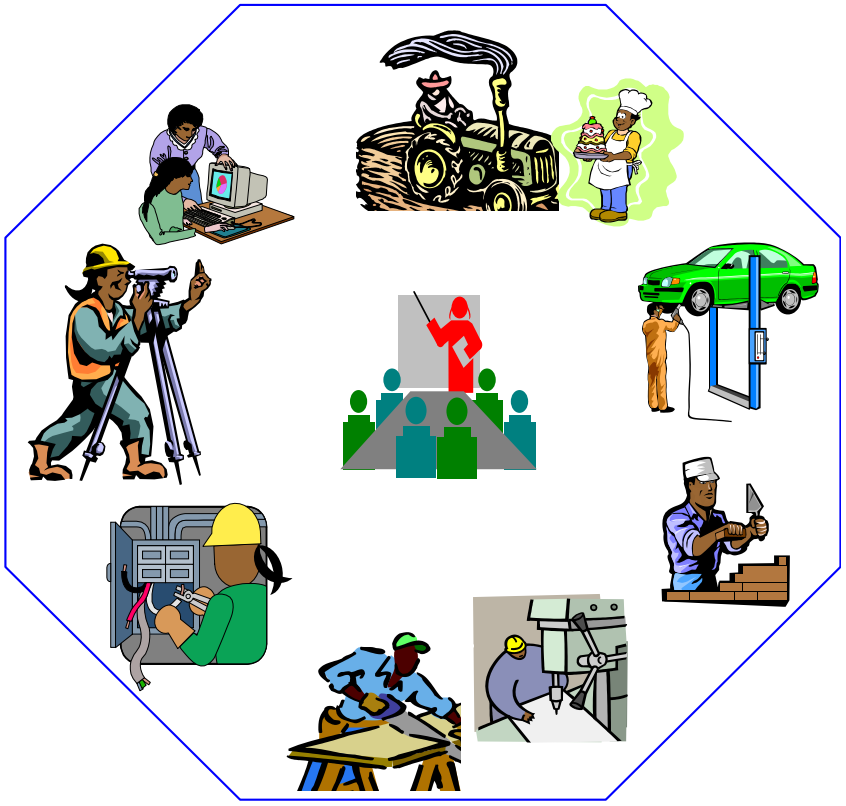
Footwear Production LEVEL II

Based on Nov, 2019 V5 OS and Feb, 2020 V1 Curriculum



Module Title: - Performing basic lasting operation

LG Code: FWP2 MO9 LO(1-4) LG (39-42)

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November, 2020

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LG#39	LO #1- **Identify and prepare tools, materials and machines**

Instruction sheet

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

- Identifying and checking hand lasting materials and tools.
- Checking tools for serviceability, safety and faults.
- Clearing work area following workplace standard procedures.
- Identifying, arranging and making ready machines for specified products.
- Cleaning, checking, maintaining and storing hand tools and equipment
- Obtaining work instructions, specifications and operation details related to lasting machines
- Identifying safety with regard to tools, equipment and machine.
- Identifying safety of operator and workplace.

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

- Identify and check hand lasting materials and tools.
- Check tools for serviceability, safety and faults.
- Clear work area following workplace standard procedures.
- Identify, arrange and make ready machines for specified products.
- Clean, check, maintain and store hand tools and equipment
- Obtain work instructions, specifications and operation details related to lasting machines
- Identify safety with regard to tools, equipment and machine.
- Identify safety of operator and workplace.

Learning Instructions:

Read the specific objectives of this Learning Guide.

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- Read the information written in the “Information Sheets 1”.
- Accomplish the “Self-check. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheets 1.
- Read the information written in the “Information Sheet 2”.
- Accomplish the “Self-check 2”. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2.
- Read the information written in the “Information Sheet 3”.
- Accomplish the “Self-check 3”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 4”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 3.

- Information Sheet 1 Identifying and checking hand lasting materials and tools

Lasting is a term related to the process involved in stretching (in some areas by compressing) the upper material over the last and securing it. The upper will conform to the contours of the last and when, the last is removed, upper retains much of the shape.

There are many variations in the way which footwear can be made from the Lasting point of view. These are known as lasting constructions.

The types of constructions used will often depend upon what the finished shoe is used for so each will demand different considerations. The methods can be divided into two groups: -

Direct attachment- it is when the soles are attached directly to the lasted upper. Example: - includes Cemented (Stuck-on) Constructions, Direct Molded Constructions, etc.

Indirect attachment- it is when the soles are attached to the welt or runner or any other intermediate component which are already being attached to the lasted upper.

Example:- includes Good year Welted Construction, Veldtschoen Construction, etc.

Generally, the lasting department is divided into three sections:

- ASSEMBLY: - joining of different component of shoe parts for lasting operation.
- LASTING: - is stretching (in some areas by compressing) the upper material over the last and securing it. It includes toe(fore part) lasting ,side and seat lasting ,heat seating
- BOTTOMING:-preparation of the bottom parts of shoe. it includes insole preparation ,sole attaching ,sole pressing

A shoe nearly always has to be made on a last to achieve a shape to give the necessary comfort and fit. Lasting is the process of stretching, the upper leather over the last and securing it to the insole, runner etc., so that the upper conforms

to the last contours.

The areas of the last which present the greatest difficulties in lasting are mostly in those where the major shape changes occur, to facilitate shape retention it is essential to apply correct strains at certain major points.

The amount and direction of strains must be suitable to both material and the design of the upper to help to produce good shape retention throughout the life of the shoe. Shoes must be lasted to match in pairs so that the design of the uppers is correctly matched. It is important that the back height will be according to specification; otherwise if the back is too high, the shoe will rub the heel, if too low the shoe may not fit the foot as desired.

The top line of every shoe must be reasonably tight. It is essential during lasting that the top line is pulled somewhat tight to maintain correctly the balanced top lines. If the initial stretch is not taken out of the upper, the top line becomes loose, resulting in poorly fitting shoes. The top line must also be correctly balanced, i.e. the outside quarter 2-3mm below the height of the inside quarter, the reason for this being the difference in the anklebone height, or according to the specification.

Traditional hand lasting involves the use of twelve basic lasting strains, which make the upper conform to the shape of the last. The order in which these lasting strains are taken can vary to suit the individual situation, and the laster may modify the order, to make sure that the upper is lasted properly. For example, if the upper is tending to the swing to the outside then the laster will remedy this by pulling the upper from the inside first, in other words, the lasted will:

- Ensure that the upper conforms to the shape of the last
- Ensure that the upper is positioned centrally on the last
- Take care that the upper components are falling on the proper places on the last as specified by the designer.
- Make sure that the upper should free from wrinkle

From lasting point of view the main materials that used for shoe making process are:-

A. Shoe last
B. uppers
C. insoles
D. soles
E. toe-puff
F. counter stiffeners
G. nails and tacks
H. adhesives

I. solvent

2.1 SHOE LAST

Most shoes are made to a last. The last is a foot model with dimensions and shape similar to the anatomical foot but sufficiently different to be exact. Shoe fit and to some extent the last influences its durability.

"The close relationship between a man and his shoe maker was based on the shared secret of the client's measurements. The statistics of clients were never disclosed."

Traditionally before mass production, the original shoemaker started the process by taking a footprint outline of the sole. He whittled or chiseled a wooden last from the print. A last (‘least’, Old English meaning footprint) was traditionally made from **wood** but are now available in **metal** or **plastic**. They are complex structures made from many measurements (statistically determined). Lasts are not the same size and dimensions of the anatomical foot but instead an abstract form with specific functions. It is usually deeper in the mid foot region, has a sharp 'feather edge' where the upper surface meets the sole, is clipped in along the topline (around the ankle) and is flared over and extended in the toe region. This provides shape, which applies appropriate tension when the shoe distorts to contain the loaded foot. Lasts provides a working surface on which flat leather components can be given plastic form. The physical dimensions accommodate the foot during activity and the last contains contemporary fashion and styles such as toe shape. To allow the last to be removed from the shoe they are often hinged around the instep. Shoe lasts are not made to resemble feet but instead to suit the shoe manufacture. Modern lasts are totally unlike the foot with the sole of the last, flat in order to assist in manufacture.

Generally shoe last is the most important tool of shoe manufacturing process.

2.1.1Material used in Last manufacturing

1) Classification of shoe last based on the nature of material which is made from is a show below

a) Wooden last

Last manufactured from seasoned wood was earlier widely used for shoe making purpose. Due to the low life span and non availability of seasoned wood the same has been replaced by synthetic material. However, till date the designers worldwide prefer to use wooden last for designing of shoe (Fig: 1).

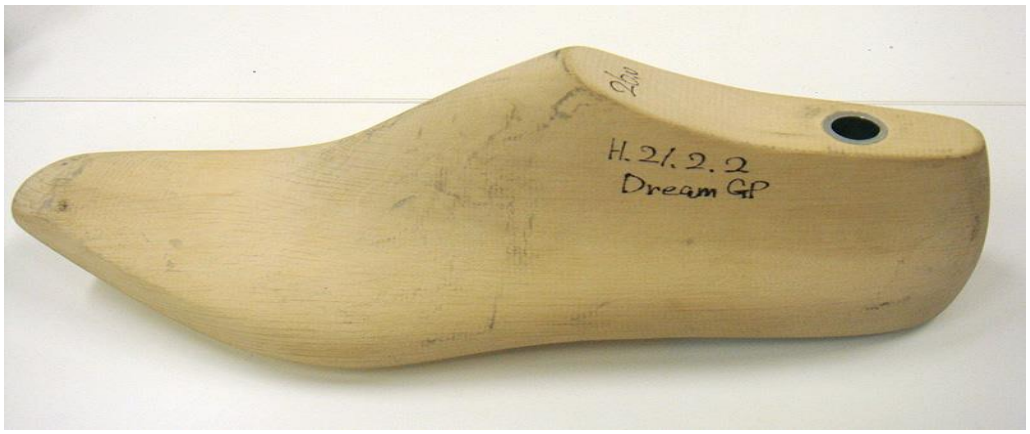


Fig1. A wooden Block last

b) Plastic last

Modern day shoe lasts are made of high density polyethene (HDPE) that are 100% recyclable. The advantage of plastic shoe last is its durability and dimensional stability (Fig 2).

Fig2. Plastic last

c) Metal last

In shoe making where the lasts are subjected to be exposed to extreme heat and pressure (e.g. DMS, DVP and DIP construction), aluminum last are best to be used(Fig:3).

Fig3. Metal block last

2) The shoe lasts are further classified based on the Hinge and the Bottom plate used as per the user specification.

Classification based on hinge used:

a) Standard connectional Hinged Last:

This hinge is used in most of the last used for manufacturing closed footwear. However it is difficult to mount a moccasin upper on this last where extreme stress causes damage of top line.

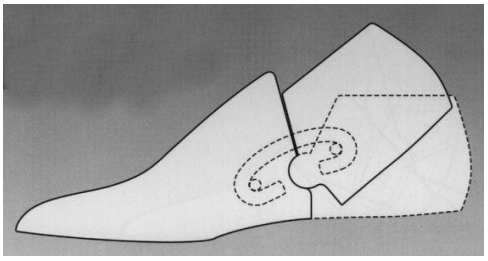


Fig 4.standard Connectional Hinged last

b) Telescopic last: Suitable for all types of footwear (fig: 5).

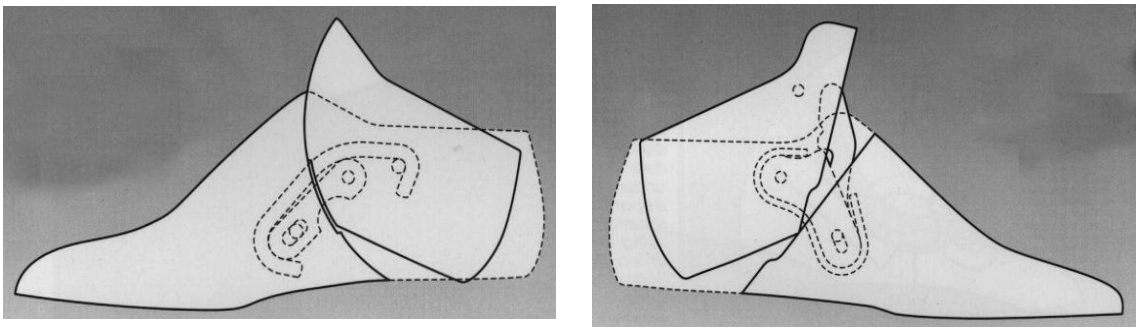


Fig5. Telescopic last

d) **Reverse hinged last** :

Generally used in last for mounting in the injection molding machine (Fig: 6).

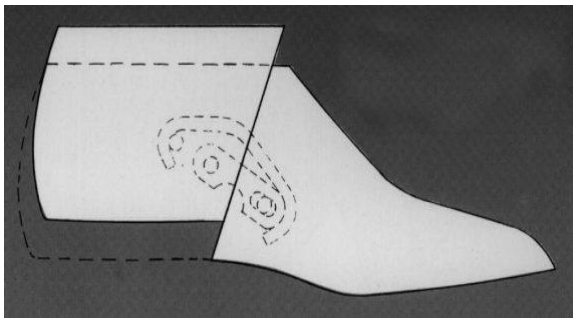


Fig6. Reverse hinged last

3) **<u>Classification based on bottom plate:</u>**

The steel plate used on the last bottom for the following reason

a. To prevent damage of the feather edge of the last
b. To help clenching of lasting tacks on the insole.

The plating is generally done by the last based on the shoe manufactures demand which is as follows:

a. Last without plate:

Lasts without bottom plate is popularly used by sports shoe manufacturing and sandal manufacturing where tack lasting is prohibited.

Fig7. Last without bottom plate

b) Heel plated last

Heel plated last is used for all the closed shoe manufacturing where tacks are used for attaching the lasting margin with the insole

Fig8. Heel plated last

Steel plates are also used in:

c) Heel and waist plated last

Fig9. Heel and waist plated last

d) Heel Shank and Toe plated last

Fig10. Heel Shank and Toe plated last

e) Full bottom plated last

Fig11. Fully plated last

2.1.2 Main part of shoe last

Chart showing the main parts of a Shoe Last

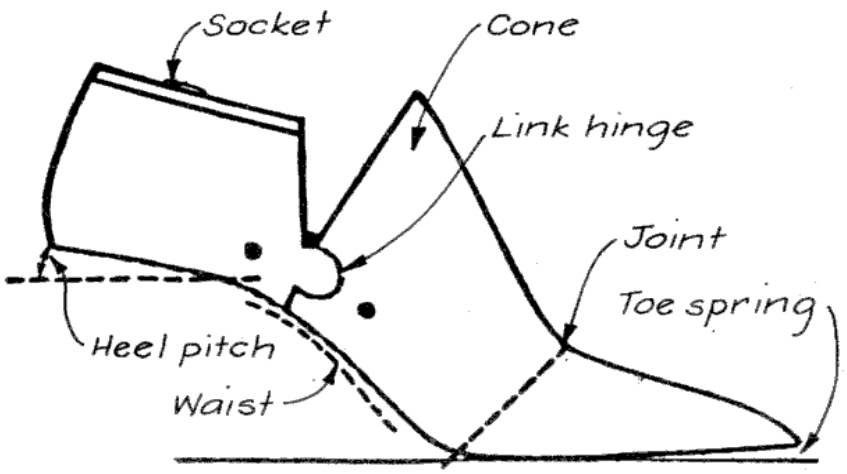


Fig 12.main parts of shoe last

Each "shoe last" is designed for a particular heel height, toe shape, and type of footwear. Many styles of shoes can be made on the same shoe last, but the toe shape and heel height will be the same for each pair made on that shoe last.

If you want to have shoes with different toe shapes, then it is necessary to create more than one pair of shoe lasts. A proper fitting pair of shoe lasts is a solid investment, and the first step towards creating proper fitting and fashionable

footwear.

For example the figure show below describes three types of shoe made on the same last (Fig: 13).

Fig13.Different styles of can be made on the same “Shoe Last”

2.2. UPPER

Lasting involves forming the upper by stretching it over the last. For foot comfort the upper must conform to the shape of the last and retain much of it. Also the shoe upper after a period of wear must also conform to the shape of the foot.

Fig14. A shoe upper

To last the upper well we should use the minimum strain necessary to make the upper conform to the last. By stretching too tight we may cause upper cracks and inadequate shape retention of the shoe. For quality and productivity it is important to skillfully design and maintain the whole production process from material selection to pattern engineering, cutting, closing and lasting.

Traditionally, for adequate shape retention the upper was left on the last for two to three days, or even longer. Today we use techniques, which will give us better shape retention of the upper in a much shorter time. These methods are known as combination of Mulling and Heat Setting and there are a number of variations to these two basic processes. Research has shown that if the leather upper is mulled before lasting in which moisture is imparted into the leather fibers and lasting and

subsequent heat setting done immediately after, the result is better shape retention properties in the mellowed upper.

Mulling can be done in a variety of ways but each method if done correctly will give the required results. The great advantage of mulling is that it allows the leather upper to be stretched more easily and it is less likely to crack. Perhaps the most common method in use today is to subject the vamp area to steam vapors immediately before forepart lasting, the time required and the temperatures used will vary according to the type of upper leather being used but is only a matter of 1/4th a minute or so, this method also has advantage of softening the toe-puff at the same time (thermo-plastic toe-puffs).

Another method is to use a Rapid Conditioning Cabinet for mulling; in this machine a rapid stream of humid air is blown over the leather uppers. The temperature of the air is 5``0° C and the cycle time is 15-30 minutes. Every upper is subjected to identical treatment, and very consistent moisture gains are obtained.

In modular ('rink') production configurations the upper is passed through steam in a tunnel prior forepart lasting. The shoe is lasted immediately after. Leather uppers conditioned this way get mulled but the extra moisture does not remain in the material more than about 20 seconds, so the lasting must be done immediately.

Heat setting is usually carried out after the upper has been completely lasted before any of the bottoming operations (roughing etc.) are done. Great advances have been made in this field in recent decades allowing progress from the old style of cabinet which usually consists of two or three chambers, the first imparting steam or moisture into the upper and other's rapidly drying it out (a process which can take about 4 minutes to the modern HVA (High Velocity air) heat setters which force the moisture in to the upper and immediately out again to complete the heat setting process in around 100 seconds (slight variations according to the type of material).

Heat setting will ensure about 70 -80% shape retention of most types of upper material, including PU and PVC coated fabrics but there is usually no advantage in using moisture on man-made upper materials, only dry air is used and the temperature related to time will vary according to the material.

2.3. SOLES

It is the layer of the material which covers the bottom of the shoe and is the walking surface of that shoe. Generally the key parts of sole includes: -

a) insole
b) Midsole

c) Out sole
d) Heel
e) Welt

2.3.1 INSOLES

The insole is the foundation of the shoe to which anchor the upper, heel and outsole. No matter how light a substance the fashion may demand, it is the basic component on which the whole shoe is built. Insoles therefore have a strong bearing on wear, comfort; shape retention, foot health and appearance. Leather is still an important insole material, particularly in men's high grade shoes, but in women's fashion shoes, where lightness and flexibility are most important, man-made insoles are in great but is used because of their suitability for the purpose, having been made to meet specific demands.

This is the inner sole of the shoe, which is next to the foot under the shoe sock. And also it is the back bone of the shoe to which upper is attached and helps to the foot to absorbs the moistures and socks.

Insole may be made all in one piece or alternatively in two pieces. When an insole is made from the two pieces it is known as the Blended insole**.**

2.3.1.1. Types of insoles

The different types of insoles are made according to the construction of the footwear. They are:

a) Continental insole
b) Blended Insole
c) Half Insole (Backer Board with steel shank)
d) Half insole of a backer board and the insole board sandwiched together
e) Polypropylene Injected Insole

2.3.2 Midsole

It is the Intermediate sole between outsole and upper and it helps to Increases shock absorption & adds comfort to the shoe.

Commonly midsole is Used in sandals and some safety and sports footwear types.

2.3.3. Heel

Heel is the Raised component at the bottom of the shoe that Provides elevation to the shoe for proper walking.

It has the following properties:

- Strength
- Durability
- Abrasion resistance

Fig 15: Wooden Heel

2.3.4. Welt

Welt is Other Key Parts in Shoe Bottom which is a decorative strip of leather or other material Attached to the outsole. A welt can be decorative as well as functional in nature

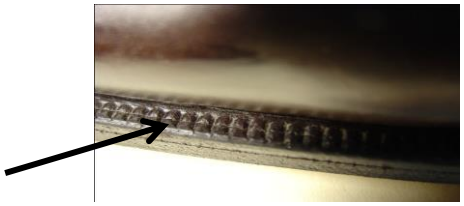


Fig 16: Welt

2.3.5. Outsole

Out sole is the Bottom-most part and Walking surface of shoe having following properties:

- Anti-skid
- Abrasion resistance
- Flexibility

2.3.5. 1.Types of sole/out sole

The sole made of a diversity of material, i.e. leather, pure rubber, resin rubber compound, plastic etc. based on this different types of sole are used in footwear industry ,but the common types of sole are:-

2.4. TOE PUFFS

The function of the toe puff is basically to provide shape to the forepart of the shoe, and in certain case, in the industrial boots, to give protection to the foot of the wearer. It is the mean by which the shape of the last forepart is reproduced in the finished shoe, and thus plays an important part in the appearance and the general performance of the majority of the footwear types. The choice of the toe puff for any given footwear type is influenced by many factors of the last shape, upper material type, production methods to be used, fashion and the views of individual customers; all must be considered before a decision can be reached.

2.4.1. Types of toe puff

The basic types of toe puff are used by the footwear industry are: -

a) **Paint on liquids -** This is mostly done for the veldtschoen sandals. For this purpose, a light puff is adequate and shellac or a celluloid solution is painted. In this case there are problems of contamination of the upper and the adhesion to the last.
b) **Print on Hot-Melt Resin -** This is a further development of the paint on liquid type, in which the solvent has been eliminated. Three types have been developed. The Tm-line process of the BUSM Co. uses a polyamide resin in the rod form, which is extruded, melted, and injected into a mold cavity adjacent to the flesh side of the leather. The transfer sheet method of the print a puff method of Vik supplies is the best known, incorporates a thermoplastic polyamide resin cast on the release paper, on contact with a heated die-in the shape of the required toe-puff the resin is melted and transferred to the upper. In a method developed by Sigma in Italy, a thermoplastic resin is injected into the mold in the shape of the toe puff, and automatically applied to the upper before it sets. In this application, the dangers of insufficient fusing or inadequate activation of the adhesive surface are overcome because an evenly coated plastic film is formed on the surface of the upper.
c) **Impregnated Fabrics -** The fabric used to make these types of toe puffs are the woven, non-woven, needle punched and stitched bounded. The toe puffs are in two forms. The first type is the thermo-plastic toe puff which can be softened by heat and rendered sufficiently extensible and malleable to accept pulling over the lasting operations. The second type is the solvent activated , in which the toe - puff is rendered soft and extensible in the factory by being treated with solvent dipping or conditioning machine, again to make it receptive to shoe making operations.

d) Thermoplastic (heat activated) -Adhesive coated heat-activated puffs are based on EVA, Neoprene, Polyurethane, or gutta-perche. Resin or plasticizer is added to impart the required adhesive properties.

e) Solvent activated - These puffs are impregnated with either nitrocellulose or polystyrene resin. The solvent blend should contain toluene, which dissolves more readily with the resin.

f) Extruded Filmic (heat activated) **-** Filmic puffs are a further development of the celluloid impregnated puff, are made from such polymers as ABS, Surlyn A and EVA. All filmic puffs developed recently are thermoplastic, having a heat sensitive adhesive in the bonding press in the same way as the impregnated types are activated. Some filmic puffs can compress and thereby absorb the creasing action of the upper.

g) Pre molded steel toe cap

This type of toe cap is used in safety footwear where the toe cap is made of steel capable to withstand impact at least 200 joule and compression up to 15000 N. Although traditionally made of steel (fig: 17), the reinforcement can also be made of a composite material, a plastic such as thermoplastic polyurethane (TPU).

