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Norwegian Embassy
Islamabad

MARBLE TECHNICIAN

Learner Guide

National Vocational Certificate Level 1

Version 1 - JULY 2020

NAVTTC

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Published by
National Vocational and Technical Training Commission
Government of Pakistan

Headquarter
Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
www.navttc.org

Responsible
Director General Skills Standard and Curricula, National Vocational and Technical Training Commission
National Deputy Head, TVET Sector Support Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Layout & design
SAP Communications

Photo Credits
TVET Sector Support Programme

This document has been produced with the technical assistance of the TVET Sector Support Programme, which is funded by the European Union, the Federal Republic of Germany and the Royal Norwegian Embassy and has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in close collaboration with the National Vocational and Technical Training Commission (NAVTTC) as well as provincial Technical Education and Vocational Training Authorities (TEVTAs), Punjab Vocational Training Council (PVTC), Qualification Awarding Bodies (QABs)s and private sector organizations.

Document Version
July, 2020
Islamabad, Pakistan

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Contents

Introduction

Welcome to your Learner's Guide for the *Marble Technician Level-1* Program. It will help you to complete the program and to go on to complete further study or go straight into employment.

The *Marble Technician Level-1* program is to engage young people with a program of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The program has been developed to address specific issues, such as the national, regional and local cultures, the manpower availability within the country, and meeting and exceeding the needs and expectations of their customers.

The main elements of your learner's guide are:

- **Introduction:**
  - This includes a brief description of your guide and guidelines for you to use it effectively
- **Modules:**
  - The modules form the sections in your learner's guide
- **Learning Units:**
  - Learning Units are the main sections within each module
- **Learning outcomes**:
  - Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - This is the main content of your learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) you will require to achieve learning outcomes stated in the curriculum
  - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules**:
  - This contains the summary of the modules that make up your learner's guide
- **Frequently asked questions**:
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This further helps you in preparing for your assessment.
- **Multiple choice questions for self-test**:
  - These are provided as an exercise at the end of your learner's guide to help you in preparing for your assessment.

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Module-1

Detail of Competency Standards.

Module 1: Maintain Workplace Safety

Objective: This module covers the skills and knowledge required to protect from all security threats by ensuring personal saftey, workplace safety, Machines/tools and equipment safety, interpret environmental regulation preparation and saftey of all tools and equipment.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Adopt Personal safety	***Trainee will be able to:*** • Arrange PPEs as per requirements • Wear proper PPE as per nature of job • Store PPEs at appropriate place after use	• Define Personal Protective Equipment (PPE.) • List of PPEs • Types and use of PPEs	
LU2. Adopt workplace safety.	***Trainee will be able to:*** • Perform cleaning of workplace. • Avoid hazardous (electric / chemical) by adopting safety precautions • Identify emergency exit • Operate Firefighting equipment • Identify emergency shutdown switch of machines.	Types of physical hazards Types of chemical hazards Types of electrical hazards Differentiate between physical, chemical and electrical hazards Reporting risks and hazards	
LU3. Adopt safety of tools and equipment	***Trainee will be able to:*** • Identify insulated tools and equipment • Clean tools after use. • Store tools and equipment at appropriate place.	• Name and Use of insulated equipment • Knowledge of Safe storage • Knowledge of cleaning tools	

LU4. Maintain First aid Box	***Trainee will be able to:*** • Identify first aid box • Check first aid box for Emergency Medicines. • Check Expiry date of the Medicines • Demonstrate mock first aid treatment against electric shock • Demonstrate mock exercise against minor injury.	Knowledge of Medicine in First Aid Box Understanding of First Aid Treatment Treatments of various hazards	
LU5. Adopt Machines Safety	***Trainee will be able to:*** • Check belts of Machine • Check blades of machines • Check Machine for short circuit • Perform test operation on Machine	Types of belts Types of blades(cutters) Importance of/machines/ tools safety	
LU6. Adopt environmental regulation	***Trainee will be able to:*** • Interpret environmental regulation • Adopt work friendly environment.	Types of Risks Risk Management / Assessment Monitor and risk control measures	

Examples and illustrations

Personal Protective Equipment:

PPE are equipment that will protect the user against health or safety risks at work. It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses. It also includes respiratory protective equipment (RPE).

Basic Types of PPE:

Following are the basic types of PPE.

1.Head Protection:

PPE includes hard hats and headgears and should be required for tasks than can cause any force or object falling to the head. When performing head protection safety checks, ensure that there are no dents or deformities on the shell and connections are tightened inside. Do not store in direct sunlight and always replace a hard hat if it was used for any kind of impact, even if damage is unnoticeable.

2.Face and Eye Protection:

PPE includes safety goggles and face shields and should be used for tasks that can cause loss of vision and an eye, burns, splashes, sprays of toxic liquids etc. When conducting equipment safety checks, ensure that there are no cracks or deformities on the lenses, ensure the strap is in good working order and is firmly sealed to the cheek and forehead.

3.Foot Protection:

PPE includes knee pads and safety boots and should be used for tasks that can cause serious foot and leg injuries from falling or rolling objects, hot substances, electrical hazards and slippery surfaces. Use boots with slip-resistant soles that protect against compression and impact.

4.Hands Protection:

PPE includes safety gloves and should be used for tasks that can cause hand and skin burns, absorption of harmful substances, cuts, fractures or amputations. When inspecting hand protection equipment, ensure that they fit perfectly with no spaces and are free from cuts, burns and chemical residue. Always replace them if any sign of contamination was observed.

5.Body Protection:

PPE includes safety vests and suits and should be used for tasks that can cause body injuries from extreme temperatures, flames and sparks, toxic chemicals, insect bites and radiation. Ensure that they are clean and free from cuts and burns. Always get a good fit to ensure full body protection.

6. Hearing protection:

PPE includes ear muffs and plugs and should be used for tasks than can cause hearing problems and loss of hearing. When ensuring hearing safety, the equipment must fit the ear canal perfectly. Recommended types include formable earplugs to fit on different sizes of ear canals.

7. Fall Protection:

PPE includes safety harnesses and lanyards and should be strictly used for task that can cause falling from heights and serious injury or death. When inspecting equipment, ensure that the straps are free from tears, deformities and burn marks and buckles are connected securely and tightly. It is very important to dispose them if used after a falling incident.

8. Respiratory Protection:

PPE includes respirators and should be used for task that can cause inhalation of harmful materials to enter the body. When conducting respiratory protection safety, ensure that the equipment is fit-tested and the employee has undergone proper training before wearing one.

Where to store PPE

The general maintenance and storage of PPE usually includes keeping it in a clean and dry place, where it can be easily accessed and is not exposed to potentially damaging conditions. A cupboard is fine, as long as it meets the above criteria, but avoid storing your PPE with other items such as consumables or machinery.

The most important things to remember are to keep your PPE storage area clean, tidy, and organized. Avoid stacking things on top of each other excessively and utilize organizational tools like wall hooks and shelves where possible

https://millops.community.uaf.edu/tag/ppe/

First Aid Box:

It is a set of materials and tools used for giving emergency treatment to a sick or injured person. First aid kits are designed to manage all types of injuries including basic cuts, scrapes and burns etc.

