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Analysis of Rejection Data in the Lasting Section of the Footwear Industry

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ABSTRACT

In this project work paper, an attempt is made to provide a fundamental concept on the footwear, history, choice of lasting process, materials, Quality control in lasting, DIP section (Direct injection process), and causes of rejection in lasting department and DIP section and how to minimize the rejection in the lasting department. In the footwear industry, different types of construction are used to make a complete shoe. This project work is carried out about the rejection rate in the lasting section of "Royal Footwear Ltd". In this industry, direct injection lasting process, PU pouring lasting process, and Cemented lasting construction are used to make complete upper. These constructions are very simple systems of shoe making and very popular, common, and easy systems and enhance the production capacity of other lasting processes. In this research, rejection data of the lasting department is collected and analyzed. And the graphical representation of the data is also visualized. A conclusion is made about the rejection rate of different types of footwear for six months.

Keywords: Analysis of rejection, Quality control, Data in the Lasting, Section, DIP, and Footwear industry.

INTRODUCTION:

Footwear is an essential part of wearing. It is also a part and parcel of fashion accessories. It is commonly believed that shoe is one of the best mediums to represent one's personality. So, people have perplexity for footwear. There are a number of other important reasons to wear shoes, including fashion and comfort, which are related to the design and construction process of shoe making process. Each method of construction/lasting, as well as the finished footwear, has unique characteristics. The scope of the project work is defined by the title " Studies on analysis of rejection rate in lasting section of footwear industry", in later chapters the details about this respect are described. Many varieties of footwear exist, including the Oxford, Derby, Boot, Moccasin, Sandal, Sports, and Slipon. The footwear industry in Bangladesh is now on growing condition. The process of lasting is crucial for achieving the two goals including quality and quantity because the establishment of the factory is heavily dependent on these factors (Mahir *et al*., 2023).

More recently, progress has focused on combining operations and automating as much of the setup, movement, and operation of the equipment as feasible through the use of computers. Several manufacturers now prefer the use of cement lasting to the more conventional tack lasting procedure as a result of the development of substantially improved adhesive. This is particularly true for forepart lasting. As nearly all flat lasting techniques enhance sticking the front part with glue. We should use an adequate regulating system to monitor the lasting process in

order to increase the quality of footwear and acquire exportable footwear. The process of making shoes involves a wide range of activities. Each step contributes in its own unique way to the quality of the products that are delivered to the consumer. The materials and procedures used in the last step of production are the focus of shoe room and finishing producers.

The shoes come at the shoe room after going through every stage of production. Here, the finger prints are covered up, small blemishes are fixed, and the goods are given the finishing touch to increase their appeal and, consequently, their value to the consumer. The shoe has a high quality reputation in the eyes of the perceptive customer due to its visual, sensory, and functional qualities. The finishing process varies depending on the type of material used, the method of construction, and a number of other factors, such as production facilities and machinery. Being an effective shoe finisher requires in-depth under-standing of the various upper and shoe finishing types, the nature and properties of shoe finishing chemicals, and how well those chemicals work with the earlier leather finish.

Aim of this project work

The aim of this research study in rejection rate of footwear industry and reduce of the rejection of lasting section. The other objectives of this project work can be summarized as follows:

1) To find out the operation which are responsible for rejection in Royal Footwear Limited.
2) To analyzed rejection which varies articles such as sample-01 (Aqua 50), sample-02 (Aqua 100 JR), sample-03 (TS-700), sample-04 (In many Adult), sample-05 (Jhon), sample-06 (Marcro), sample-07 (Ezee)
3) To analyze the rejection data and compare with others articles.

Literature review

Last is the solid foundation providing a base for manufacturing of a shoe. It is the fundamental to shoe manufacture since it dictate the exact shape, size and fit of the shoes made on it. Last design depends on fashion trends as well as on the anatomy of the foot.it is based on the shape of foot undergoes or performs. Since the fact has flexibility to accommodate changes while performing the lifting action a last has to incorporate these changes in mean form.