Fig 17: Steel toe cap for safety footwear

2.5. COUNTER STIFFENER

A stiff material similar to that of the toe puff which may be molded to the shape of the last back part or, alternatively, inserted flat and molded during the subsequent process. It is normally inserted between the lining and the upper to support the back of the shoe and grip the foot.

Apart from the material used which is similar to that used for toe-puff except for the thickness, leather board can also be used.

2.5.1. Types of counter stiffener

The three types of stiffeners are flat stiffener, Semi-molded stiffener and the Fully-molded Stiffener.

a) Flat stiffener
b) Semi –molded stiffener
c) Fully- molded stiffener

Material for the counter stiffeners which are commonly used in the industries are:

a) Thermoplastic
b) Solvent activated
c) Leather board

2.6 NAILS, TACKS AND STAPLES

There are many types of tacks and nails used in the manufacture of shoes designed to suit numerous lasting and assembling operations.

Machine tacks with special finishes to enable trouble free running in machines are produced in various lengths to suit the material being used.

2.6.1. Types of nails and tacks

(A) (B)

Square machine tacks Round machine tack

(C)

Hand tack

(D)

Heel building nail

(E)

Screw eclipse nail

(F)

Buttress heel attaching nail.

(G)

Rubber heel nail

(H)

Lightning nail

(I)

Temporary attaching nail

Fig 18: different types of nails

2.6.2. Use of nails and tacks

The nine tacks and nails illustrated are made for the following operations: -

a) Used for seat, side and toe lasting

b) A general-purpose tack used for hand lasting sandals and repair works

c) Building leather heel and heel attaching

d) The inside attachment of wooden heel

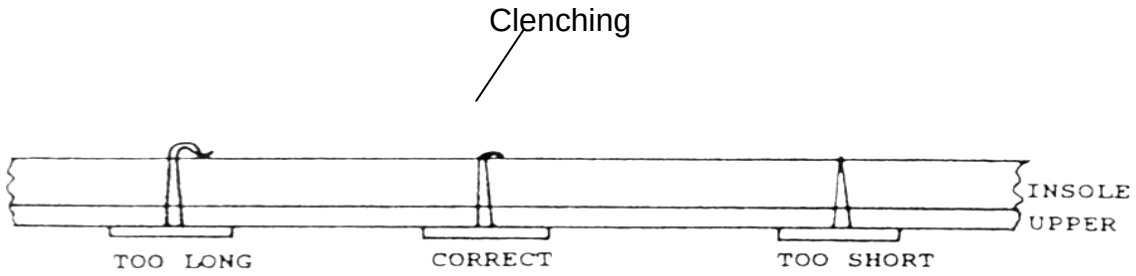
e) The inside attachment of plastic heels

f) The outside attachment of rubber heels

g) The outside attachment of leather built heels

While deciding on the length of the tack required for lasting purposes, it is generally accepted that the tack is 1m.m longer than the thickness of material or materials it has to penetrate, to allow clenching. The tack or nail clenches when it hits the last bottom plate.

When uppers are lasted, the tacks penetrate the insole and must be turned over (clenched) so as not to stick into the foot.



2.6.3 Hand lasting tacks vs. machine lasting tacks

Hand lasting tacks are much sharper than machine tacks and have a much rougher finish to help penetration while hand lasting.

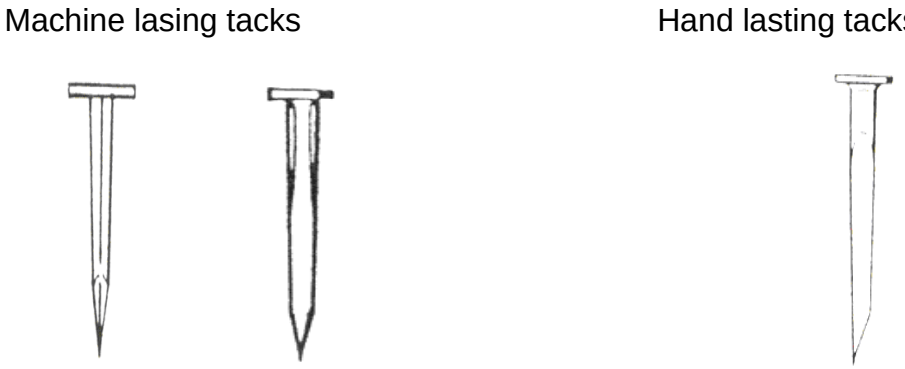


Fig19:- Machine and Hand lasting tacks

A hand tack has to be pushed by hand into the material before being driven home, a rough sharp tack gives a temporary hold into the material, whereas a smooth machine tack would not hold. A smooth finish is given to machine lasting tacks to enable the tack to run easily in the machines. Special points and spirals are put onto heel nails to ensure correct penetration and grip during wear.

2.6.4. Staples

There are numerous ways of attaching heels whether they are wood, plastic or leather. The heels may be attached by an ordinary staple, a specially designed nail or an ultrasonic staple Staples are used for various shoe making operations like:-

- Insole attaching
- Side lasting for stitch down or welted footwear
- Heel attaching in leather sole with knock on heels

Generally there are two types of staples are used, they are

a) Pre-formed staples

b) Wire staples

Preformed staples are used for insole attaching or heel attaching in case of knock on heels. A driver fitted in to the machine drives the staples. In most cases the staplers are pneumatically driven.

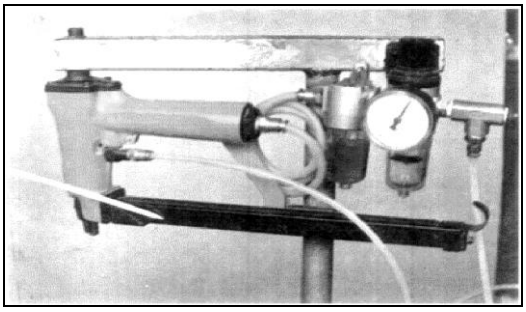


Fig20. Pneumatic stapler

Wire staples Wire staples are used while side lasting of welted footwear or Stitch down lasting. The wire from a coil cut in a certain length by the lasting machine subsequently it takes the shape of a staple pin by an in built bending mechanism before being driven into the lasting margin.

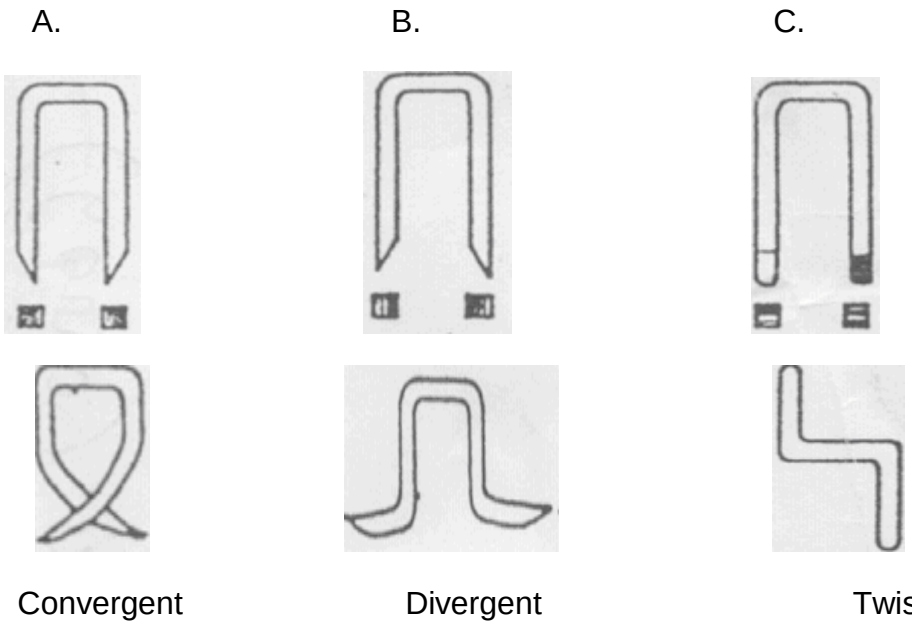


Fig21. Wire staple types

2.7. ADHESIVES

When two surfaces are joined with the help of chemical material is called an adhesive and the process of thus joining is known as adhesion.

Application of the adhesives on the bottom part is most vital as it stuck the both surfaces to make it as a complete shoe. The adhesives can be applied by hand brush or by a pressure extruder brush or by a roller type machine. A thin layer (low viscosity) of adhesive must be applied as a prime coat to facilitate the easy penetration of adhesive into the fiber structure of upper. Then a second coat is applied. Application of two coats of adhesive is always advisable. While in case of P.U. & P.V.C. unit soles a thin layer of single coat only is applied. More adhesive layer in the unit sole may cause depletion of the bondage. Drying of the adhesives applied on the upper and sole completely is a must because evaporation of solvent from the joining part is vital for correct attachment. Shoes are kept on open make total evaporation of the solvents. Heating cabinet's conveyer with heater or tunnel heater is also used for this purpose.

2.7.1. Types of Adhesives

1. Natural Rubber / Latex Adhesive

It is a combination of 60% concentrated latex mixed with solution of ammonia in water. **And also it is** Milky white, sensitive to pressure, heat, grease, oil, and plasticizer.

It is used for laminating, folding, fitting, outsole channel closing of welted constructions, outsole attachment to the upper where the sole is stitched to the upper, top line binding, upper to the lining attachment.

Unsuitable for oil leather and loose fiber leathers could cause shrinkage and wrinkles.

2. Rubber Solution

It is prepared by milling latex together with the compounded rubber and dissolving in solvent like CCl4 or benzene or gasoline. It has the following characteristics

- It is usually amber colored, giving off a pungent color.
- It has poor heat resistance & sensitive to oil & grease.
- It is used for temporary bonding for edge folding, upper to lining attachment and sock lining attachment to insole.
- Used for laminating, folding, fitting.
- Inflammable and toxic in nature.
- Not easy to remove if spilled and creates stains.

3. Poly-chloroprene Adhesives (Neoprene)

These adhesives are produced by dissolving the base polymers in organic solvents. Neoprene is a polymer of 2 – Chloro Butadiene as a main constituent. They have low viscosity and good wetting properties. It is product of Du – Pont.

Pressure sensitive when dry, Poor resistance to plasticizer (PVC), Good Water resistance

Film flexibility, high bond strength, easy handling, application through a brush or spray, resistant to deterioration caused by chemicals, oils and heat.

Readily crystallizes even at room temperature, possess high polarity, dissolve in a no. of solvents, can control tack retention time.

Commonly Poly-chloroprene Adhesives Uses for**:-**

- Permanent Stick (need not to be stitched), Attachment of upper components & lining components
- Attachment of upper with insole, Side Lasting.

And its Melting Temperature is 70 to 80^0C

4. Polyurethane Adhesives (PU)

These are produced when a di-isocyanides having two isocyanides groups is reacted with a di-ol having two hydroxyl groups.

It has the following main characteristics

- High resistance to PVC plasticizer, oil, grease, heat.
- Strong Adhesive bond, highly reactive, good wetting & penetrating properties.

Commonly Polyurethane Adhesives Uses for shoe uppers, shoe soles, adhesives and shoes finishes. And Its Melting Temperature is 80 to 90^0C

5. Hot melt Adhesives

These solvent less adhesives are based on thermoplastic materials. A thermoplastic is a polymer that turns to liquid when heated and freezes to a solid upon cooling. The Bonding process of hot-melt adhesive is heated and applied in its liquid state with the aid of glue guns or nozzles and the bonding is obtained in few seconds by cooling.

These are applied in molten state and on cooling form a rigid, strong bond. It can be both reactive and non-reactive. It does not contain solvent or dispersant.

Commonly hot melt Adhesives are:

- Used for Permanent / temporary bonding or attachment of lining to uppers, top line folding formation, lasted upper is stitched to the insole, insole rib or outsole depending on the shoe construction.
- Used for attachment of uppers to the insole in Toe lasing, side & seat lasting operation.
- Used for sole attachment with lasted uppers. Used in thermo-folding machine

Its Melting Temperature is:-

Polyester Adhesive – 210 to 230^0C, Superior wear & physical properties

Polyamide Adhesive - 180 to 210^0C, Very good flexibility

2.7.2. Properties of Shoe Trade Adhesives

Generally the main characteristics of shoe trade adhesives are:-

- High Cohesive Strength and bond with wide range of shoe materials.
- High resistance to Creep up to 60^0 C.
- Grease, plasticizers, perspiration, water or other substances to which it might normally be exposed should not reduce bond strength.
- High resistance to aging.
- High flexibility and high resistance to flex cracking.
- Easily applied by hand or machines.
- Controllable viscosity and good wetting and penetrating properties.
- High enough solid content so that only one coat is needed, even on very porous materials.
- Controllable drying rate to suit work organization.
- Green strength should suit the process.
- Should be non-inflammable and non-toxic to avoid the need for extraction equipment.
- Excess or spilled adhesive should be easily removed from visible parts of the shoe leaving no marks or stain on upper.
- Should be economical.
- Long shelf & pot life. Not too sensitive to change in temperature
- Long tack life for maximum versatility in work organization.
- No shrinkage on drying or the material may wrinkle or bonds may shears.

2.7.3. Adhesive Selection

The selection of adhesives for the application of the shoe making process is based on the following main criteria that are:-

a) Strength

The adhesive must create a bond, sole attaching adhesive must keep the sole well bonded to the upper during the wear and should have sufficient heat resistance

b) Suitability for use with shoe materials:

The adhesive must be compatible with all the materials in the shoe. The neoprene adhesive will not bond well to leather with high fat content (Oil Leathers)

c) Suitability for use in shoe processes:

The adhesive should meet manufacturing requirements. E.g. Tackiness not

required for socking and stiffener adhesives. Quick tack required for folding cement.

d) Shelf and Pot life:

Adhesives should preferably have a long shelf life (Before opening time) & Pot life (After Opening time).

e) General condition:

- Safety - Adhesives should preferably be non-toxic and non-inflammable, vapor harmful to inhalation, skin protection.
- Adhesives should not shrink or contract on drying
- Adhesives does not cause discoloration or spoil the surface finish of the upper.
- Adhesives should not affect the upper materials.
- Adhesives should be easy to remove if necessary.
- Ease & Rapid Application – Hand Brush, Machines, Rollers, Spray Gun
- Drying Time – Quick or minimum
- Storage – ability to withstand temp. variation condition
- Resistance to moisture and water.

2.7.4. The most commonly used adhesives in lasting operation

Sr. No	Operation	Adhesive Chemicals	Melting Temperature	Remarks
1	Toe Lasting	1. Polyester Hot melt adhesives (white) 2. Polyamide Hot melt adhesive (yellow) 3. Neoprene 4. PU	210 to 240^0C 180 to 210^0C 70 to 80^0C 80 to 90^0C	
2	Side & Seat Lasting	1. Polyamide Hot melt adhesive (yellow) 2. Neoprene 3. PU	180 to 210^0C 70 to 80^0C 80 to 90^0C	

3	Upper Pasting	1. PU + Hardener 2. Neoprene + Hardener	80 to 90^{0}C 70 to 80^{0}C	
4	Sole Pasting	1. PU + Hardener 2. Neoprene + Hardener	80 to 90^{0}C 70 to 80^{0}C	

2.7.5 Mechanism of Adhesive Bond

There are two main mechanisms by which an adhesive sticks to a materials.

1. Specific Adhesion
2. Mechanical Adhesion

1. Specific Adhesion

- It gives a chemical bond between the adhesives and the surfaces being joined. The adhesive, therefore, does not have to penetrate the materials but is bonded to the material by chemical action. Diffusion zone required in between the adhesive and the materials.
- The Chemical Bonding theory of adhesion involves the formation of covalent, ionic or hydrogen bonds across the interface.
- E.g. Sticking of Thermoplastic rubber (TR) soling. If a PU adhesive is applied to TR without pretreatment, it can be easily by peeled off. TR requires a chemical pretreatment, HALOGENATION, to make it compatible with the PU adhesives so that a chemical bond can be formed.

2. Mechanical adhesion

- It gives physical bond in which the adhesive keys into the fibers or structures of the material to be bonded. It can be done only with porous materials like leather and fabric by roughing process. The mechanical theory of adhesion is a “Hook and Eye Theory”. The adhesive flows into the surface structure of the materials, and when the solvent in the adhesive has evaporated, the adhesive is keyed into the materials. The joint made cannot be broken without physically breaking either the adhesive or the surface of the materials.
- The adhesive is applied and securely anchored to both surface to be bonded. Enough adhesive must be on each surface so that, when the two

surfaces are brought together, the adhesives join to form a strong bond.

- The effectiveness of the bond will depend on the strength of material, and on the size, depth & shape of the pores. Deep and undercut pores will lead to the stronger bonds than shallow identification. Good forms can be formed to fibrous surfaces because adhesive can surround the fibers.

Advantage of adhesive bonding

- Rapid, economical joining
- A means of providing new structural or composite unit
- More uniform distribution of stress
- A means for obtaining surface free from holes
- Minimizing potential points of corrosion so evident in mechanical joining

Self-Check 1	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 33-34.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1) What do we mean by adhesion? (1point)
2) List all the types of last. (2 points)
3) What is the difference between stiffener and toe puff?(2 points)
4) What are the properties of heel? (4 point)
5) List all the main materials that are used for shoe making process in lasting section. (5 point)

Test II: Multiple Choice

Directions:

1. There are eight [6] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
2. A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

1. Which mechanism of adhesive bond gives chemical bond between the adhesive and the surface being joined?
   A. Specific adhesion
   B. Mechanical adhesion
   C. Chemical adhesion
   D. Electrical adhesion.

2. Which of the following is not the property of polyurethane (PU) adhesive?

A. High resistance to PVC plasticizer.
B. Strong adhesive bond
C. Good wetting and penetration
D. Less reactive

3. Which staples are used when side lasting of welted footwear or stich down lasting is done?
   A. Preformed staples
   B. Wire staples
   C. Machine lasting tacks
   D. all

4. Which is a decorative strip of leather or other material attached to the outsole?
   A. heel
   B. sole
   C. welt
   D. outsole

5. Which one of the following is a correct statement?
   A. Joint, socket and heel pain are some of the parts of shoe last
   B. Bottoming includes insole preparation, sole attaching and sole pressing
   C. The topline of every shoe must be reasonably tight
   D. all

6. Which is the inner sole of the shoe, which is next to the foot under the shoe sock?
   A. insole
   B. sole
   C. heel
   D. welt

- **Score = _____ Rating: _____**

- Information Sheet 2 Checking tools for serviceability, safety and faults

Check the tools

Before any use of the tools there must be checking practice. Tools are checked for the sake of serviceability and safety, and faults to be reported. Some of check points for the tools can be:

- Checking if there is breakage on the tools
- Checking sharpness of Blades, Dies ,etc., …
- Checking the accuracy of measuring, and other related tools.

Safety measures while using the hand tools

In cutting operation, methods for holding the tools used and method of operating must be clearly known for the sake of safety. For example the method of hand cutting must be in a way that the cutter's finger or hand will not be damaged.

- Clothing requirements: - wearing a protective cloth is important especially during machine operations.
- Precautions: - Method of holding the knife must be in a proper way. And method of cutting must be in a way that the cutter's finger or hand will not be damaged.

Location of hand tools

- Location: - Hand tools should be safely located when not in immediate use.
- Safety: - Hand tools should be used safely and effectively according to their intended use.
- Systematically arrangement: - Materials should be clamped or fixed in position.

Self-Check 2	Written Test

Instructions: Write all your answers in the provided answer sheet on page no.15.

Test I: Short Answer Questions:

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers. **(Total points: 4X2=8)**

1. What are the check points of the hand tools?
2. What are the safety aspects of the hand tools?
3. How can we keep the hand tools?
4. Define the step by step procedure of using grading tool.

- Information Sheet 3 Clearing work area following workplace standard procedures

Clean work area and hand tools:

Summary

The objective of this information sheet is to show you how to keep work areas and tool clean and operational. At the end of each working day clean the tools and equipment you used and check them for any damage. If you note any damage, tag the tool as faulty and organize a repair or replacement.

Preparation and Safety:

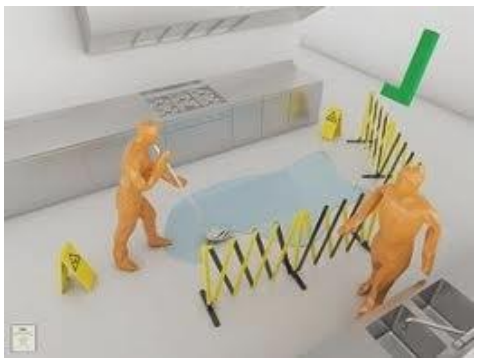
Personal safety:

Whenever you perform a task in the workshop you must use personal protective clothing and equipment. Among other items, this may include:

- Work clothing - such as coveralls and steel-capped footwear
- Eye protection - such as safety glasses and face masks
- Ear protection - such as earmuffs and earplugs
- Hand protection - such as rubber gloves and barrier cream
- Respiratory equipment - such as face masks and valved respirators

If you are not certain what are appropriate or required, ask your Instructor.

Safety check:



- Some cleaning agents are toxic. Refer the instructions on any cleaning agent and follow any recommendations before using it.
- Do not use flammable cleaners or water on electrical equipment.
- Make sure designated walkways are kept clear of any obstructions.
- Always wear protective clothing and the appropriate safety equipment.
- Make sure that you understand and observe all legislative and personal safety procedures when carrying out the maintenance tasks. If you are unsure of what these are, ask your Instructor.

Points to Note:

- Clean tools and equipment helps work more efficiently. At the end of each working day clean the tools and equipment you used and check them for any damage. If you note any damage, tag the tool as faulty and organize a repair or replacement.
- Electrical current can travel over oily or greasy surfaces. Keep electrical power tools free from dust and dirt and make sure they are free of oil and grease.
- All workshop equipment should have a maintenance schedule. Always complete the tasks described on the schedule at the required time. This will help to keep the equipment in safe working order.
- Store commonly used tools in an easy-to-reach location. If a tool, or piece of equipment, is too difficult to return, it could be left on a workbench or on the floor where it will become a safety hazard.
- Keep your work area tidy. This will help you work more efficiently and safely.
- Always use chemical gloves when using any cleaning material because excessive exposure to cleaning materials can damage skin.
- Some solvents are flammable. Never use cleaning materials near an open flame or cigarette.

- The fumes from cleaning chemicals can be toxic, so wear appropriate respirator and eye protection wherever you are using these products.
- When cleaning products lose their effectiveness they will need to be replaced. Refer to the suppliers' recommendations for collection or disposal. Do not pour solvents or other chemicals into the sewage system. This is both environmentally damaging and illegal.

Cleaning of equipments

To maintain cleaning equipment and keep it in a good working condition, it must be thoroughly cleaned and stored correctly every time it is used. If regular maintenance does not occur, the equipment may, over time, become dangerous to individuals.

Equipment and Floor that will need cleaning includes:

- Garbage receptacles

- Pans
- Brooms, dusters and brushes
- Mops and buckets
- Electrical equipment, Ex: vacuum cleaners, polishers, scrubbers.

  Every time a piece of equipment is used, the general rule is to clean it straight away so it is ready for the next person to use. The manufacturers' instructions should be strictly followed when maintaining and cleaning equipment.

Cleaning of Work Area

You have to be:

- Clear and clean the area
- Store any reusable materials
- Check, clean and store away any tools and equipment
- Dispose of hazardous and non-hazardous waste according to legal and workplace requirements.

SKILLS AND ACTIONS NEED TO CLEAN UP YOUR OWN WORK AREA

Cleaning and clearing techniques:

- Select and use an appropriate method for cleaning

- tools and specialist equipment
- any leakages
- Restore your work area to a safe and tidy condition
- Make sure that any materials, components, tools and equipment that you may need for the next task are set up ready for use.

Material storage techniques:

- Sort reusable equipment, components and materials from waste
- Reusable materials are correctly stored
- All tools and equipment are properly stored.

Safe disposal techniques:

- Handle and dispose of waste materials appropriately according to organizational and legal requirements
- Recognize what materials are hazardous and require special procedures
- Report any problems associated with cleaning, storing or disposing of materials and equipment to the relevant person.