A basic workplace first aid kit includes:

- *Plasters:* Used for small cuts and grazes
- *Dressings:* Used to apply pressure to larger wounds and help to stop bleeding
- *Bandages:* Used to support joints, hold dressings in place, put pressure on wounds and to stop swelling
- *Disposable gloves*: Used to reduce the risk of infection
- *Face shields or pocket masks:* Used to prevent infection when you give rescue breaths
- *Cleansing wipes, alcohol free wipes:* Used to clean the skin around the wound
- *Adhesive tape:* Used to hold dressings or the loose end of bandages in place
- *Pins and clips:* Used to fasten the loose end of bandages
- *Scissors or tweezers:* Used to cut bandages or sticky tape or someone's clothing if you need to get to a wound

First Aid Box

Fire Extinguisher:

A fire extinguisher is an active fire protection device used to extinguish or control small fires, often in emergency situations. Typically, a fire extinguisher consists of a hand-held cylindrical pressure vessel containing an agent which can be discharged to extinguish a fire.

Types of Fire Extinguishers:

There are three main types of extinguisher and they work in slightly different ways:

- **Water extinguishers**:

  Water extinguishers are the most common, are essentially tanks full of water with compressed (tightly squeezed) air as the propellant to make them come out. Water extinguishers work by removing heat from the fire.

- **Dry chemical extinguishers:**

  Dry chemical extinguishers are tanks of foam or dry powder with compressed nitrogen as the propellant. They work by smothering the fire: when you put a layer of powder or foam on the fire, you cut the fuel off from the oxygen around it, and the fire goes out.

- **Carbon dioxide (CO_2) extinguishers:**

  Carbon dioxide extinguishers contain a mixture of liquid and gaseous carbon dioxide (a non-flammable gas). CO2 is normally a gas at room temperature and pressure. It has to be stored under high pressure to make it a liquid. When you release the pressure, the gas expands enormously and makes a huge white jet. CO2 attacks the fire triangle in two ways: it smothers the oxygen and, when it turns from a liquid back to a gas, it "sucks" in a massive amount of heat from its surroundings (the latent heat of vaporization), which cools whatever you spray it on by removing heat.

Operating a Fire Extinguisher:

There are four (4) basic steps for using modern portable fire extinguishers.

The acronym **PASS** is used to describe these four basic steps.

1. Pull (pin):

Pull pin at the top of the extinguisher, breaking the seal. When in place, the pin keeps the handle from being pressed and accidentally operating the extinguisher. Immediately test the extinguisher. (Aiming away from the operator) This is to ensure the extinguisher works and also shows the operator how far the stream travels

2. Aim:

Approach the fire standing at a safe distance. Aim the nozzle or outlet towards the base of the fire.

3. Squeeze:

Squeeze the handles together to discharge the extinguishing agent inside. To stop discharge, release the handles.

4. Sweep:

Sweep the nozzle from side to side as you approach the fire, directing the extinguishing agent at the base of the flames. After an A Class fire is extinguished, probe for smoldering hot spots that could reignite the fuel.

Operating a fire extinguisher
https://www.artofmanliness.com/articles/how-to-use-a-fire-extinguisher/

CPR- Cardio Pulmonary Resuscitation:

CPR – or Cardiopulmonary Resuscitation – is an emergency lifesaving procedure performed when the heart stops beating. Immediate CPR can double or triple chances of survival after cardiac arrest.

How CPR is Performed:

There are two main stages to CPR: the preparation stage and the CPR stage.

Preparation Step:

Before performing CPR on an adult, use the following preparation steps:

Step 1. Call Emergency services:

First, check the scene for factors that could put you in danger, such as traffic, fire, or falling masonry. Next, check the person. Do they need help? Tap their shoulder and shout, "Are you OK?"

If they are not responding, call emergency service or ask a bystander to call emergency service before performing CPR.

Step 2. Place the person on their back and open their airways:

Place the person carefully on their back and kneel beside their chest. Tilt their head back slightly by lifting their chin. Open their mouth and check for any obstruction, such as food or vomit. Remove any obstruction if it is loose. If it is not loose, trying to grasp it may push it farther into the airway.

Step 3. Check for breathing:

Place your ear next the person's mouth and listen for no more than 10 seconds. If you do not hear breathing, or you only hear occasional gasps, begin CPR.

If someone is unconscious but still breathing, do not perform CPR. Instead, if they do not seem to have a spinal injury, place them in the recovery position. Keep monitoring their breathing and perform CPR if they stop breathing.

Step 4. Perform 30 chest compressions:

Place one of your hands-on top of the other and clasp them together. With the heel of the hands and straight elbows, push hard and fast in the center of the chest, slightly below the nipples.

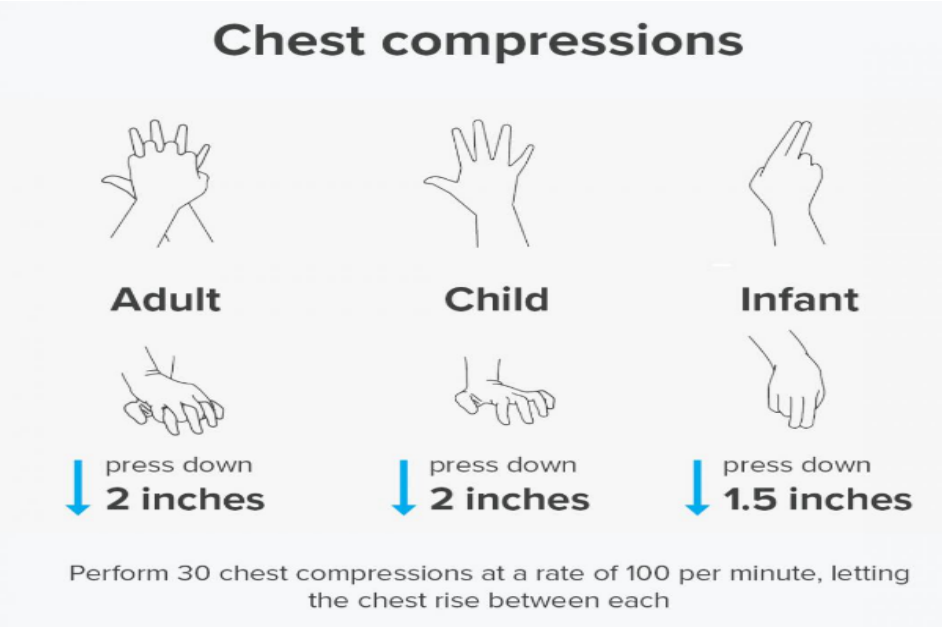
Push at least 2 inches deep. Compress their chest at a rate of least 100 times per minute. Let the chest rise fully between compressions.

