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SURGICAL INSTRUMENTS MANUFACTURING TECHNICIAN

LEARNER GUIDE

National Vocational Certificate Level 2

Version 1 - May, 2019

NAVTTC

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Introduction

Welcome to the Learner's Guide for the Surgical instruments Manufacturing Technician expert program me. It will help you to complete the program me and to go on to pursue further study or go straight into employment.

The Surgical instruments Manufacturing Technician expert program me is to engage young people with a program me of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The program me 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 this learner's guide are:

- Introduction:
  - This includes a brief description of guide and guidelines to use it effectively
- Modules:
  - The modules form the sections in this 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 learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) The learner will be required 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 section contains the summary of the modules that make up this 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 learners for their your assessment.
- Multiple choice questions for self-test:
  - These are provided as an exercise at the end of your learner's guide to help the learners in preparing for their assessment.

SURGICAL INSTRUMENTS MANUFACTURING TECHNICIAN

Module-1

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Module 1: Perform Grinding

Objective of the module: The aim of this module to develop the knowledge, skills and understanding needed to perform grinding

Duration: 70 hours **Theory:** 14 hours **Practical:** 56 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Perform wheel grinding	**The learner will be able to:** Mount grinding wheel on bench grinding machine as per job requirement Perform dressing of grinding wheel using appropriate dresser if required Grind the instrument to remove excess material as per product requirement Control size of instrument during and after grinding using appropriate gauges	Understand health and safety requirements of grinding work (Safety guard) Understand inspection, mounting and usage of different types of grinding wheels Understand grinding wheel dressing requirements Understand operation/ perform of grinding Understand gauges used for size and shape measurement in grinding process Understand the defects of work pieces grinded and its corrective measures	Bench/ pedestal grinding machine with dust collector Measuring instruments and gauge Container for Coolant **Consumable:** First aid box with complete accessories Personal protective equipment (Helmets, Safety Goggles, Safety Shoe, Apron, Ear Plug/Muff etc.) Grinding wheel Wheel Dresser Coolant work piece Process travel card
LU2: Perform filing	**The learner will be able to:** Select appropriate file (size and shape) according to	Understand health and safety requirements of filling work Understand inspection of filling	Bench Vices Measuring instruments and gauges (Vernier caliper, steel rule, specific gauges etc.) **Consumable:**

	job finish requirement Clamp the instrument using appropriate vice File the instrument according to required shape Control shape and size of instrument during and after filing using appropriate gauges	Understand operation/ perform of filling Understand gauges used for size and shape measurement in filling process Knowledge about types of vices Knowledge about types of files (shapes and sizes) Understand the defects of work pieces filled and its corrective measures	First aid box with complete accessories Personal protective equipment (Helmets, Safety Goggles, Safety Shoe, Apron, Ear Plug/Muff etc.) File (Different sizes and shapes) work piece Process travel card
LU3: Perform drilling	**The learner will be able to:** Prepare pedestal drill machine using drill bits and fixtures according to job requirement Sharpen the drill bit using tool grinder if required Clamp the work piece on drill machine using fixtures Drill holes in work piece as per required sizes	Understand health and safety requirements of drilling work Understand inspection of drill machines, drill bits, taps and reamer Understand operation of drill machines, drill bits, taps and reamer Understand gauges used for size and shape measurement in drilling process Knowledge about types of fixtures and vices Understand drill bit sharpening	Pedestal drilling machine with accessories (chucks, sleeves etc.) Fixtures and Vices Measuring instruments and gauges Tool and cutter grinder machine **Consumable:** First aid box with complete accessories Personal protective equipment (Helmets, Safety Goggles, Safety Shoe, Apron, Ear Plug/Muff etc.) Drill set Tap set reamers work piece Process travel card

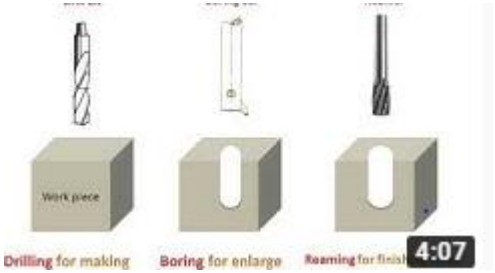
	Perform countersink on drilled holes where required Perform reaming in drilled holes where required Perform tapping in drilled holes where required Control quality of instrument during and after drilling using appropriate gauges Prepare report of completed work.	Understand cutting lubricants used in drilling and tapping Basic understanding of commonly used drilling processes Understand the defects of drilled work pieces and its corrective measures Understanding PTC (process travelling card) and its applications (Storage of job, quality, quantity etc)	

Videos

Understand health and safety requirements of drilling work
Understand inspection of drill machines, drill bits, taps and reamer
Understand operation of drill machines, drill bits, taps and reamer
Understand gauges used for size and shape measurement in drilling process
Knowledge about types of fixtures and vice
Understand drill bit sharpening
Understand cutting lubricants used in drilling and tapping
Basic understanding of commonly used drilling processes

Understand the defects of drilled work pieces and its corrective measures
Understand the defects of work pieces grinded and its corrective measures
Understand the defects of work pieces grinded and its corrective measures
Understand grinding wheel dressing requirements
Understand inspection, mounting and usage of different types of grinding wheels
Understand grinding wheel dressing requirements

	**How to use a Vernier caliper?** **Understand the defects of work pieces grinded and its corrective measures** https://www.youtube.com/watch?v=vkPlzmalvN4
	**How to use a steel rule?** **Understand the defects of work pieces grinded and its corrective measures** https://www.youtube.com/watch?v=0KXPuBUdDtw https://www.youtube.com/watch?v=kIEaoslrVf8
	**How to perform the grinding?** **Understand grinding wheel dressing requirements** **Understand operation/ perform of grinding** **Understand gauges used for size and shape measurement in grinding process** https://www.youtube.com/watch?v=HutAoN9_7cc

	**How to perform filing?** **Understand inspection of filling** **Knowledge about types of files (shapes and sizes)** **Knowledge about types of vices** https://www.youtube.com/watch?v=BM8gZuLr0CE https://www.youtube.com/watch?v=lOR2UwZRBws
	**How to perform drilling?** **Understand inspection of drill machines, drill bits, taps and reamer** **Understand operation of drill machines, drill bits, taps and reamer** **Understand gauges used for size and shape measurement in drilling process** **Understand drill bit sharpening** https://www.youtube.com/watch?v=ZGU1zP7KPbY https://www.youtube.com/watch?v=T62n26xQbmI
	**How to use a safety precaution?** **Understand health and safety requirements of filling work** https://www.youtube.com/watch?v=4xQb30huEf0 https://www.youtube.com/watch?v=pXS6ESHeeqk https://www.youtube.com/watch?v=4xQb30huEf0

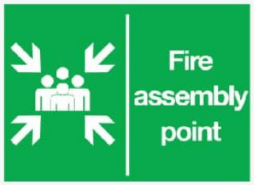
Example and illustration

health and safety requirements

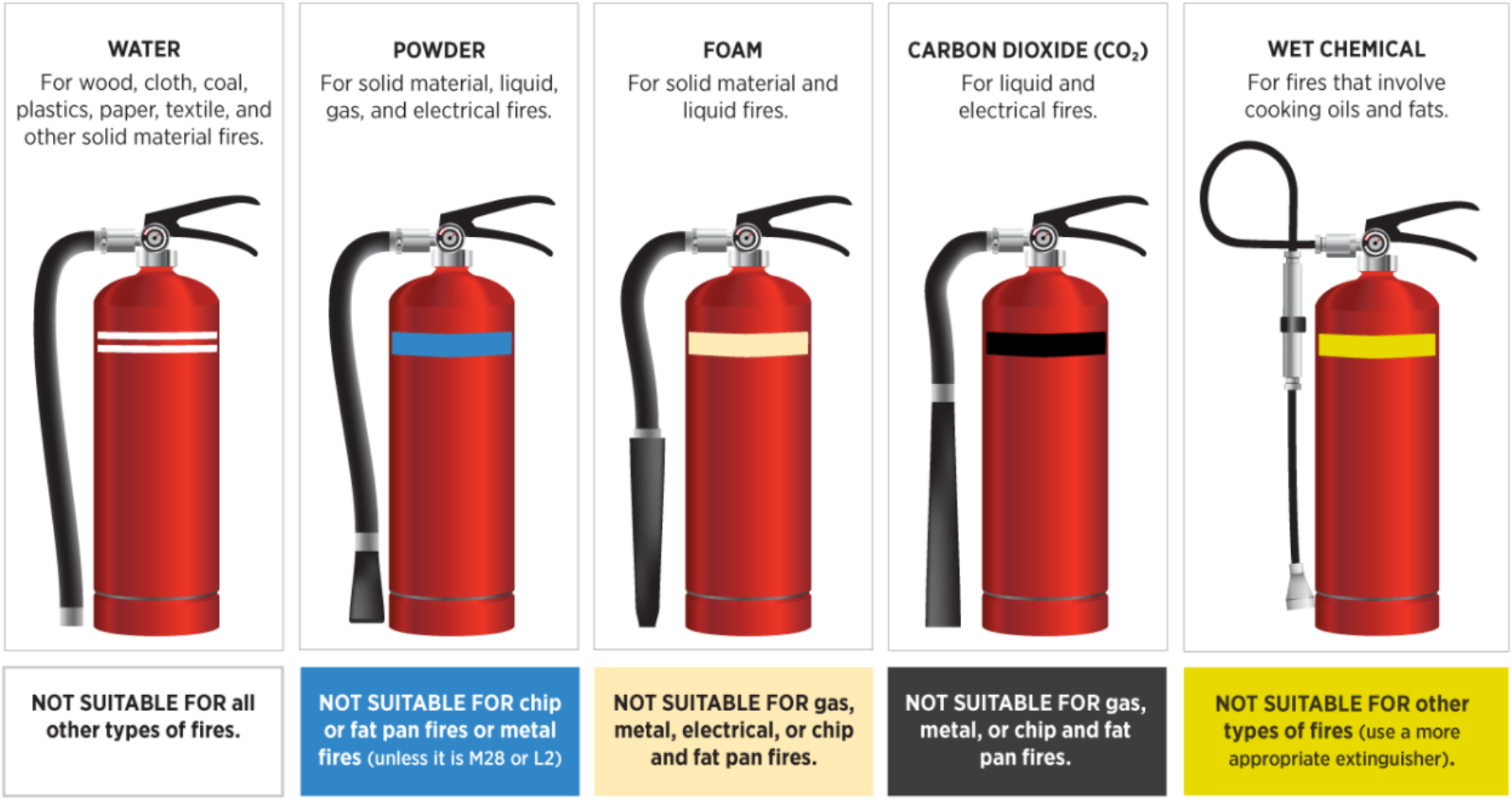
Understand health and safety requirements of grinding work (Safety guard)

Emergency notices

Sign	Description
	Fire Extinguisher sign - displayed next to all fire extinguishers to easily identify the location of the nearest extinguisher.
	Fire Alarm Call Point sign - located at all fire alarms.
	Fire Hose Reel sign – located at all fire hose points.
	Fire Blanket sign - located at all fire blanked locations
	In Case of Fire, Do Not Use the Lift sign - displayed at all lifts alongside the 'Use Stairs' sign to indicate safe escape route.

Sign	Description
	Fire Door Keep Shut sign - displayed on each side of all fire doors to ensure safety.
	Fire Exit sign - displayed along all designated fire escape routes (with arrows) and above all emergency exits (without arrows).
	Fire Assembly Point - a pictogram or written sign displayed at the outside point of assembly where people must gather after evacuation.
	In Case of Fire, Use Stairs sign - an information sign displayed next to lifts and at the top of staircases so people know not to use the lift for safety reasons.