Hazardous and non-hazardous materials:

- Types of waste material generated in the work area
- Know how to handle hazardous waste and reusable materials safely including:
  - Fluids
  - Adhesives
  - Solvents.
- Personal protective equipment is required and how to use it.

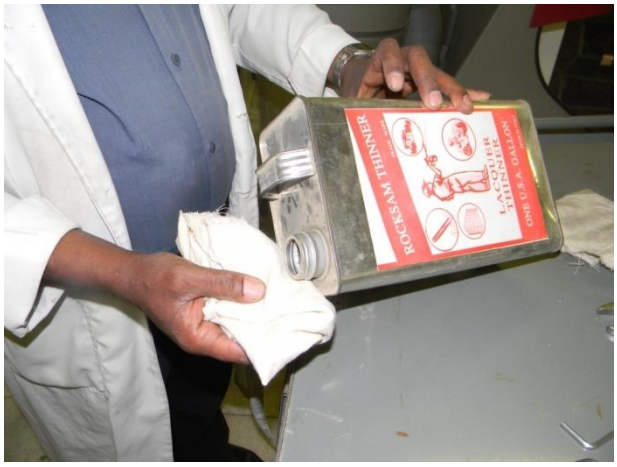
Step by Step Instructions:

Clean hand tools

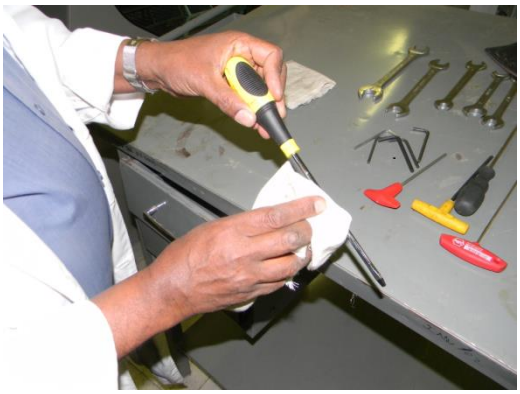
Keep your hand tools in good, clean condition with two sets of rags. One rag should be lint-free to clean or handle precision instruments or components.

The other should be oily to prevent rust and corrosion.

- Use kerosene/solvent for cleaning tools



- Clean tool and keep their place




Clean floor:

Wipe off any oil or grease on the floor and check for fluid leaks. If you find any, top up the hydraulic fluid. Occasionally, apply a few drops of lubricating oil to the wheels and a few drops to the posts of the safety stands.


Points to Note

- Clean tools and equipment helps work more efficiently. At the end of each working day clean the tools and equipment you used and check

them for any damage. If you note any damage, tag the tool as faulty and organize a repair or replacement.

- Electrical current can travel over oily or greasy surfaces. Keep electrical power tools free from dust and dirt and make sure they are free of oil and grease.

- All workshop equipment should have a maintenance schedule. Always complete the tasks described on the schedule at the required time. This will help to keep the equipment in safe working order.
- Store commonly used tools in an easy-to-reach location. If a tool, or piece of equipment, is too difficult to return, it could be left on a workbench or on the floor where it will become a safety hazard.
- Keep your work area tidy. This will help you work more efficiently and safely.
- Always use chemical gloves when using any cleaning material because excessive exposure to cleaning materials can damage skin.
- Some solvents are flammable. Never use cleaning materials near an open flame or cigarette.
- The fumes from cleaning chemicals can be toxic, so wear appropriate respirator and eye protection wherever you are using these products.
- When cleaning products lose their effectiveness they will need to be replaced. Refer to the suppliers' recommendations for collection or disposal. Do not pour solvents or other chemicals into the sewage system. This is both environmentally damaging and illegal.

Work area should be cleaned as per standard procedure:

Work area should be cleaned by following workplace standard procedures:

- **Dust bins for bio-degradable waste materials**

Bio-degradable garbage (waste materials) means the garbage or waste materials that are capable of being destroyed by the action of living beings.

- **Dust bins for non-biodegradable waste materials**

  A Non-bio-degradable waste material (garbage) means the garbage or waste materials that are not capable of being destroyed by the action of living beings.

- **Cleaning of workshop**

  Clean floors and decking at the end of each shift and place all rubbish and waste in approved containers for disposal.

- **Housekeeping of cutting department**

  -Good housekeeping promotes safety and prevents accidents.

  -Do not use any equipment if it is damaged. It is important to tag it out and report it to your supervisor immediately.

  - Always practice good housekeeping before, during and after the job.

- **Housekeeping of leather stores**

  In footwear manufacturing the leather must have good quality in order to be used for footwear production. Leather stores plays a big role in taking care of the leather stored so housekeeping of leather stores must be given an emphasis.

  The store must be clean and free of dusts and other waste materials.

Self-Check 3	Written Test

Instructions: Write all your answers in the provided answer sheet on page 13.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers. **(Total points: - 10)**

1. What is the difference between Bio-degradable and Non-bio-degradable waste materials? (Points: 2)
2. What is the need of housekeeping in cutting department? (Points: 2)
3. Why housekeeping is important for leather stores? (Points: 2)
4. What are the cleaning and checking method of hand tools? (Points: 4)

- Information Sheet 4 Identifying, arranging and making ready machines for specified products

Machines used for hand lasting

Machine is a device consisting of fixed and moving parts that modifies mechanical energy and transmits it in order to reduce the time and effort. The following are the machines that are used in collaboration with the above tools to produce a complete foot wear in an industry.

1. Heat setter

Fig 11: Heat setter

It is the machine used for shape retention of the lasted upper. In other words it is used to relax the stress applied on the upper due to lasting pull and make the upper get permanent shape. Retention of shape of shoe is the result of good heat setting.

If the lasted upper is not going to the process of heat setting it will lose its shape.

The traditional way of shape retention is done by exposing the shoe to sunlight for 48 hour causing increased last inventory.

There are two considerations for the heat setting machine to minimize the production cost.

1. Time for heat setting
2. Number of lasts

Different materials need different heat setting methods.

For example

- Leather requires steam heat setting.
- Man-made materials require dry heat setting

2. Roughing and scouring machine

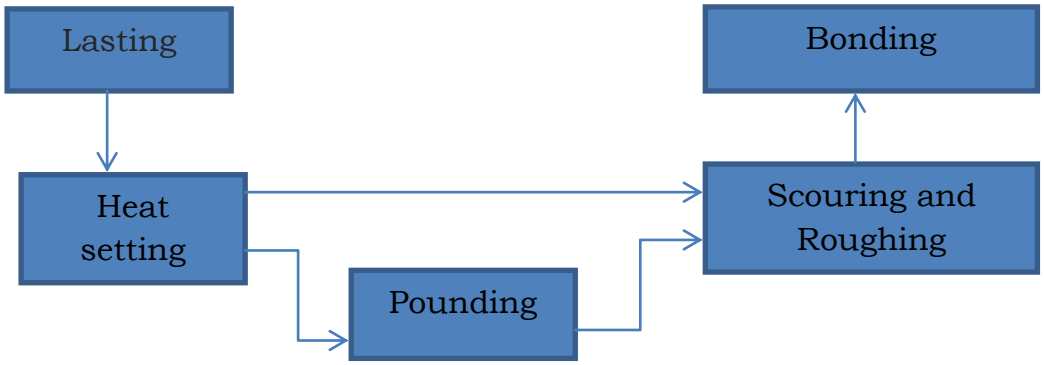


Diagram 1: process flow chart for scouring and roughing

Fig12: Roughing and Scouring machine

Both operations are conducted on the roughing machine and prepare the upper for bonding.

Scouring operation removes the excess material on the lasting margin and flattens the surface before the surface is roughed. Over scouring damages the material.

The roughing operation removes the grain surface of the leather and raises the fibers for good adhesion.

It is usually done after heat setting operation followed by bonding process.

The objective of roughing is to allow deeper penetration of the adhesive and provide a fiber surface for effective bonding.

The following are the common mistakes that are observed with their causes while roughing:

1. Material roughed over/under featheredge:
   It is due to shoe held at wrong angle and careless unskilled operator.
2. Material surface loose/torn: It is due to
   - Too much pressure while roughing
   - Shoe held in one place for a long time
   - Long fibered leather

3. Grain surface not removed: it is due to
   - Inadequate pressure while roughing
   - Shoe not held square to the brush
   - Wire brush not sharp
4. Surface loose to torn: it is due to
   - Too much pressure applied on the shoe against the brush
   - Loose fibred leather
5. Surface not completely removed: it is due to
   - Too little pressure applied on the shoe against the brush
   - Whole lasted margin not presented to the brush.
   - Wire brush not sharp enough

Corrections

i) Re-rough, apply more pressure

ii) Re-rough, cover whole lasted margin, move shoe up and down slightly while roughing

iii) Sharpen the wire brush

6. Roughing under the featheredge.

Cause

- Operator Skill low

Corrections

- Operator practice, re-rough to feather edge.

1. Upper material removed completely.

Causes

- Over scouring reduces the upper material thickness.
- Operator Skill low

Corrections

- Remove only extra material in toe and seat area
- Operator training.

Keep in mind that:

- Very long or very short fiber length is not good for bonding.
- Certain sole materials can be scoured or roughed for a better adhesion.
- It is necessary to mark the area to be roughed before operation.
- The roughing should be up to the featheredge.
- Roughed shoe shall be dust free for better adhesion.

Safety measures

- wear safety glasses
- keep hands off the roughing and scouring wheel

- keep finger behind the featheredge while roughing/scouring
- do not wear loose clothes
- use hair net for long hair/tie hair
- never rough when wire brush is spinning in reverse direction
- Switch off dust extractor when sharpening wire brush.

Note: smooth and continuous movement of the upper while roughing and scouring brings the best result

3. Heel crowning machine

Heel crowning operation is performed by a machine consisting of a hot plate and a conical hammer to flatten the lasting margin in the heel seat region as well as heating the upper around the counter simultaneously.

The outcome of this operation is a correct shape of heel, sharp feather edge and flat lasting margin. This operation facilitates correct placement of polymer heel in case of women's footwear without any gap between feather edge of the lasted upper and heel edge. Also the aesthetics of the finished shoe can be enhanced. This is a pneumatically operated machine with the pressure and heat regulation to suit various upper materials.

Fig 13: Heel crowning machine

4. Pounding machine

Fig 14: pounding machine

It is used for the process of flattening and leveling of excess material on the lasting margin to define the featheredge.it is usually done after heat setting and before roughing.

The upper is pounded down to the last, and toes leveled to the last by means of a mechanical drum (rollers mounted on spindles).

The uppers are mechanically hammered down. The purpose of pounding is to last surplus upper down as level to the insole as possible, to add better finish and avoid bumps.

Generally pounding operations helps for prominent featheredge and avoid gaps during attaching the sole and this helps for nice finish.

The recommended parameters are:

- ✓ RPM of the machine shall be 2000.
- ✓ The temperature must be in the range of 75-80 degree Celsius.

Failure analysis

- Not enough material removed
- Inadequate or excessive pressure
- lasted edge not held square to drum
- Holding the shoe at one spot
- Excessive pounding

5. Heat re-activator

A variety of machines have been made for sole and shoe bottom activation, the choice of the machine is mainly made on the output required and the price. For example some flash heat activators have setting for temperature and cycle time. Some cheaper models have no provision for temperature and time setting; therefore rely on the operator's skills

Heat reactivating before sole pressing

After the sole and the upper have been prepared for sole adhesion, compatible adhesive is applied to both the upper and the sole. The adhesive film is given enough time for drying. Then the upper and the sole are heat reactivated so that the adhesive film gets activated enough for proper bonding.

Heat reactivators are of flash heat types; Eject types and Black heat types.

- Flash heat type has two heating levels. When not in use the elements give off a fraction of the full heat.

  A claimed advantage is that an even shoe bottom is produced because only the cemented surface is heated the sole does not soften unduly.

Different coloured soling respond differently to flash activation. Light colour takes longer than dark colours to reach the same surface temperature. The light colours must be for longer period or they must be placed nearer the heating elements.

- Black heat type of heater consisted of a heating element controlled by simmer stat type of temperature control. Slow heat builds, heating through the sole. This heating softens some soling materials, causing print through which is

visible after sole pressing. Thermoplastic soles may melt when in contact with the metal grid.

Drying and activation chamber

Fig15: drying and reactivation chamber

In order to reduce the last rotation time during bulk production, drying cum reactivation chambers are used where dry air of 45^0 C- 50^0 C is blown over the adhesive film of the lasting margin and the sole((Fig: 15). At the end of the chamber an infra-red lamp used for reactivation of adhesive. This machine significantly reduces the drying time.

Starting work: The heat reactivator cabinet must be at the normal operating temperature before starting work. On flash heat types, this can be achieved quickly by turning on to full power once or twice.

The heating elements should periodically be checked.

A temperature of 75 ... 90 degree Celsius, is required to reactivate the adhesive film (depends on the adhesive, consult your adhesive supplier).

- Check the temperature by using special temperature indicating crayons or laser temperature gun. A small amount of crayon wax is placed on the adhesive film to the forepart and seat of the soles before reactivation to check the temperature.
- Adjust the heating elements or tray position accordingly if the cemented sole surface is either too hot or not hot enough.

- Also, adjust the heating elements or the tray angle for various heel heights and sole thickness.
- Timing device on the reactivator acts as an extra method of temperature control.
- Adjust the timing for various colours of sole because in most activators light coloured soling materials need much longer heat reactivation than darker materials to reach the same surface temperature.
- Certain soling materials may soften excessively under heat reactivation. Reduce the heat applied to the sole and heat reactivates the cemented upper, (follow the instruction of the adhesive supplier).

Fig 16: A Typical Flash Reactivator

1. Sole press

The sole and the heel are positioned to the bottom of the shoe (known as sole spotting) and the shoe is placed in to the sole attaching machine. This serves to press the sole and heel firmly to the bottom of the lasted upper giving a permanent attachment. The usual machine has inflatable, leather covered pads and clamping arms for pressing the sole and heel to the shoe.

Sole pressing

The main purposes of these operations are to activate and press the sole and the shoe bottom together so that they may not come apart in wear.

A variety of machines have been made for sole and shoe bottom activation, the choice of the machine is mainly made on the output required and the price. For example some flash heat activators have setting for temperature and cycle time. Some cheaper models have no setting; therefore rely on the operator's skills. Modern sole presses are all equipped with a variety of pads to allow for various heel heights and adjustable pressure for the wide range of soling materials.

Sole attaching presses are of two main types, Traditional type of presses (universal type) and Enveloping bag presses.

- In the traditional type of presses- the lasted upper is held in position by two jacks, one at the forepart and the other at the back of the last, while pressure, either hydraulic or pneumatic, is applied to the sole. In simplest machines the pressure is applied mechanically.

The pad box can be of rubber, water or air bags. There can a back support for high heels. This type of sole press is very effective in case of leather or sole of similar design and high heel shoe.

Fig: 17 Universal Sole press

- **Enveloping bag presses-** in this type of press the lasted upper with sole spotted in position is either partially or totally enclosed in a rubber bag so that pressure is applied from several directions at once. This is advantageous not only for walled soles but for welted or stitch down constructions where consolidation of the welted/flange sole bond is important.

Fig: 18 Enveloping Bag press (Dr. Funk's press)

Setting up the press

I) Position a shoe having sole spotted on the pad box and make adjustments according to contour of the sole bottom.

This may involve re-setting the angle of the box, changing the rubber blocks or profiles and inserting waist wedges, depending on the type of press and the heel height.

II) Position the toe and heel jacks independently for the last size and adjust for height.

III) Bring the press to its clamped position and then apply pressure to find whether sole distortion occurs.

Any serious distortion of the sole must be reduced as far as possible by reducing the pressure to the acceptable minimum. Serious distortion prevents an adhesive bond.

Bonding pressures of about 5 kg/cm^2 is usual. Satisfactory flat bonds can often be achieved at half this pressure. Actual pressures applied depend on the type of

sole, being lowest for soft materials such as TPR and highest for hard materials such as leather. However carbon paper test shall be carried out daily to ensure correct pressure application throughout sole cavity

IV) Spot the sole and press it immediately after heat reactivation. This demands very high skill in order to place the sole on the lasted upper correctly and often an irreversible process after the sole pressing.

V) Keep the shoe under pressure for 10-12 seconds or longer.

Pressure distribution

- Destructive sole bond testing will reveal any weakness in the attachment due to uneven or insufficient pressure.

i) Check the pressure distribution by carbon paper method.

In this method, a lasted upper and sole are prepared up but excluding cement. Carbon paper between two white paper sheets is placed between the sole and upper. After the pressure has been applied in the press, the sheet of white paper is examined for an even print.

Any variability in the lasted margin region must be investigated.

Fit of upper to soles

I) when sole units have a wall, check that the lasted upper is *not* bridging the wall at any point.

II) Check soles with stuck-on rands in a similar way if the rand is high.

The inner edge of the rand should be skived to avoid bridging effect.

III) Avoid stretching the sole.

Some soles can be stretched to fit when spotting but this can lead to narrowing of the waist of the sole, being risk of bridging this area.

To reduce toe spring, have PVC sole somewhat smaller than the shoe. Spot and stretch the forepart of the sole first then spot the waist and heel.

IV) Keep bottom filling materials or scrims within the lasted margin.

Apart from the reduction in bonding area caused by an overlap, the additional bulk of filler will also produce localised high spots of pressure which may lead to areas of poor adhesion nearby.

Sole design

- The margin for cementing area of a Unit Sole should be minimum of 10 mm;
- The margin should not be on too deep angle or too curved.
- The cavity under this margin should not extend too deeply in.

Other popular sole press machines

A) Press for flat sole B) Sole pressing with side wall

Fig 19: Different types of sole pressing machine

7. De lasting machine

Fig20: De lasting machine

It is used to remove the finished shoe from the last. The hole of the last is inserted in the pin fitted on the last post of the machine and you shall input the necessary adjustments to the machine to get the correct removal of the shoe from the last without damage of last or the shoe.

Self-Check 4	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 58-59.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Define the terms ‘tool’ and ‘machine’.(2 points)
2. What is the primary and secondary function of the pincer?(2 points)
3. List all the tools that are required for hand lasting?(3 points)
4. What is the difference between roughing and scouring operations?(3 points)
5. List all the common mistakes observed with their causes while doing roughing operation.(4 points)

Test II: Multiple Choice

Directions:

- There are eight [6] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
- A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

1. Which statement is not correct?

- Very long or very short fiber length is not good for bonding
- It is necessary to mark the area to be roughed before operation
- Roughed shoe shall be dust free for better adhesion
- There is no problem if roughing is done above the featheredge.

2. Which machine is used for removal of the shoe from the last?

A) Heat setting
B) De lasting
C) Heat reactivator
D) Sole pressing

3. Which operation removes the excess material on the lasting margin and

Flattens the surface before roughing?

A) Roughing

B) Scouring
C) Sole pressing
D) Heat setting

4. Which tool is used to remove unnecessary nails or tacks from the shoe during lasting?

A) Nail lifter
B) Scissor
C) Rampi
D) Hammer

5. Which tool is used for attachment of bottom components such as outsole And shoe repairing manually?

A) Nail lifter

B) Scissor

C) Rampi

D) Cobbler's Anvil

6. Which one of the following is not a type of sole pressing machine?

A) Universal sole press

B) Ball press

C) Dynamic sole press

D) Sole press with side wall

Information Sheet 5 Cleaning, checking, maintaining and storing hand tools and equipment

A **Tool** is an item or implement used for a specific purpose. A tool can be a physical object such as mechanical tools including saws and hammers

A **hand tool** is a device for performing work on a material or a physical system using only hands. The hand tools can be manually used employing force, or electrically powered, using electrical current. Virtually every type of tool can be a hand tool and many have also been adapted as power tools, which get their motive power from motors or engines rather than from human mechanical action.

Equipment is defined as a set of tools, devices, kit, etc., assembled for a specific purpose.

The difference between hand tool and equipment is usually that hand-tools usually refer to manual tools. Equipment is usually referring to anything that is powered by either electricity or by a motor off some sort.

A work instruction is a tool provided to help someone to do a job correctly. This simple statement implies that the purpose of the work instruction is quality and that the target user is the worker.

Work instruction, including plans, specifications, quality requirements and operations details relevant to the task should be obtained, confirmed and applied to the allotted task.

Work instructions for machines used in cutting department

1, Work instruction for Swing arm clicking press

-Receive the leather with work-ticket. Verify the leather for quality and area issued.

-Put the leather on the leather horse.

-Before cutting, collect the dies for right article, & size to be put on the table. Do not keep the dies on top of other.

-Check the die for deformation of shape before proceeding for cutting.

-Set the correct pressure & adjust the height of the head 10-15 mm above the die.

-Cut large components first. Take small sizes from more defective skin.

-Components should be placed edge to edge to minimize waste.

-Ensure that components are cut pair wise & components should be placed edge to edge to minimize waste.

-Bundling of components should be done on 10 Pairs basis with flesh side up.

-Always transfer the cut component with upper job-card.

-Clean your work place after completing your work and place the dies in the specified die rack.

-Throw the leather waste in to bin only.

-Switch off the machine when not in use.

-Return the remaining quantity of leather to the department in-charge.

2, Work instructions for the travel head clicking press

-Receive the material with work-ticket. Verify the material for quality and quantity issued.

-Layer the material and staple it before cutting.

-Before cutting, collect the dies for right article, & size to be put on the table. Do not keep the dies on top of other.

-Check the die for deformation of shape before proceeding for cutting.

-Set the correct pressure & adjust the height of the head before cutting.

-Ensure that components are cut pair wise & components should be interlocked well (minimum 2 mm gap is recommended) to minimize waste.

-Making a bundle of components should be done on 10 Pairs basis.

-Always transfer the cut component with upper job-card.

-Clean your work place after completing your work and place the dies in the specified die rack.

-Throw the waste in to bin only.

-Switch off the machine when not in use.

-Return the remaining quantity of material to the department in-charge.

3, Work instruction for the strap cutting machine

-Do not operate the machine without prior approval.

-Do not work without written job order card.

-Only one person is allowed to work on the machine at one time.

-Before starting cutting straps, set the correct width of knife and pressure.

-Switch off the machine when not in use.

-Put the leather on the leather horse.

-Components should be placed edge to edge to minimize waste.

-Always transfer the cut-comp. after stamping with job-card.

-Clean your work place after completing your work.

-Return the remaining quantity of leather after cutting to the department in change.

-Throw the leather waste in to bin only.

4, Work instruction for the splitting machine

-Do not operate the machine without prior approval.

-One person is allowed to work on the machine at one time.

-Set the correct thickness before starting splitting of components

-Match the split component with the thickness gauge once a day.

-Switch off the machine when not in use.

-Do not split leather in layers

-Clean your work place after completing your work.

-Empty the leather waste in to waste bin only.

5, Work instructions for the stamping machine

- Receive the cut-components with upper job card on 10 Pairs basis.

-Check the digits for stamping as per plan no., size etc.

-Check for the temperature of the heated number plate / die (70-80 degree Celsius).

-Place each component on machine platform carefully with specified margin/place on the components.

-Keep the hands away from the heated number plate/die

-Clean your work place after completing your work.

-Switch off the machine when not in use.

1.1.2 Specification

Standard specification of article

It is a specification for an article derived from a standard.

Special instruction from buyer

-In this case customers are the owners of the specification/requirement. And also the product must feet or conform to known customer or buyer requirements.

1.2 Quality requirements

The first requirement for a shoe upper material is that it should take the desired shape during making. The second requirement is that, it should retain the shape during storage and wear. Lastly it should be able to take new shape to adjust to the feet of the wearer. And also attaching of the upper with the sole requires some quality requirements. In order to achieve this quality requirements one should realize and fulfill the following key points:

Quality specification sheet:-

It is a sheet that contains the exact statement of the particular needs to be satisfied and the requirement for a particular material or component.