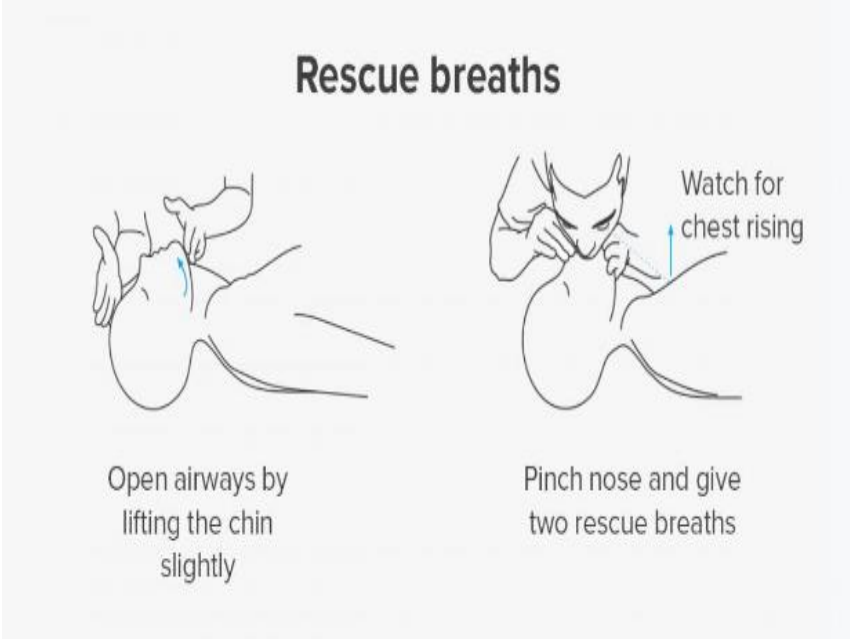
Step 5. Perform two rescue breaths:

Making sure their mouth is clear, tilt their head back slightly and lift their chin. Pinch their nose shut, place your mouth fully over theirs, and blow to make their chest rise. If their chest does not rise with the first breath, retilt their head. If their chest still does not rise with a second breath, the person might be choking.

Step 6. Repeat:

Repeat the cycle of 30 chest compressions and two rescue breaths until the person starts breathing or help arrives. If an AED arrives, carry on performing CPR until the machine is set up and ready to use.





CPR Method

https://www.medicalnewstoday.com/articles/324712.php

Workplace Emergency:

A workplace emergency is an unforeseen situation that threatens your employees, customers, or the public; disrupts or shuts down your operations; or causes physical or environmental damage. Emergencies may be natural or manmade and include the following:

- Floods,
- Hurricanes,
- Tornadoes,
- Fires,
- Toxic gas releases,
- Chemical spills,
- Radiological accidents,
- Explosions,
- Civil disturbances, and
- Workplace violence resulting in bodily harm and trauma.

How do you protect yourself, your employees, and your business?

The best way is to prepare to respond to an emergency before it happens. Few people can think clearly and logically in a crisis, so it is important to do so in advance, when you have time to be thorough.

What is an emergency action plan?

An emergency action plan covers designated actions employers and employees must take to ensure employee safety from fire and other emergencies. Not all employers are required to establish an emergency action plan. Even if you are not specifically required to do so, compiling an emergency action plan is a good way to protect yourself, your employees, and your business during an emergency.

Putting together a comprehensive emergency action plan that deals with all types of issues specific to your worksite is not difficult.

When developing your emergency action plan, it's a good idea to look at a wide variety of potential emergencies that could occur in your workplace. It should be tailored to your worksite and include information about all potential sources of emergencies. Developing an emergency action plan means you should do a hazard assessment to determine what, if any, physical or chemical hazards in your workplaces could cause an emergency. If you have more than one worksite, each site should have an emergency action plan.

At a minimum, your emergency action plan must include the following:

- A preferred method for reporting fires and other emergencies;
- An evacuation policy and procedure;
- Emergency escape procedures and route assignments, such as floor plans, workplace maps, and safe or refuge areas;
- Names, titles, departments, and telephone numbers of individuals both within and outside your company to contact for additional information or explanation of duties and responsibilities under the emergency plan;
- Procedures for employees who remain to perform or shut down critical plant operations, operate fire extinguishers, or perform other essential services that cannot be shut down for every emergency alarm before evacuating; and
- Rescue and medical duties for any workers designated to perform them.

You also may want to consider designating an assembly location and procedures to account for all employees after an evacuation.

Identifying workplace hazards

Every workplace has hazards. As an employer, you have a legal responsibility to look after your employees' safety and protect them against health and safety hazards at work. In order to manage workplace health and safety and help prevent accidents and sickness absence, it's important to identify, monitor and reduce the risk associated with workplace hazards.

What are workplace hazards?

Workplace hazards are any aspect of work that cause health and safety risks and have the potential to harm. Some hazards are more likely to be present in some workplaces than others, and depending on the work that you do, there will be hazards that are more or less relevant to your business.

What are the most common workplace hazards?

There are many types of workplace hazards, which tend to come under four main categories:

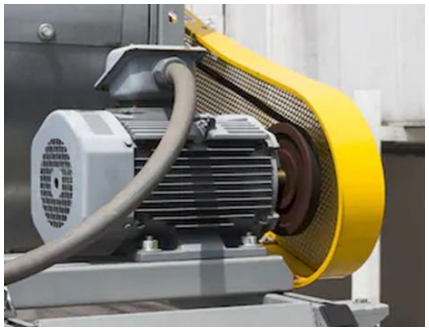
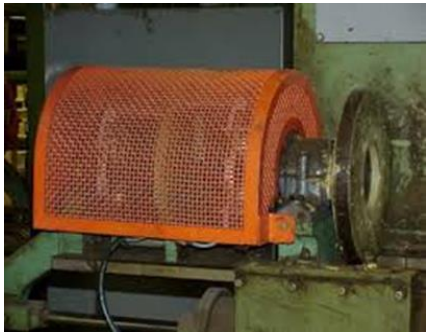
- *physical hazards* – the most common workplace hazards, including vibration, noise and slips, trips and falls;
- *ergonomic hazards* – physical factors that harm the musculoskeletal system, such as repetitive movement, manual handling and poor body positioning;
- *chemical hazards* – any hazardous substance that can cause harm to your employees;
- *biological hazards* – bacteria and viruses that can cause health effects, such as hepatitis, HIV/AIDS and Legionnaire's disease.

Machine Guarding Safety.

Each piece of machinery has its own unique mechanical and non-mechanical hazards. Machines can cause a variety of injuries ranging from minor abrasions, burns or cuts to severe injuries such as fractures, lacerations, crushing injuries or even amputation. Machine guards are your first line of defence against injuries caused by machine operation. Each machine must have adequate safeguards to protect operators and other employees in the immediate work area from hazards created by ingoing nip points, rotating parts, sparks and flying debris.

Having an understanding of how a machine works, and how the guards can protect you, will result in a reduced risk of injury. In order to be in compliance with OSHA requirements, all guards must:

- **Prevent contact** – machine guards must provide a physical barrier that prevents the operator from having any part of his/her body in the "danger zone" during the machine's operating cycle;
- **Be secured in place or otherwise be tamper proof** – machine guards must be secure and strong so that workers are not able to bypass, remove, or tamper with them. They must be attached to the machine where possible. If the guard cannot be physically attached to the machine it must be attached elsewhere;
- **Create no new hazard –** A safeguard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards, for instance, should be rolled or bolted in such a way that they eliminate sharp edges. Machine guards should not obstruct the operator's view; **Allow for lubrication with the guard still in place** - If possible, one should be able to lubricate the machine without removing safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance worker to enter the hazardous area.
- **Not interfere with the machine operation -** Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the worker's apprehensions about injury.