Main types of portable extinguishers, their uses and colour coding



For more detailed information, please visit https://www.highspeedtraining.co.uk/hub/fire-safety-signs/

First aid equipment

Standard Kit Contents:	Small	Medium	Large
Guidance Leaflet	1	1	1
Medium Sterile Dressings	4	6	8
Large Sterile Dressing	1	2	2
Triangular Bandages	2	3	4
Safety Pins	6	12	24
Eye Pad Sterile Dressings	2	3	4
Blue Detectable Plasters	40	60	100
Sterile Cleansing Wipes	20	30	40
Adhesive Tape	1	1	1
Nitrile Disposable Gloves (Pairs)	6	9	12
Finger Sterile Dressings	2	3	4
Resuscitation Face Shield	1	1	2
Foil Blanket	1	2	3
Hydrogel Burn Dressing	1	2	2
Shears	1	1	1
Conforming Bandage	1	2	2
Green Moulded Case	1	1	1

For more detailed information, please visit
https://www.eurekadirect.co.uk/First-Aid-Kits-Cabinets/Catering-First-Aid-Kits/Catering-Kit-BS85991-Compliant-Standard-Case

Accident and incident log

JUST CONNECTIONS

Accident and Incident Log

Partners for Inclusion

Date & Time	Who was involved	What happened	Outcome	A & I Form completed by	Who was responsible for taking to office & when	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	
					Print Name	
					Sign	
					Date	

Accident & Incident log uploaded to web June 2014

For more detailed information, please visit https://www.youtube.com/watch?v=inZczv3bLu4

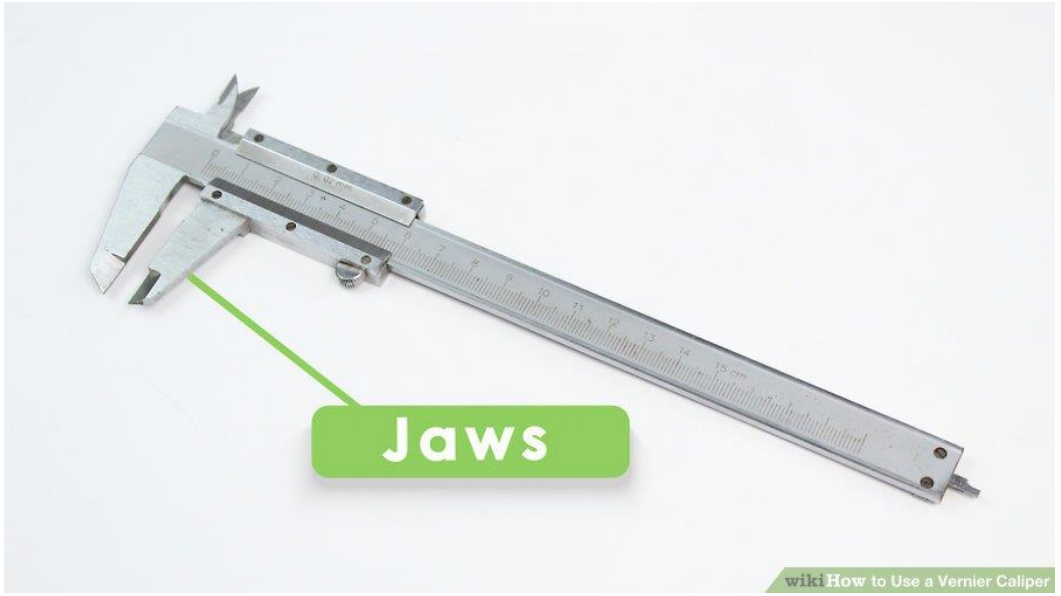
Understand gauges used for size and shape measurement in grinding process

Understand gauges used for size and shape measurement in grinding process

How to Use a Vernier Caliper

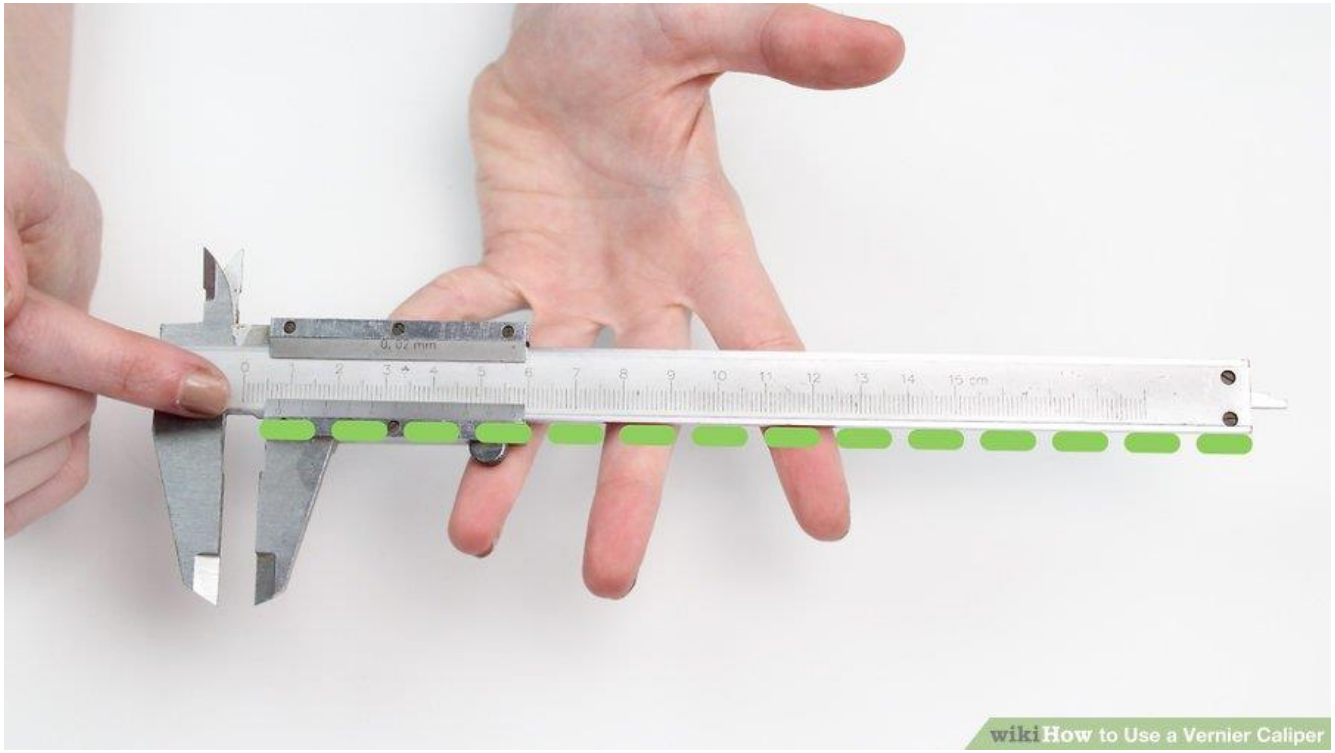
A Vernier caliper is an instrument that measures internal or external dimensions and distances. It allows you to take more precise measurements than you could with regular rulers.

Preparing Your Instruments and Tools



Understand the parts of the Vernier caliper.

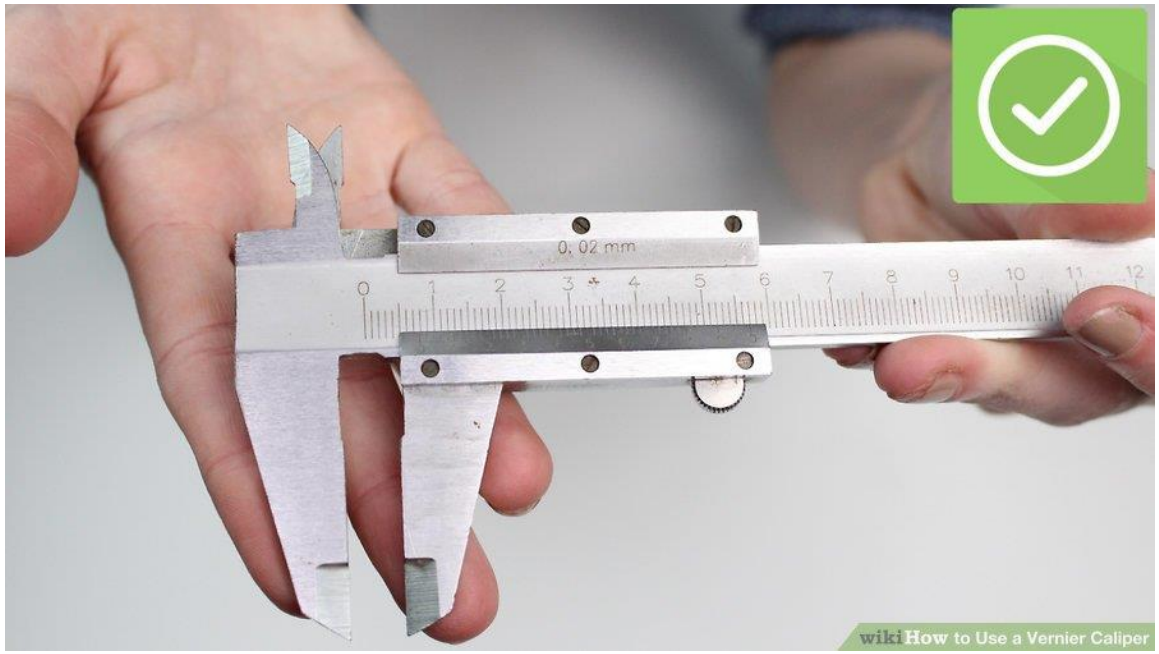
A Vernier caliper has main jaws that are used for measuring external diameter, as well as smaller jaws that are used for measuring the internal diameter of objects. Some models also have a depth gauge. The main scale is fixed in place, while the Vernier scale is the name for the sliding scale that opens and closes the jaws.



Read the scales on your Vernier caliper.

Each scale of your caliper reads like an ordinary ruler. Typically, a caliper has a main scale marked with numbered inches or centimeters, plus smaller divisions between them. The sliding (Vernier) scale should have a label engraved on it to tell you what it represents.

- If the sliding scale doesn't have a label, you can assume the numbered divisions represent 1/10 of the smallest division on the main scale. For example, if the main scale's smallest lines represent 0.1 inches, then each numbered division on the Vernier scale represents 0.01 inches.
- The main scale is "life size," while the sliding scale is magnified for easy reading. This magnification system allows the Vernier caliper to measure more precisely than a ruler.



Check the scale of your smallest divisions. Before making a measurement, count the number of lines between two numbers on your Vernier scale. Use this to determine how much distance each of the smallest lines represents.[3]

- For example, the numbers on a Vernier scale represent 0.1 inches, and there are five unnumbered lines between them. 0.1 inches ÷ 5 = 0.02 inches, so each of the unnumbered lines represents 0.02 inches.

For more information please visit: https://www.wikihow.com/Use-a-Vernier-Caliper

The Steel Rule

With the technical advances being made, most people are inclined to think that complex electrical measuring equipment is needed to inspect parts made by the machinist or toolmaker. Although this is true in some cases, the majority of the parts that are made do not require this sophisticated equipment.

One tool that is very common in the machine shop area that is not a high precision measuring tool is the steel rule.

Figure 1

The rigid six-inch rule is a common measuring tool found in the machine shop. The rule is a strip of metal graduated in inches and fractions of an inch to give actual measurements.

When tolerances of fractional dimensions are required, the steel rule is used. The most commonly used steel rule is the 6" rule. Although rules come in 6-inch increments (Example: 6", 12", 18", 24", and 36" lengths), the 6-inch rule is the most popular because it fits into the apron pocket easily. It also comes in various widths and thicknesses to meet varying requirements, as will be seen in the slide series.

Rules vs. Scales

The terms "rules" and "scales" are used in different ways by different workers, sometimes causing confusion. While some manufacturing workers do not differentiate between these terms, others use the term "rule" when referring to a measurement tool that provides actual linear measurements. In other words, one inch on the rule represents exactly one inch of linear distance. On the other hand, to these workers, a scale is a measurement tool in which an actual measured linear distance

represents another imaginary (smaller or larger) linear distance. For example, on an architect's scale (Figure 2), one inch of measured distance may represent one foot of actual linear distance. When this principle is in operation, a "key" should indicate the ratio of measured distance to actual distance or "scale" that is being used.

Figure 2: Architectural Scale

Increment division

There are four basic divisions that are found on a fractional inch rule. These are: 1/64, 1/32, 1/16 and 1/8 of an inch.

Let's look at each graduation a little closer. A 1/64" graduate scale means that in a 1-inch length, there are 64 lines dividing that inch.

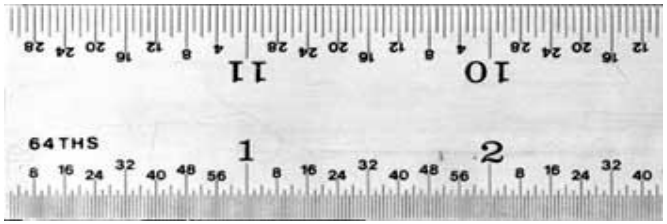


Figure 3

These are the smallest graduations on the rule, therefore making the accuracy of a steel rule 1/64". This is sometimes argued by some of the metal workers who say they can measure to within ±.003 with the rule. They are right for they have worked with it a long time and have become masters at reading the graduations. However, the rule is only intended to measure to 1/64" accuracy, and other instruments are used to measure to closer tolerances.