Test	Equipment (M/Cs)	Requirement
Breaking load and extension at break	Tensile tester	
Twist per unit length	Twist Tester	
Fastness of color to abrasion	Bally Finish Tester	

Table-4 Simple example of specification for physical testing of threads

Self-Check 5	Written Test

Instructions: Write all your answers in the provided answer sheet on page no.5

Test I: Short Answer Questions:

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers. **(Total Points:-3X2=6)**

1. What is hand tool?
2. What is equipment?

What is the difference between hand tool and equipment?

Information Sheet 6 Obtaining work instructions, specifications and operation details related to lasting machines

Lasting is a term related to the process involved in stretching (in some areas by compressing) the upper material over the last and securing it. The upper will conform to the contours of the last and when, the last is removed, upper retains much of the shape. Before lasting toe-puff and counter stiffeners are attached to upper and then the upper and lining are pasted. This whole process is called upper preparation.

Toe puff attaching In mechanized lasting thermoplastic toe-puff is attached with help of toe-puff attaching machine. The toe-puff can be of woven or non-woven material. One side of the toepuff is painted with hot-melt adhesive. The adhesive sided of the toe-puff is placed on the flesh side of the upper and then placed in the machine. The toe-puff must be placed 5 mm inside from edge of the lasting margin. The toe-puff must be properly attached all around with the upper.

Counter stiffener attaching In mechanised lasting thermoplastic counter stiffener is used. The counter stiffener is painted with hot-melt adhesive on both-side. The counter stiffener is placed between upper and the lining. The counter stiffener must be centrally aligned with upper.

Once the counter stiffener is inserted in the upper the upper is placed on the hot mould of the machine and the mould is closed. The heated mould melts the adhesive and attaches it to the upper and lining. The counter stiffener also becomes soft on heating. After this the upper is immediately placed on the cold mould and its closed. The cold mould has similar shape as the back part of the last. The back part of the upper takes the shape of back part of the last on which lasting operation is to be performed

Lining pasting The upper and lining is pasted together with help of adhesive. Normally latex is used to paste lining with upper.

Stitch vamp all around lasting margin sometimes the upper and lining are stitched together along the lasting margin. This done when the upper and lining is not pasted properly. Some lining material like foam lining and synthetic lining is difficult to paste so they are stitched together. If the pasting of upper and lining is not proper the upper may open after toe-lasting as the lining will stick to the last and upper will come out. Then rework has to be done after toe-lasting.

Self-Check 6	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 11.

Test I: Short Answer Questions Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. What are reasons for toe puff not attaching properly with upper? (3 points)

2. What is the purpose of hot mould? (2 points)

3. What is the purpose of the cold mould? (2 points)

4. What are the reasons for wrinkles in lining during counter moulding? (2 points) 5. Why vamp and lining is stitched around the lasting margin? (3 points)

Information Sheet 7 Identifying safety with regard to tools, equipment and machine.

Lasting is a term related to the process involved in stretching (in some areas by compressing) the upper material over the last and securing it. The upper will conform to the contours of the last and when, the last is removed, upper retains much of the shape.

From lasting point of view the main materials that used for shoe making process are:- A. Shoe last B. uppers C. insoles D. soles E. toe-puff F. counter stiffeners G. nails and tacks H. adhesives I. solvent SHOE LAST1 Most shoes are made to a last. The last is a foot model with dimensions and shape similar to the anatomical foot but sufficiently different to be exact. Shoe fit and to some extent the last influences its durability. In machine lasting normally plastic lasts are used. These can be C-hinge, V-hinge, Slidometric, telescopic or solid last depending in the design of the footwear

1 Lasts are discussed in detail in the Footwear production level II, Learning Guide-1, Unit of competency- Perform basic lasting operations. LG code - IND FWP2 M07 0212 LO1-01, Module code - IND FWP2 TTLM 0212v1

Normally these lasts are with heel plates where the seat lasting machine secures the upper with nails. There machines where seat lasting can be done with hot-melt adhesives, in these case lasts without plates can be used

UPPER Lasting involves forming the upper by stretching it over the last. For foot comfort the upper must conform to the shape of the last and retain much of it. Also the shoe upper after a period of wear must also conform to the shape of the foot.

To last the upper well we should use the minimum strain necessary to make the upper conform to the last. By stretching too tight we may cause upper cracks and inadequate shape retention of the shoe. For quality and productivity it is important to skillfully design and maintain the whole production process from material selection to pattern engineering, cutting, closing and lasting. INSOLES The insole is the foundation of the shoe to which anchor the upper, heel and outsole. No matter how light a substance the

fashion may demand, it is the basic component on which the whole shoe is built. Insoles therefore have a strong bearing on wear, comfort; shape retention, foot health and appearance. Leather is still an important insole material, particularly in men's high grade shoes, but in women's fashion shoes, where lightness and flexibility are most important, man-made insoles are in great but is used because of their suitability for the purpose, having been made to meet specific demands.

Insoles used for machine lasting must be properly moulded and must be matching the bottom profile of the last. If it’s not so the wiper plate may fold the insole at the time of toe-lasting or seat and side lasting.

OUT SOLE

Out sole is the Bottom-most part and Walking surface of shoe having following properties: • Anti-skid • Abrasion resistance • Flexibility

Types of sole/out sole The sole made of a diversity of material, i.e. leather, pure rubber, resin rubber compound, plastic etc. based on this different types of sole are used in footwear industry ,but the common types of sole are:- • Leather • Poly-urethane (PU) • Poly vinyl chloride (PVC) • Thermo-plastic rubber (TPR) • Rubber (Vulcanized, resin) • Ethyl vinyl acetate (EVA), Phylon

TOE PUFFS2 The function of the toe puff is basically to provide shape to the forepart of the shoe, and in certain case, in the industrial boots, to give protection to the foot of the wearer. It is the mean by which the shape of the last forepart is reproduced in the finished shoe, and thus plays an important part in the appearance and the general performance of the majority of the footwear types. The choice of the toe puff for any given footwear type is influenced by many factors of the last shape, upper material type, production methods to be used, fashion and the views of individual customers; all must be considered before a decision can be reached.

2 Toe-puffs

are discussed in detail in the Footwear production level II, Learning Guide-1, Unit of competency- Perform basic lasting operations. LG code - IND FWP2 M07 0212 LO1-01, Module code - IND FWP2 TTLM 0212v1

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For mechanized lasting normally thermoplastic toe-puffs are used. These can be attached in stitching department. The major advantage of thermo-plastic toe-puff is that it can be attached and can be used later. Solvent activated toe-puffs can also be used for mechanized lasting but these must be put on lasting conveyor. These have to used immediately after putting on the upper. COUNTER STIFFENER A stiff material similar to that of the toe puff which may be molded to the shape of the last back part or, alternatively, inserted flat and molded during the subsequent process. It is normally inserted between the lining and the upper to support the back of the shoe and grip the foot. Apart from the material used which is similar to that used for toe-puff except for the thickness, leather board can also be used.

Types of counter stiffener .The three types of stiffeners are flat stiffener, Semi-molded stiffener and the fully molded Stiffener. a) Flat stiffener b) Semi –molded stiffener c) Fully- molded stiffener Material for the counter stiffeners which are commonly used in the industries are:

a) Thermoplastic b) Solvent activated c) Leather board

Thermo-plastic counter stiffeners are preferred for mechanized lasting as these can be fixed in closing department.

NAILS, TACKS AND STAPLES

There are many types of tacks and nails used in the manufacture of shoes designed to suit numerous lasting and assembling operations. Machine tacks with special finishes to enable trouble free running in machines are produced in various lengths to suit the material being used. Use of nails and tacks The nine tacks and nails illustrated are made for the following operations: - a) Used for seat, side and toe lasting b) Building leather heel and heel attaching c) The inside attachment of wooden heel

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d) The inside attachment of plastic heels e) The outside attachment of rubber heels f) The outside attachment of leather built heels in mechanized lasting round tacks are used for insole attaching and in seat lasting machines. Insole attaching can be done with staples or adhesive tapes also.

Buttress nails are used for attaching plastic heels.

3. ADHESIVES

When two surfaces are joined with the help of chemical material is called an adhesive and the process of thus joining is known as adhesion. Application of the adhesives on the bottom part is most vital as it stuck the both surfaces to make it as a complete shoe. The adhesives can be applied by hand brush or by a pressure extruder brush or by a roller type machine. A thin layer (low viscosity) of adhesive must be applied as a prime coat to facilitate the easy penetration of adhesive into the fiber structure of upper. Then a second coat is applied. Application of two coats of adhesive is always advisable. While in case of P.U. & P.V.C. unit soles a thin layer of single coat only is applied. More adhesive layer in the unit sole may cause depletion of the bondage. Drying of the adhesives applied on the upper and sole completely is a must because evaporation of solvent from the joining part is vital for correct attachment. Shoes are kept on open make total evaporation of the solvents. Heating cabinet's conveyer with heater or tunnel heater is also used for this purpose.

3 Adhesives are discussed in detail in the Footwear production level II, Learning Guide-1, Unit of competency- Perform basic lasting operations. LG code - IND FWP2 M07 0212 LO1-01, Module code - IND FWP2 TTLM 0212v1

In mechanized lasting various adhesives are used. • Latex used for lining pasting and socks attaching • Polyamide is used in seat and side lasting machine. • Polyester is used in toe-lasting machine • Polyurethane used for sole attaching SOLVENTS Solvents are organic compounds used in various applications at the time of footwear production. The main solvents used are: • Methyl Ethyl Ketone (MEK) • Toluene • Ethyl Acetate • Different primers • Different finishing sprays.

MEK is used for cleaning PVC and PU soles before attaching with the lasted upper. This helps to remove dust, grease, plasticizers from the surface of the sole. Toluene is used to dip the solvent activated toe-puffs and counter stiffeners. Since toluene is

less volatile it keeps the toe-puff and counter-stiffener soft for a considerable period of time compared to other solvents like MEK or Ethyl Acetate. Ethyl Acetate is used as one of the component in the TPR primer.

Self-Check 7	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 10-11.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Name any six materials used in lasting? (3 points)

2. Which type plate be used in lasts when one is using seat lasting machine with tacks? (2 point)

3. How much strain must be given on upper during lasting? (2 Point)

4. What problem can occur if the moulding of the insole is not proper? (2 points)

5. Name any five types of sole? (5 points)

Test II: Fill in the blanks

Directions: There are five [5] questions in Test II. Select the appropriate word to fill in the blanks. Only write the word in the answer sheet provided. A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Information Sheet 8 Identifying safety of operator and workplace

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the top thermal (heated) parts of the machine • Do not put your hand between the heated parts • Do not attempt any electrical repairs • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of toe puff attaching machine.

Counter moulding

The process of toe counter moulding is done by pneumatic machines which have heated parts.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the hot moulds (heated parts) of the machine • Do not put your hand between the heated parts • Carefully hold the upper so that the pincers do not injure the fingers

• Keep away from the moving parts of the machine • Do not attempt any electrical repairs • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of counter moulding machine.

Lining pasting

The process of lining pasting is done by hand or latex spray machine with thermal unit.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the top thermal (heated) parts of the machine • Do not put your hand between the heated parts • Do not attempt any electrical repairs • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

Precaution for health hazards

• Use glove while spraying • Use mask to prevent fumes of latex to go inside your body •The machine must have good exhaust system that the spray particles do not spread in the work shop.

In case of manual application only precautions from health hazards must be considered.

Insole attaching

The process of insole attaching is done by pneumatic machines. This can be done by hand also with help of tacks, staples or self adhesive tapes.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the nozzle from which the tack or staples come out • Do not use the machine without last and insole • Wear protective glasses while using the machine • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of insole attaching machine. Mulling and toe lasting machine

The process of mulling and toe lasting is done by pneumatic machines which have heated and moving parts.

Safety precautions while operating the machine (mulling machine)

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the top thermal (heated) parts of the machine • Do not put your hand between the heated parts • Keep away from the moving • Do not attempt any electrical repairs

Toe mulling machine • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of toe puff attaching machine.

Safety precautions while operating the machine (toe lasting machine)

• Operator must know the emergency switch/button of the machine

• Switch off the machine when not in use for long time

• Keep hand away from the moving parts of the machine like wiper, pincer, toe pad, back rest injector, insole rest etc.

• Do not put your hand on the heated parts like the injector and wiper plate • Carefully hold the upper so that the pincers do not injure the fingers

• Do not attempt any electrical repairs

• Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it.

• Know your fire drill • One operator at a time on the machine

• In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of toe lasting machine.

Mulling (seat) and seat & side lasting machine

The process of mulling and seat & Side lasting is done by pneumatic machines which have heated and moving parts.

Safety precautions while operating the machine (toe lasting machine)

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Keep hand away from the moving parts of the machine like wiper, pincer,

Training, Teaching & Learning materials for Footwear Production level III TVET program 2012 fingers • Do not put your hand on the heated parts like the Nozzle and wiper plate • Carefully hold the upper so that the pincers do not injure the fingers • Do not attempt any electrical repairs • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of seat and side machine.

Heat setting machine

In the process of heat setting the upper is passed through a chamber with hot air and humidity so that the upper retains its shape after delisting.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine • Switch off the machine when not in use for long time • Do not put your hand in the chamber • Do not attempt any electrical repairs • The operator must wear cotton gloves for picking up the lasted upper from the machine • Always wear approved footwear and clothing in shop floor • If the hair is longer than shoulder use a hair net and tie it. • Know your fire drill • One operator at a time on the machine • In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of heat setting machine.

Pounding and heel crowning machine

The process of heel crowning is done by pneumatic machines which have heated and moving parts.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine

• Switch off the machine when not in use

• Keep hand away from the moving parts of the machine

• Keep hand away from heated parts of the machine

• Do not attempt any electrical repairs

• Always wear approved footwear and clothing in shop floor

• If the hair is longer than shoulder use a hair net and tie it.

• Know your fire drill

• One operator at a time on the machine

• In case of any injury, even minor report to your supervisor and get necessary medical attention.

There are no major health hazards during the use of Crowning machine.

Roughing and scouring machine

The process of is done on a roughing and scouring machine attached with a dust collector. The machine has a motor with shaft. The roughing wire brush and the emery wheels are attached to the two ends of the shaft.

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine

• Switch off the machine when not in use

• Keep hand away from the moving parts of the machine

• Use safety glasses while using the machine

• Use mask while using the machine

• Switch off the exhaust at time of sharpening of the wire brush

• Do not attempt any electrical repairs

• Always wear approved footwear and clothing in shop floor

• If the hair is longer than shoulder use a hair net and tie it.

• Know your fire drill

• One operator at a time on the machine

• In case of any injury, even minor report to your supervisor and get necessary medical attention.

The leather dust is health hazard and can cause lungs related diseases on prolonged use if proper safety measures are not taken. The operator must always wear mask at time of roughing and scouring operation.

Adhesive application, Sole preparation and drying

The process of adhesive application and sole preparation is done by hand. In both cases the material used are solvent based and these volatile solvents are health hazard.

Though these chemicals is not necessarily hazardous to human health, one must be aware that the inherent source of the hazard can be either the chemical itself, any emission generated during the use or handling of the chemical (e.g. vapors, fumes, effluent) or the containers used for storage and transport of these chemicals.

The impact of such exposure can range from temporary effects such as dizziness, headache, irritation of eyes, skin or lungs, allergic reaction, collapse due to lack of oxygen, poisoning of liver, kidney, nervous system to long term impairments such as ulcer, bronchitis, genetic defects and, in some rare cases, even instantaneous death.

Chemical can enter the body by:

• Inhalation through the lungs;

• Absorption through the skin;

• Ingestion through the mouth;

The adhesives and solvents used for footwear production are:

• Poly urethane (Solvent based)

• Poly chloroprene (Solvent based)

• Latex

• MEK

• Toluene

Both solvent based adhesives have hazardous chemicals like benzene, toluene, Methyl ethyl Ketone, Ethyl acetate etc. Latex has ammonia which has pungent smell and causes irritation in the eye. Apart from health hazards these chemicals are highly inflammable. This makes its storage and use more hazardous. Thus while using these adhesives and solvents the following safety aspects must be kept in mind.

• Work in well ventilated area.

• If fumes are more use special exhaust table

• All workers must wear protective clothing.

• Workers must use latex gloves while using these chemicals.

• Reduce the number of workers from these areas.

• No smoking must be allowed on the factory floor.

• These materials must be stored separately with adequate fire safety measures. • Availability of first aid

• Trained first aid personnel

Sole re-activation and attaching

The process of is done on a re-activator and sole attaching machine. These machines are pneumatic with moving and heated parts

Safety precautions while operating the machine

• Operator must know the emergency switch/button of the machine

• Switch off the machine when not in use

• Keep hands away from the heated parts of the machine

• Keep hand away from the moving parts of the machine

• Do not attempt any electrical repairs

• Always wear approved footwear and clothing in shop floor

• If the hair is longer than shoulder use a hair net and tie it.

• Know your fire drill

• One operator at a time on the machine

• In case of any injury, even minor report to your supervisor and get necessary medical attention.

Self-Check 8	Written Test

Short Answer Questions

Directions: Answer the question listed below. Examples may be necessary to aid some explanations/answers.

1. Describe are the safety precautions while operating the machines.

LG#40	LO #2- **Perform basic lasting procedure**

Instruction sheet

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

- Describing basic methods of lasting.
- Identifying appropriate method of attaching insoles and performing
- Identifying correct methods of toe-puff and counter stiffener attachment and performing
- Identifying essential drafting pulls.

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

- Describe basic methods of lasting.
- Identify appropriate method of attaching insoles and performing
- Identify correct methods of toe-puff and counter stiffener attachment and perform
- Identify essential drafting pulls.

Learning Instructions:

Read the specific objectives of this Learning Guide.

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- Read the information written in the “Information Sheet 4”.
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Information Sheet 1 Describing basic methods of lasting

In actual lasting the upper can be attached to the insole, runner or sole

- by grindery such as tacks, wire staples, pre-formed staples, wire, and thread attachment,
- by adhesive such as pressure sensitive, heat activated, hot melt adhesives,
- In string lasting the upper is held in place by a string.

A footwear upper can be turned into a shoe in different ways. The following are the some of the other methods employed for lasting of footwear upper:

A) Lasting Up

B) Lasting Down

C) Flanged Lasting

D) Force lasting

A) LASTING DOWN

In this lasting method, the upper and the upper lining are pulled down.

A-1 Rib Lasting

A-2 Flat Lasting

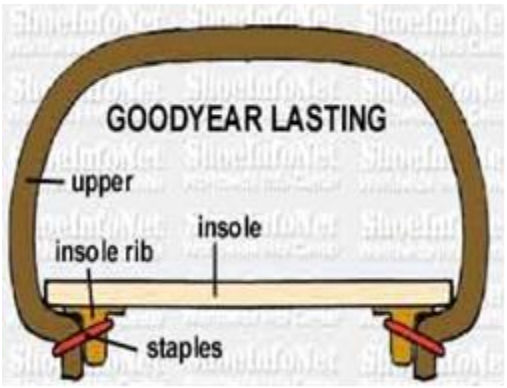


Fig 1:A-1 Rib Lasting

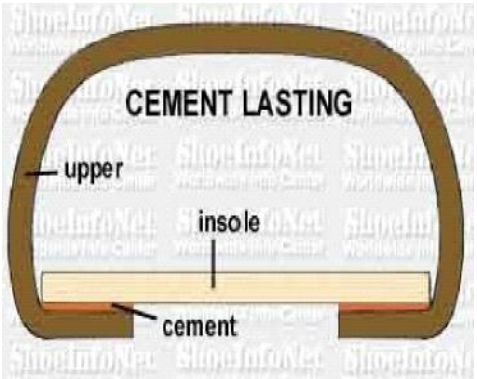


fig 2: A-2 Flat Lasting

B) LASTING UP

Moccasin can be 'lasted up' by hand pincers by securing the vamp by tacks on top of the forepart of the last. After lasting, the plug (apron) will be tacked into position ready for hand stitching. Stitching is done by removing tacks at a time.

Fig 3:B-1 Lasting Up a Moccasin

Fig 4:B-la Lasting Up a Moccasin by securing by tacks

Fig 5:B-lb.Attaching Plug (Apron) by tacks, then stitching

C) FLANGED LASTING

In Flanged lasting the upper is attached onto the Runner (sometimes called insole) by adhesive, or (as done earlier) by a special stapling machine, or (as done earlier) by machine, which do the lasting and stitching in one operation. Today, pre-molding the toe of the upper prior flanged cement lasting is quite common.

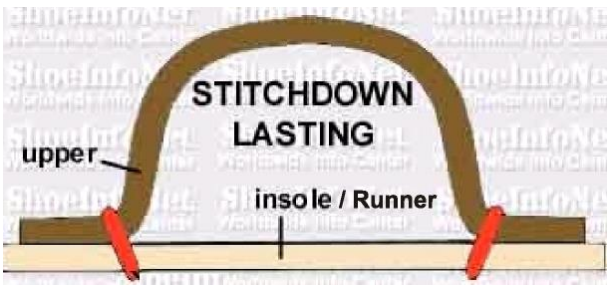


Fig 6: Flanged lasting

D) FORCE/SLIP LASTING

The upper is forced over the front of the last with the back being pushed into right position etc., e.g. slip-lasted shoe (Californian shoe), moccasin, strobel (sewn-in-sock) etc.

Fig 7: California shoe lasting

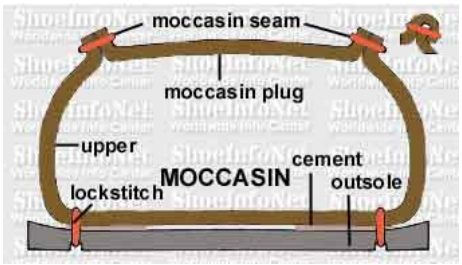


fig 8: True moccasin

Self-Check 1	Written Test

Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. What are the materials used for attaching the upper with the insole, runner or sole? (5 points)

2. List down the methods of lasting the footwear upper. (5 points)

3. Explain the listed methods diagrammatically. (5 points)

4. What is flanged lasting? (2 points)

5. What is the difference between rib lasting and flat lasting? (3 points)

Information Sheet 2 Identifying appropriate method of attaching insoles and performing

Introduction

Hand lasting operation is generally describe as performing a mounting and stretching of upper on the last by using hand lasting tools and equipment manually. The insole is first attached to the last. The toe-puff and stiffener are inserted into the upper. There are various types of these materials that can be used. If the shoe is laced up, a string is used to tie up the lace holes prior to lasting. We then place the upper on the last and proceed with the 'drafting pulls'. By using hand lasting pincers the "First Drafting Pull" is made. For each of the pulls in the first part of the operation we call it a draft. The drafts are made in numerical order and in the direction indicated in the diagrams. The first drafting pull is along the length of the last, positions the upper and is creating some tension on the top line. The toe end is then secured to the insole by a 13 mm tack. The second and third drafting strains position the front of the shoe. (At this point a careful check is made that the whole upper is straight). The fourth draft is made to position the seat. (At this point we check that the back seam is straight and the back height of top line is in the correct position).

1. *INSOLE ATTACHING*

The selected insole is tacked onto the bottom of the last, with three insole tack/ nail. The surplus material of the insole is then cut-off, which results in a well-marked feather edge, once the lasting is completed. The insole should be correctly molded and beveled as per the last profile.

2. *DRAFTING*

Drafting can be defined as the operation at which the initial stretch of the upper is taken and the upper is aligned correctly onto the last, with twelve initial strains, in directions as shown in the diagrams, thus giving the upper the nearest shape of the last. In order to carry out the operation of lasting accurately and speedily, the drafting should be performed very accurately.

Self-check 2	Written test

Test I: Short Answer Questions

Instructions: Write all your answers in the provided answer sheet on pages17.

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. What is hand lasting operation? (5 points)
2. Discus about insole attaching? (5points)
3. What you mean by drafting and process of drafting? (5 points)

Information Sheet 3 Identifying correct methods of toe-puff and counter stiffener attachment and performing

Lasting involves forming the upper by stretching it over the last. For foot comfort the upper must conform to the shape of the last and retain much of it. Also the shoe upper after a period of wear must also conform to the shape of the foot. For proper lasting of the upper leather, some reinforcements material are needed for strengthening the upper for the stress applied during lasting operation and hence toe puff, counter stiffener are attached. The Lining of upper play important role for shape retension.