Different Types of Last

1) Solid block last
2) Scoop block last
3) Thong's last
4) V-hinge last (vertical hinge last)
5) Telescopic last

Lasting

Lasting is the process of stretching the upper leather over the last and securing it to the bottom of the insole with either tacks or with adhesive so that the leather conforms to the last continuous and retain that shape when the last is removed. The top line of every shoe must be tight. It is essential during lasting. The top line must also be corn correctly balanced i.e. the outside quarter 3 m. m. below the height of inside quarter because of ankle bone height.

1) Ensure that the upper conforms to the shape of the last.
2) That the upper is positioned centrally on the last.
3) The upper components are falling on the proper place on the last as specified by the designer.

Shape Retention

Once the upper has been lasted it is vital that the shape is retained after the last has been removed. This will ensure that the shoe will have good appearance and will fit the foot well. To achieve this upper must possess two very important characteristics.

1) It must be elastic (capable of being stretched and returning to its original shape.
2) It must be plastic (capable of assuming a given shape)

Method of Lasting

The following method of lasting are follows.

a. Lasting down.
b. Lasting up.
c. Force Lasting
d. String Lasting.

a. Lasting Down

In this lasting method of the upper and upper lining are lasted in between the insole and sole either with tacks and or adhesive.

1) **Rib Lasting-** The upper in pulled down and attached to a rib on the insole by cement or wine staple. A welt in then sewn on and the sole attached to it.
2) **Flanged Lasting-** The upper is pulled down and the edge is turned and stuck to the runner.

The sole is then sewn to the projecting edge of the upper and runner.

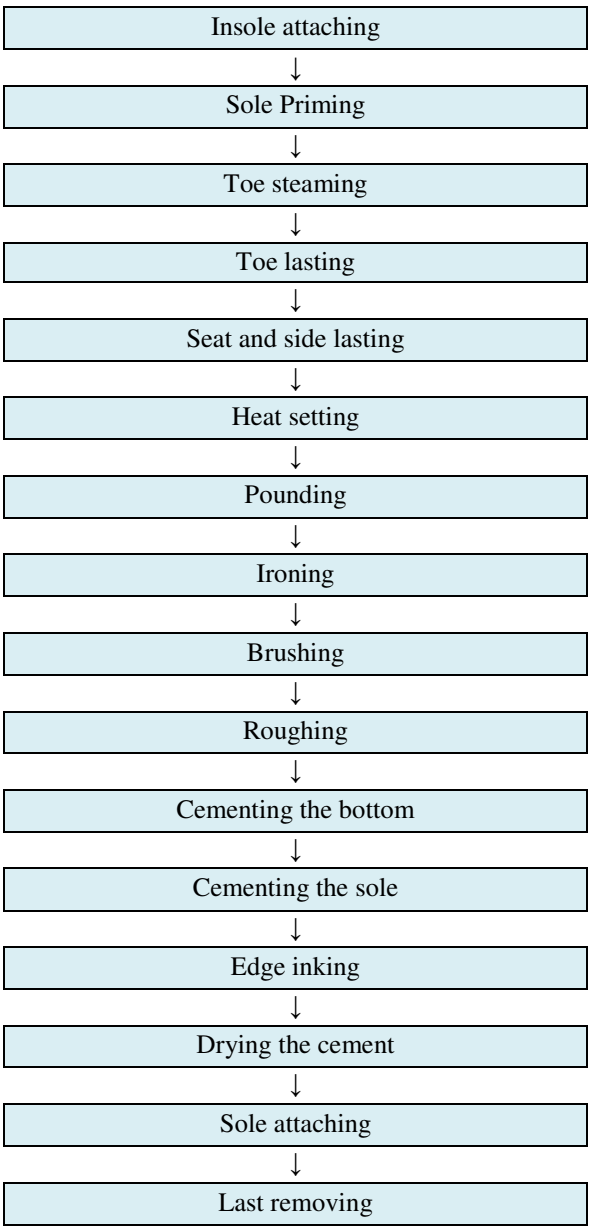
3) **Flat Lasting-** The upper is pulled down and the edge turned under the insole and stuck into position ready for the sole to be attached. Sometimes string is sewn to the edge of the upper, and is used to pull the upper over the last. This is called string lasting and is just one method of flat lasting.