The next set of graduations is the 1/32" scale, which divides a 1-inch length into 32 divisions. A 1/32 division is equal to 2/64 divisions.

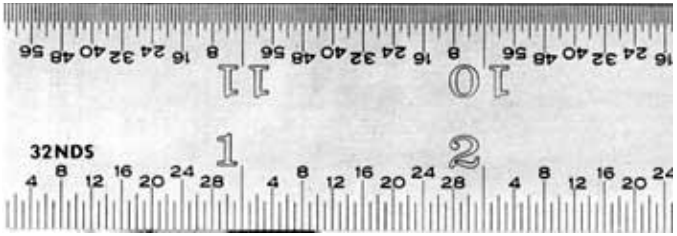


Figure 4

The 1/16" scale divides a 1-inch length into 16 divisions and is a total of 4/64 or 2/32 graduations.

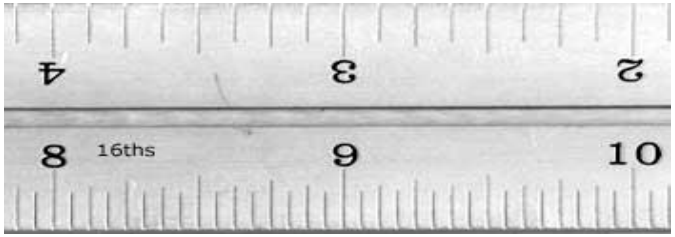


Figure 5

The 1/8" scale divides a 1-inch length into 8 equal divisions and is a total of 8/64, 4/32, or 2/16 graduations.

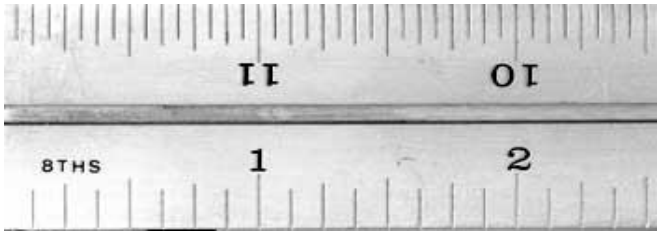


Figure 6

As you can see, a combination of two or more of the various graduations will make up a larger graduation. The same holds true with graduations larger than 1/8". Any combination of the four different sized graduations will give a reading up to the 1-inch length. Figure 7 is a decimal equivalent chart that shows all the various fractions possible in one inch.

DECIMAL EQUIVALENTS

1/64	.015625	17/64	.265625	33/64	.515625	49/64	.765625
1/32	.03125	9/32	.28125	17/32	.53125	25/32	.78125
3/64	.046875	19/64	.296875	35/64	.546875	51/64	.796875
1/16	.0625	5/16	.3125	9/16	.5625	13/16	.8125
5/64	.078125	21/64	.328125	37/64	.578125	53/64	.828125
3/32	.09375	11/32	.34375	19/32	.59375	27/32	.84375
7/64	.109375	23/64	.359375	39/64	.609375	55/64	.859375
1/8	.125	3/8	.375	5/8	.625	7/8	.875
9/64	.140625	25/64	.390625	41/64	.640625	57/64	.890625
5/32	.15625	13/32	.40625	21/32	.65625	29/32	.90625
11/64	.171875	27/64	.421875	43/64	.671875	59/64	.921875
3/16	.1875	7/16	.4375	11/16	.6875	15/16	.9375
13/64	.203125	29/64	.453125	45/64	.703125	61/64	.953125
7/32	.21875	15/32	.46875	23/32	.71875	31/32	.96875
15/64	.234375	31/64	.484375	47/64	.734375	63/64	.984375
1/4	.25	1/2	.5	3/4	.75	1	1.

As can be seen on the chart, 3/8" is only given as 3/8". It is not 24/64", 6/16", or 12/32". Any of these fractions does equal 3/8", but it is reduced to its lowest terms. Another example would be 7/16". This could be given as 14/32" or 28/64", but these are not in their lowest terms.

Also, the 1/2 division, the 3/4 division and 1-inch division are not read as 8ths, 64ths, 32nds, or 1/16, even though they are made from these combinations. They are read as 1/2", 3/4", or 1 inch. Now that you have this information under your belt, let's look at how a rule should be used.

To get the full accuracy out of a rule, it is important to use it correctly. Never use the end of the rule to align with the edge of the work for a measurement (Figure 8). The end of a rule is often rounded off from misuse, and a true measurement will not be made.

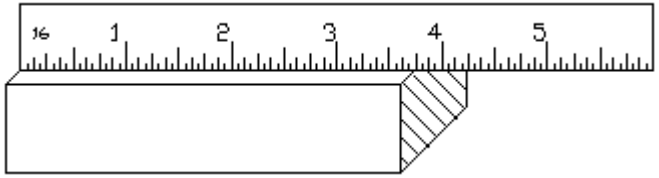
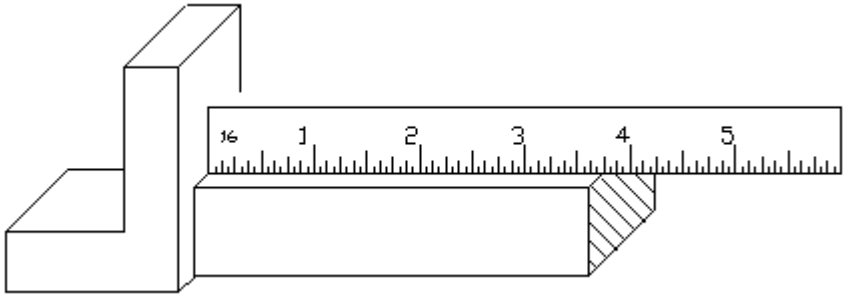


Figure 8



Even if the workpiece is held firmly against a reference surface, such as an angle plate (Figure 9), this will not assure an accurate measurement if the end of the rule is worn off.

Figure 9

To offset this, use an inch graduation as a reference point on the rule (Figure 10). Precision and reliable measurements are possible this way. With the graduation directly on the edge of the work, and by not using the end of the rule, wear is inconsequential.

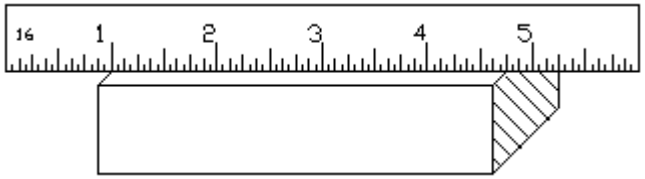
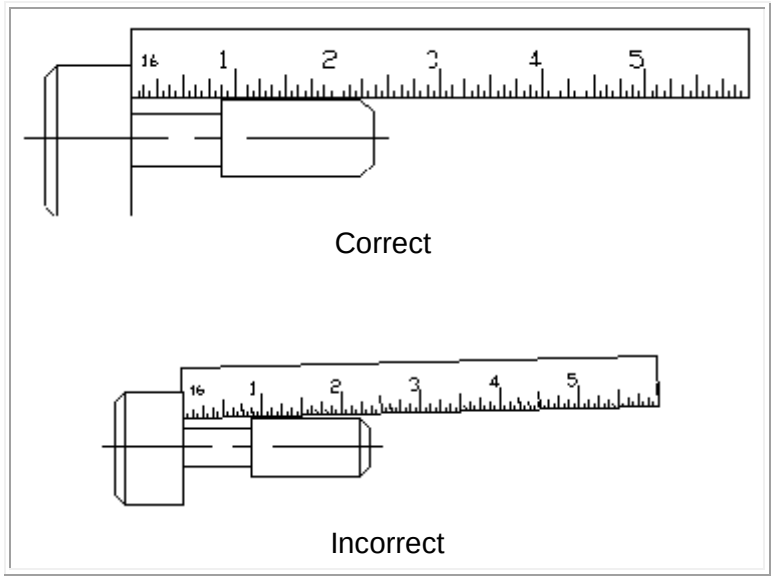
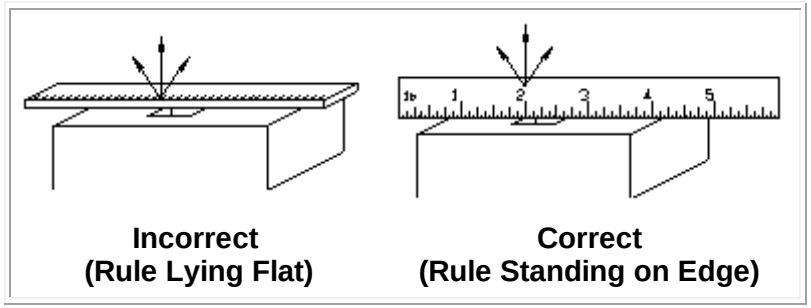


Figure 10

When measuring a length, the rule must be kept in a straight line parallel to the centre line of the work. If it is tilted, the measurement will be longer than the actual part.



One other important factor in using the rule is to be aware of parallax. This is an observation error from the person measuring or holding at the part in relation to the part being held.



In the drawing on the left shows an incorrect way of measuring, and parallax is greatly increased because of the thickness of the rule. The graduations do not come in direct contact with the work. The arrows pointing to the right and left will cause parallax, and even though the arrow pointing straight up is the correct way to view the rule, there is a chance for error in reading due to the thickness of the rule.

The drawing on the right shows the rule on its edge. As can be seen, the graduation comes in contact with the work, which is the correct way of measuring. Although the arrows pointing to the right and left will cause an improper reading, it will not be as great an error as when the rule is used in the manner shown in the drawing on the left. The proper way is to view the graduation straight up as the centre arrow illustrates.

For more information please visit: https://www.wisc-online.com/LearningContent/mtl1101/StlRule.htm

Understand inspection, mounting and usage of different types of grinding wheels
Understand grinding wheel dressing requirements

072200880 Perform Wheel grinding

Grinding is a cutting method that involves the use of a grinding wheel to abrasively machine the material that you wish to cut. In manufacturing and tool making there are a wide variety of grinding machines and methods that can be used on many different materials, including metals.

Grinding is recognized for producing very fine finishes and accurate shapes, while also having the ability to rapidly cut large volumes of metal in mass production contexts. In general, it is better suited for cutting very hard materials than other forms of machining and traditionally was one of the only practical methods of cutting materials such as hardened steels. One reason it is commonly used with plate and sheet is its ability to make very shallow cuts, for instance reducing a shaft's diameter by half a thousandth of an inch.

While it might not seem like it when first encountered, grinding is a true metal-cutting process. The way it works, at the microscopic level, is that each grain of the abrasive material serves as an individual cutting edge. As the grinder is applied to the material to be cut, the abrasive shears tiny chips. However, grinding is often thought of as a separate category from cutting and is referred to as such on-shop floors.

Understand health and safety requirements of filling work
Understand inspection of filling
Understand operation/ perform of filling
Understand gauges used for size and shape measurement in filling process
Knowledge about types of files (shapes and sizes)

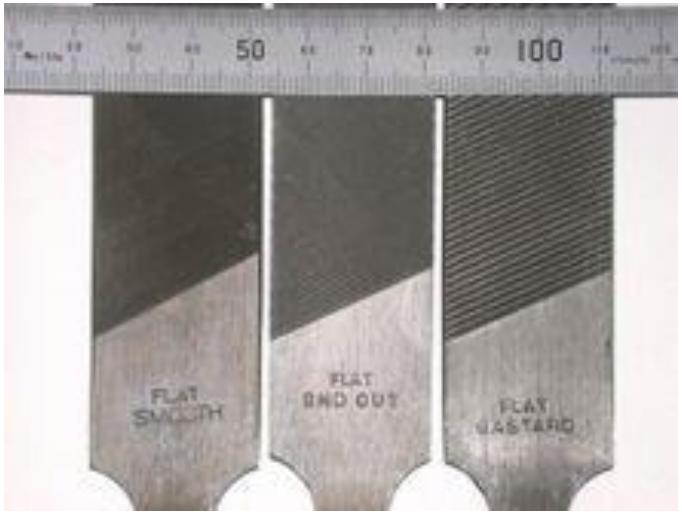
Perform Filling

A **file** is a tool used to remove fine amounts of material from a workpiece. It is common in metalworking, and other similar trade and hobby tasks. Most are hand tools, made of a case-hardened steel bar of rectangular, square, triangular, A file is a tool used to remove fine amounts of material from a workpiece. It is common in woodworking, metalworking, and other similar trade and hobby tasks. Most are hand tools, made of a case-hardened steel bar of rectangular, square, triangular, or round cross-section, with one or more surfaces cut with sharp, generally parallel teeth. A narrow, pointed tang is common at one end, to which a handle may be fitted.