Preparation of upper for hand lasting process include the following operations

a. Toe puff attaching

b. Counter stiffener attaching

c. Lining pasting

d. Lacing the tabs

e. Application of talcum powder/chalk (Last slipping agent)

1. toe puff attaching

The prepared toe- puff material is inserted between the upper and the lining in toe cup area by positioning toe puff. If the toe puff is leather, the skived and prepared toe-puff is mellowed by soaking water and then glue is applied. It is then inserted between the lining and upper.

- The toe puff of non woven fabric material is solvent activated and when it is soft, it is inserted between the upper and lining. Toe-puff is attached to the upper after dipping it in the solvent (in case of solvent activated toe-puff). However care must be taken to drain excess solvent to prevent sipping which often spoil the grain of upper.
- The toe puff must be placed skived part facing lining and 7-8 mm inside from the edge of the upper. The thickness for a non woven toe puff varies from 0.8-1.2 mm depending upon the footwear manufactured.

2. counter stiffener attaching

The edge skived and prepared stiffener material is inserted in between the upper and the lining in order to retain the shape of the last. The solvent activated counters are attached in the same manner as the toe puff. However, the top edge must reach upto the quarter top line stitching (for normal dress shoe) or as per the instruction from the pattern engineers. The thickness used for counter stiffener varies from 1.2-1.4mm depending upon the purpose of the footwear for which it will be used.

3. LINING PASTING

The lining should be pasted on the upper cleared off of any wrinkles. Once the toe puff And the counter stiffener has been attached to the upper; the lining on the upper has to be stuck to the upper material (leather or synthetic) by means of an adhesive, leaving no wrinkles and air pockets behind. This might cause a problem while lasting later on, which in turn might affect not only its wearer also it might cause an effect on its sale ability.

5. application of talcum powder

To facilitate easy slipping of the last, the prepared upper and the shoe last, are both given a coating of talcum powder or chalk.

It is important to fasten the eyelets with the help of cotton thread in case of laced upper. Upper with elastic gussets are reinforced with non stretchable 10 mm tape under the gusset, which must be removed before delasting.

Self-check 3	Written test

Instructions: Write all your answers in the provided answer sheet on pages14.

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

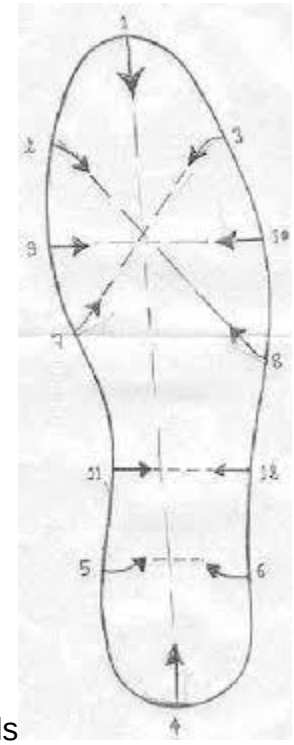
1. What are the major preparations of materials on hand lasting?(5 point)
2. What is the use of application of talcum powder on the upper?(3 point)
3. What kind of shoe reinforcement do you use?(3 point)
4. What is the usage of toe puff in the shoe?(2 point)

What is the usage of counter stiffener on the shoe?(2point)

Information Sheet 4 Identifying essential drafting pulls.

Tack lasting

Although many shoes of this type are now lasted by other methods (e.g. cement-lasting or combinations of cement-seat, tack-side and cement-forepart lasting), this section describes techniques and equipment for tack-lasting the complete upper. Tack-lasting combined with stitched-on soles results in stiff, and rather inflexible foreparts. To compensate for this, additional 'toe spring' is often allowed for in the last used for this construction.



Fig,Twelve drafting pulls

II.4.1 Manual lasting techniques

(i) Back tacking

Footwear is usually hand tack-lasted with a round vertical steel peg, or lasting jack, inserted into the socket on top of the last. In this position, the bottom of the insole provides an upwards facing surface ready for tacking. Pincers, incorporating a hammer head, similar to those used for cement-lasting, are normally used for this operation. After lining up the back-seam, the upper is tacked to the seat of the insole by one or two tacks.

(ii) Pulling over

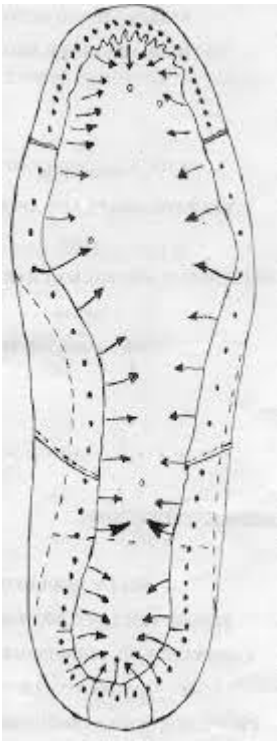
Any lining material must always be pulled tight before pulling on the upper itself. Normally, the first lasting pull is straight over the toe. The pincers lever the lasting allowance of the upper over the toe of the insole. The thumb of the free hand holds the material while the pincers push a tack into position. The tack is then hammered down. This is basically the method used to insert all tacks, although in some cases it is necessary for the pincers to pleat and twist the margin to obtain a smooth feather-edge line. When soles are to be stitched-on, tacks are placed well back from the insole edge to leave room for the stitching. Tacks are inserted on either sides of the toe to stretch the upper forward from the heel over the toe. The seat and forepart just ahead of the waist are then tacked.

(iii) Seat lasting

Strains are taken and tacks inserted alternatively at approximately 5 mm. intervals round one half, and then the other half of the seat. Small pleats are produced between each tack.

(iv) Toe lasting

The same procedure as for seat lasting is also used for toe lasting. More skill is generally required to remove puckers over the toe and to pleat the material neatly than is needed for seat lasting.



Fig,A fully hand lasted upper

(v) Side lasting

Tacks are generally spaced at about 10 mm. intervals down the sides. Much less force is required for this operation than for lasting the seat and toe.

II.4.2 Tack lasting machinery

Small footwear manufacturing enterprises will not find it economical to invest in elaborate tack-lasting machines. However, where output levels exceed one hundred pairs per day, there may be a case for investing in relatively simple, manually-powered drafting and lasting machines. With machines of this type, the tacks are individually driven in by the operator. Two such machines cost approximately US$8,000, and may also be used for cement-lasting if necessary. The essential difference between these two machines is that pincers are used on the drafting machines to take the initial strains

over the toe, while wiper plates are used to assist toe- and seat-lasting on the second machines. Side tack-lasting is carried out by hand in either of these machines.

A type of machine which is used for side and waist lasting by large-scale enterprises can also be used to completely tack-last shoes. In these machines, the operator holds the work up to the machine so that the lasting margin is gripped by a pincer. A knee operated lever can twist the pincers to the left or right as required and a wiper holds the margin while a tack is automatically driven. Simplified versions of these machines are available for tack side-lasting.

Self-check 4	**Written test**

Instructions: Write all your answers in the provided answer sheet .

Directions: Answer the question listed below.

1. What are the procedures for drafting pulls?

LG#41	LO #3- **Identify and perform post manual lasting operations**

Instruction sheet

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

- Determining heat setting temperature and timing
- Performing soles preparation.
- Describing and performing uses and application of the adhesive.
- Determining and performing sole press pressure and timing.
- Cleaning and maintaining work area.
- Following environmental procedures and collecting, treating and recycling waste

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

- Determine heat setting temperature and timing
- Perform soles preparation.
- Describe and perform uses and application of the adhesive.
- Determine and perform sole press pressure and timing.
- Clean and maintain work area.
- Follow environmental procedures and collecting, treating and recycling waste

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- Read the information written in the “Information Sheet 5”.
- Accomplish the “Self-check 5”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- Read the information written in the “Information Sheet 6”.
- Accomplish the “Self-check 6”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Information Sheet 1 Determining heat setting temperature and timing

Introduction

Lasting involves forming the upper by stretching it over the last. For foot comfort the upper must conform to the shape of the last and retain much of it. Also the shoe upper after a period of wear must also conform to the shape of the foot.

To last the upper well we should use the minimum strain necessary to make the upper conform to the last. By stretching too tight we may cause upper crack and inadequate shape retention of the shoe. For quality and productivity it is important to skillfully design and maintain the whole production process from material selection to pattern engineering, cutting and lasting.

Traditionally, for adequate shape retention the upper was left on the last for two to three days, or even longer. Today we use techniques, which will give us better shape retention of the upper in a much shorter time. These methods are known as combination of Mulling and Heat Setting and there are a number of variations to these two basic processes. Research has shown that if the leather upper is mulled before lasting in which moisture is imparted into the leather fibers and lasting and subsequent heat setting done immediately after, the result is better shape retention properties in the final upper.

Mulling can be done in a variety of ways but each method if done correctly will give the required results. The great advantage of mulling is that it allows the leather upper to be stretched more easily and it is less likely to crack. Perhaps the most common method in use today is to subject the vamp area to steam vapors immediately before forepart lasting, the required and the temperatures used will vary according to the type of upper leather being used but is only a matter of $1/4^{th}$ a minute or a so, this method also has advantage of softening the toe-puff at the same time (thermo-plastic toe-puffs).

Another method is to use a Rapid Conditioning Cabinet for mulling; in this machine a rapid stream of humid air is blown over the leather uppers. The temperature of the air

approx 50'C and the cycle time is 15-30 seconds. Every upper is subjected to identical treatment, and very consistent moisture gains are obtained.

In modular ('rink') production configurations the upper is passed through steam in tunnel prior forepart lasting. The shoe is lasted immediately after Leather uppers conditioned this way get mulled but the extra moisture does not remain in the material more than about 20 seconds, so the lasting must be done immediately.

Heat setting is usually carried out after the upper has been completely lasted before any of the bottoming operations (roughing etc.) are done. Great advances have been made in this field in recent decades allowing progress from the old style of cabinet which usually consists of two or three chambers, the first imparting steam or moisture into the upper and other's rapidly drying it out (a process which can take 4 minutes to the modern HVA (High velocity air) heat setters which force the moisture in to the upper and immediately out again to complete the heat setting process in around 100 seconds (slight variations according to the type of material).

Heat setting will ensure about 70-80% shape retention of most types of upper material, including PU and PVC coated fabrics but there is usually no advantage in using moisture on manmade upper materials, only dry air is used and the temperature related to time will vary according to the material.

What is Heat setting?

Heat setter is the machine used for shoe shape retention. Heat setting serves to relax the various lasting strains within the upper and set the upper into its new 3-dimensional shape in a short period of time. Heat setting does not physically fix the upper in a given conformation; it removes the tendency of the upper to spring back to un-stretched, un-lasted size and shape.

Heat seating has a very important role to play in the shape retention of the footwear. All the stresses and the strain borne by the upper during the lasting pulls are relaxed by means of the heat and moisture. Improper heat setting might lead to the sagging of the shoe, which affects the sale-ability of the shoe. Heat setting is treating the lasted upper with heat, Vapor and chilling. This is done to ease the upper from elasticity and plasticity which has occurred during lasting.

- Moisturized heat setting is required for leathers and dry heat setting is required synthetic materials or man-made materials.
- Average temperature – 100^0 to 140^0 and the dwell timing is 3-4 minutes.
- For lighter leather's like sheep goat, kid baby, cow calf 100^0 – 120^0C is advisable
- For Heavy Leathers cow and Buff temperature is 120^0 – 140^0C.

In some specific case the temperature needs to be reduced or increased i.e. some upper leather/ Lining/ Decorates cannot with stand the above temperature. Decoration (Nu buck, Suede) surface getting Burnt etc… Also some leather's and materials need higher temperature to impregnate the top surface

The leather shoes pass through high velocity air or hot moist air in the first section, this serving to relax the materials down to the last secondly, they pass through a hot, dry air section. This removes the moisture and sets the shoe more accurately to its new shape. Heating is ensured by high velocity air currents being blown over all parts of the shoe.

After lasting, the shoe is 'set' in a heat setting chamber to ensure that the shape of the product matches the last. Leather uppers when changed from the flat skin into a three dimensional shape by lasting, would, left long enough, naturally assume the new shape and retain it. This was because of the inherent properties of leather.

Types of heat setters

There are two main types of heat setting machines:

1. Infra-Red heat setting machine
2. High Velocity Air-jet machine (HVA)
3. Conventional Heated Cabinets (CHC)

Infra-Red heat setting machine

The early heat setters used only infrared heated elements. The lasted shoes were passed by a conveyor system through the cabinet. The basic disadvantage was that, this form of heat was very directional and certain parts of the shoe did not received as much heat-treated as others.

High Velocity air-jet (HVA) (for stress relaxation)

HVA setters offer several advantages largely centered on the efficiency of the setter in putting heat into the shoe upper.

The high air speeds, typically 12 to 14 meters per second, result in much quicker heat transfer to the upper, allowing reduced throughput times, smaller machines and significant savings.

The principle on which this works is that, the upper has been subjected to a variety of strains and pulls in lasting which set up stress in the material. To get the material to lay do 'tightto-wood', it would be an advantage to relax these stresses. So H.V.A. setters were introduced which set out to do this. The shoes pass through hot moist air in the first section, this serving to relax the material down to the last. Secondly, they pass through a hot, dry air section. This removes the moisture and sets the shoe more accurately to its new shape. In both parts of the cabinet, all round heating is ensured by high velocity air currents being blown over all parts of the shoe.

Rapid heat setting in small machines is more important given the use of rink systems in place of conventional making tracks. HVA setters are now available in a multitude of lengths, widths and heights. They can have moist setting zones followed by a dry air zones or have dry zone only. Their function is almost taken for granted now a day and then often act primarily as conveyors to move shoes from one operation to the next in a small rink module. Here the shoe may be on the last for half an hour or less. Hence the setting operation must be highly efficient as the upper will have no chance to relax of its own accord before the last is slipped.

Conventional Heated Cabinets (CHC)

The heat setter machine uses high-temperature steam and hot air to soften mold the upper outside quickly, it can save power energy and last.
Special stainless steel heating chamber with convention of hot air and steam can relieve the stress inside the upper and make it stick to the last better. It has thoroughly altered the conventional process with roasting the upper unscientifically so as not to influent the flexibility and glossary.

The adjustable temperature controller can set the optimal temperature in light of shoe materials. The speed can be controlled by regulation of timer.

Purpose of heat setting

Heat Setting serves to relax the various lasting strains within the upper and 'set' the

upper into its new 3-dimensional shape in a short space of time. Heat setting does not

physically 'fix' the upper in a given conformation: it removes the tendency of the upper

to spring back to its upstretched, lasted size and shape.

It is used to remove the stress and make the upper grain get permanent shape. Retention of shape of upper is the result of good heat setting.

If the lasted upper is not going to the process of heat setting it will lose its shape.

The traditional way of heat setting is done by exposing the shoe to sunlight.

There are two considerations for the heat setting machine to minimize the production cost.

1. Time for heat setting
2. Number of lasts

Different materials need different heat setting methods.

For example

- Leather requires steam heat setting.
- Man-made materials require dry heat setting.

Machine Operation Instructions

SAFETY:

1. Do not put your hand within the tunnel when machine is running.
2. Do not raise heat setting temperature more than 140^{o}C for leather Upper.
3. Ensure that there is enough water in the tank before switching on the machine. Use distilled water only.
4. Concentrate on job while operating machine.

OPERATIONS:

1. Switch on the air compressor and the machine at least 20 minute before operation.
2. Set conveyor movement to 3 – 4 minutes.
3. Set heating temperature according to the Upper & Lining material.
4. For leather upper press steam button on.
5. No Steamer is required for Nu buck, Suede leather

Adjustment of machine parameter for different types of upper materials

Sl. No	Upper & Lining materials	Temperature
1	Grain leather – Cow, Buff, Goat, Sheep, Calf	Moist air at 120^0C - 130^0C
2	Nu buck, suede Leather - Cow, Buff, Goat, Sheep	Dry air at 120^0C—130^0C
3	P.U. Coated leather, Finished split, Poromerics,	Dry air at 120^0C—130^0C
4	PU Patent Synthetic, PVC , Fabrics	Dry air at 100^0C

Table. 1 Recommended heat setting for upper material

* Note that to adjust the parameters you have to press select button to ensure the indicator light is near the corresponding parameters e.g. temperature, conveyor speed, steam control button.

It is advisable of check the leather finish after heat setting and adjusts temperature accordingl

Faults in heat setting

Losses of shape of the shoe after heat setting are due to:-

- Upper too hot when last is slipped
- Inadequate exposure to heat setting
- Overheated during heat setting

Other reasons for loss of shape

- Use of wrong shank
- Mismatched sole unit
- Excessive pressure during sole pressing

Corrective measures

- ✓ Adequate cooling of upper before lasting
- ✓ Check steam, temperature and dwell time

Self-Check 1	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 12-13.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

6) Explain what you mean by heat setting. (1point)
7) List and explain briefly about heat setting techniques. (1 point)
8) Identify the types of heat setting machine. (1 point)
9) Describe the purpose of heat setting operation during lasting operations. (4 point)
10) Identify and describe the adjustment of heat setting machine parameters for different types of upper materials. (5 point)

Test II: Multiple Choice

Directions:

- There are six [6] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
- A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

7. Which of the following machine uses for shoe shape retention during lasting operation in shoe manufacturing process?
   E. Heat setting machine
   F. Sole press machine
   G. Wrinkle casing machine
   H. Pounding machine

8. Which of the following statement is wrong?
   E. Sheep, Calf, Grain leather – Cow, Buff, Goat- Moist air at 150^0C - 160^0C
   F. split, Poromerics, P.U. Coated leather, Finished moist air at Moist air at 100^0C
   G. PU Patent Synthetic, PVC , Fabrics at Dry air at 100^0C
   H. None

10. Which of the following is the safety aspect of heat setting machine operation during lasting?
   A. Do not put your hand within the tunnel when machine is running.
   B. Do not raise heat setting temperature more than 140^oC for leather Upper.
   C. Ensure that there is enough water in the tank before switching on the machine
   D. All

11. Which of the following main factors that leads to the heat setting machine to minimize the production cost.
   A. types of leather
   B .method of heat setting
   C. cycle time for heat setting
   D. number of operators

5 .Which of the following statements are correct?

E. Leather requires dry heat setting.
F. Man-made materials require steam heat setting.
G. Heat setting is usually carried out after the upper has been completely lasted before any of the bottoming operations (roughing etc.) are done
H. Different materials need same heat setting methods.

6. Which of the Following are causes of Losses of shape of the shoe after heat setting

A. Upper too hot when last is slipped
B. Inadequate exposure to heat setting
C. Overheated during heat setting
D. all

Information Sheet 2 Performing soles preparation

Introduction

The manner in which the upper material and sole material prepared before bonding and the way in which a compatible adhesive is applied to both the surfaces is known as bonding system.

The methodology of the bonding systems in the upper and the sole materials play an important role in the footwear manufacturing process. If the preparation of the upper and sole material will not be proper there will be no proper adhesive between the sole and the upper, thus creating a lot of problems for both the manufacturers and the customers.

SOLE PREPARATION PROCESS

Generally sole preparation a process of making the sole compatible for the application of the adhesive for the bonding system of the upper and the sole material for full shoe production. It includes the following main preparation operations:-

a. Roughing;-

Roughing is done to remove the grain on leather or glazed surfaces and then raise fibers on the leather. This is essentially a preparation for sole adhesion.

b. Scouring:-

Scouring is done to remove excess pleats on the lasting especially at the toe. This operation is done to obtain a flat bottom profile before roughing. A scouring wheel with 24 or 36 grit abrasive paper is generally used.

c. Wiping:-

Solvent wiping removes surface contamination such as grease from leather, plasticizers from PVC, mold-releasing agent from soling materials and soaps in vulcanized rubber. It also improves the surface wetting by the cement. With rubber and plastics, suitable solvents can soften and swell surface layers to facilitate infusion of cement.

d. Priming;-

Chemical priming makes a surface more compatible with the adhesive by chemically modifying the surface. E.g. “Satreat” chlorinates crepe, vulcanized rubber and thermoplastic rubber to allow some specific adhesion to PU cement. Isocyanate primers improve specific adhesion to nylon, polyester an EVA. A special primer for EVA deposits a polymer film. Dilute cement films are applied on very porous substances to provide better foundation for the main cement layer.

e. Sole marking:-

This operation is required for mark of the lasted upper with cup sole for roughing purpose in order to remove the grain layer of upper leather.

Recommended Preparation for Shoe Material

A) UPPER MATERIALS

ɔer materials	**Preparation**	**Adhesive**
ATHER		
in leather (resin shed, aniline nu buck	Rough or scour to remove any finished and grain layer	Polychloroprene or PU. (PU adhesives better on
de	Lightly rough or scour to tease up fibers flattened by lasting	Priming is recommended before cementing very absorbent leather
ned splits	Rough or scour to remove Finish and tease to leather Fibers	

'atent	Rough or scour to remove PU film (and leather grain If present), to within 3 mm Of edge of sole.	
U Coated (e.g. Scuff esistant	Rough or scour to remove PU coating or MEK Solvent wipe to clean surface.	
VC coated leather	Rough or scour to roughen PVC film but not remove it or MEK solvent wipe to remove surface finish.	

C - COATED FABRICS

lid or semi-expanded	Either: Rough or scour just to remove finished layer but not remove coating or Solvent wipe (MEK) to remove finish.	PU
ft cellular	Solvent wipe (MEK) to Remove finish	PU

THETIC SUEDES

or PVC	Rough or solvent wipe (MEK) to disturb the surface layer	PU

COATED FABRICS

ypes	Rough or scour to remove PU coating completely Except for 3 mm and around feather edge	PU. Two coats usually necessary to avoid starvation if textile base is exposed.

)ROMERICS

ypes	Rough or scour into Surface micro porous layer	PU

XTILES

st natural and certain thetic fibred materials	Non usually necessary	PU or polychloroprene, Two coats usually beneficial.
cult materials uding nylon.	Lightly rough or scour if Practicable. Prime with Isocyanate or special SAT nylon primer.	PU or polychloroprene. Two components adhesive are often better.

B) SOLE MATERIALS

Sole material	Preparation	Adhesive
LEATHER		
	Rough. Loose flesh fibers Should not be present	Polychloroprene or PU (Two coats)
RUBBER		
Resin or micro	Sour, rough or Lacsol Prime	Polychloroprene
	Halogenate (e.g. Satreat) or Special rubber primer	PU
Molded units Including gristle Rubbers	Scour or rough	Polychloroprene
	Halogenate (e.g. satreat). A Pre-rough or Lacsol prime	PU
Natural crepe	Special crepe primer or Halogenate (e.g. .Satreat or Super Satreat).	Polychloroprene or PU
Thermoplastic Rubber (TR)	Halogenate (e.g. Satreat or Super Satreat) by soft Brush or spray.	PU
	Solvent wipe (petroleum Spirit)	Special polychloroprene or PU
POLY VINYL CHLORIDE (PVC)		

Solid, including Blends Cellular	MEK solvent wipe (ethyl acetate often better) Light rough	PU
MICROCELLULAR EVA		
	i) Scour or MEK solvent Wipe ii) Isocyanate primer (M 238) Or special EVA primer. (Apre-scourmaybe necessary and correct	Polychloroprene PU
POLYURETHANE		
Cellular Solid	Rough, or clean well with MEK Solvent wipe (MEK)	PU
NYLON		
	Rough plus isocyanate Prime or special primer	Polychloroprene or two -part PU
POLYESTER		
	Solvent wipe with Chlorinated solvent (e.g. Genklene) then Isocyanate	PU

STORAGE OF PRIMERS

The main purpose of the primers is to help chemically activate that outer layer of the upper material and the sole, where the film of adhesive would be applied and bonded together.

The expected shelf life of primers commonly in use is as follows:

Primer	Shelf Life
Lacsol	6 months
Satreat	3 months unopened.1 month opened
Super Satreat	2 months unopened.1 month opened
SAT EVA Primer	6 months
Isocyanate wipe (SDP 102	1 to 2 weeks
SAT nylon primer	3 months

The shelf life of any product is that span of time from the date of manufacturing to the date of expiry as indicated by the manufacturer of that product.

