the market. Follow the manufacturer's instructions for mixing and consistency.
- **Equipment Setup**: Set up the spraying equipment, which typically includes a spray gun or texture sprayer. Ensure that the equipment is clean and in good working condition. Adjust the nozzle or gun settings according to the desired texture pattern and material consistency.
- **Material Mixing:** Prepare the texture material as per the manufacturer's instructions. This may involve adding water or other additives to achieve the desired consistency. Mix the material thoroughly to ensure a uniform texture.
- **Test Spraying:** Before proceeding to the entire surface, it's recommended to perform a test spray on a small, inconspicuous area to check the consistency, pattern, and coverage of the texture. Adjust the spray gun settings or material consistency if necessary.
- **Application Technique:** Hold the spray gun or texture sprayer at a consistent distance from the surface, typically around 12 to 18 inches (30 to 45 cm). Begin spraying in a continuous motion, moving the gun or sprayer evenly across the surface to achieve uniform coverage.
- **Overlapping Technique:** For larger surfaces or to ensure even distribution, use an overlapping technique. Overlap each pass by about 50% to blend the texture and avoid visible seams or lines.

- **Texture Build-Up:** Apply the texture material in multiple coats if a thicker or more pronounced texture is desired. Allow each coat to dry before applying the next layer. Follow the manufacturer's instructions for drying times between coats.
- **Cleanup:** After completing the spraying process, clean the spray gun or texture sprayer thoroughly using water or appropriate cleaning agents, as recommended by the manufacturer.
- **Drying and Finishing:** Allow the applied texture to dry completely according to the manufacturer's instructions. Once dry, the texture can be left as is or further finished by sanding, painting, or other decorative treatments as desired.


**Fig** 5.10. Spraying

- **Stippling:** Stippling involves using a brush, roller, or sponge to create a textured effect by dabbing or stippling the texture material onto the gypsum surface. This technique creates a pattern of small dots or stippled marks, which can range from fine and subtle to more pronounced textures.

**Fig** 5.11. Stippling

- **Stenciling:** Stenciling is a method where a pre-cut stencil is placed on the gypsum surface, and texture material is applied over it using a brush, roller, or trowel. The stencil design creates a pattern or texture on the surface, allowing for precise and repeatable textured effects.

**Fig** 5.12. Stenciling

- **Textured Rollers**: Textured rollers have raised patterns or textures on their surface. They are rolled onto the gypsum surface, transferring the texture material and creating a consistent pattern across the area. Textured rollers are available in various designs, allowing for a wide range of textured effects.

**Fig** 5.13. Textured Rollers

- **Custom Techniques:** Various custom techniques can be employed to create unique textures on gypsum surfaces. These techniques may involve using tools like brushes, sponges, combs, or even unconventional materials to achieve desired textures.

Before applying texture to gypsum surfaces, it's important to properly prepare the surface by cleaning, priming, and ensuring it is free from any debris or imperfections. Additionally, it's advisable to practice the chosen texture application technique on a sample board or a small area before applying it to the entire surface.

D. **Sanding**: Sanding is performed after the joint compound or skim coat has dried to achieve a smooth and even surface. It helps to level the compound and remove any ridges or imperfections.

Sanding can be done using sandpaper or a sanding block, and it's important to follow proper sanding techniques to avoid damaging the gypsum board.

E. **Priming:** Priming is an essential step before applying paint or other finishes. A primer helps to seal the gypsum board surface, improve adhesion, and provide a uniform base for the finish coat. Primers are typically applied with a brush or roller and allowed to dry before proceeding with the final finish.

# Self- check 6.1

**Part 1: Choose the best answer**

1. What is the purpose of finishing techniques for gypsum board?
   a. To improve the aesthetics of the surface
   b. To enhance the durability of the gypsum board
   c. To improve the sound insulation properties
   d. All of the above
2. Which of the following is a common finishing technique for gypsum board?
   a. Taping and mudding
   b. Skim coating
   c. Texture spraying
   d. All of the above
3. Which finishing technique is used to create a smooth and seamless surface between gypsum board joints?
   a. Taping and mudding
   b. Skim coating
   c. Texture spraying
   d. Sanding
4. What is the purpose of skim coating in gypsum board finishing?
   a. To create a textured surface
   b. To level out imperfections and create a smooth finish
   c. To enhance the fire resistance of the gypsum board
   d. All of the above
5. Which finishing technique is used to add texture or patterns to the surface of gypsum board?
   a. Taping and mudding
   b. Skim coating
   c. Texture spraying
   d. Sanding

**Part II: Write true if the statement is correct and write false if the statement is incorrect**

1. Taping and mudding is the final step in finishing gypsum board.
2. Skim coating involves applying a thin layer of joint compound over the entire surface of the gypsum board.
3. Texture spraying is primarily used for achieving a smooth, seamless surface.
4. Sanding is done to remove imperfections and create a textured finish on the gypsum board.

**Part III: Give Short Answer for the following question:**

1. What is the purpose of taping and mudding in gypsum board finishing?
2. How is skim coating applied in gypsum board finishing?
3. What are some common tools or equipment used for texture spraying in gypsum board finishing?

# Reference


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