A rasp is a form of file with distinct, individually cut teeth used for coarsely removing large amounts of material.

Files have also been developed with abrasive surfaces, such as natural or synthetic diamond grains or silicon carbide, allowing removal of material that would dull or resist metal, such as ceramic.

Types



Relative tooth sizes for smooth, 2nd cut and bastard files

Files come in a wide variety of materials, sizes, shapes, cuts, and tooth configurations. The cross-section of a file can be flat, round, half-round, triangular, square, knife edge or of a more specialized shape. Steel files are made from high carbon steel (1.0 to 1.25% carbon) and may be through hardened or case hardened.

There is no unitary international standard for file nomenclature; however, there are many generally accepted names for certain kinds of files. A file is "blunt" if its sides and width are both parallel throughout its length. It is "tapered" if there is a reduction in its dimensions from its heel toward its point. A file may taper in width, in thickness, or both. A "tang" is a protrusion at the heel, tapered, parallel sided, or conical, for gripping, inserting in a handle, or mounting in a chuck.

The cut of the file refers to how fine its teeth are. They are defined as (from roughest to smoothest): rough, middle, bastard, second cut, smooth, and dead smooth. A single-cut file has one set of parallel teeth while a cross-cut or double-cut file has a second set of cuts forming diamond shaped cutting surfaces.[1] In Swiss-pattern files the teeth are cut at a shallower angle, and are graded by number, with a number 1 file being coarser than a number 2, etc. Most files have teeth on all faces, but some specialty flat files have teeth on only one face or one edge, so that the user can come right up to another edge without damaging the finish on it.

Some of the common shapes and their uses:

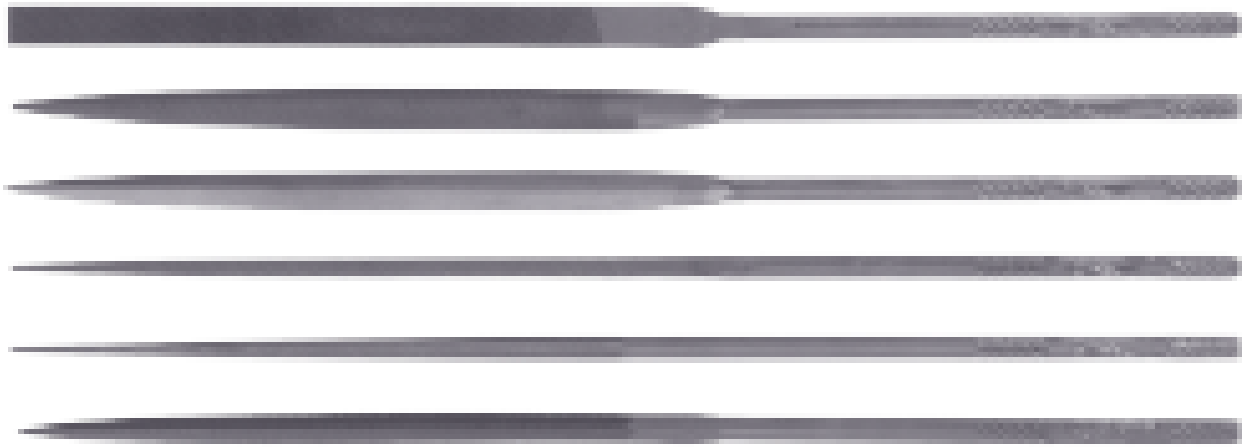
Name	
Flat file	Similar to a mill file, but may be double-cut
Hand file	Parallel in width and tapered in thickness, used for general work
Square file	Gradually tapered and cut on all four sides. Used for a wide variety of tasks
Three square/Triangular file	Triangular in cross-section, which may taper gradually, often to a point on smaller files. The sides may be equal in cross-section, or have two long and one short surface
Rat tail	Round in cross-section and gradually tapered over their length. They are used for enlarging round holes or cutting scalloped edges
Round	Round in cross section and equal diameter over their length (not tapered). They are used for smoothing inside holes and circular grooves, and for sharpening certain kinds of saw.
Half round file	Has one flat and one convex surface, and either tapering slightly or maintaining an even thickness, width, or both over their length
Combination file	Tangles, flat sided or half-round, with two to four cutting surfaces, typically including a combination of single cut, double cut, or rasp

Diamond files

A selection of diamond impregnated files

Instead of having teeth cut into the file's working surface, diamond files have small particles of industrial diamond embedded in their surface (or into a softer material that is bonded to the underlying surface of the file). The use of diamonds in this manner allows the file to be used effectively against extremely hard materials, such as stone, glass or very hard metals such as hardened steel or carbide against which a standard steel file is ineffective. Diamond files are also the only type that may be used with a back-and-forth motion without damaging the file. These may also be called diamond laps, as the "teeth" are not regular projections, as in a file, but particles, usually shaped and located randomly and held in place by a softer (any other) material.

Needle files



A needle file set depicting various shapes, from top to bottom: pillar, half round, barrette, square, round, triangular.

The image to the left shows a selection of needle files in an assortment of cross-sectional shapes.

Needle files are small files that are used in applications where the surface finish takes priority over metal removal rates but they are most suited for smaller work pieces. They are often sold in sets, including different shapes.

Machine Files

A selection of machine files

Files are produced specifically for use in a filing machine, which is similar in appearance to a scroll saw with a vertically reciprocating file mounted in the middle of a table. A workpiece is manipulated around the file's face as the shape requires.

A cone point (as pictured in the top and bottom files at left) allows a file to centre itself in its mount. Files with flat mounting surfaces must be secured with set screws.

Filing machines are rarely seen in modern production environments, but may be found in older toolrooms or die making shops as an aid in the manufacture of specialist tooling.

Perform drilling

Process

Drilled holes are characterized by their sharp edge on the entrance side and the presence of burrs on the exit side (unless they have been removed). Also, the inside of the hole usually has helical feed marks.

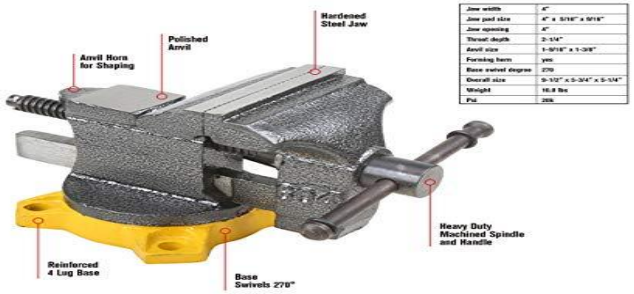
Drilling may affect the mechanical properties of the workpiece by creating low residual stresses around the hole opening and a very thin layer of highly stressed and disturbed material on the newly formed surface. This causes the workpiece to become more susceptible to corrosion and crack propagation at the stressed surface. A finish operation may be done to avoid these detrimental conditions.

For fluted drill bits, any chips are removed via the flutes. Chips may form long spirals or small flakes, depending on the material, and process parameters. The type of chips formed can be an indicator of the machinability of the material, with long chips suggesting good material machinability.

When possible, drilled holes should be located perpendicular to the workpiece surface. This minimizes the drill bit's tendency to "walk", that is, to be deflected from the intended centre-line of the bore, causing the hole to be misplaced. The higher the length-to-diameter ratio of the drill bit, the greater the tendency to walk. The tendency to walk is also pre-empted in various other ways, which include:

- Establishing a centering mark or feature before drilling, such as by:
    - Casting, forging a mark into the workpiece
    - Center punching
    - Spot drilling (i.e., center drilling)
    - Spot facing, which is machining a certain area on a casting or forging to establish an accurately located face on an otherwise rough surface.
- Constraining the position of the drill bit using a drill jig with drill bushings

Knowledge about types of vices



For more information please visit: https://www.wikihow.com/File-Metal

Understanding PTC (process travelling card) and its applications (Storage of job, quality, quantity etc)

Example of PTC (Process Traveller Card)

Company Name					Forms
Effective Date	09.04.2018	Rev #	01	Rev. Date	09.04.2018

PROCESS TRAVELER

PIT-17-01-01

INSTRUMENT_____ Sample /Cat. No._____

STEEL BATCH NO._____LOT NO. _____

Sr #	Mfg. Steps	Units started	Completed by	Date completed	Units accepted	Units reworked	Units rejected	Prod. Foreman by	QA Checked by
1.	Cutting								
2.	Forging								
3.	Milling								
4.	Assembling								
5.	Grinding								
6.	QA Inspection 4%								**
7.	H. Treatment								
8.	Hardness								
9.	Acid								
10.	Fitting								
11.	Spot Weld								
12.	Rough Polish								
13.	U. Clean								
14.	E. Polish								
15.	Setting/Adj								
16.	Sand Blast								
17.	Final Polish								
18.	Satin Finish								
19.	U. Clean								
20.	Passivation								
21.	Boil Test								
22.	Marking								
23.	Oiling								
24.	QA Inspection 4 %								**
25.	Packing								
26.	Label								

*Vendor Step ** Identifies QA Checks and all other Inspections are by Manufacturing

SURGICAL INSTRUMENTS MANUFACTURING TECHNICIAN

Module-2

LEARNER GUIDE

National Vocational Certificate Level 2

Version 1 - May, 2019

Module 2: 072200881 Assemble Surgical Instruments

Module 2: Assemble Surgical Instruments

Objective of the module: The aim of this module to develop the knowledge, skills and understanding needed to assemble surgical instruments

Duration: 12 hours **Theory:** 48 hours **Practical:** 60 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Perform fastening	**The learner will be able to:** Drill holes in work pieces at specified areas Use pin grinder at narrow areas if required Assemble the instrument components by riveting where applicable Tap drilled holes and assemble the surgical instrument	Understand health and safety requirements of fastening processes Understand usage of hammers / mallets Understand usage of files Understand operating of pin grinder Understand operation of tapping Understand operating drill machine Understand sharpness requirements of drill bits Understand types of fasteners (Rivets, screws) and fastening techniques Understand instrument functionality requirements	Riveting press Orbital riveting punch “peen” (to develop the shape on the rivets) Pin grinder Wheel Grinding machine Hammers Mallets Measuring instruments and gauges (Vernier Caliper, Micrometer etc.) Drill Machine Screw drivers set Combination pliers Allen key set (L-key) Anvil/ work station (Brass block etc.) **Consumable:** First aid box with complete accessories Personal protective equipment (Safety Goggles, safety gloves, Safety Shoe, Face mask, Apron, etc.)