Once a stock container has been opened, the shelf life may be reduced. If a primer shows signs of deterioration. E.g. sediment or undue discolorations, do not use.

Halogenation primers such as Satreat should be kept in black polythene containers with the caps firmly screwed on to avoid degradation by exposure to sunlight or uptake of moisture.

The physical and the chemical treatment of the sole and the upper material are to be done before the adhesive is applied to either of them. The adhesive applied (shown in the table) should be compatible to both the surfaces. Enough time is then given to each one of them for drying (either in normal conditions or by forced drying). After that proper activation time and temperature should be given to heat the adhesive film on the upper and the sole so that proper and efficient bonding takes place**.**

Self-Check 2	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 22.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Explain what you mean by sole preparation. (4point)

2. List and discus briefly about main sole preparation operation in shoe production. (5 point)

3. Identify and discus about recommended preparation operation for shoe material in related to the upper material and sole material with the proper adhesives. (5 point)
4. Describe the purpose of priming and wiping operation during sole preparation operations. (5 point)
5. Discus and describe the difference between roughing and scoring operation during sole preparation operation. (5 point)

Score = _____

Rating: _____

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answer

Information Sheet 3 Describing and performing uses and application of the adhesive.

INTRODUCTION

An adhesive is a material used for holding two surfaces together. Ann adhesive must wet the surfaces, adhere to the surfaces, develop strength after it has been applied, and remain Stable.

Adhesion is a specific interfacial phenomenon. Surface preparation before applying the adhesive is of prime importance.

The raw materials for adhesives are mainly polymeric materials, both naturally occurring and synthetic.

A useful way to classify adhesives is by the way they react chemically after they have been applied to the surfaces to be joined. There is a huge range of adhesives, and one appropriate for the materials being joined must be chosen.

For a material to perform as an adhesive it must have four main requirements:

• It must "wet" the surfaces - that is it must flow out over the surfaces that are being bonded, displacing all air and other contaminates that are present.

• It must adhere to the surfaces - That is after flowing over the whole surface area it must start to adhere and stay in position and become "tacky".

• It must develop strength - The material must now change its structure to become strong or non-tacky but still adherent.

• It must remain stable - The material must remain unaffected by age, environmental conditions and other factors as long as the bond is required.

The basic definition of an adhesive as used by the Adhesive Sealant Council in America is a material used for bonding that exhibits flow at the time of application.

ADHESIVE TYPES

Adhesives can be classified into three main types given below.

1. Chemical reactive type

Basically an adhesive of this type is supplied in a low molecular weight form and after application a polymerization reaction is allowed to take place. These polymerizations can be achieved by:

X-Polymers-H-Adhesives-7

Two component pack

Supply the produce as a two component pack, i.e. base plus hardener. Examples of this type are:

• Epoxy adhesives based on epichlorhydrin bisphenol. Cured with amines or Polyamide.

• Phenolic adhesives i.e. a novalac type with hex methylene tetra mine.

• Unsaturated polyesters using an organic peroxide, i.e. M.E.K. peroxide and cobalt naphthenate.

• Polysulfide with lead dioxide or an isocyanate.

• Polyurethanes with isocyanate.

• Silicone polymers utilizing a metal salt of' an organic acid, e.g. lead octane.

• Reactive acrylics - rely on peroxides or amines.

Moisture

Polymerization can be achieved by relying on moisture either on the surface of the adherent or in the atmosphere to affect a cross-linking mechanism on some other "natural" component.

In this case the adhesive is supplied as a single component. Examples are:

• Polyurethane containing an isocyanate group.

• Cyanoacrylates. These are the instant bond adhesives.

• Silicones containing an acetyl group. These are the common R.T.V. silicones which with moisture releases acetic acid causing a cross-linking of the paste to an elastomer.

• Anaerobic which rely on absence of oxygen.

Heat

The final method of curing a chemical reactive type is by utilizing heat to polymerize the adhesive components. Examples are:

• Epoxies with the catalyst incorporated in the adhesive in a latent form, e.g.

Dicyandiamide which will require a temperature of 175o C to effect a cure.

• Phenolic of the resole type.

• Polyvinyl acetates which are based on polyvinyl alcohol reacted with an aldehyde.

The conversion is normally about 80% and on heating after application the crosslinking is completed.

• Urethanes incorporating a blocked isocyanate. The free isocyanate groups are all reacted with a temporary blocking agent such as phenol which is stable up to 150oC.

The problems associated with the above three types of adhesives are:

• Two components types - difficult to ensure correct and adequate mixing of the two components (often by unskilled personnel or in adverse conditions).

• Moisture curing types - poor shelf life even when stored in sealed containers. Once container is opened the life will drop rapidly.

• Heat curing types - again poor shelf life plus the problem of heating the adhesive or adherent.

2. Thermoplastic type

Basically the adhesives in this class are thermoplastic in nature which means they are heated to a sufficient temperature where they will flow and wet the substrates and then set and develop the bulk strength on cooling. The ideal Hot Melt adhesive is a solid up to a temperature of 80o C (as a minimum) but will then melt sharply to give a low viscosity fluid that is easily applied and capable of wetting the adherent followed by rapid setting upon X-Polymers-H-Adhesives-8 cooling. They normally contain a base high molecular weight polymer together with resins and viscosity depressants.

Examples of polymers that are used as the base for Hot Melt adhesives are:

• Ethylene vinyl acetate - a polyethylene chain containing the highly polar acetate group.

• Ethylene-ethyl acrylate which has an ethyl acrylic grouping.

• Ionomers - derived from ethylene acrylic acid copolymers but including a metal cation or some of the pendant carboxyl groups. The metal cation is free to cross-link with the anionic side groups similar to a thermosetting resin but the reaction is thermally reversible.

• Phoenixes - similar chemical structure to epoxides.

• Polyamides of low to intermediate molecular weight based on the unsaturated dibasic acids of vegetable origin.

• Polyesters (saturated).

• Vinyl resins such as polyvinyl acetate, polyvinyl butyrin and polyvinyl ethers – used in various special areas.

2. Evaporation or diffusion types

In adhesives of this class the adhesive polymers is essentially in its final form however, wetting of the adherent is achieved by dissolving or dispersing the polymers in a suitable solvent.

Solvent Based Systems

• Rubber adhesives - usually based on an elastomer which is either natural or synthetic.

The synthetic rubbers that are used in adhesives are polychloroprene nitrile (a Copolymer of butadiene and acrylonitrile) butyl (a copolymer of isobutylene and Isoprene) and styrene butadiene rubber. Natural rubber is essential isoprene.

Normally resins, usually phenol-formaldehyde based, are incorporated.

• Vinyl resins such as polyvinyl acetate, polyvinyl chloride, polyvinyl ether etc.

• Acrylic resins based on methyl methacrylate, ethyl acrylate, acrylic acid etc.

• Miscellaneous resins such as cellulose acetate and polyamides.

Water Based Systems

There are very few polymers of sufficient molecular weight to be attractive as adhesives that will dissolve in water. However, dispersions or emulsions are very important.

Examples are:

• Rubber lattices - again either natural or synthetic such as polychloroprene, nitrile or styrobutadiene rubber.

• Vinyl resins, where polyvinyl acetate emulsions are very widely used.

• Acrylic resins which offer some advantages over PVA types such as water and Solvent resistance.

The problems associated with evaporation type adhesives are fairly straightforward.

• Elimination of the dispersing medium which could be toxic or inflammable or slow to leave the adherent.

• A large percentage of the adhesive is basically waste and non-recoverable.

• Possible damage to the adherent by the dispersing medium.

X-Polymers-H-Adhesives-9

The disadvantages of Hot Melt adhesives are of course the heating associated with their application and possible thermal degradation if held at a high temperature for a long time and the thermoplastic nature of the polymer. Also the stress concentrations built up by the actual covering and shrinking process.

ADHESION

Importance of right selection of adhesives with different material is very important for any Industry. In footwear industry different types of adhesives are used to accomplish different operation. But the most important of them all is the adhesion of sole to the upper.

Consumers are demanding quality and longevity from their footwear. In present day scenario the biggest problem is the adhesion of soles to upper. All though in present day market there are many good adhesives that can give good bonding for

upper and sole. But due to lack of technical knowledge manufacturers of footwear do not choose the right adhesive for the material they are using. In some case the method used for sole adhesion is not correct.

Mechanism of Adhesive Bond

There are two main mechanisms by which an adhesive sticks to a material. These are referred as mechanical adhesion and specific adhesion.

Mechanical Adhesion:

This is the common of the two, being effective to some extent in all examples of bonding. Many materials have visibly rough surfaces, or have a fibrous structure, which is porous. Close examination shows that even the smoothest surfaces contain microscopic pores. When adhesive is applied in liquid form to the surface, some of it flows into these pores. After drying, the adhesive layer will be "keyed" to the material surface rather like two pieces of jig saw puzzle are joined together.

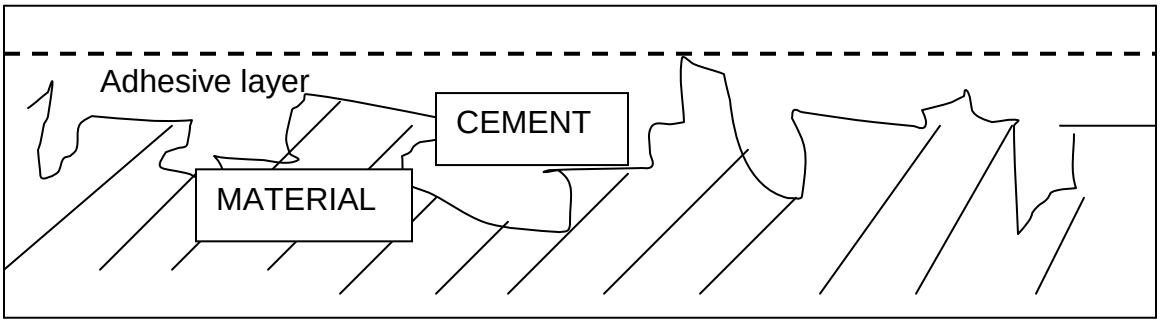

Fig 1. Mechanical adhesions

The effectiveness of the bond will depend on the strength of material, and on the size, depth and shape of the pores. Deep and undercut pores will lead to the stronger bonds than shallow indentations. Good forms can be formed to fibrous surfaces because adhesive can surround the fiber.

Specific adhesion: On the molecular scale, bonding occurs when adhesive molecules diffuse into and become inter-twined with the molecules in the material surface. For this to happen, the attractive forces between adhesive molecules and

material molecules must be at least as strong as the attraction of adhesive molecules for each other.

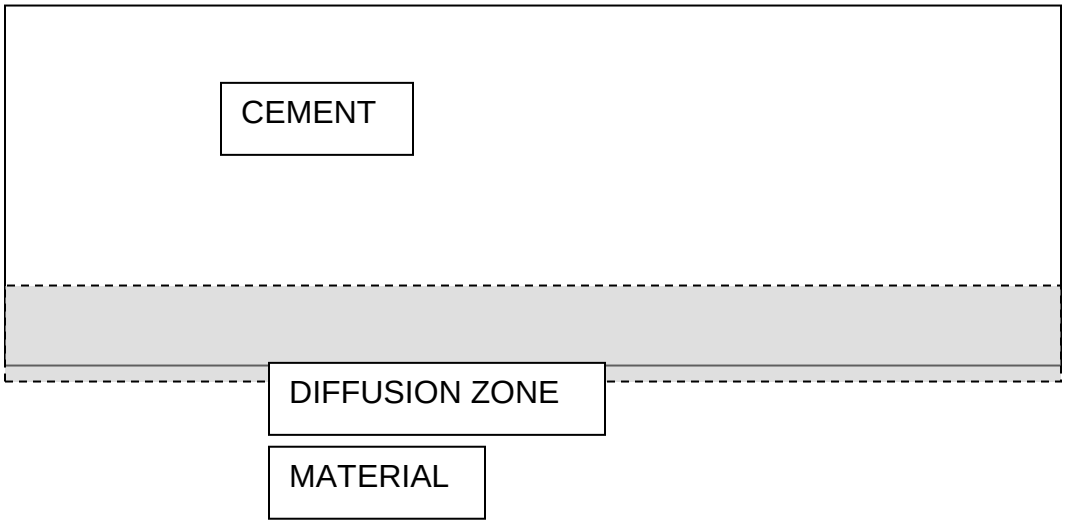

Fig2. Specific adhesion

The diffusion processes helped by the presence of solvents in the adhesive which swell or partially dissolve the material surface. Heat performs the similar functions when using hot melt cements and causing one cement film to coalesce with another after reactivation.

In another type of specific adhesion the molecule in the cement become bound by strong chemical bonds to molecules in the material. For this to happen there must be specific chemical structure present in two bonding surfaces. Frequently the material surface is made chemically reactive to the cement just before spreading by applying a special primer. An example is the use of a halogenating agent on thermo plastic rubber before applying PU Cement.

Links of Adhesion

Before starting the attachment of lasted upper with the outsole it is important to understand how the adhesives, upper and the sole material related in terms of linkage, generally the links can be seen as in five categories such as :-

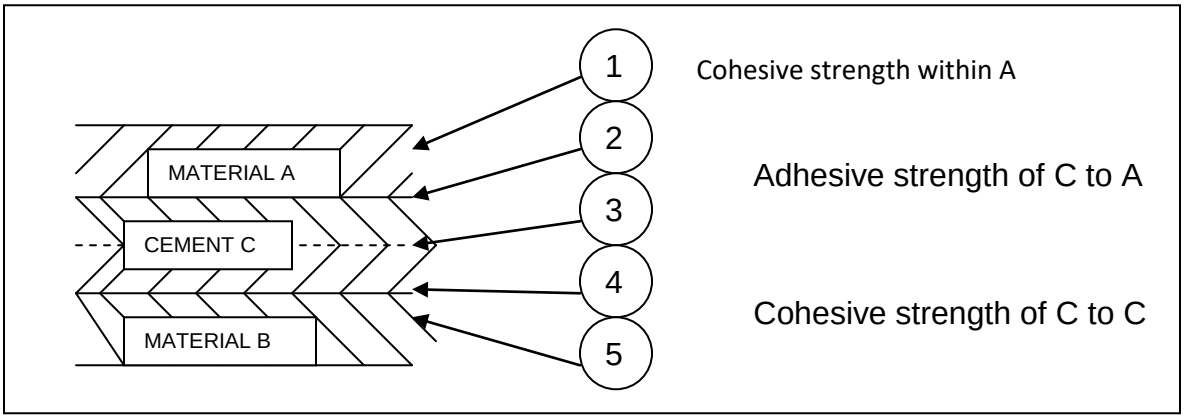

Fig3. Links of adhesion

It is possible to identify 5 areas (links) within an adhesive bond, which contributes to its strength. The bond will be as strong as the weakest of these links. To ensure that each link is as strong as possible, the correct bonding procedures should be followed. The account below is particularly relevant to sole bonding, but is applicable to any type of bonding.

Link 1 & 5:

Weak layer within the materials A and B must be removed by roughing & and scouring. E.g. the grain layer from leather, the PU layer from PU coated fabric and sometimes the surface layer from vulcanized rubber soling.

Link 2 & 4:

Satisfactory adhesion of cement C to both A & depends on number of factors:-

a. Correct surface preparation:

Roughing /scouring increases the number and depth of surface pores. This gives better mechanical adhesion to most materials but care must be taken not to overdo it, and to remove all loosened material before applying adhesive.

Solvent wiping removes surface contamination such as grease from leather, plasticizers from PVC, mold-releasing agent from soling materials and soaps in vulcanized rubber. It also improves the surface wetting by the cement. With rubber and plastics, suitable solvents can soften and swell surface layers to facilitate infusion of cement.

Chemical priming makes a surface more compatible with the adhesive by chemically modifying the surface. E.g. “Satreat” chlorinates crepe, vulcanized rubber and thermoplastic rubber to allow some specific adhesion to PU cement. Isocyanate primers improve specific adhesion to nylon, polyester an EVA. A special primer for EVA deposits a polymer film. Dilute cement films are applied on very porous substances to provide better foundation for the main cement layer.

b. Correct selection of adhesive:

The adhesive must be compatible with both surfaces to be bonded.

c. Correct viscosity and surface tension:

Surface tension should be low to give better wetting of surfaces. Viscosity should not be too high or penetration into small surface pores may be prevented. Too low a viscosity means two or more coats will be applied on the on porous materials.

d. Correct amount an distribution:

There must be enough adhesive left on the surface after drying, and should be uniformly spread over the whole bonding area.

e. Correct drying time:

For full strength to develop, it is important that all traces of solvents from cements and primers are removed from the bond. This happens more quickly if the bond is left open to dry for sufficient time. Drying time depends on the type of the solvent, the porosity of the material, the temperature and efficiency of airflow.

Link 3:

Apart from correct preparation of surfaces and correct selection and application of

adhesive, it is equally important the bond is closed properly.

i. Correct reactivation temperature:

A weak bond will result if there is poor cohesion between the two cement layers. To avoid this problem it is best to soften one or both dry cement surfaces by heating in

the reactivation to correct temperature. The bond must be closed immediately after heating.

ii. Correct bonding pressure:

The pressure applied to the bond should be adjusted according to the softness of the materials being bonded. Softer material will need less pressure tan harder materials. Too much pressure may cause permanent deformation to cellular soling materials. Too little pressure and harder soles will not conform closely enough to the upper.

iii. Correct pressure distribution:

Where the bond is not flat, as in most sole bonds, it is important to support the underside of the bond in such a way that the pressure is evenly distributed. Sometimes toe spring causes lower pressure so poor bonding at toe.

iv. Correct dwell time:

When pressure is applied to a bond the materials do not react instantaneously. Time is required for them to conform to each other. Dwell time depends on plasticity and elasticity of the materials, but is between 9-15 seconds for sole attaching.

Sole Adhesion Monitoring & Quality Assurance

Sole adhesion is one of the most crucial operations in footwear industry. Weakness in a stuck on bond are not generally apparent in a finished shoe and it is advisable to make regular spot checks to get reduce variability in result. Continuous monitoring is essential to get good and consistent quality. For a system should be made so that everything runs smoothly. Following steps must be taken:

1. Priming of sole:

Florescent chemicals visible in UV light must be added to primers and each pair sole must be checked under UV light sole that it's correctly primed. UV chamber may be used to check correct application of primers.

Small amount of primer should be taken out from the main bottle or container at a time. The container should not allow any light to reach the primer.

Correct amount of powder provided by supplier must be mixed according to instruction. Everyday new primer mixture should be used.

2. Upper preparation:

The bottom of lasted upper should be absolutely flat. It should have a lasting margin of at least 12mm. Appropriate surface preparation of upper must be done according to the material.

3. Mixing of hardener:

Mixing of hardener to adhesive should be done as per suppliers' direction. Measuring instruments must be provided to mix accurate quantity of hardener and adhesive.

4. Drying time:

Conveyor speed is set in such a way that the adhesive becomes completely dry when it reaches sole press. Partition or a mark can be made so that the sole attacher does not pick before it's dry. Speed of the conveyor should be adjusted depending on the weather conditions.

5. Shelf life:

Shelf life is the recommendation of time that adhesive can be stored, during which the defined quality of a specified proportion of the goods remains acceptable under expected (or specified) conditions of distribution, storage and display. Adhesive with expired shelf life shall not be used under any circumstances.

6. Pot Life

This is the useable life of an adhesive sitting in a bench container. Some adhesives will begin to set in the container quicker than others, due to their different chemical makeup and reactivity. Atmospheric and climatic conditions can also affect the pot life of an adhesive. Adhesive with too much viscosity shall not be used for cementing.

7. Reactivation:

Machine should be adjusted such that the surface temperature of sole and upper is around 75-90 deg. C (as per recommendation of manufacturer). Surface temperatures must be checked at regular intervals and a chart must be maintained. Machine must be calibrated at regular intervals.

8. Pressure of sole press:

Both appropriate pressure and distribution of pressure is important for adhesion. The machine calibration must be checked at regular intervals e.g. once or twice in a

month. Secondly carbon paper test must be done at least two times in a day, before starting work in morning and after lunch break. Chiller must be used after sole press for immediate de-lasting.

9. Green test:

Random samples must be taken and sole adhesion be tested on “sole adhesion tester” at regular intervals. (Minimum twice a day.)

Faults and Likely Causes: If the bond strength is not good it is important to examine the type of separation when the sole has been stripped, and establish the weakest link in the bond.

The links in a stuck-on bond are:

- Upper material
- Adhesion to upper
- Poor coalescence of adhesive film
- Cohesive failure
- Adhesion to sole
- Sole material

Various types of separations: Upper material breakdown**:**

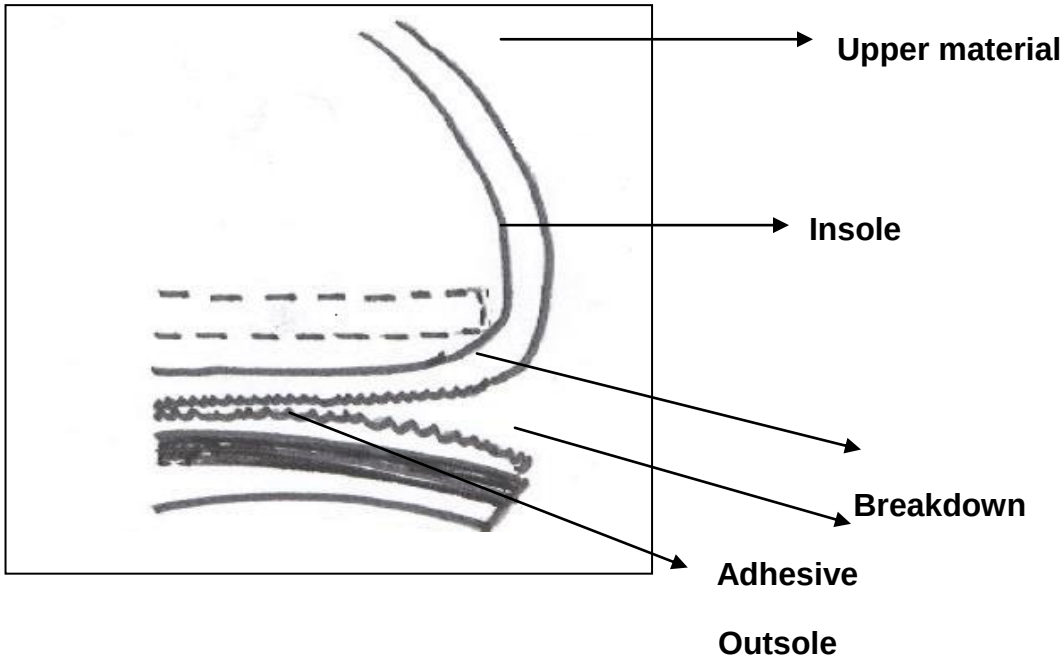

Fig 4.upper material break down

When the sole is separated, it pulls away a layer of the lasted margin. If the layer is thick, with the separation occurring deep into the material, the bond strength is usually satisfactory. If the layer is shallow the bond can be weak.

Examples of weak bond with upper failure include:

- Inherently weak material such as goat leather.
- Weak surface layer, not fully roughed from material, such as grain of leather and coating of PUCF materials.
- Separation of lacquer (top finish) from plastic coated fabrics, this should be removed by solvent wiping before cementing.