TYPES OF HAZARDS

A wide variety of mechanical motions and actions may present hazards to workers operating or working around machinery. The three basic types of hazardous mechanical motions and actions are:

- **Hazardous Motions –** *including rotating machine parts, reciprocating motions (sliding parts or up/down motions), and transverse motions (materials moving in a continuous line);*
- **Points of Operation –** *the areas where the machine cuts, shapes, bores, or bends the stock being fed through it;*
- **Pinch Points and Shear Points** – *the area where a part of the body or clothing could be caught between a moving part and a stationary object. This would include power transmission apparatuses such as flywheels, pulleys, belts, chains, couplings, spindles, cams, gears, connecting rods and other machine components that transmit energy.*

There are also non-mechanical hazards that can injure machine operators or personnel working in the vicinity of machinery. These hazards include flying splinters, chips or debris; splashes, sparks or sprays that are created when the machine is operating. These hazards can be prevented through the use of machine guarding and wearing/use of required personal protective equipment (PPE).

METHODS OF SAFEGUARDING

There are five (5) general types of machine safeguards that can be used to protect workers and personnel in the immediate vicinity of machinery. They are:

- **Guards** – *these are physical barriers that prevent contact. They can be fixed, interlocked, adjustable, or self-adjusting.*
- **Devices –** *these limits or prevent access to the hazardous area. These can be presence-sensing devices, pullback or restraint straps, safety trip controls, two-hand controls, or gates.*

- **Automated Feeding and Ejection Mechanisms –** *These eliminate the operator's exposure to the point of operation while handling stock (materials).*
- **Machine Location or Distance –** *this method removes the hazard from the operator's work area.*
- **Miscellaneous Aids –** *these methods can be used to protect both operators and people in the immediate vicinity of operating machinery. Examples include shields to contain chips, sparks, sprays or other forms of flying debris; holding tools that an operator can use to handle materials going into the point of operation; and awareness barriers to warn people about hazards in the area.*

VIDEOS:

	How to use a fire extinguisher https://www.youtube.com/watch?v=lUojO1HvC8c
	Introduction to PPE's https://www.youtube.com/watch?v=r9vp1q1L2ro

	Health and Safety Training https://www.youtube.com/watch?v=dCOojwkWO8c
	How to Perform CPR https://www.youtube.com/watch?v=hizBdM1Ob68

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Module-2

Module 2: Maintain Tools and Equipment

Objective: This module covers the skills and knowledge required to Maintain tools Cabinet, Arrange tool & Equipment, Calibrate measuring tools, Prepare tools for job, Clean Tools & equipment and Manage Inventory of tools and equipment.

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1. Arrange Tools and Equipment	***Trainee will be able to:*** •Identify Tools and Equipment •Interpret job card • Prepare list of tools and equipment as per demand • Collect tools and equipment from store	• Uses of different Tools • Types and uses of equipment	
LU2. Maintain tool Box	***Trainee will be able to:*** • Check Physical Condition of Tools & Equipment before use • Perform preventive maintenance as per standards • Perform corrective maintenance Place tools and equipment at appropriate place	• List of tools in tool box • Preventive and corrective measures for tools and equipment	

LU3. Calibrate measuring tools	***Trainee will be able to:*** • Check calibration status of the measuring tools • Perform calibration of measuring tools as per standards • Record Calibration test results	• Calibration techniques • Importance of calibration	Theory- 05 Hrs. Practical- 20 Hrs. Total- 25 Hrs.		Class Room and workshop
LU4. Manage Inventory of tools and equipment	***Trainee will be able to:*** • Check number of tools and equipment as per record. • Report for faulty tools and equipment. • Generate demand for deficit tools and equipment • Maintain record of all tools and equipment	• Inventory Management	Theory- 07 Hrs. Practical- 18 Hrs. Total-25 Hrs.		Class Room and workshop

Examples and illustrations

Arrange Tools and Equipment in Tools Box A **toolbox** (also called **toolkit**, **tool chest** or **workbox**) is a box to organize, carry, and protect the tools. They could be used for trade, or hobby, and their contents vary with the craft of the owner. A toolbox could refer to several types of storage to hold tools. It could mean a small portable box that can carry a few tools to a project location or a large storage system set on casters. Modern toolboxes are predominantly metal or plastic. Toolboxes can be mainly divided as 5 types. They are: • Plastic • Steel • Aluminium • Waterproof • Cantilever	

Cutting Tools for Marble Processing:

Marble is one of the emerging industries of Pakistan. According to estimates Pakistan has over 297 billion tons of marble and granite reserves and more than 100 types of colours and verities of marble and granite are available in Pakistan. To cut granite (marble) or fabricate something out of granite (marble), it is necessary to use a material that is considered to be harder than granite (marble). Few tools are hard and tough enough to cut through granite (marble). Diamond-tipped saw blades are the most widely used blades for cutting through granite (marble). Using improper tools can compromise the granite (marble) cutting operation. Proper selection of a cutting tool is also an important criterion. Cutting tool should have right composition so that tool life will be more and wear should be minimum.

Tool List

Cutting, Grinding, drilling and polishing are the basic operations in Marble industry. These are discussed below

Diamond Saw Blades:

There are different types of blades used for cutting the Marble, A few examples are given below. These different blades are useful for various cuttings like Dry cutting, Wet cutting, smooth cutting, soft stone cutting, hard stone cutting, curve cutting, straight cutting

 **DURASTAR PRO BLADE**	 **GRANITE MASTER**	 **NYLAH TURBO BLADE**
• Suitable for soft Granite and Engineered Stone. • Used for Dry cutting	• Fast cutting for Class 5 Granite • Non chipping • Wet and dry cutting	• Suitable for Granite, Blue Stone and general purpose • Fast cutting • Non chipping

 **VACUUM CONCAVE BLADE**	 **CONVEX BLADE**	 **SWIFLEX COBRA BLADE DOUBLE SIDED**
• Curved cut jobs such as sinkholes/counter tops • Wet cutting	• Suitable for Engineered & Granite Stone • For sink cut outs & other similar work	Electroplated • For dry cutting and grinding • Superior plating quality for fast and clean cutting and grinding • Special diamonds for extremely long life time

Grinding and Drilling bits.

There are different Grinding tools used as shown below.