b. Lasting Up- Moccasin is an example of lasting up. The upper in pulled up and attached by a seam to the apron. More shape is then put into the upper by the last or metal foot being pushed in to the shoe. A sole can be stuck on while the last is in. The sole is usually seen on as well.

c. Force Lasting /Slip Lasted- The upper is sewn to the in sock and flat foam cover. The last in then "slipped" or forced in the platform cover and then wrapped over the edge and the sole attached.

d. String Lasting- This method of lasting has been gaining popularity in recent years as it replaces all lasting operations with a simple operation, with the use of special string. Stitching machine is used to attach a strong string to the edge of the lasting allowance of the upper [Manual of shoe making- R. G Miller (Ed)]

Operational Sequence of Flat Lasting Process



Upper Receiving

We received complete shoe upper from sewing department. If any fault that have occurred in sewing department it is impossible to recover in lasting department. So when we receive shoe upper it is very important to check that shoe upper. If pattern of

the sample are wrong there is no way to recover in sewing and lasting department. Before cutting the shoe upper component we should check the knife of the shoe upper by trailing. Before going in mass production of any article it is very important to make two or five pair of that article.

We must be check the following points

1) Lasting margin are even and fixed length.
2) No missed stitches.
3) No adhesive should present in shoe upper which is not removal.
4) Both facing lines are equal.
5) Both side eyelets are parallel.
6) No wrinkle in shoe upper outer side which are visible.
7) Vamp cloth lining will be clean and without crease.
8) Toe puff is in its right position.
9) Top lines are equal.
10) It is necessary to trimming extra lining that is visible

Different Operations of lasting department and description of these procedures

In our project work, only toe puff attaching & back part moulding was done in closing department.

Back Part Moulding

After the insertion of stiffener the pack part should be moulded by the machine. In this case the seat sinking is really an important subject. Seat sinking really meant positioning the upper at the seat so that just the correct amount of upper material would fold over the insole at the seat to give the correct back height. The back seam was also centralized.

Toe Puff Attaching

The toe puff needs to be positioned between the upper and lining level with the edge of the upper. Toe puff is ironed or fused by heat and pressure. The toe puff must be positioned so its fore part is 10 mm under the fore part lasting edge of the upper. The toe puff is used to reproduce the shape of the last and to maintain the shape throughout the active life of the shoe.

Various types of material are used for toe-puffs such as

(1) Elastic, (2) Print on, (3) Rubber, (4) Heat activated thermo plastic.

In heat activated thermo plastic toe-puff, the back part of the puff is coated with thermo activated adhesive and heat fused to the reverse side of the vamp. The puff is softened by heat just prior to lasting and hardened on cooling.

If the upper is a plain vamp or does not have a toe cap a boomerang shape toe-puff must be used.

If the upper has a toe cap, a cap shaped toe puff must be used.

If the upper is unlined single side thermo plastic toe-puff must be used.

A double sided thermo plastic toe-puff must only be used in unlined uppers.

Assembling

First need to collect or assemble various components. These are last (metal plated bottoms), complete uppers, insole, adhesives, eyelets, lace, masking tape etc.

Insole Attaching

There are three holes in the metal plate usually filled with a rubber plug. The insole is accurately laid to the bottom of the last and attaching to the last using special tacks driven through into the rubber plug. But some time the tack on the insole has not been filled. So the standing tack could cause an immediate and serious injury when the shoes are tried on.