Adhesion peeling from upper:

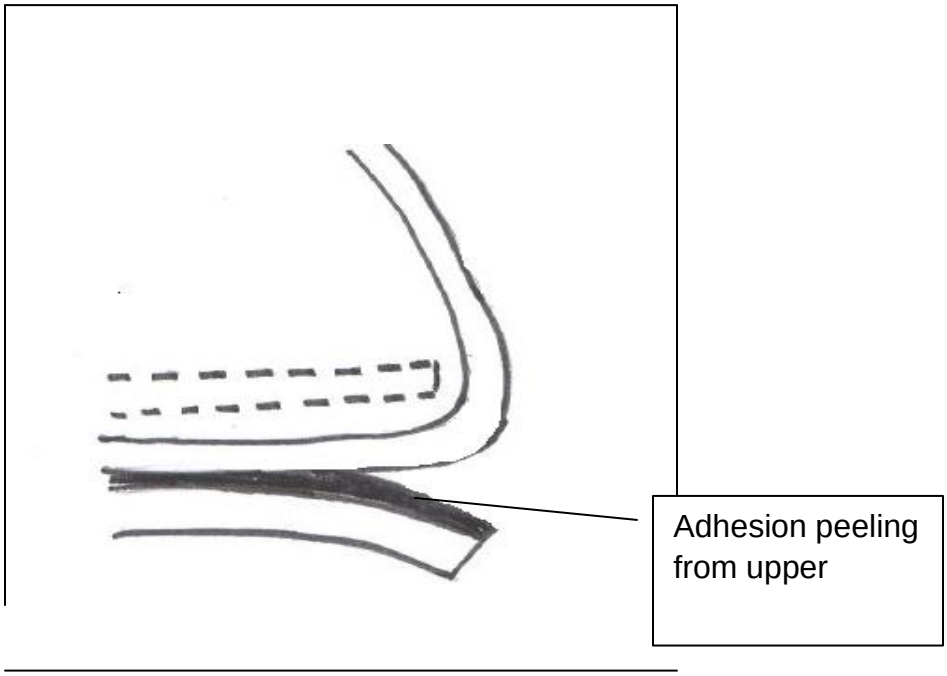

Fig 5.adhesion peeling from upper

This normally indicates an inadequate bond and possible causes of this include:

- Insufficient roughing of leather preventing adhesive penetration.
- Greasy leather.
- Incompatibility of adhesive and upper. Some plastic and textile uppers such as nylon are difficult to stick unless specially primed or surface scoured or roughed.
- Inadequate preparation by roughing or solvent wiping to remove lacquer or other contaminations from the surfaces.

Poor coalescence of adhesive film:

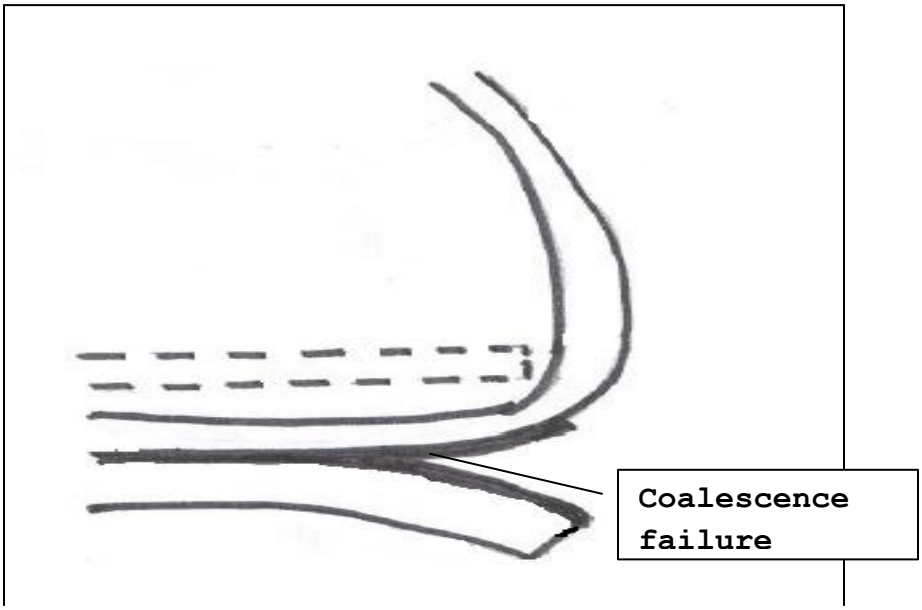

Fig 6.coalescence failure

The common weakness can often be identified by shiny patches where the two adhesive films have not combined. Possible causes are:

- Insufficient heat reactivation of adhesive. Light colored materials often required more heat reactivation.
- Insufficient or uneven pressure. Uneven pressure may result from excessive pleats in the lasted margin; bridging of the upper across the walls of the ill-fitting sole units; overlapping or too thick bottom filler; shanks protruding or incorrectly shaped press pads. These points should be investigated before increasing the overall pressure on the sole press.
- Stale adhesive film due to too long an interval between cementing and assembly. It is important to work with the open times specified by the adhesive supplier.
- High grease content in upper leather; polychloprene adhesive are the most vulnerable in this case.

- Excessive penetration of adhesive giving a “starved surface”.
- Incompatible adhesives on sole and upper

Cohesive failure of adhesive:

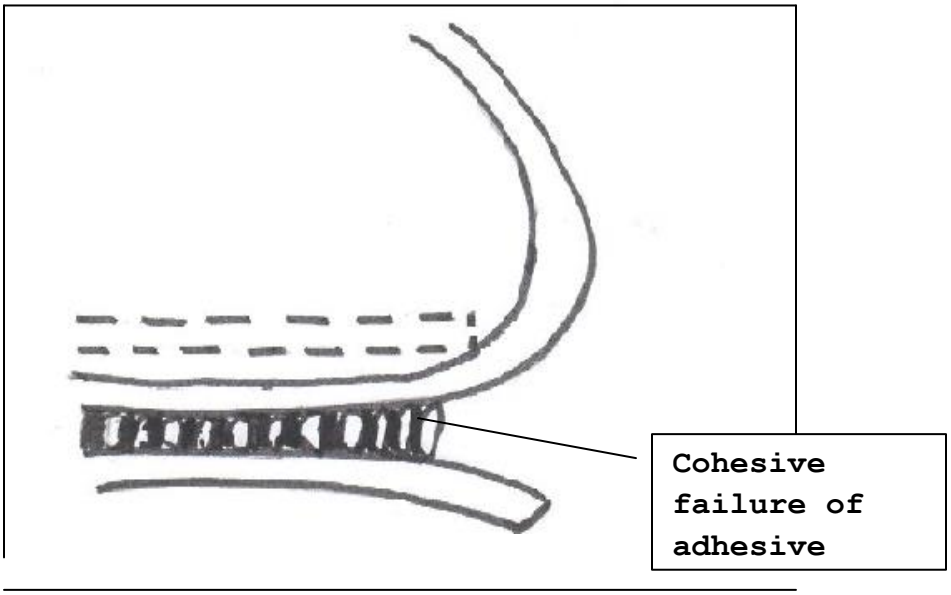

Fig 7. Cohesion failure of adhesives

Legging of the adhesive occurs as the joint is separated and the adhesive remains on both surfaces, usually in a tacky state. This fault can be caused by:

- Too short a drying time of the adhesive resulting in the solvent retention.
- Insufficient time in the press to allow the adhesive to cool from heat reactivation.
- Softening of the adhesive due to migration of plasticizers from PVC; or grease from leather.
- Shoes exposed to high temperatures in storage or wear.
- Over heat-reactivation resulting in over-over-softening of adhesive.

Adhesive peeling from sole:

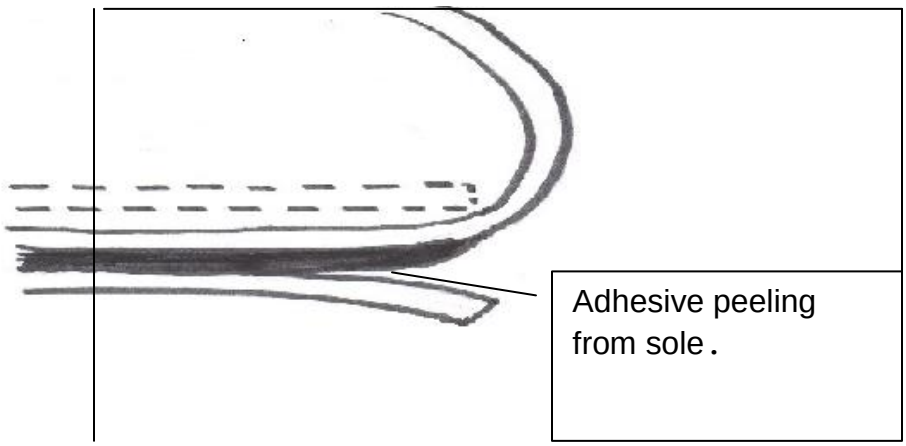

Fig 8. Adhesives peeling from sole

This is normally indicates an inadequate bond and reasons for this include:

- On leather soles, incorrect roughing to allow adhesive penetration.
- On rubber soles, inadequate preparation, mechanical or chemical to eliminate a stale surface or contamination, or to make the surface receptive to adhesive used.

- On PVC soles, inadequate preparation to remove contamination such as mold release agent or lacquer, or to make the surface receptive to adhesive used.
- Active chemical in primer is exhausted.
-

Breakdown within the soling material:

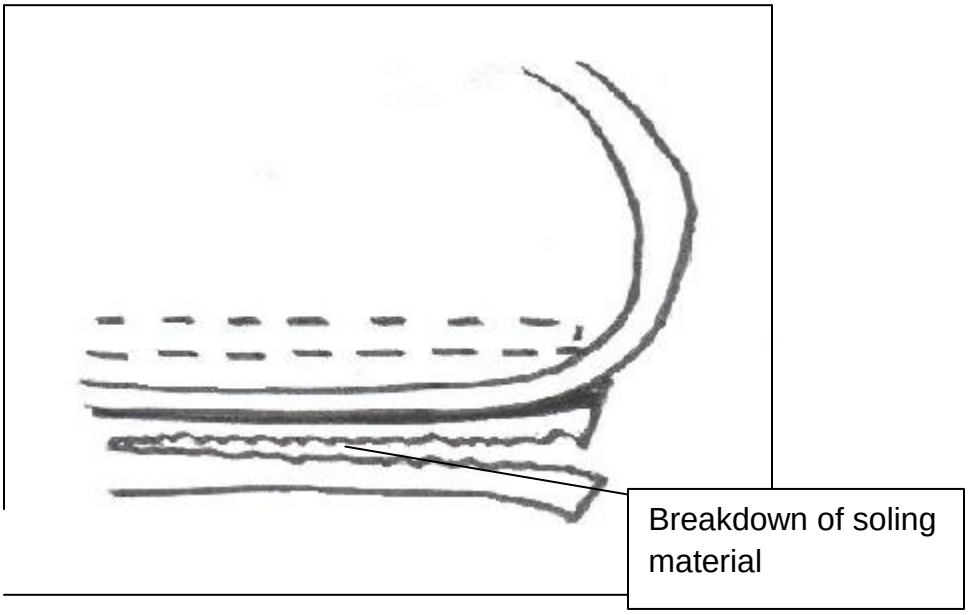

Fig 9. Break down of sole material

Sole, when separated, leaves a layer of material stuck to the adhesive film to the upper. This usually indicates adequate bond strength but it may be suspect if only a very shallow layer of material separates, particularly on leather and some cellular soiling.

Failure analysis in adhesive bond

There are about 4 categories of failure analysis:

1. Adhesion failure between adhesive and upper

The following are the possible causes:

- ✓ Inadequate roughing due to lack of skill
- ✓ Very thick adhesive

- ✓ Lasting margin is not wiped of oil or grease.
- ✓ Improper adhesive usage

The following shall be done to prevent the problem:

- Adequate roughing shall be given to the upper
- The wire brush shall be sharpen
- Avoid using brass brush

2. Non-calescence of two adhesive film(cohesive failure)

The following are the possible causes:

- ✓ Too old adhesive
- ✓ Inadequate drying time
- ✓ Too thick adhesive layer
- ✓ Too little or too high activation chamber
- ✓ Too long drying time
- ✓ Incorrect sole dimension(cavity)with the upper
- ✓ Inadequate or very high sole pressing pressure/time

3. Adhesion failure between sole and adhesive

The following are the possible causes:

- ✓ Contaminated sole surface i.e. either the sole does not pass in the process of wiping or dust is collected on it due to long time exposure after wiping.
- ✓ Inadequate process of wiping/priming
- ✓ Inadequate roughing of sole
- ✓ Use of improper adhesive

4. Upper material failure

The possible causes are:

- ✓ Over roughing(roughing too deep)
- ✓ Very weak upper material

Self-Check 3	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 40-41.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Explain what you mean by adhesives and its application on shoe manufacturing process. (2 point)

2. Identify and discus about classification of adhesives. (5 point)

3. Explain the use of adhesives for shoe production. (3 point)

4. Describe the difference between solvent based adhesive and water based adhesives. (5 point)

5. Define and describe the adhesions and its categories. (5 point)

Test II: Multiple Choice

Directions:

1. There are eight [5] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
2. A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

1_____ is a material used for holding two surfaces together

A. Adhesion

B. Solvents

C. Adhesives

D. bond

2. Which of the following statement is correct about a material to perform an adhesive must have the following main requirements?

A. It must "wet" the surfaces

B. It must adhere to the surfaces

C. It must remain stable.

D. all

3. Types of adhesive that supplied in low molecular weight form and after application a polymerization reaction is allowed to take place.

E. Thermoplastic type

F. Evaporation or diffusion types

G. Chemical reactive types

H. Solvent Based

4._____increases the number and depth of surface pores in shoe manufacturing process

A. Solvent wiping

B. Roughing /scouring

C. Chemical priming

D. Attaching

5. Form the following one is the failure of adhesion bond in Order to make full shoe?

A. Adhesion failure between adhesive and upper

B. Non-calescence of two adhesive films (cohesive failure)

C. Adhesion failure between sole and adhesive

D. all

Score = _____

Rating: _____

Information Sheet 4 Determining and performing sole press pressure and timing.

SOLE PRESSING

The main purpose of these operations is to activate and press the sole and the shoe bottom together so that they may not come apart in wear. A variety of machines have been made for sole and shoe bottom activation, the choice of the machine is mainly made on the output required and the price. For example some flash heat activators have setting for temperature and cycle time. Some cheaper models have no setting; therefore rely on the operator's skills. Modem sole presses are all equipped with a variety of pads to allow for various heel heights and adjustable pressure for the wide range of soling materials.

Types of sole press

Sole attaching presses are of two main types, Traditional type of presses and Enveloping bag presses.

- **In the traditional type of presses, the** lasted upper is held in position by two jacks, one at the forepart and the other at the back of the last, while pressure, either hydraulic or pneumatic, is applied to the sole. In simplest machines the pressure is applied mechanically.

The pad box will contain rubber pads, water or air bags. There can be a back support for high heels.

- **Enveloping bag presses-** In this type of press the lasted upper with sole spotted in position is either partially or totally enclosed in a rubber bag so that pressure is applied from several directions at once. This is advantageous not only for walled soles but for veldt or stitch down constructions where consolidation of the veldt/flange sole bond is important.

Machine adjustment

1. Position a shoe having sole spotted on the pad box and make adjustments according to contour of the sole bottom.
   This may involve re-setting the angle of the box, changing the rubber blocks or profiles and inserting waist wedges, depending on the type of press.

2. Position the toe and heel jacks independently for the last size and adjust for height.

3. Bring the press to its clamped position and then apply pressure to fmd whether sole distortion occurs. Any serious distortion of the sole must be reduced as far as possible by reducing the pressure to the acceptable minimum. Serious distortion prevents an adhesive bond. Bonding pressures of about 5 bars is usual. Satisfactory flat bonds can often be achieved at half this pressure. Actual pressures applied depend on the type of sole, being lowest for soft materials such as TPR and highest for hard materials such as leather.
4. Spot the sole and press it immediately after heat reactivation.

5. Keep the shoe under pressure for 12 to 15 seconds or longer.

Check performance of sole press

- **Pressure distribution**

- Destructive sole bond testing will reveal any weakness in the attachment due to uneven or insufficient pressure.

1) Check the pressure distribution by **carbon paper method.**

In this method, a lasted upper and sole are prepared up but excluding cement. Carbon paper between two white paper sheets is placed between the sole and upper. After the pressure has been applied in the press, the sheet of white paper is examined for an even print.

Any variability in the lasted margin region must be investigated**.**

Carbon Paper Test for the Soles

This test is done to ensure that the sole press is set correctly and the pressure is acting at every point on the feather edge of the last.

1. Take two sheets of foolscap paper & put a carbon between them & staple the sheets together. Place a sole on the press and keep paper on it.
2. Place this paper between sole & lasted upper & start the sole press. Use normal pressure & cycle time as in regular production.
3. Remove last and check the carbon paper impression. The feather edge & lasting margin should be seen as a clear line.
4. If the line is not clear then readjust the pads till a clear feather line is seen.

5. The carbon paper test should be done every morning & when the correct impression is obtained, the operator should get it signed by the supervisor & then start production.
6. Pads on the sole press become hard after a few months & will require to be changed. Always keep an extra set for such replacement.

- Fit of upper to soles

1. When sole units have a wall, check that the lasted upper is not bridging the wall at any point.

2. Check soles with stuck-on rands in a similar way if the rand is high. The inner edge of the rand should be skived to avoid bridging effect.
3. Avoid stretching the sole. Some soles can be stretched to fit when spotting but this can lead to narrowing of the waist of the sole, being risk of bridging this area. To reduce toe spring, have PVC sole somewhat smaller than the shoe. Spot and stretch the forepart of the sole first then spot the waist and heel.

4. Keep bottom filling materials within the lasted margin.
   Apart from the reduction in bonding area caused by an overlap, the additional bulk of filler will also produce localized high spots of pressure which may lead to areas of poor adhesion nearby

How to Check Sole Adhesion after sole press

1. After attaching the sole wait for 1 hour and then do test on Satra adhesion tester. This is called the green test where the adhesive has not set firmly.
   - ✓ Green test values should be 90% of the final test values. For e.g. if adhesion standard at toe is 20kg the green test value should be 18kg at least.
2. Check one pair in every batch/plan or at least twice a day.
3. After 24 hours of sole fixing check sole adhesion and ensure it meets the sole bond standards of 20kg at toe, 25kg at the sides & 30kg at the heel.
4. If adhesion is not satisfactorily check cause of failure
   - ✓ Adhesive not dry enough
   - ✓ Poor roughing
   - ✓ Poor laminar strength
   - ✓ Improper application of adhesive
   - ✓ Improper pressing
   - ✓ Improper activation

- ✓ You can do a test on tensile testing machine to get accurate information on cause of failure.

5. Keep records of plan wise sole bond tests for traceability
6. Keep enough adhesive for 30 minutes only. This because when you use a hardener the shelf life of the adhesive is about 40 – 50mts and the adhesive must be consumed in this period.

FAULTS, CAUSES AND CORRECTION

S.NO	FAULTS	CAUSES	CORRECTIONS
1	Sole gaping	• Sole or shoe bottom not fully covered with adhesive • Sole not prepared as per the procedure • Not enough activation • Cycle time on press too short • Insufficient pressure on sole press • Wrong adhesive used	• Make sure that the whole surface on the sole and the shoe are fully covered with adhesive • Follow the sole preparation procedure • Increase flash heat cycle time • Increase cycle time on the press • Increase pressure on the sole press
2	Sole layed too far forward	• Poor sole potting by the operator • Operator not trained correctly	• Operator must take care while spotting the sole on to the shoe bottom • Operator must be given good training procedure
3	Sole layed too far back	• Poor sole spotting by the operator • Operator not trained correctly	• Operator must take care while spotting the sole on to the shoe bottom • Operator must be given good training procedure
4	Sole layed to one side	• Poor sole spotting by the operator • Operator not trained correctly	• Operator must take care while spotting the sole on to the shoe bottom • Operator must be given good training procedure
5	Damaged upper	• Operator not positioning the shoe on to the sole press directly under the heel pad	• Make sure the shoe is positioned directly under the heel pad before pressing the sole

			pressure activation buttons.

Routine maintenance of Sole press machines

1. Check the forepart and waist pad boxes of the sole press
2. Select the correct pad for the last
3. Check the heel pad assembly
4. Set the tone pads
5. Check the distance from the edge of the toe of the last to the toe pad should be 35mm
6. The distance between the heel pad and the top of the last should be approximately 25mm
7. Set the pressure. This depends on the type of soling materials. For micro and thermo plastic rubber because of their softness the pressure required is approximately 3 bars.
8. Set the cycle timer. This also depends on the type of adhesive and the soling materials. To obtain the best results it must not be set under 15 seconds.
9. Place the joined upper and sole as in (8) positioned under the toe pad and the heel pad.
10. Apply pressure evenly throughout the sole bottom. Thus the sole is evenly layed.

Self-Check 4	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 48.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. Explain what you mean by sole pressing and its main purpose. (5 point)

2. Define and discuss the types of sole press sport training. (3 point)

3. Explain sole press machine adjustment during lasting operation. (2 point)

4. Define and describe the ways of checking the performance of sole press. (2 point)

5. Define and describe how to check sole adhesion after sole press. (5 point)

6. Discus briefly about sole press faults, causes and correction measurements (3)

7. Explain the routine maintenance of sole press machine (5)

LG#42	LO #4- Determine quality check points of the lasted shoes

Instruction sheet

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

- Identifying and performing final check points on the lasted shoes.
- Describing and demonstrating method of handling of the complete finished shoe.
- Describing and performing method of packing the finished shoe.
- Cleaning and maintaining work area

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

- Identify and perform final check points on the lasted shoes.
- Describe and demonstrate method of handling of the complete finished shoe.
- Describe and perform method of packing the finished shoe.
- Clean and maintain work area

Learning Instructions:

Read the specific objectives of this Learning Guide.

- Read the specific objectives of this Learning Guide.
- Read the information written in the “Information Sheets 1”.
- Accomplish the “Self-check. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheets 1.
- Read the information written in the “Information Sheet 2”.
- Accomplish the “Self-check 2”. Again you can request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- If you earned a satisfactory evaluation proceed to “Information Sheet 3”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Information Sheet 2.
- Read the information written in the “Information Sheet 3”.
- Accomplish the “Self-check 3”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- Read the information written in the “Information Sheet 3”.
- Accomplish the “Self-check 3”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.
- Read the information written in the “Information Sheet 4”.
- Accomplish the “Self-check 4”. Request the key answer / key to correction from your teacher or you can request your teacher to check it for you.

Information Sheet 1 Identifying and performing final check points on the lasted shoes

Inspection is an important function though it does not add value to the product but adds to its cost. Too much inspection is needless and too little inspection may not provide requisite quality assurance. Inspection planning, therefore, must serve as essential element in quality assurance program me. Inspection planning consists of six basic elements.

1. What to inspect (specifications)?

Specifications are the tools of inspection.in absence of specifications, neither buying nor selling of footwear can be tough of. The drawing sheets, sequence of operations, bill of materials, commercial standard pertaining to the country's law, packaging instructions, and assembly and test instructions are all examples of specifications.

2. When to inspect (stages of inspection)?

Stages of inspection identify, within the conversion process, the points at which the inspection tests need to be carried out to identify the defects and initiative corrections there by ensuring production of goods of the right quality at minimum cost to the organization.

Inspection should be conducted as the production is coming off the line so that correction (if any) is made at the earliest. This kind of inspection is called **patrolling** or **roving** inspection and it is done at the place of actual production. They should make frequent spot check on all aspects of manufacturing in the department to which they belong. Additionally it should be the responsibility of the roving inspector to regularly check machine settings like temperature, dwell times, pressure, etc. This is particular importance in the lasting and making department.

Inspection should be carried out on the components before they are transferred to other section, department or division. This kind of inspection is known as **stage inspection**. This type of inspection identifies the sources of defects thereby fixing the responsibility on individuals.

Inspection should be conducted prior to an operation after whose completions no rework what so ever is possible. This type of inspection is called **critical operation inspection.**

While performing inspection, care must also be taken to inspect goods

- Prior to a costlier operation
- Prior to an operation which conceals the defects of the previous operations
- Prior to an operation that is likely to endanger costly tooling.

All shoe s shall be subjected to inspection after lasting to ensure that they have been lasted properly and that all proportions are accurate. After roughing operation, correction to inaccurate lasting is very difficult as roughed areas invariably become visible in the finished shoe. Inspection after lasting is therefore essential. The inspector, who must be able to make small corrections to the lasting, should have the following equipment in his /her workplace.