TURBO GRINDING CUP WHEEL

Fast stock removal
• Suitable for all types of Natural & Engineered Stone
• Dry/ wet use
• 2 layered

PROFILE ROUTERS F PROFILE

Excellent performance to grind profiles

ELECTROPLATED DRUM

For smoothing and shaping internal holes

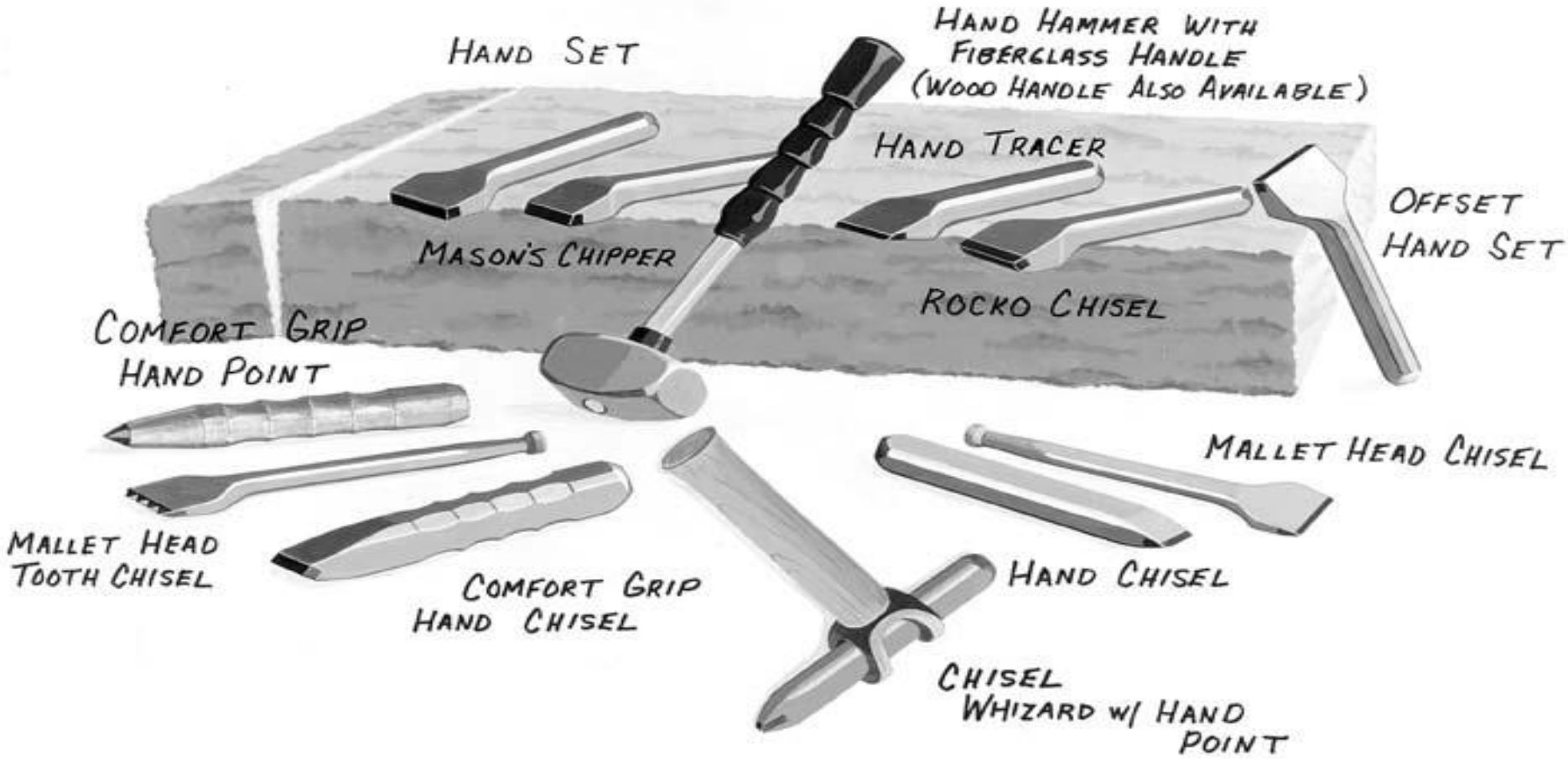
VACUUM BRAZED DRUM

For smoothing and shaping internal holes & curves

ELECTROPLATED CORE DRILL BITS

Ideal for Marble, Limestone & Porcelain for a clean Non-chipping cut/hole

Hand Tools:


HAND SET
HAND HAMMER WITH FIBERGLASS HANDLE (WOOD HANDLE ALSO AVAILABLE)
HAND TRACER
OFFSET HAND SET
MASON'S CHIPPER
ROCKO CHISEL
COMFORT GRIP HAND POINT
MALLET HEAD CHISEL
MALLET HEAD TOOTH CHISEL
COMFORT GRIP HAND CHISEL
HAND CHISEL
CHISEL WHIZARD w/ HAND POINT

Tool cleaning, storage, and maintenance

In order to work safely, it is extremely important that all workshop equipment is maintained and inspected before it is used each time. Taking care of tools and equipment, and keeping them well maintained, will make them last longer before needing replacement.

Cleaning:

Tools are expensive items, so it is essential they are kept clean and in good working order. Some tools may need cleaning with high pressure air. They should be kept clean by wiping off any dirt, grease, or metal chips before being stored.

Storage:

Never leave tools lying round the workshop. Lost tools would be expensive to replace, but they may also cause damage or injury if not properly stored. After finishing the work look around in workshop or workplace if any tools are left behind and store them properly.

Small hand tools, such as screwdrivers, pliers, or spanners, can be hung on a panel or pegboard mounted on the wall. Measuring instruments, gauges, and meters should be stored where they cannot be damaged by weather or impact with other tools. Small tools may also be stored in a chest, cabinet, or tray system.

Maintenance:

If a tool or piece of equipment is damaged, it should not be used because it may be dangerous. It may damage other worker or property if used. Ensure equipment is clean and tidy. Damaged tools or equipment should not be used; they might damage other property and they are potentially dangerous. It is not acceptable to use a tool or piece of equipment that is damaged in any way.

Corrective maintenance

Corrective maintenance can be defined as a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment, machine, or asset can be restored to an operational condition within the tolerances or limits established for in-service operations.

Corrective maintenance is maintenance which is carried out after failure detection and is aimed at restoring an asset to a condition in which it can perform its intended function.

Preventive maintenance (PM) has the following meanings:

1. The care and servicing by qualified personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection, and correction of incipient failures either before they occur or before they develop into major defects.
2. Maintenance, including tests, measurements, adjustments, and parts replacement, performed specifically to prevent faults from occurring.

What is Instrument Calibration?

The process of evaluating the measurements made by the instrument to be calibrated against an instrument known to be making measurements that surpass the suitable limits of precision and correctness is known as instrument calibration. If any variation is found, then the instrument is calibrated so that it can give exact readings and values. It is common for any instrument to lose its calibration after a long period of usage. After the process of calibration, the instrument is good to use again.

Calibration is necessary for:

1. A crucial measurement
2. If the instrument has undergone adverse conditions and cannot give the right reading.
3. When the output does not match the stand-in instrument.
4. Drastic change in weather
5. Cyclic testing of instruments

When are Instruments Calibrated?

Instruments which measure length, weight, temperature, pressure etc. should be calibrated against some standard measurement at regular intervals. Methods of calibration depend on whether the instrument is calibrated regularly or only occasionally for a special task where a highly calibrated instrument is required. It is essential to get the instruments calibrated every now and then even if they are in good condition to prevent wrong measurements.