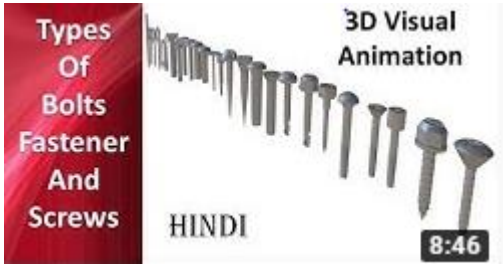
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	components using screws where applicable Check functionality and quality of surgical instruments and prepare a report	Understand operating riveting press Understand usage of measuring instruments and gauges (Vernier Caliper, Micrometer etc.) Understand technical drawings and work instructions Understand the defects of fastening process (Improper fitting and functionality etc.) and its corrective measures Understanding PTC (process travelling card) and its applications (Storage of job, quality, quantity etc.) Understanding of handling methods of fastening process of work piece	Rivets Files Drill set Tap set Pin Grinder tools (Cutters and stones etc.) Different size of screws work piece Process travel card
LU2: Apply setting	**The learner will be able to:** Adjust alignment of surgical instruments using mallet hammer Grind / file the surgical instruments where required Check functionality of surgical instruments and prepare a report	Understand health and safety requirements of apply setting processes Understand usage of hammers / mallets Understand usage of files Understand operating of pin grinder and wheel grinder Understand instrument functionality requirements Understand usage of measuring instruments and gauges (	Pin grinder Wheel Grinding machine Hammers Mallets Measuring instruments and gauges (Vernier Caliper, Micrometer etc.) Screw drivers set Combination plier Allen key set (L-key)

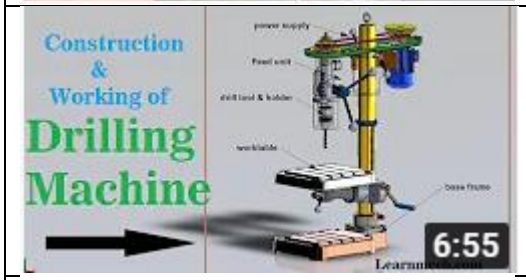
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		Vernier Caliper, Micrometer etc.) Understand technical drawings and work instructions Understand the defects of setting process (Improper fitting and functionality etc) and its corrective measures Understanding PTC (process travelling card) and its applications (Storage of job, quality, quantity etc) Understanding of handling methods of setting process of work piece	Anvil/ work station (Brass block etc.) **Consumable:** First aid box with complete accessories Personal protective equipment (Safety Goggles, Safety Shoe, Face mask, Apron, etc.) Files Pin Grinder tools (Cutters and stones etc.) work piece Process travel card
LU3: Inspect quality of instruments	**The learner will be able to:** Gather technical sheets, drawings, samples etc. Arrange required measuring tools and gauges for quality inspection Check setting of surgical instruments as per specification	Understand basic health and environment safety requirements of quality inspection processes (Proper light system, free of moisture, ventilation system etc) Understand technical drawings and work instructions Understand instrument functionality as per customer requirements Understand usage of measuring instruments and gauges (Vernier Caliper, Micrometer etc.) Understand the defects of instruments (Improper fitting and functionality, cracks, pin holes etc) and its corrective measures	Measuring instruments and gauges Magnifying glass **Consumable:** First aid box with complete accessories Personal protective equipment (Safety Goggles, Safety Shoe, Face mask, Apron, etc.) Cotton/ cleaning clothes Paraffin oil Drawing sheet work piece Dull stick Polish sticks Process travel card

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	sheet or sample Measure sizes and shapes of surgical instruments using gauges Prepare quality inspection report	Understanding PTC (process travelling card) and its applications (Storage of job, quality, quantity etc) Understanding of handling methods of work piece	

Videos:

Understand health and safety requirements of fastening processes
Understand sharpness requirements of drill bits
Understand types of fasteners (Rivets, screws) and fastening techniques
Understand instrument functionality requirements
Understand operating riveting press
Understand usage of measuring instruments and gauges (Vernier Caliper, Micrometer etc.)
Understand operating of pin grinder
Understand sharpness requirements of drill bits
Understand operating drill machine

	**What is Fastening?** **Understand health and safety requirements of fastening processes** **Understand usage of hammers / mallets** **Understand usage of files** **Understand operating of pin grinder** **Understand operation of tapping** **Understand operating drill machine** **Understand sharpness requirements of drill bits** **Understand types of fasteners (Rivets, screws) and fastening techniques** **Understand instrument functionality requirements** **Understand operating riveting press** https://www.youtube.com/watch?v=cFdmnvlP-PI https://www.youtube.com/watch?v=1uJfGIyrdbs
	**How to inspect of quality instruments?** **Understand usage of measuring instruments and gauges (Vernier Caliper, Micrometer etc.)** **Understand usage of measuring instruments and gauges** **(Vernier Caliper, Micrometer etc.)** **Understand instrument functionality as per customer requirements** https://www.youtube.com/watch?v=rs_Qytrvahk https://www.youtube.com/watch?v=IkFz34OXLfg https://www.youtube.com/watch?v=HZyIHWq3z8M

	**How operating of pin grinder?** **Understand operating of pin grinder** https://www.youtube.com/watch?v=C_7N7T8VF0A
	**How to sharpness requirements of drill bits?** **Understand sharpness requirements of drill bits** https://www.youtube.com/watch?v=y0SQkzScQk0 https://www.youtube.com/watch?v=Qze0GyBxBRY
	**How to operating drill machine?** **Understand operating drill machine** https://www.youtube.com/watch?v=OX3qYmcE3hQ
	**How to usage of hammers / mallets?** **Understand usage of hammers / mallets** https://www.youtube.com/watch?v=uSf_TKmSyas

	**How read technical drawings and work instructions?** **Understand technical drawings and work instructions** https://www.youtube.com/watch?v=jIDWH2ST5yY
	**How to check defects of surgical instruments (Improper fitting and functionality, cracks, pin holes etc) and its corrective measures?** **Understand the defects of fastening process (Improper fitting and functionality etc.) and its corrective measures** https://www.youtube.com/watch?v=AL9vIckHkQE

Illustration and Example

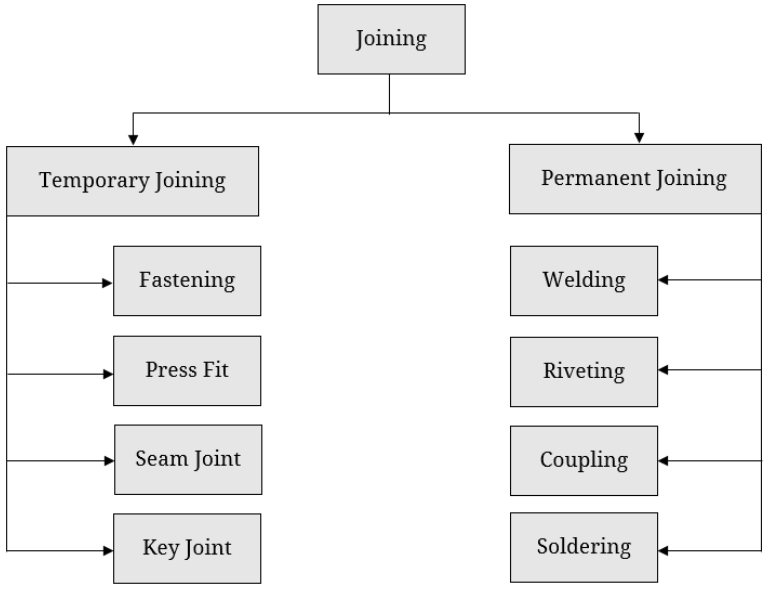
Understand health and safety requirements of fastening processes

What is fastening?

Fastening is one temporary joining process that employs additional elements to mechanically assemble or attach two or more parts together. Additional mechanical elements that are used for fastening is called fasteners. However, threaded elements like nut-bolt, screw, etc. are commonly considered as fasteners as it can provide reliable and sound joint. The term fastening, however, encompasses a larger group of fasteners. Apart from threaded fasteners, clamp, clip, ring, button, chain, pin, nail, metallic latch, hook, lobster, rope, cable, hose, flange, buckle, etc. are also fastening elements.

Joining

is a part and parcel to every manufacturing process as it facilitates easy, efficient and economic fabrication of products. Complex shaped objects or high-quality objects cannot be produced directly by casting. For research purposes or prototype development costly casting methods (like investment casting) can be employed to directly obtain desired product; but such a strategy will not be economical in industrial aspect where large scale production is required. To maintain production cost minimum, a basic shaped object is primarily made by casting and further processing are performed on it to impart intended features and functionalities as well as to improve upon surface finish and dimensional tolerance. Joining is one such post-processing technique which is employed to assemble individual components or structures to ultimately build a larger one.



By definition, joining is one of the manufacturing processes that is used to assemble two or more solid components either temporarily or permanently. Joining can be realized by utilizing additional elements (such as filler metal, rivet, strap, nut-bolt, screw, cotter, key, etc.) and/or taking assistance of external input (such as heat, pressure, shock wave, etc.). Not only metals, joining can be carried out for plastic, ceramic and composite also. To join a wide variety of materials in several ways, there exist quite a few joining processes, which can be broadly classified into two categories-temporary joining and permanent joining.

SURGICAL INSTRUMENTS MANUFACTURING TECHNICIAN

Module-3

LEARNER GUIDE

National Vocational Certificate Level 2

Version 1 - May, 2019

Module 3: 072200879 Perform Polishing

Objective of the module: The aim of this module to develop the higher-level knowledge, skills and understanding needed to perform polishing

Duration: 170 hours **Theory:** 136 hours **Practical:** 34 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Prepare workstation for polishing	**The learner will be able to:** Identify polishing and cleaning processes required for the instrument using work instructions / specification sheets Arrange material, tools and gauges for the identified polishing and cleaning processes Check quality of work pieces before polishing	Understand health and safety requirements of polishing and cleaning processes Understanding polishing, its types and requirements. Basic knowledge of polishing wheel (leather, cotton, dull brush etc), polishing belts and their specifications and uses Identify polishing materials (lustres etc) and their applications Knowledge of vibratory polish machine, ring grinding and blade grinding machine Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	Polishing lathe with attachments Vibratory polish machine Ring grinding machine Blade grinding machine Magnifying glass with light Tool kit **Consumable:** First aid box with complete accessories Personal protective equipment (Safety Goggles, Safety Shoe, Face mask, Apron, etc.) Belts Wheels Polishing lusters Lubricant (for lusters) Cotton/ cleaning clothes work piece/ job Polishing media of different grains for vibratory polish Grinding wheel Process travel card
LU2: Apply initial	**The learner will be able to:**	Understand health and safety requirements of	Polishing lathe with attachments

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
polishing	Load leather wheel and polishing belt on polishing lathe Polish surgical instrument as per required surface finish Control the quality of polishing using measuring instruments and gauges Handle and store polished instruments to avoid any surface damage	polishing and initial polishing processes Understand usage of measuring instruments and gauges (Vernier calliper, production gauges etc) Understanding of belt/wheel adjustment technique Understand polishing techniques and methods Identify polishing material used in various polishing stages Awareness of safety measures for storage and product handling	Vibratory polish machine Ring grinding machine Blade grinding machine measuring instruments and gauges (Vernier calliper, production gauges etc) Tool kit **Consumable:** First aid box with complete accessories Personal protective equipment (Safety Goggles, Safety Shoe, Face mask, Apron, etc.) Emery Belts Polishing Wheels Polishing lusters Lubricant (for lusters) Cotton/ cleaning clothes work piece/ job Process travel card
LU3: Apply electrochemical polishing	**The learner will be able to:** Load leather wheel and polishing belt on polishing lathe Polish surgical instrument as per required surface finish Control the quality of polishing	Understanding safety precaution and Personal Protective Equipment for electrochemical polishing and storage Basic understanding of electrochemical polishing process parameters (Current, time,	Electrochemical polishing plant Hangers Magnifying glass with light Tool kit **Consumables:** First aid box with complete accessories Personal protective equipment (helmets,

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	using measuring instruments and gauges Handle and store polished instruments to avoid any surface damage	temperature etc) Understand holding requirements of electrochemical polishing process Knowledge of chemicals, its composition and their reactions e.g. such as mixtures of sulphuric acid, Glycerine and phosphoric acid. Understanding of visual inspection of electrochemical polishing Understanding of time management Understanding of contingency management Knowledge about basic maintenance of electrochemical polishing Understand the defects of electrochemical polished work pieces and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	safety goggles, safety gloves, safety shoes, ear plugs/ muffs, apron etc) Sulphuric acid Phosphoric acid Glycerine Wooden husk Copper wire Process travel card (PTC)
LU4: Apply sand blasting	**The learner will be able to:** prepare sand blasting machine for	Understand health and safety requirements for sand blasting process	Sand blasting machine with complete accessories Magnifying glass with light **Consumables:**

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	operation as per requirements Place/hold instruments inside sand blasting machine and perform operation as per required surface finish Inspect the instrument according to specifications Handle and store polished instruments to avoid any surface damage	Understand handling and storage requirements of sand blasted product Identify sand blasting materials Understand finishing application of sand blasting materials Understanding of visual inspection of sand blasting Understanding of time management Understanding of contingency management Knowledge about basic maintenance of sand blasting machine Understand the defects of sand blasted work pieces and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	Sand (Silicon Carbide) Rubber Gloves Long shoe Dust Mask PPEs
LU5: A Perform Ultrasonic Cleaning	**The learner will be able to:** Fill cleaning chemical solution in the ultrasonic cleaning machine bath up to required level Set temperature of ultrasonic cleaning machine as per product	Understanding safety precautions and Personal Protective Equipment for ultrasonic cleaning Understand handling and storage requirements	Ultrasonic cleaning machine with complete accessories (Trichloroethylene transfer Pump) Hanging jigs (stands, container hanger) for Ultrasonic cleaning machine **Consumables:** Trichloroethylene