- Good lighting
- Work ticket holder
- Hammer
- Lasting pincer
- Creep rubber pad for upper correcting

The lasting inspector should use the following sequence for carrying out his inspection:

- He should begin by reading the work ticket so that he can determine the correct dimension and specifications for the shoes.
- The vamp length and the back height should be checked.
- The back seams and the side seams and fore seams should be straight and uniform
- Trims. Aprons, eyelet facing etc. should not be distorted and should be uniformed from the pair to pair.
- The uppers should be checked to ensure that they have been sewn according to the specifications and no stiches or details are missing.
- The soles should be examined for general damage (e.g. lasting crack, open seams, etc.)

Inspection must be conducted on the completed assemblies under conditions similar to field conditions. This kind of inspection is known as **functional**

inspection. This inspection should take place after the last has been removed from the shoe and the tacks on insole have been filled.

The inspector should carry out a general examination of the shoes and ,most important, should look inside the shoe to check that there are no standing tacks, which should causes an immediate and serious injury when the shoes are tried on.

Any necessary repairs should be carried out before the shoes are sent for finishing in the shoe room.

As with lasting inspection, no special equipment is required, but the inspector should have the following equipment at his work place:

- Good lighting
- Work ticket holder
- Creep rubber pad for upper correcting
- Long reach pincer
- Small hand iron
- Hot air blower
- Pair of scissors
- Gas flame or spirit lamp

The pre inspector should follow the sequence used by lasting inspector, checking the same points again; additionally the following points must be examined.

- There must be no tacks let standing on the insole
- The insole must be smooth and should not have become creased during lasting
- The lining must be smooth and free from creases.
- The soles and heels should be checked to ensure that they correspond to the specifications (height and length of heel, cleanliness o soles and heel etc.)

Inspection should be conducted prior to the shipment of the goods to the customer. This kind of inspection is referred to as **final inspection.**

The final inspection must, as the name suggests, be the last operation before the shoes are packed. The shoes are subjected to final inspection before they are allowed to leave the factory.

The shoes therefore are inspected when the last operation in the shoe room has been completed. Remember that the returns from the stores or form the customers are very costly. It is better to identify any faults before the shoes leave the factory.

The final inspector carries the responsibility of ensuring that all quality standards have been met. It is not normally the responsibility of the final inspector to carry out repairs; they should return faulty or damaged shoe for rectification to the department concerned.

For this equipment he requires at this work place is limited to:

- Good lighting
- A pair of scissors
- A gas flame or spirit lamp for thread burning
- A polishing duster

All aspects of the shoes must be checked including those already checked during previous inspections. Additionally the final inspector should check the following points.

- The sock should be accurately positioned, firmly bonded in place, and the lining and sock should be free from adhesive. The stamping should be accurate.
- The upper leather finishing has been carried out according to the specification.
- All necessary labels and tickets have been attached.
- The pair wise and size ratios correspond to the order requirement.

3. Where to inspect (places of inspection)?

It is the area where the inspection is carried out so as to bring out the desired quality with the minimum inspection and minimum cost. For example inspection of the finished products should be performed as near as possible to the packing operations. This avoids the need to transport and the likely risk of damage and deterioration to quality. Such an inspection does not disturb production schedules and is generally faster.

4. How to inspect (inspection devices)?

The accuracy of measurement, a prime factor in inspection, is achieved by use of various types of measuring devices. The common measuring devices in the lasting department are:

- Measuring instruments-like steel rulers
- Laboratory testing equipments,which may be destructive tests
- Non-destructive testing-this may be done visually for testing of flaws and defects in materials without their physical destruction or without impairing their usefulness or serviceability.

In the **sole adhesion test**, equipment is available which can be used to carry out this test within the factory and without the need to destroy the sole (see fig. 1). The test should be carried out when the sole bond has had sufficient time to fully develop (as defined by the adhesive manufacturer). It is not necessary to test every pair, in fact testing 3 & 4 pairs per day is sufficient but it is how ever important to repeat the test for different constructions and /or different types of shoes & sole materials. Carrying out this simple test will give a good indication of operations such as roughing, adhesive application, sole pressing are being correctly carried out & that the adhesive, upper & sole materials are in order.

Fig 1: SATRA Sole adhsion test

Remember that when one link is the chain of sole attaching operation is not perfect, the sole will almost certainly become detached from the upper during wear. Until the problem has discovered, many thousands of pairs could have been made, all of which are potential returns.

5. How much to inspect (sampling or cent percent inspection)?

Inspection may be done either on each piece (called as cent per cent inspection) or on samples (called as sampling inspection).

The choice between the cent per cent and the sampling inspection depend on the following factors:

- Cost of inspection versus cost of failure
- Nature of inspection
- Lot size
- Manufacturing process
- Stage of inspection
- Functional importance of the item
- Stage of development
- Results of sampling inspection
- Re-inspection of segregated lots
- Vendor's quality rating
- Inspection performed as a moral check on stage inspectors or line inspectors

6. Who should inspect? (Qualification of inspector)

The qualifications, experience, type of training and the essential traits for the inspectors should be specified.

The inspector should be:

- ✓ Qualified
- ✓ Experienced
- ✓ Shall have adequate training
- ✓ Must use the right equipment.

It is normal practice in the footwear industry to inspect pair by pair at the end of the process. The following guidelines will help ensure that the inspection is done correctly:

1. Do not inspect unless there is an approved sample signed by the customer.

2. A technical specification sheet for each style approved by the production manager/customer.

3. Sufficient light should be available on a clean table. Lighting levels should be 1300 lux.

4. A list approved by the production manager showing major & minor defects

in cutting/sewing/lasting. The general rule is that no major defect is allowed & 2-3 % minor defects are allowed. Without a list of major & minor defects no inspection is possible. In case a major defect occurs not listed in the defect list the quality controller should not be blamed. This new defect should be added to the list for future lots.

5. Keep a tape, scale 12" & 6", scissor, crepe rubber piece & stitch gauge with you always.

6. Major defects should be destroyed or punched through so that they are not recycled or mixed with good shoes. Keep the defective shoes with you till you get replacements.

7. Keep track of defects as shown in the quality inspection report. This report gives number of pairs defect wise. Look for the top three defects & take steps to correct them immediately. Stoppage of production could also be one of such measures. If the same defect recurs for 3 days the quality control system has failed & the Quality Control inspector is responsible.

> One should remember that recording of defects is not the main job. Corrective & preventive action is the main job of the Quality Control inspector.

8. A 10 minute break is necessary after every two hours otherwise inspection fatigue occurs. During these periods you may go to the line & look at ways to correct quality problems.

9. A shoe must be inspected by looking at it with the toes facing you and with the back strap flack seam facing you. Shoes must inspected pair wise always.

10. Have a 10 minute discussion daily with production supervisors about major problems & how to correct these. If these are not attended to, stop inspection & report to the production manager.

11. Quality inspectors suddenly change standards of inspection when a complaint is received. Many times he rejects up to 70-80%. This is simply ridiculous because with such a high rate of rejection it means that the quality control

system has collapsed and the Quality Control inspector is responsible.

12. The following charts must be clearly displayed at the Quality Control table

Back height chart

Major and minor defects list

Key points raised by the customer if any

Approved sample

Defect file (see pt. 14)

13. Keep a defect file for each customer. Whenever a complaint is received keep a copy in this file along with corrective & preventive action taken. The purpose of this file is to catalogue defects & ensures that they do not recur.

14. Final inspection by itself is not enough. This must be supported by laboratory test reports on materials & the final shoe. Fit and wear trials help immensely in quality control.

15. Remember that final inspection in only a postmortem. It is much better to spend time on in process quality control. The rule "Do it right the first time" is to be always followed.

HOW TO CONDUCT EXTERNAL INSPECTIONS

Many customers send their representatives for final inspection or hire third party who are specialized in inspection work and has worldwide recognition. This procedure covers fully packed consignments.

1. Inspection can only be done on the basis of an approved sample & technical specifications from the customer.

2. A copy of the order should be available with packing instructions.

3. A copy of the invoice should be available showing style wise quantities.

Packing lists should also be available.

4. The consignment should preferably be kept in an inspection room with cartons stacked serially as per packing list.

5. Count number of cartons to ensure that there is no shortage.

6. Check the quantities of the two lowest & two highest sizes of the order physically i.e. if an order is from 5-11 sizes check quantity of sizes 5, **6, 10, 11** physically. Since these are edge sizes quantities will be small & can be checked easily. This is to prevent any packing mistakes/malpractice.

7. Draw samples for inspection as per random sampling table.

8. Draw pairs for inspection in all sizes.

9. Keep a list of major & minor defects & inspect shoes & tabulate results on the inspection sheet.

10. Randomly selected samples may be sent to laboratory test for the following tests:

- Sole adhesion
- Sole abrasions
- Sole flexing
- Cold crack if shoes going to cold climates the test is don at -20° C

11. Checked cartons shall be sealed with special tamper proof tape. Keep record of cartons opened & sizes checked.

12. Check carton labeling, boxes, box labels to ensure that they are as per order.

13. Issue certificate if the quality is satisfactory.

14. In case tests for PCP, Azodyes are required do these tests before issuing certificate.

TEST CRITERIA FOR VISUAL EXAMINATION

Restitution of the last shape

- Longitudinal profile
- Crow section
- Toe tip
- Heel seat
- Upper close

Stand of the shoe

- Point of tread
- Heel position
- He'll pitch
- Side pitch

Upper material (upper and lining material)

- Uniformity of color
- Uniformity of glaze
- Dirt and smudge
- Visible material defects
- Wrinkles
- Loose grain
- Mechanical damages

Bottom material/bottom parts

- Uniformity of color
- Uniformity of texture
- Dirt and smudge
- Visible material

Defects Susceptibility of breakage Working-lip of upper

Seams: Type of stitch

Stitch density

Edge distance

Stitch pattern

Thread tension

Needle hole mechanical damages

Preparation of upper

- Skived edges
- Folded edges
- Edge inking
- Wiping action

Shoe fasteners

Lace fastener:

- Eyelet hole
- Reinforcement shoe lace
- Hook eyelet
- Lace strip

Hook and loop fastener:

- Version
- Adhesive
- Attachment

Elastic gusset stretchable length:

- Tying
- Seam looking
- Band incorporation

Zipper:

- Running ability
- Coverage
- Incorporation look

Buckles

- Attachment firmness
- Overlay Attachment
- Abrasion

Shore assembly

- Vamp length
- Back height
- Upper closure
- Lasting wrinkles
- Pressure marks
- Grain coating
- Grain cracks
- Traces Distortion

Shoe bottom

- Heels cover
- Sole cementing
- Sole arching
- Position of top piece
- Sole finish
- Heel attachment
- Dirt and smudge
- Tacking Insole
- Wrinkles
- Top piece fastening

Self-Check 1	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 18-19.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

11) What do we mean by inspection? (3 points)

12) List down the equipment's needed while conducting inspection. (4 points)

13) When do we conduct functional inspection? (3 points)

14) What are the elements of inspection planning? (6 points)

15) What are the factors that should be considered to select the cent percent or the sampling inspection?(4 points)

Test II: Multiple Choice

Directions:

- There are eight [6] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
- A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

12. Which statement is correct?

I. You should inspect goods prior to a costlier operation.

J. You should inspect goods prior to an operation which conceals the defects of the previous operation.

K. You should inspect goods prior to an operation that is likely to endanger costly tooling.

L. all

13. Which one of the following is not the qualification of the inspector?
    I. experienced
    J. having adequate training
    K. low skill
    L. use the right equipment
14. Which one is not a test criterion for visual examination of bottom parts of a shoe?
    I. Uniformity of color
    J. Uniformity of texture
    K. Dirt and smudge
    L. Skived edge

15. What we call it if inspection is conducted prior to the shipment of the goods to customer?
    E. Final inspection
    F. Functional inspection
    G. Stage inspection
    H. Critical operation inspection
16. What we call it if inspection is carried out on the components before they are transferred to other section, department or division?
    I. Final inspection
    J. Stage inspection
    K. Critical operation inspection
    L. Functional inspection

17. Which is the specification for inspection of footwear?
    E. Bill of materials
    F. Packing instruction

G. Commercial standard

H. all

Information Sheet 2 Describing and demonstrating method of handling of the complete finished shoe

The last stage in the manufacturing of a shoe is the finishing process, which generally consists of three stages; brushing, creaming and polishing. In the last step of the production it is particularly important to have high and consistent quality, that is why the costly manual operations is seen as an obstacle.

Practical in Lasting and Finishing Processes

- All finishing material required
- Shoes to finish
- Wrinkle chaser
- Spray gun
- Spray booth
- Edge cleaning Machine
- Tools for cleaning
- Brushing machine
- Adhesives
- Brushes – 5 mm for edge coloring and 25 mm for socking
- Socks
- Laces
- Waxes

- Sponges
- Spirit lamp
- White starch free rags
- Repair waxes, sprays, pigments in matching color
- Accessories for packing and shape retention

Self-Check 2	Written Test

Instructions: Write all your answers in the provided answer sheet.

Test I: Short Answer Questions

1.Describe the method of lasting and finishing processes.

Information Sheet 3 Describing and performing method of packing the finished shoe.

What is Packaging?

Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of design, evaluation, and production of packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells.

Package labeling or **labeling** is any written, electronic, or graphic communications on the packaging or on a separate but associated label.

Brief history of packaging

The first packages used the natural materials available at the earlier time: Baskets of reeds, wood, ceramic wooden barrels, woven bags, etc. were the most popular packaging material. Processed materials were used to form packages as they were developed: for example, glass and bronze vessels. The study of old packages is an important aspect of archaeology.

The earliest recorded use of paper for packaging dates back to 1035, when a Persian traveler visiting markets in Cairo noted that vegetables, spices and hardware were wrapped in paper for the customers after they were sold.

Iron and tin plated steel were used to make cans in the early 19th century. Paperboard cartons and corrugated fiberboard boxes were first introduced in the late 19th century.

In 1952, Michigan State University became the first university in the world to offer a degree in Packaging Engineering.

Packaging advancements in the early 20th century included Bakelite closures on bottles, transparent cellophane overwraps and panels on cartons, also for increased processing efficiency and improved food safety. As additional materials such as aluminum and several types of plastic were developed, they were incorporated into packages to improve performance and functionality. In-plant recycling has long been common for production of packaging materials. Post-consumer recycling of aluminum and paper based products has been economical for many years: since the 1980s, post-consumer recycling has increased due to consumer awareness, and regulatory pressure.

The purposes of packaging and package labels

Packaging and package labeling have several objectives

- **Physical protection** – The objects enclosed in the package may require protection from, among other things, mechanical shock, vibration, electrostatic discharge, compression, temperature, etc.
- **Barrier protection** – A barrier from, water, water vapor, dust, etc., is often required. Permeation is a critical factor in design. Some packages contain desiccants or Oxygen absorbers to help extend shelf life. Controlled atmospheres are also maintained in some packages. Keeping the contents clean, fresh, sterile and safe for the intended shelf life is a primary function.
- **Containment or agglomeration** – Small objects are typically grouped together in one package for reasons of efficiency. For example, a single box of 1000 pencils requires less physical handling than 1000 single pencils.
- **Information transmission** – Packages and labels communicate how to use, transport, recycle, or dispose of the package or product. With pharmaceuticals, food, medical, and chemical products, some types of information are required by governments. Some packages and labels also are used for track and trace purposes.
- **Marketing** – The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package graphic design and physical design have been important and constantly evolving phenomenon for several decades. Marketing communications and graphic design are applied to the surface of the package and (in many cases) the point of sale display.

- **Security** – Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering. Packages can be engineered to help reduce the risks of package pilferage: Some package constructions are more resistant to pilferage and some have pilfered indicating seals. Packages may include authentication seals and use security printing to help indicate that the package and contents are not counterfeit.
- **Convenience** – Packages can have features that add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, dispensing, reuse, recycling, and ease of disposal. In footwear boxes can be designed to create convenience of carrying by an individual.
- **Portion control** – Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities (such as shoes can be divided into packages that are a more suitable size for the stores or warehousing. It is also aids the control of inventory:

Shoe Packaging types

Footwear packaging may be looked at as being of several different types. For example a **transport package** or **distribution package** can be the shipping container used to ship, store, and handle the product or inner packages. For shipping of footwear waterproofing of the corrugated cartons are important for seaworthy packing.

Individual shoe boxes are used for shape retention of the shoe by separating one pair from the other. For further reduction of moisture and to prevent the formation of mold, silica gel pouch is often used within the shoe box.

Symbols used on packages and labels

Corrugated cartons:

Corrugated cartons (fig: 1) are the outermost packing component for a commodity like footwear. This may often contain following information.

- Size and number of pairs of footwear which may have either solid or assorted sizing.

- Address of the customer.
- Address of the manufacturer
- A Bar code containing information of warehousing, logistics and retailing
- Gross and Net weight
- Date of manufacture

Fig: 1 A consignment of footwear ready for shipment

Fig: 2: A Bar Code Encoding

Fig: 3 Keep away from water sign

The shoe box

Shoes are further kept in a shoe box which may contain the following parts

a. Packing papers
b. Shoe stick and /or shoe tree
c. Silica Gel
d. A Label

a. Packing paper

Packing paper is used for stuffing the shoe to prevent shape loss due to transport (Fig: 4). the same paper also used for wrapping the shoe before putting them inside the shoe box. The packing paper avoids any scratch on the shoe upper surface and also helps absorption of moisture during storage.

Fig: 4 packing paper

b. Shoe tree

Shoe tree generally made using Cedar wood. This accessory consists of a forepart resembling the shoe shape and the heel part connected by a spring (Fig: 5). Shoe tree is the ideal accessory to retain the shape of the shoe during display in the store. The same is provided with the merchandise in case of high value footwear. Being made of Cedar wood, shoe tree prevent bad odor inside the shoe.

Fig: 5 Shoe tree

c. Shoe stick

This is a flexible plastic stick (Fig: 6) used in the finished shoe after packing papers are stuffed within. The stick is very helpful in keeping the topline shape undistorted.

Fig: 6 Shoe stick

d. Silica gel

Silica gel is a desiccant absorbs moisture from the atmosphere thus reducing the chance of fungal growth within the shoe box (Fig: 7).

Fig: 7 Silica gel

Shoe box Label

The label on a shoe box contains all information about the design the end user need. The picture of the design, design description, size, retail price and Bar code for the retail store are the usual information a shoe box label may carry. The Fig:8 illustrates a typical shoe box label used by the companies in shoe retail.

Fig: 8 Shoe box label

Packing method of shoe for the customers

There are more than one shoe boxes kept within the corrugated carton for the purpose of transport to the warehouse of the customer. The type of packing system followed depends on the customer's discretion and communicated with the order sheet. Depending upon the customer need, the packing of footwear is carried out with two different methods.

Solid packing:

Solid packing is when a carton will have multiple pairs of shoe of the same size. For example, in solid packing, all the shoes within a particular carton may have only size 39 and the carton is labeled accordingly.

Assorted packing:

Based upon the customer's instruction a carton may have multiple pairs of shoe of different sizes. This type of packing is known as assorted packing. In case of assorted packing the carton will have the detail of sizes and corresponding pairs in each size. An example is given below:

39	40	41	42	43	44	45
1	2	4	4	2	1	1

Self-Check 3	Written Test

Instructions: Write all your answers in the provided answer sheet on pages 28-29.

Test I: Short Answer Questions

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

1. What is the difference between packing and labeling? (3 points)

2. List down the objectives of conducting packing and labeling? (5 points)

3. What is the purpose of packing paper? (2 points)

4. Explain about silica gel and its purpose. (5 points)

5. Explain about the packing methods. (5 points)

Test II: Multiple Choice

Directions:

- There are eight [6] questions in Test II. Select the best answer for each question and write only the letter that corresponds to your answer in the provided answer sheet.
- A correct answer scores 1 point and an incorrect answer scores 0 point. No marks will be given for a question if more than one answer is supplied.

Start here:

1. Which part is not found in the shoe box?

   A. packing papers

   B. silica gel

C. Shoe stick

D. emery paper

2. Which information is not included in the shoe box label?

A. size

B. retail price

C. name of purchaser of the shoe

D. picture of the design

3. Which information is available in the corrugated cartons?

A. Address of the customer
B. Gross and net weight
C. Size and number of pairs of footwear
D. All

4. Which one is not the importance of individual shoe boxes?

A. shape retention

B. to hold the mold

C. reduction of moisture

D. prevent formation of mold with the help of silica gel

5. Which one of the following is not the purpose of packing?

A. exposes to dust particles

B. barrier protection

C. securing

D. marketing

6. Which type of packing is more suitable if the cartoon have multiple pairs of shoe of the same size?

A. solid packing

B. assorted packing

C. corrugated packing D. all

Information Sheet 4 Cleaning and maintaining work area

How to Maintain Cleanliness and Organization in the Workplace

Assess Risks. Before you can improve workplace cleanliness, you must identify and prioritize areas of concern. ...

Make Daily Cleanup a Routine Habit. ...

Make It Easy For Employees to Be Clean. ...

Make Hygiene a Priority. ...

Choose Responsible Cleaning Products. ...

Declutter. ...

Control Dust.

Is it necessary to clean the work area after working?

1. Preventing Injuries—Slips, trips and falls are a leading cause of accidents. To prevent these accidents, it's important to clean up spills and dust as soon as possible. Keep walkways and work areas clear of tools, clutter, supplies and potential hazards such as cords and hoses to prevent tripping.

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Self-Check 4	Written Test

Instructions: Write all your answers in the provided answer sheet.

Test I: Short Answer Questions

1.Describe the organization in the work place.

Operation title 1: -Identifying essential drafting pulls

Purpose	To understand and able to hand lasting
Equipment ,tools and materials	Shoe nail tacks Pincer Hammer Shoe last Insole
Conditions or situations for the operations	• . All tools, equipment's and materials should be available on time when required. Appropriate table, working area/ workshop to assemble cream separator practice.
Procedures	2. Drive in fully the initial tacks riveted 3. Take pulls at 10mm intervals and insert tacks firstly in the inside waist 4. The inside fore parts lasted followed by the outside 5. The seat is then lasted and care should be taken not to bring over too much upper material.
Precautions	. Preparing materials, tools and equipment are according to inseminator command.
Quality criteria	• Did trainees performing the drafting pulls

LAP Test 1	Practical Demonstration

1. Name: _____ Date: _____
2. Time started: _____ Time finished: _____

3. ***Instructions:***

   1. You are required to prepare 12 drafting pulls and lasting operation of 2 pairs.
   2. You are given three (3) hours to complete the above mentioned task.
   3. Request your teacher for evaluation and feedback of your work.

Operation title 2: -Performing soles preparation

Purpose	To make the sole compatible for the application of the adhesive for the bonding system of the upper & the sole material for the full shoe production
Equipment ,tools and materials	Sole Adhesive Cutter Marking pen
Conditions or situations for the operations	• . All tools, equipment's and materials should be available on time when required. Appropriate table, working area/ workshop to assemble cream separator practice.
Procedures	1. Roughing 2. Scouring 3. Wiping 4. Priming 5. Sole making
Precautions	. Preparing materials, tools and equipment are according to inseminator command.
Quality criteria	• Did personal protective equipment worn while preparing the sole • Did trainees roughing, scouring, wiping, priming & sole making

LAP Test 2	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions:

1. You are required to perform all of the following practical operations:

   1.1 sole preparation for different types of sole

   1.2 application of adhesives on upper materials

   1.3 Heat setting operation for one pair shoe

   1.4 Sole press operation of one pair shoe

2. Request your teacher for evaluation and feedback

Score = _____

Rating: _____

Note: **Satisfactory rating – 100%**

You can ask you teacher for the copy of the correct answers

Reference Materials

Book:

TTLM of footwear level one on os Version 4January 2012 **IND BFP1 TTLM 0212v1**

Galenleather.com/bog

TTLM of footwear level two on (OS) Version 4January 2012 **IND FP2 TTLM 0212v1**

www.geine leather , hhh.leather

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experts of Oromia Regional TVET bureau and Federal TVET bureau in Bishofitu city BIN INTERNATIONAL HOTEL

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