1. **Maintaining a Record** – When an instrument is being calibrated it is mandatory to maintain a record of every minute detail of the results before and after the calibration.
2. **Inspect the Documentation** – Regular inspection of the calibration process is mandatory other than just documenting the process. The changes can easily be detected if the calibration process is closely audited every single time. It is necessary to document the changes

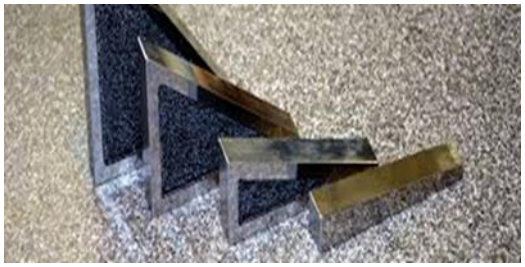
Calibration Procedures

- The measurements acquired from the scale are compared with the measurements of the sub-standard instrument and the calibration curve is formed from the obtained values.
- If the measurements from the instruments are parallel to the substandard then it is a good enough calibration. Otherwise the readings will have to be taken multiple times.

Auto- Calibrated digital Level

Calibrating Machine for Marble and Natural stone

Surface Plates & Granite Surface



Angle Block Calibration

Tools Maintenance:

The condition of your tools is important to the quality of your pieces. Your tools working correctly and efficiently add to the satisfaction of your efforts, but also ensure your safety. But it is just as importance to set up a routine maintenance program to assure everything is running correctly, are correctly sharpen, that calibration is true, and tool are clean. After purchasing a new tool make sure you keep the operating and care instruction. Some people keep them in binders, some put them in plastic sleeves, Best is to keep them in a handy drawer. Please don't ignore the following points.

- Don't ignore the maintenance instruction, tools are always running in a harsh environment. Oil that keeps a motor running smoothly attracts dust, and usually in the most inconvenient places. Proper care will keep them running efficiently, help in maintaining their new tool look, and increase their lifespan. Some tool parts need proper oiling, or lubrication, while some components of an electrically driven tool need to be kept free of dust and debris.

- Power tools require little maintenance if store in a clean, dry protected area, keeping dust and debris away from them, and protecting them from the elements. Make sure that the cord is free of cuts or abrasions. You can also check the switch to see that it is properly connected to allow current to flow to the motor. Some power tools, including routers, have a pair of brushes that might need to be repaired or replaced as they wear down over time. Double check that chucks and bits are proper tightened. Keep tools in their case when not in use and make sure there is a proper shortage place for tools that do not have a protective case.

- Saws and sanders require more attention for their maintenance. The nature of the tool entails cutting or abrasive action. The cutting and abrasion surfaces wear-out and must be change or restore frequently. Flattening tool surfaces, keeping sawdust and resin buildup away from integral components, checking electronic components for sustained damage, wheel and bearings function and proper lubrication are important to proper operation and lifespan of the tools. Worn out drive belts can cause amplified vibration and slippage and will tend to break.

- Air powered tools are usually piston-driven and this necessitates lubrication. Add a few drops of pneumatic oil into the air intake coupling. Tools used daily can also be oil daily. Use of tape on threaded surfaces will keep a tight seal which avoids loss of pressure on components. Clean or replace filters depending on use of the tool, and the overall environment in which it is used.

- Always protect your tools from moisture and extremes in temperature, exposure to moisture causes corrosion on unprotected metal surfaces. Use tools as they are intended, tools are usually made for specific purposes, when they are subjected to misuse and stresses, they weren't designed, they will often break down and fail to work correctly

MARBLE TECHNICIAN

Learner Guide

National Vocational Certificate Level 1

Version 1 - JULY 2020

Module-4

Module 4: Identify Machines & Its Attachments

Objective: This module covers the skills and knowledge required to Identify Machine and its sizes, Identify components & Attachments, Identify capacities & capabilities of Machine, Identify basic tools and supplies associated with Machines and Maintain Inventory of Machines & attachment

Duration: 100 Hours **Theory: 22 Hours** **Practice: 78 Hours**

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
L1. Identify Machine and its sizes.	***Trainee will be able to:*** • Identify marble cutting machines • Check specifications of Vertical cutting machine. • Check specifications of Gang Saw machine. • Check specifications of Bridge Cutting machine. • Check specifications of Cross cutting machine. • Check specifications of Section cutting machine. • Check specifications of Resizing machine. • Check specifications of Table Cutting machine	• Identification of Marble cutting machines • Specifications of Marble cutting machines.	Theory- 05 Hrs. Practical- 20 Hrs. Total- 25 Hrs.		Class Room and workshop

L2. Identify components & Attachments	***Trainee will be able to:*** • Identify components of Vertical cutting machine. • Identify components of Gang Saw machine. • Identify Components of Bridge Cutting machine. • Identify components of Cross cutting machine. • Identify components of Section cutting machine. • Identify components of resizing machine. • Identify components of Table Cutting machine	• Identifications of Components and Attachments of Marble Cutting Machines.	Theory- 05 Hrs. Practical- 20 Hrs. Total- 25 Hrs.		Class Room and workshop
L3. Identify capacities & capabilities of Machine	***Trainee will be able to:*** • Check capacity as per manufacturers specifications • Check capability as per manufacturers specifications • Interpret proper capacity of machine • Interpret proper capability of machine	• Comparison techniques for capacities and capabilities of Marble cutting machines	Theory- 05 Hrs. Practical- 15 Hrs. Total- 20 Hrs.		Class Room and workshop
L4. Identify basic tools and supplies associated with Machines	***Trainee will be able to:*** • Check standard tools supplied with machines • Check spares/consumable materials • Follow manufacturers specifications for tools and supplies	• Knowledge about basic tools and supplies associated with Marble cutting Machines	Theory- 5 Hrs. Practical- 15 Hrs. Total- 20 Hrs.		Class Room and workshop

L5. Maintain Inventory of Machines & attachment	***Trainee will be able to:*** • Check number of machines as per record • Report for faulty machine • Generate demand for defective parts of machines • Maintain record of all machines.	• Inventory management of Machines & attachment	Theory- 02 Hrs. Practical- 08 Hrs. Total- 10 Hrs.		

Illustration and Examples:

Marble Cutting Machine

1. **Types of Marble Cutting Machines**
2. **Parts of Marble Cutting Machines**
3. **Capacity and capability of Marble Cutting Machines (Specifications)**

A. Vertical Marble Cutting Machine

Vertical cutting machine or Block cutters are equipped with a large diameter diamond saw blade to cut blocks in a vertical direction. These cuts are made in both directions.

At the same time, these also include a further horizontal saw blade to cut the strips once the right vertical thickness has been achieved.
Once the strips are obtained, these are processed in the cutter to obtain the desired measurements.

Types of Vertical Cutting Machines.

Multi-Blades Block Cutter

Multi-blade block cutter is specialized for cutting block with latest design and best technology. Used hydraulic devices to make machine working more powerful and highly-efficiency.

Hydraulic multi-blades block cuter

Hydraulic block cutter machine is a combination of multiple blades and feeds at the same time. Machine adopts a suspension structure. The main machine saw blade rotates, feeds, retreats and the overall horizontal movement of the trolley are controlled by electric control box, with high automation. Multi blade block cutter machine has precise cutting and stable performance. It is used for cutting marble granite, sandstone and other stone blocks. It can cut block into slabs with different thicknesses and stone products of various specifications. At present, there are four hydraulic guide pillars with 12 pieces of saw blades, five hydraulic guide pillars of multi blades such as 14 pieces, 16 pieces, 18 pieces, 22 pieces of saw blade and so on. According to various kinds of stone materials, hardness of materials and so on, several kinds of improved block cutter have been developed.