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	requirements Arrange instruments in a hanger or tray Perform chemical fuming on instruments for specified time duration Dip instruments in chemical for specified time duration Shower instruments with chemical while holding above the machine bath Control the quality of instruments as per requirements Handle and store instruments to avoid any surface damage	after cleaning Basic understanding of ultrasonic cleaning process parameters Knowledge of chemicals used in ultrasonic cleaning (e.g. Trichloroethylene) commonly known as Triclone Understanding of visual inspection of ultrasonic cleaned instruments Understanding of time management Understanding of contingency management Knowledge about basic maintenance of ultrasonic machine Understand the defects of ultrasonic cleaned work pieces and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	Dust Mask
LU6: Perform passivation	**The learner will be able to:** Boil water in required quantity as	Understanding safety precaution and Personal	Passivation tubs Heating equipment for passivation Hanger

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	per work instructions Dip instruments in boiling water for specified time to check rusting tendency of surfaces Inspect instruments for rusting Fill bath with passivation chemical at required level Dip the instruments in passivation chemical for specified time Rinse the instruments in water and dry in hanging position above the passivation bath Check the quality of instruments as per requirements	Protective Equipment for passivation. Basic understanding of passivation process and chemicals e.g. Nitric Acid and citric acid Understand handling and storage requirements after passivation Understanding of visual inspection of passivation Understanding of time management Understanding of contingency management Knowledge about basic maintenance of passivation plant Understand the defects of passivation work pieces and its corrective measures Understanding process travelling card (PTC) and its applications. (Storage of job, quality, quantity etc)	Passivation Tray **Consumables:** LPG Passivation Chemical solution (Combination of Nitric and Citric acid etc.)
LU7: Perform final polishing	**The learner will be able to:** Load leather wheel and polishing belt on polishing lathe Polish instruments as per required surface finish by using	Understanding safety precaution and Personal Protective Equipment for final polishing Basic knowledge of leather wheel and Buff	Polishing lathe with attachments Magnifying glass with light **Consumable:** First aid box with complete accessories Personal protective equipment (helmets, Safety Goggles, Safety Shoe, Safety Gloves, Face mask, ear plugs/ muffs,

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	specified emery grain belts (i.e.200,300 & 400) Use dull brush, buffing or water sand finishing for required final finishing, Control the quality of polishing as per requirements Handle and store polished instruments to avoid any surface damage Prepare report of completed work	polishing Understand handling and storage requirements after final polishing Knowledge and understanding of visual inspection after final polishing Understanding of time management Understanding of contingency management Knowledge about basic maintenance of polishing lathe Understand the defects of final polished work piece and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	Apron, etc.) Belts Wheels Polishing lusters Lubricant (for lusters) Cotton/ cleaning clothes work piece/ job Process travel card (PTC)

Videos:

	**How to prepare the workstation for polishing?** https://www.youtube.com/watch?v=2jnJe2jANms https://www.youtube.com/watch?v=43M6KIKMzuA
	**How to perform the polishing?** https://www.youtube.com/watch?v=AZg89dzSitg
	**How to perform the electrochemical polishing?** https://www.youtube.com/watch?v=w7iY-ILmj8g
	**How to perform the electro polishing?** https://www.youtube.com/watch?v=ShesRgLm6qk https://www.youtube.com/watch?v=QFeoMux6NA8 https://www.youtube.com/watch?v=39JEdQ_s6GQ

	**How to perform the passivation?** https://www.youtube.com/watch?v=gXl7FwP7BW0 https://www.youtube.com/watch?v=qRVsS1wNEUI https://www.youtube.com/watch?v=9hiVjucXWXg
	**How to perform the ultrasonic?** https://www.youtube.com/watch?v=ydrCPtU2atU https://www.youtube.com/watch?v=bZvMoxLVNA0
	**How to perform the final polishing?** https://www.youtube.com/watch?v=z4pnOW5kovI https://www.youtube.com/watch?v=gX0kkJqTiyk
	**How to perform Vibrating polishing machine & deburring process?** https://www.youtube.com/watch?v=VvIVpJORp-A https://www.youtube.com/watch?v=Mkix_6vNNN4

Examples and illustrations

Prepare workstation for polishing

Polishing

is the process of creating a smooth and shiny surface by rubbing it or using a chemical action, leaving a surface with a significant specular reflection (still limited by the index of refraction of the material according to the Fresnel equations.) In some materials (such as metals, glasses, black or transparent stones), polishing is also able to reduce diffuse reflection to minimal values. When an unpolished surface is magnified thousands of times, it usually looks like mountains and valleys. By repeated abrasion, those "mountains" are worn down until they are flat or just small "hills." The process of polishing with abrasives starts with coarse ones and graduates to fine ones.

The strength of polished products is normally higher than their rougher counterpart owing to the removal of stress concentrations present in the rough surface. They take the form of corners and other defects which magnify the local stress beyond the inherent strength of the material.

Polishing with very fine abrasive differs physically from coarser abrasion, in that material is removed on a molecular level, so that the rate is correlated to the boiling point rather than to the melting point of the material being polished

Features:

- Polished 18-gauge brushed stainless steel
- Dust hood with light and top shelf
- Main access door with safety switch
- Easy access to filters for simple replacement
- Dual downdraft vacuum system
- Safety cover

Exterior Dimensions:

- Base footprint: 34.25″ x 16″ (870 x 406 mm)
- Floor to top of cabinet: 37″ (940 mm)
- Across front: 46″ x 20″ (1168 x 508 mm)
- Floor to top of shelf: 52.5″ (1334 mm)

Complete Polishing Station Includes:

- 115v or 220v Duel-Shaft Polishing Motor
- 6 Filters
- 2 Unsewn 10″ Buffing Wheels
- 8″ Deburring Wheel
- 2 Deburring Wheel Hubs
- White Fine Rouge Bar
- Abrasive Dressing Stick

Apply Initial Polishing

Polishing

are finishing processes for smoothing a workpiece's surface using an abrasive and a work wheel. Technically polishing refers to processes that use an abrasive that is glued to the work wheel, while buffing uses a loose abrasive applied to the work wheel. Polishing is a more aggressive process while less harsh, which leads to a smoother, brighter finish. A common misconception is that a polished surface has a mirror bright finish, however most mirror bright finishes are actually buffed.

Polishing is often used to enhance the appearance of an item, prevent contamination of instruments, remove oxidation, create a reflective surface, or prevent corrosion in pipes. In metallography and metallurgy, polishing is used to create a flat, defect-free surface for examination of a metal's microstructure under a microscope. Silicon-based polishing pads or a diamond solution can be used in the polishing process. Polishing stainless steel can also increase the sanitary benefits of it.

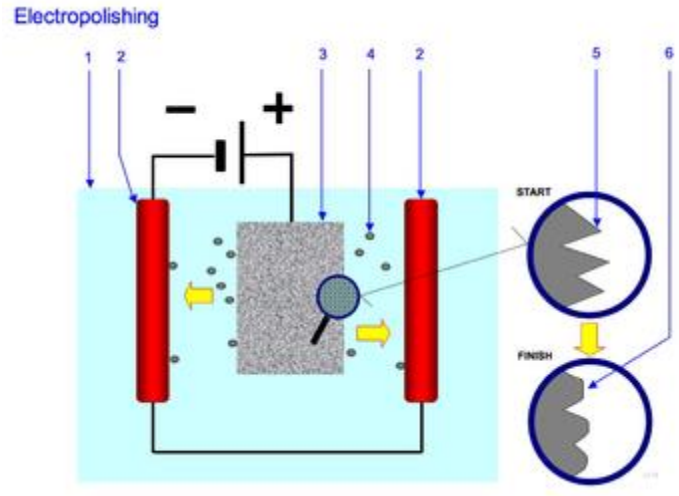
The removal of oxidization (tarnish) from metal objects is accomplished using a metal polish or tarnish remover; this is also called polishing. To prevent further unwanted oxidization, polished metal surfaces may be coated with wax, oil, or lacquer. This is of particular concern for copper alloy products such as brass and bronze.

While used less extensively than traditional mechanical polishing, electro polishing is an alternative form of polishing that uses the principles of electrochemistry to remove microscopic layers of metal from a base surface. This method of polishing can be fine-tuned to give a wide range of finishes, from matte to mirror-bright. Electro polishing also has an advantage over traditional manual polishing in that the finished product will not experience the compression and deformation traditionally associated with the polishing process.

Apply electrochemical polishing

Electro polishing, also known as electrochemical polishing, anodic polishing, or electrolytic polishing (especially in the metallography field), is an electrochemical process that removes material from a metallic workpiece, reducing the surface roughness by levelling micro-peaks and valleys, improving the surface finish. It is used to polish, passivate, and deburr metal parts. It is often described as the reverse of electroplating. It may be used in lieu of abrasive fine polishing in microstructural preparation.

Mechanism



Electro polishing principle:

1. Electrolyte

2. Cathode

3. Work-piece to polish (Anode)

4. Particle moving from the work-piece to the cathode

5. Surface before polishing

6. Surface after polishing

Typically, the work-piece is immersed in a temperature-controlled bath of electrolyte and serves as the anode; it is connected to the positive terminal of a DC power supply, the negative terminal being attached to the cathode. A current pass from the anode, where metal on the surface is oxidised and dissolved in the electrolyte, to the cathode. At the cathode, a reduction reaction occurs, which normally produces hydrogen. Electrolytes used for electro polishing are most often concentrated acid solutions having a high viscosity, such as mixtures of sulfuric acid and phosphoric acid. Other electro polishing electrolytes reported in the literature include mixtures of perchloric acid with acetic anhydride (which has caused fatal explosions), and methanolic solutions of sulphuric acid.

To electro polish a rough surface, the protruding parts of a surface profile must dissolve faster than the recesses. This process, referred to as anodic levelling, can be subject to incorrect analysis when measuring the surface topography. Anodic dissolution under electro polishing conditions deburrs metal objects due to increased current density on corners and burrs. Most importantly, successful electro polishing should operate under diffusion limited constant current plateau, achieved by following current dependence on voltage (polarisation curve), under constant temperature and stirring conditions.

Safety concerns include:

- highly corrosive and acidic electrolytic solutions
- build-up of oxygen and hydrogen
- large currents used to electro-polish large parts

Trapped gases can turn explosive in the presence of a spark. Stir the solution lightly and allow them to escape. For protection against large currents, use electrical equipment such as cables, rectifiers, and bus bars of the required capacity and quality.
Ensure that you train your operators and technicians. Also ensure that they use personal protective equipment (PPE) when handling the corrosive and acidic electro polishing solutions. For the same reason, use equipment that resists corrosion and acids.
Always ascertain that you dispose the rinse water in an environment-friendly manner as required by applicable laws. This disposal is more of a problem when your electro-polish large components on-site where equipment for handling such water may not be available. Before electro polishing, you have to mechanically polish surfaces that are blasted with grit, sand, or glass-beads and those that are polished with coarse abrasives. You also have to clean all electro-polished parts to remove the electrolytic solution.

Apply sand blasting

Sandblasting is the “generic” term for abrasive blasting. This is ironic, in that the use of actual silica sand is never recommended due to its health hazards.
Sandblasting or abrasive blasting (also referred to as media blasting) is the operation of forcibly propelling a stream of abrasive material against a surface under high pressure to smooth a rough surface, roughen a smooth surface, shape a surface, or remove surface contaminants and paints/coatings. Compressed air is typically used to propel the blasting material (often called the media). There are several variants of the process, such as soda blasting, bead blasting, and shot blasting. To keep things simple, we will mostly refer to the generic terms “sandblasting” and “sandblaster”, although most of what follows applies all of the variants mentioned above.

it is very important to remember that your air compressor is the most important component of your entire sandblasting system. The production rate, efficiency and cost per square foot of sandblasting are highly influenced by the volume (CFM) and pressure (PSI) of compressed air maintained through the blast nozzle of your sandblaster. We will get into more about this as we go on, but please keep this in mind.

There are two general types of sandblasters: portable and cabinet. As the name suggests, a portable blaster can be moved around a work area, or taken to a remote location, if desired. A cabinet is a fixed, enclosed unit, which is placed in a fixed location like a workshop or garage. There are two general kinds of sandblasting cabinets cabinets: siphon cabinets (sometimes referred to as suction cabinets) and direct pressure cabinets.