Hydraulic multi-blades block cuter

Parts of hydraulic multi-blades block cuter

Colum and Spindle

Hydraulics System

Base and Table

Power supply Main board

Processing



Multi blades block cutter specifications

Item	Units	Value
Machine Dimension	(mm)	3200 x 1650 x 900
Saw blade diameter	(mm)	1650
Most saw the number	(PCS)	12 big 12 small
The lifting stroke	(mm)	1000
Machine weight	(T)	12

B. Gang Saw or Marble Frame Machine

Marble Frame saw Machine mainly contains saw frame, chain rod, column frame, saw blade and other components. It also named marble gang saw machine, working principle of this machine is that the saw blade on the sawing frame moves reciprocating with the frame saw driven by the connecting rod, and at the same time continuously moves downward through the lifting transmission mechanism, thus realizing the sawing of marble material. The earliest frame saw was called steel sand saws because they used steel bars and sand. The development trend of steel sand saw is automation and large-scale. For example, at present, the world's largest marble frame saw machine can produce 120 plates at one time, with a sawblade stroke of 80 centimetres. In addition, the sawing parameters of the sawing machine can be automatically adjusted within a certain range, and the connecting rod stroke can be automatically compensated without stopping the machine.

Marble Gang Saw Machine

Multi Blade Gang Saw

Stone Frame Saw Cutter Machine

Gang Saw Cutting Machine

Marble Frame Saw Machine

Parts of Frame Saw or Gang Saw Machine

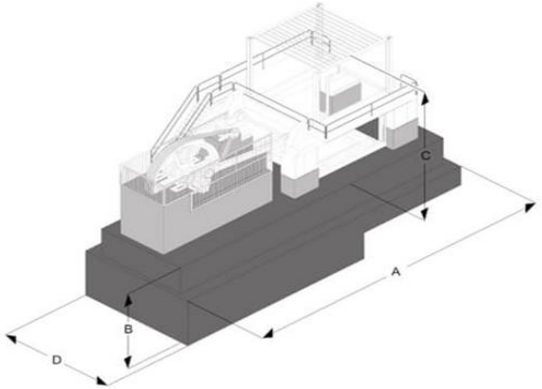
This machine is a frame or Gang saw with diamond blade translation, block jacking and closed structure. Used for cutting large marble board, suitable for mass production.



Processing



Specifications of Marble Frame Saw Machine



MODEL-MODEL	A	B	C	D
MQ 60	11080	2000	3370	4300
MQ 80	14000	3800	4960	6000
MQ 90	14000	3800	4960	6250
MQ 100	14000	3800	4960	6500
MQ 120	14000	3800	5100	7000

MODEL-MODEL	Blades (PCS)	Blade Length (mm)	Blade stroke (mm)	Main motor power (KW)	Max cutting block size (L×W×H)mm	Min.cutting thickness (mm)	Block trolley size (L×W)mm	Dimension (L×W×H)mm	Weight (Tons)
60/S600	60	3600	600	55	2500×1500×1500	16	2600×1650	11000×4125×4650	35
60/S600-H10	100	3600	600	75	2500×1500×1500	10	2600×1650	11000×4125×4650	40
80/S800	80	4400	800	110	3200×2000×2000	16	3200×2050	11900×5060×4960	55
80/S1000	80	4600	1000	110	3200×2000×2000	16	3200×2050	12510×5490×5500	57.5
80/S800-H10	140	4400	800	110	3200×2000×2000	10	3200×2050	12210×5060×4960	60
80/S1000-H10	140	4600	1000	110	3200×2000×2000	10	3200×2050	12800×5490×5500	62.5
80/S800-H12	120	4400	800	110	3200×2000×2000	12	3200×2050	12210×5060×4960	60
80/S1000-H12	120	4600	1000	110	3200×2000×2000	12	3200×2050	12800×5490×5500	62.5
90/S800	90	4400	800	110	3200×2250×2000	16	3200×2300	11900×5310×4960	60
90/S1000	90	4600	1000	110	3200×2250×2000	16	3200×2300	12510×5740×5500	62.5
100/S800	100	4400	800	132	3200×2500×2000	16	3200×2550	11900×5560×4960	62
100/S1000	100	4600	1000	132	3200×2500×2000	16	3200×2550	12510×5990×5500	67.5
120/S800	120	4400	800	160	3200×3000×2000	16	3200×3050	12100×5270×5100	70
120/S1000	120	4600	1000	160	3200×3000×2000	16	3200×3050	12510×6700×5500	72.5

C. Bridge Saw Marble Cutting Machine

Bridge Saw Marble Cutting Machine is special designed for marble cutting. Adapt with top brand PLC system, this controlling program promise customer a precious cutting with high working efficiency. The features of this marble cutting machine as follows:

1. Designed with four hydraulic steel columns, all of these steel columns made with high quality steel materials to make sure most strong cutting.
2. Max Cutting thickness of this marble cutting machine is 20cm.
3. Table of this machine can have a 90-degree automatic rotation. The rotation angle can also be customed.
4. This marble cutting machine bridge saw can cutting not only marble, but also granite and other stone materials.

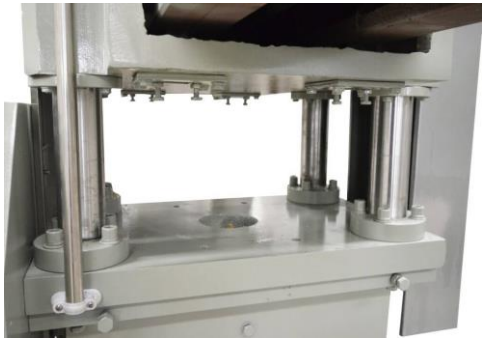
Bridge Saw Marble Cutting Machine

Parts of Bridge Saw Marble Cutting Machine

Marble Cutting Machine Table

Marble Cutting Machine Hydraulic Part

Marble Cutting Machine Bridge Part



Marble Cutting Machine Column Part

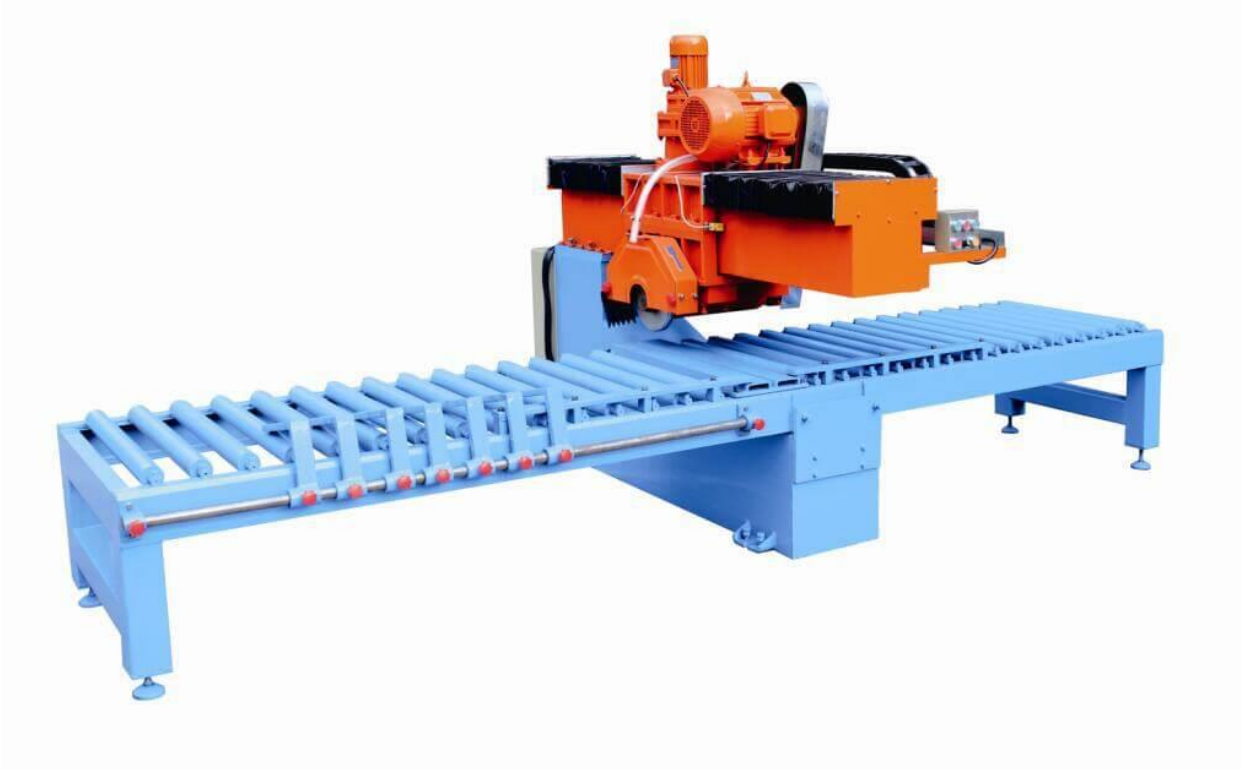
Bridge Saw Marble Cutting Machine Specifications

Item Name	Unit	Value
Blade Diameter	mm	600
Horizontal Travel	mm	3200
Longitudinal Travel	mm	3200
Vertical Travel	mm	300
Main Motor	KW	18.5
Total Power	KW	21.5
Size of table	mm	3200 x 2000
Table Rotation	n°	90
Machine overall	mm	6000 x 5000 x 2800
Weight	T	5.6

D. Cross Cutting Machine

Stone Cross Cutting Machine

Cross cutting machine for cutting marble and granite. It designs with craft and skill of vertical cutting. It can implement segment cutting to long specification slab and stone. This machine is similar with bridge saw machine, can trim the side surface with convenient operation. It is of automatic elevation, vertical automatic cutting, horizontal hand positioning. Cross marble cutting machine



Cross Cutting Machine

Parts of Cross Cutting Machine

Arm with sliding power system

Roller Table with adjustment stopper.

Specifications of Cross Cutting Machine

Item	Unit	Value
Max. cutting length	mm	4000
Max. cutting width	mm	700
Max. cutting thickness	mm	60
Blade diameter	mm	350
Main motor power	kw	7.5
Total Power	kw	8.25
Water Consumption	m^3/h	2.3
Machine Weight	kg	1350
Overall dimension (L×W×H)	mm	4000×2000×1800

E. Section Cutting Machine.

Section cutting machine is used to cut the marble tile thickness wise. Or in other words to reduce the thickness of a marble tile. It contains two electric motors; one is used to rotate the cutting blade, while the other is used to feed the marble tile against the rotating cutter.

Parts of Section Cutting Machine.

1. Base of the machine.
2. Feeding Table
3. Adjustment Rollers
4. Two Electric motor.
5. Cutting blade

Specifications.

Maximum Diameter of cutter – 18 inches

Power of each motor – 30 hp.

F. Resizing Cutting Machine.

Resizing cutting machine is used to cut both the sides of a mable tile longitudinally in one time and then cross wise to bring the marble tile upto the precise size. Distance between the two cutters can be adjusted to the requierd size.

Parts of Section Cutting Machine.

1. Base of the machine.
2. Feeding Table
3. Two Electric motor.
4. Adjusted Cutting blade

Specifications.

Maximum Diameter of each cutter – 12 inches

Power of each motor – 10 hp.

G. Table Cutting Machine

Table cutting machines are used to cut marble slabs up 2 to 3 feet length. The entire assembly of revolving cutter driven by an electric motor are fitted on a stationary column. Marble slab is put on the table and the Table is push forward against the revolving cutter by rotating a wheel manually. Height of cutter can be adjusted		

Parts of Table Cutting Machine

 **Cutter assembly**	 **Table of the machine**	 **Base of the machine**

Specification or Capabilities of the Machine.

Diameter of the cutter: - 12 to 18 inches.

Movement of the Table against the revolving cutter: - 2 to 3 Feet.

Power of the motor: - 10 hp.

Frequently Asked Questions

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency-based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
3. What are the entry requirements for this course?	The entry requirement for this course is 8th Grade or equivalent.
4. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-2 in Marble Technician. You shall be able to progress further to National Vocational Certificate Level-3-4 in Marble Technician Course; and take admission in a level-5, DAE or equivalent course (if applicable). In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
5. If I have the experience and skills mentioned in the competency standards, do I still need to attend the course to attain this certificate?	You can opt to take part in the Recognition of Prior Learning (RPL) program by contacting the relevant training institute and getting assessed by providing the required evidences.
6. What is the entry requirement for Recognition of Prior Learning program (RPL)?	There is no general entry requirement. The institute shall assess you, identify your competence gaps and offer you courses to cover the gaps; after which you can take up the final assessment.

7. Is there any age restriction for entry in this course or Recognition of Prior Learning program (RPL)?	There are no age restrictions to enter this course or take up the Recognition of Prior Learning program
8. What is the duration of this course?	The duration of the course work is 1,510 hrs. (11 months)
9. What are the class timings?	The classes are normally offered 25 days a month from 08:00am to 01:30pm. These may vary according to the practices of certain institutes.
10. What is equivalence of this certificate with other qualifications?	As per the national vocational qualification's framework, the level-4 certificate is equivalent to Matriculation. The equivalence certificate can be obtained from The Inter Board Committee of Chairmen (IBCC).
11. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
12. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	You shall be able to take up jobs in the local or overseas construction companies in heavy machinery operator job profile.
13. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels.
14. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.

15. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
16. How much salary can I get on job after attaining this certificate?	The minimum wages announced by the Government of Pakistan in 2019 are PKR 17,500. This may vary in subsequent years and different regions of the country. Progressive employers may pay more than the mentioned amount. The heavy Machinery Operator normally earns 20,000 to 25,000 in the start.
17. Are there any alternative certificates which I can take up?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
18. What is the teaching language of this course?	The leaching language of this course is Urdu and English.
19. Is it possible to switch to other certificate programs during the course?	There are some short courses offered by some training institutes on this subject. Some institutes may still be offering conventional certificate courses in the field.
20. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
21. Does this certificate enable me to work as freelancer?	You can start your small business by purchasing your own heavy construction machine and can start earning 50,000 per month. You may need additional skills on entrepreneurship to support your initiative.

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