For example,

if your sandblaster requires 12 cfm to operate with the nozzle size you are using, make sure that your air compressor can generate at least 12 cfm. It's alright if it generates more than 12 cfm, but you will experience pressure drops if it can't deliver the minimum. Keep in mind that the velocity of the abrasive material, as it leaves the blast nozzle, and the efficiency of the sandblasting process are going to be reduced by a little over 1% for every pound of pressure drop below the ideal blasting pressure. So, if you are trying to blast at 100 psi, but you can only maintain 80 psi (because your compressor does not deliver enough cfm), that pressure drop will reduce the velocity and efficiency of your sandblasting process by around 20%.

Also remember that the cfm output of your air compressor will determine the size of the nozzle you can use with your sandblaster. In other words, if you have enough cfm to maintain blasting pressure with a certain nozzle size, you may or may not have enough cfm to blast with the next bigger nozzle size, without experiencing a pressure drop.

With respect to air pressure, most sandblasters have an adjustable pressure regulator, which is used to set the final blasting pressure. So if your air compressor is capable of 125 psi, for example, you could set your adjustable pressure regulator from 10 psi up to as high as 125 psi as your final blasting pressure. Here are the typical blasting pressure ranges (in psi) for some of the most popular sandblasting materials:
Aluminium Oxide 20-90 psi

Steel Shot 20-90 psi

Safety Sign

Perform Ultrasonic Cleaning

Process characteristics

Ultrasonic cleaning uses cavitation bubbles induced by high frequency pressure (sound) waves to agitate a liquid. The agitation produces high forces on contaminants adhering to substrates like metals. This action also penetrates blind holes, cracks, and recesses. The intention is to thoroughly remove all traces of contamination tightly adhering or embedded onto solid surfaces. Water or solvents can be used, depending on the type of contamination and the workpiece. Contaminants can include dust, dirt, oil, pigments, rust, grease, algae, fungus, bacteria, lime scale, polishing compounds, flux agents, fingerprints, and mold release agents, biological soil like blood, and so on. Ultrasonic cleaning can be used for a wide range of workpiece shapes, sizes and materials, and may not require the part to be disassembled prior to cleaning.

Objects must not be allowed to rest on the bottom of the device during the cleaning process, because that will prevent cavitation from taking place on the part of the object not in contact with solvent.

lean Before Polishing

Before polishing your work piece, it's important to first clean it thoroughly. Metals appear dull when there are scratches or dirt preventing the light from reflecting directly off the surface. Dull material may just be dirty. Clean thoroughly, and if your work piece is still dull then proceed to polishing.

Polishing and Sanding

Polishing is similar to sanding. In order to make the material more reflective and smoother, when polishing you are simply removing the surface of the material down to the depth of the deepest scratch. Always work from coarse to fine when polishing (the same as if you were sanding a piece of wood).

The following steps can be followed for most reflective surfaces including metals, plastics, rubber and even wood. Every material has different properties and will buff differently. We recommend before polishing a new surface to practice on a piece of scrap to familiarize yourself with the material and how it responds to polishing.

Safety

Always wear protective gear when polishing including safety goggles or face shield, dust mask, shop apron and gloves. You may also want to protect surfaces and tools with tape or padding to prevent accidental gouging.

Workplace safety for information please visit**:**
https://www.hsa.ie/eng/Publications_and_Forms/Publications/Safety_and_Health_Management/Workplace_Safety_and_Health_Management.pdf

SURGICAL INSTRUMENTS MANUFACTURING TECHNICIAN

Module-4

LEARNER GUIDE

National Vocational Certificate Level 2

Version 1 - May, 2019

Module 4: 072200882 Perform Packing

Objective of the module: The aim of this module to develop the higher-level knowledge, skills and understanding needed to perform packing.

Duration: 80 hours **Theory:** 62 hours **Practical:** 18 hours

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
LU1: Inspect quality of instruments	**The learner will be able to:** Prepare inspection workstation including measuring and inspection tools Select appropriate inspection sample size as per customer requirements Measure and record sizes of instruments Check functionality of the instruments Inspect surface finish as per finished product requirements Mark all non-conformances	Understand health and safety requirements at work Understand measuring tools and gauges e.g. steel rule, micrometre, Vernier clapper, thread gauge, fillet gauge etc Understand product drawing/master sample Understand instrument functionality Understand surface finish requirements Understand stocking requirements	Steel Rule Micrometer Vernier Clapper Fillet gauge Thread Gauge Depth Gauge Magnifying glass with light Weighing scale **Consumable:** Paraffin oil Cloth PPEs Polythene Bag Surgical sheet (Cutting inspection) Permanent marker

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	on inspected product and send to relevant department for necessary measures Handle instruments with care to avoid any surface damage Store inspected products on instrument tray and update tag (bin card, tray card, process travel card etc.) for next process Prepare inspection report in prescribed format		
LU2: Perform Laser Marking	**The learner will be able to:** Load marking design in machine software and make necessary adjustments Prepare laser marking machine (adjust laser head height, bed position, frequency, colour, current etc.)	Understand health and safety requirements for laser marking Understand Laser marking machine operations e.g. bed setting, laser setting and positioning etc Knowledge about basic troubleshooting of Laser Marking machine Understand basic adjustment/editing tools	Laser marking machine Fixtures Vernier Caliper Steel Rule Computer system along with all accessories Container **Consumable:** PPE Cleaning clothes (flees)

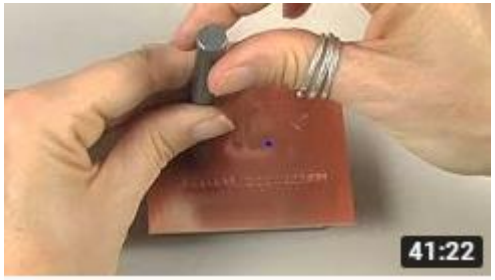
Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	Mount jigs/fixtures on machine bed in appropriate position Mark designs on instruments using laser marking machine Control quality of laser marking for size, position and colour Handle and store instruments with care to avoid any surface damage	of Laser marking design software e.g. EzCAD Basic knowledge machine maintenance Understand the defects of laser marking and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job, quality, quantity etc)	
LU3: Perform stamping	**The learner will be able to:** Prepare workstation according to work instructions Arrange and set stamping tools (manual punch, hammer, stamping die/punch) as per process requirement Perform punching on the instrument in designated area Control quality of punching Handle and store instruments with care to avoid any	Understanding safety precaution and Personal Protective Equipment for stamping. Understanding stamping machine operations Understanding about stamping tool and its adjustments Understanding of time management Understanding of contingency management Understanding basic maintenance of	Punching press Punching hammer Stamping die Fixture **Consumable:** PPE Surgical Instruments/ work pieces

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	surface damage	stamping machine Understand the defects of stamped work pieces and its corrective measures Understanding process travelling card (PTC) and its applications. (Storage of job, quality, quantity etc)	
LU4: Perform etching	**The learner will be able to:** Clean the instrument surface to ensure dryness Adjust stencil on etching machine and pour etching chemical on stencil Adjust etching current according to product thickness Perform etching by placing the instrument on etching stencil for set time, while ensuring connection with earth rod	Understanding safety precaution and Personal Protective Equipment for etching. Understand etching machine and its operations Knowledge of etching and cleaning chemicals and their application Understanding of time management Understanding of contingency management Understanding basic maintenance of etching machine Understand the defects of etched Stamps and its corrective measures Understanding process travelling card (PTC) and its applications. (storage of job,	Etching machine with accessories **Consumable:** PPE Stencil Etching chemical and cleaner Cottons/ cleaning cloths Scotch tape/ double tape Surgical Instruments/ work pieces

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
	Control quality of etching for position and sharpness Clean the etching surface with cleaner chemical and dry with cotton Handle and store instruments with care to avoid any surface damage	quality, quantity etc)	
LU5: Perform final packing	**The Learner will be able to:** Clean the instruments with cotton Apply lubricant on instrument joints	Understanding safety precaution and Personal Protective Equipment for final packing. Knowledge of packing materials and packing techniques Understanding of product handling and care requirements Knowledge of packaging, cleaning and labelling e.g. bar code printer/reader Understanding of time management Understanding of contingency management Understanding process travelling card (PTC) and its applications. (Storage of job,	Label printer Bar code printer Bar code reader Computer system along with all accessories Strapping machine Weighing scale Tool kit **Consumable:** First aid box with complete accessorie PPE (Cotton gloves) Cotton Silicon caps (Tip protectors for tip) Bubble sheet Packing boxes Labels Packing tape Polythene bag

Learning Unit	Learning Outcomes	Learning Elements	Materials Required
		quality, quantity etc)	Straps Process travel card

VIDEOS:

	**How to use the measuring instruments?** https://www.youtube.com/watch?v=rddQmcNk1w4 https://www.youtube.com/watch?v=kU1WzX6dSjg https://www.youtube.com/watch?v=IkFz34OXLfg
	**How to perform the laser marking machine?** https://www.youtube.com/watch?v=9UpF8X8jft0 https://www.youtube.com/watch?v=gjNQaQTM30w https://www.youtube.com/watch?v=mKzFSufVtbk
	**How to perform the punching?** https://www.youtube.com/watch?v=4bG5BFPoC-E
	**How to perform the etching?** https://www.youtube.com/watch?v=_g6mxHHHuCo

	**How to inspect the instruments?** https://www.youtube.com/watch?v=LLXPX4oz6es https://www.youtube.com/watch?v=FF5D6flcra0
	How to perform the Time management? https://www.youtube.com/watch?v=IdCnZMkOArY https://www.youtube.com/watch?v=KJLHlOIdqA4

Examples and illustrations

Inspect quality of instruments

Quality control inspectors use a variety of tools to ensure that all the products manufactured by the company are within the limits designated by the designers. A quality control inspector checks every aspect of the production process, using a different tool to accomplish the inspection. Manufactured goods such as surgical instruments, dental instruments, different parts etc. Inspected with some type of tool or tools.

How to Clean and Inspect Surgical Instruments

you will be aware that surgical instruments represent a large share of your department spending. The two most common complaints from surgeons regarding surgical instruments are that they are not functioning properly or that they are blemished.

It is important to ensure that the surgical instruments remain in good condition, so that the lifespan of the instrument is prolonged and that they remain capable of delivering safe care to patients.

Cleaning of Surgical Instruments

Surgical instruments should always be rinsed immediately after use. Running the instruments under warm water will help to remove blood, tissue, and fluids before the washing and disinfecting process begins.

Decontamination processes include cleaning, disinfection and sterilization. This process is used for reusable surgical instruments, to make them safe for further use on patients by staff. The effective decontamination of surgical instruments is essential to minimise the risk of transmitting infections. Automated washer disinfectors are the preferred tool for cleaning surgical instruments, as they will clean and disinfect during one cycle. Automated washer disinfectors use a spray system that distributes the water and chemicals. This ensures that all surgical instruments being cleaned are in direct contact with the cleaning solution.

Inspection of Surgical Instruments

Problems can be avoided by paying full attention to the processing of the surgical instruments and developing an understanding of the possible causes of corrosion.

Corrosion of surgical instruments will affect their performance and inspection is the easiest way to keep instruments in peak condition. A quick visual inspection after the sterilization process can help identify any problems before the surgical instruments are re-introduced into surgery. The instrument should be inspected for any remaining cleaning product residue, then check for signs of corrosion or cracks.

Function Testing Surgical Instruments

Different types of surgical instruments require different protocols for function testing. Ensure that all cutting edges are smooth and that the instruments are properly aligned and performing as they should.

New instruments should also be checked for proper function and alignment. It is a good idea to compare new surgical instruments with those that have been used before. Forceps are especially important to function test and should engage evenly when being closed. The teeth of forceps, for example, should be sharp and equally sized. Ensure that all instrument jaws, ratchets, and shanks are not bent and any instruments in disrepair should be serviced by trained technicians.

Surgical instruments that typically require function testing include:

- Scissors
- Forceps
- Clamps
- Rongeurs
- Curettes
- Retractors
- Needle Holders
- Towel Clips
- Dissectors
- Probes

The frequency of any instrument replacements can be reduced significantly by employing a preventive maintenance plan. High-quality surgical instruments will have a longer life when tested and repaired regularly. Poor maintenance creates avoidable problems for sterile service departments, which are far more costly than the price of regularly replacing these instruments.

Perform Laser Marking

"Laser marking" stands for marking or labeling of workpieces and materials with a laser beam. In this regard, different processes are distinguished, such as engraving, removing, staining, annealing and foaming. Depending on the material and the quality requirement, each of these procedures has its own advantages and disadvantages.

the basics. During laser engraving, the surface of the workpiece is melted and vaporized by the heat generated by the laser beam. This is known as "material removal". The recess formed on the surface of the workpiece in this way becomes the engraving.

Laser engraving is an incredibly versatile processing method. The effect of the heat can be used to process a variety of different materials. Stainless steel, Brass, aluminum, and many other materials can be engraved.

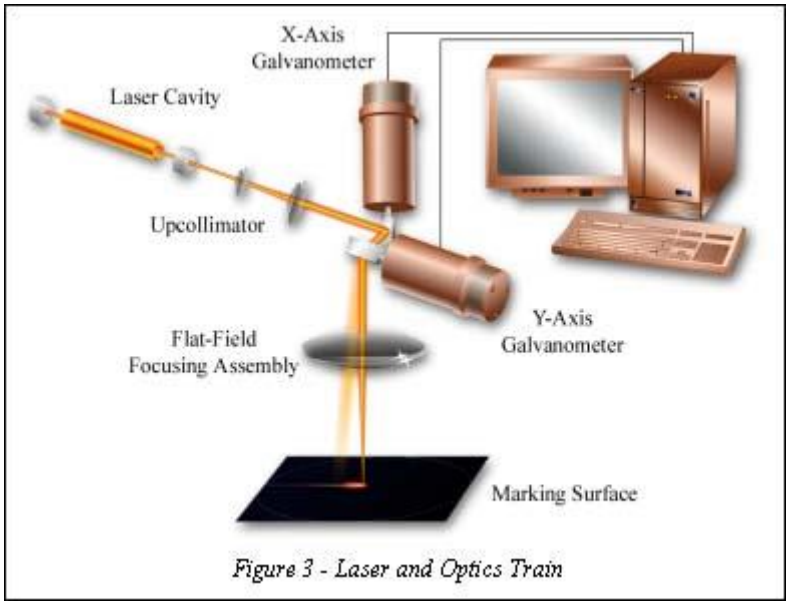


Figure 3 - Laser and Optics Train

Perform stamping

Metal stamping is a manufacturing process used to convert flat metal sheets into specific shapes. It is a complex process that can include a number of metals forming techniques — blanking, punching, bending and piercing, to name a few.

Metal stamping is a fast and cost-effective solution for this large-quantity manufacturing need. Manufacturers who need metal parts stamped for a project generally look for three important qualities:

- High quality /durability
- Low Cost
- Fast turnaround time

Types of Metal Stamping

There are three major types of metal stamping techniques: progressive, four slide and deep draw.

Progressive Die Stamping

Progressive die stamping features a number of stations, each with a unique function.

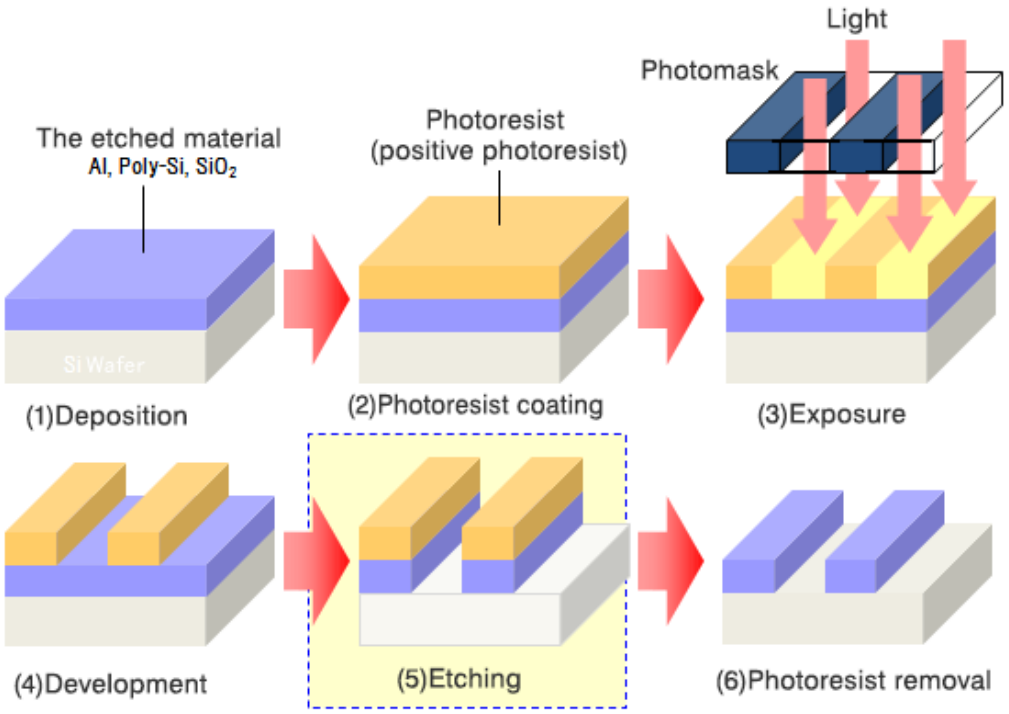
A manufacturer might have to repeatedly change the tool on a single press or occupy a number of presses, each performing one action required for a completed part. Even using multiple presses, secondary machining services were often required to truly complete a part. For that reason, progressive die stamping is the ideal solution for metal parts with complex geometry to meet:

- Faster turnaround
- Lower labor cost
- Shorter run length
- Higher repeatability

Perform etching

Etching is traditionally the process of using strong acid or mordant to cut into the unprotected parts of a metal surface to create a design in intaglio (incised) in the metal. ... In traditional pure etching, a metal (usually copper, zinc or steel) plate is covered with a waxy ground which is resistant to acid.

1. Etching is traditionally the process of using strong acid or mordant to cut into the unprotected parts of a metal surface to create a design in intaglio (incised) in the metal.
2. In traditional pure etching, a metal (usually copper, zinc or steel) plate is covered with a waxy ground which is resistant to acid



Module summary

Module	Learning Unit	Duration
Module 1: Perform Grinding **Aim:** The aim of this module to develop the knowledge, skills and understanding needed to perform grinding	**LU1:** Perform wheel grinding **LU2:** Perform filing **LU3:** Perform drilling	70 hours
Module 2: Assemble Surgical Instruments **Aim:** The aim of this module to develop the knowledge, skills and understanding needed to assemble surgical instruments	**LU1:** Perform fastening **LU2:** Apply setting **LU3:** Inspect quality of instruments	60 hours
Module 3: Perform Polishing **Aim:** The aim of this module to develop the higher-level knowledge, skills and understanding needed to perform polish	**LU1:** Prepare workstation for polishing **LU2:** Apply initial polishing **LU3:** Apply electrochemical polishing **LU4:** Apply sand blasting **LU5:** Perform Ultrasonic Cleaning **LU6:** Perform passivation **LU7:** Perform final polishing	170 hours
Module4: Perform Packing **Aim:** The aim of this module to develop the higher-level knowledge, skills and understanding needed to perform packing	**LU1:** Inspect quality of instruments **LU2:** Perform Laser Marking **LU3:** Perform stamping **LU4:** Perform etching **LU5:** Perform final packing	80 hours

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-3 in Fan Manufacturing Technician (Assembler). You shall be able to progress further to National Vocational Certificate Level-4 in Fan Manufacturing Technician (Supervisor); and take admission in a level-5, DAE or equivalent course. 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 ……..
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 qualifications framework, the level-4 certificate is equivalent to Matriculation. The criteria for equivalence and 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 fan manufacturing industries in the functions of packing and painting of fans.
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.
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 of stitching leather garments, gloves or other products. You may need additional skills on entrepreneurship to support your initiative.

MODULE 1

Question 1 Grain number of grinding wheel is ___ to grain size.

A Directly proportional

B Inversely proportional

D Does not depend

C None of the mentioned

Question 2 Which of the following is a correct range for grain number of the grinding wheel for coarse grains?

A 220-600

B 80-180

C 30-60

D 10-24

Question 3 Which of the following grinding machine will give a better result for rough machining?

A Fine Grain

B Very fine grain

C Coarse grain

D None of the mentioned

Question 4 Which of the following operation is performed to provide recess for bolt heads or nuts?

A Counterboring

B Spot facing

C Tapping

D None of the mentioned

Question 5	To produce more accurate holes, which of the following operation should be performed second?	A	Drilling
		B	Reaming
		C	Centering
		D	Boring
MODULE 2			
Question 6	Which type of key is used for coupling a pulley with a shaft	A	Taper key
		B	Woodruff key
		C	Gib head key
		D	Flat saddle key

Question	**7**	For riveting aluminum sheets, the material of rivet should be	A	Aluminum
			B	Copper
			C	Brass
			D	Wrought-iron
Question	**8**	Process control is carried out	A	Before production
			B	During production
			C	After production control
			D	All of the above

MODULE	**3**

Question	**9**	Which of the following come under the components of EP process?	A	Electrolyte solution
			B	Dc power supply
			C	Work piece
			D	All of the mentioned

Question 10 The protective coatings are used to _____

A Corrode the metal

B Prevent from corrosion

C Increase the corrosion

D Slightly increase the corrosion

Question 11 The oxidation resistance is given by the protective coatings.

A Positive discrimination

B Diversity

C Equality

D Self-importance

Question 12 The process of coating iron or steel sheet with a thin coat of zinc to prevent iron from rusting is called _____

A Tinning

B Galvanisation

C Metal cladding

D

Electroplating

Question 13 In pickling and etching _____ acids are used.

A Sulphuric acid

B Hypo chlorous acid

C Phosphoric acid

D Phosphorous acid

Question 14 Is the following statement true or false?

A TRUE

B FALSE

Question 15 The paint coated layer cannot be removed by

A Soaps

B Caustic soda

C Trisodium phosphate

D Sulphuric acid

MODULE 4

Question 16 Which of the following is an example of QA?

A Verification

B Software testing

C Validation

D Documentation

Question 17 Which of the following option involves material and component control?

A Development of standards

B Development of specification

C Quality control

D Feedback

Question 18 What does QA and QC stand for?

A Quality Assurance and Queuing Control

B Quality Adjustment and Quality completion

C Quality Assurance and Quality control

D Quality Adjustment and Queuing control

Question 19 What is the first step of QA?

A Development of standards

B Identification of customer need

C Servicing

D Material control

Question 20 Which of the following option is not correct regarding QA and QC?

A Process capabilities should be monitored on intermittent basis

B Measuring equipment's must have a calibration certificate

C Normally many inspections are done during the process of manufacturing

D QA depends on the activities of the entire company

MODULE 1		
Question 1 Grain number of grinding wheel is ___ to grain size.	B	Inversely proportional
Question 2 Which of the following is a correct range for grain number of the grinding wheel for coarse grains?	D	10-24
Question 3 Which of the following grinding machine will give a better result for rough machining?	C	Coarse grain
Question 4 Which of the following operation is performed to provide recess for bolt heads or nuts?	A	Counterboring
Question 5 To produce more accurate holes, which of the following operation should be performed second?	A	Drilling
MODULE 2		
Question 6 Which type of key is used for coupling a pulley with a shaft	C	gib head key
Question 7 For riveting aluminum sheets, the material of rivet should be	A	Aluminum

Question 8	Process control is carried out	A	During production

MODULE 3

Question 9	Which of the following come under the components of EP process?	D	All of the mentioned
Question 10	The protective coatings are used to _____	B	Prevent from corrosion
Question 11	The oxidation resistance is given by the protective coatings.	A	True
Question 12	The process of coating iron or steel sheet with a thin coat of zinc to prevent iron from rusting is called _____	B	Galvanization
Question 13	In pickling and etching _____ acids are used.	A	Sulphuric acid
Question 14	Is the following statement true or false?	A	TRUE
Question 15	The paint coated layer cannot be removed by	C	Sulphuric acid

MODULE 4			
Question 16	Which of the following is an example of QA?	C	Quality Assurance and Quality control
Question 17	Which of the following option involves material and component control?	C	Quality control
Question 18	What does QA and QC stand for?	B	Quality Assurance and Quality control
Question 19	What is the first step of QA?	B	Identification of customer need
Question 20	Which of the following option is not correct regarding QA and QC?	B	Identify potential risks; measure frequency and severity; examine alternative solutions; decide which solution to use and implement it; monitor results

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