Priming

To obtain satisfaction bonding between two materials using an adhesive normally requires some form of surface preparation to improve the adhesion between the cement and the material surfaces.

Different types of primers

(a) Cleaners, (b) Fillers, (c) Modifiers, (d) Activators

Activators are used on thermoplastic rubber

We must check the following points

1) Watch for areas of sole missed by priming treatment.
2) Change priming cloths regularly, this may necessary/every 12 pairs.

Toe Steaming

Before lasting the vamp portion of the upper with the too-puff conditioned using steam. The moisture is forced into the fibrous structure of the leather. The vamp is rendered pliable which reduces problems of teasing and cracking and the material stretches during lasting. There are two types of conditioning equipment.

1) Contact type
2) Open steam chamber

Toe Lasting

This machine pulls the upper down the last at the toe and vamp region and attaches the upper along the lasted margin at insole. This machine is normally pneumatically operated. The upper in fed into the pincers. The lasted insole rest pushes the gripped upper upwards upper is stretched and is shaped to the contours of the last at the vamp and toe region. The stretched upper is held tight at the toe by a toe band. The pincers release the upper. Hot melt cement is applied automatically by an applicator over the lasted margin of the insole. The heated wiper plates wipe the stretched upper over the lasted margin.

Seat and Side Lasting

In seat and side lasting the same tack lasting process can be used. The seat of the upper is placed on a peg which is then pushed into the machine the upstanding upper material is wiped once or twice with metal plate and then held in compression whilst up to required amount tacks are driven simultaneously to secure the upper to the insole. In my project work both seat and side lasting is done manually.

Heat Setting

Heat setting helps lasted upper retain their shape by relaxing the internal substance that would otherwise tend to pull them back to their original that shape.

Hot Air Treatment

Blower machine is used to remove any crease and spot which are present in upper. This also tightens the grain surface and conditions it to receive a later coat of dressing. Hot air extruded from the blower machine.

Pounding

This operation follows the lasting operation. The lasted upper is pounded to remove creases and to flatten the surface. A neat and clean feather edge is obtained. The machine is fitted with different tools or gadget, for hammering, removing excess of material by chopping or grinding and to remove creases. A drum is fitted with spindles, having rings mounted on them. The rotating drum along with the loose rings provides hammering effect. An electrically vibrating iron piece removes creases and smoothens the material.

Ironing

This operation is used to clear the wrinkle from the upper and make the upper smooth. The purpose of this operation is to iron the shoe whilst it is held on a shape identical to the original last so that no distortion may appear. The aim of ironing must be to act in moderation and try to clear the defect without entirely removing the print of the grain. When using heat iron on shoe, serious damage may be done to the upper by excesses heat. Iron temperature depends on the types of leather. Full chrome leather will stand higher temperate but vegetable, half chrome, synthetic will burn with a very little heat. Care must be taken in coloured leather because the shade of coloured leather is spoiled by the direct contact of hot iron. For this reason A Teflon paper must be stuck with iron device.

Brushing

This is the most important operation; Finishing is the hart of the lasting. Finishing is normally done by hard wax. Finishing is necessary to bring smooth grain and recommended colour of leather. There are two types of brush are used in brushing operation such as hard brush and soft brush. Different types of wax are used to bring recommended colour. Shiny or natural waxes are used in brushing operation which gives the shoe its luster.

Dressing with Cream

This operation is most important treatment, which give the shoe its luster. These are non-film forming and can only impart a semi-gloss to the material. However, they do tend to improve the feel and "handle" of materials silicon have been introduced in creams for patents to prevent it sticking to itself as can happen in the shoe box. This can be done by sponge or cloth, allowed to dry and then brushed on a power driven cloth mop. Further shiny wax can be applied at this stage by power mop.

Bottom Roughing

This operation involves the removal the grain and finish from the complete area of lasting allowance by means of a wire brush or abrasive. It is essential that a good feather line is determined so that the sole can be bonded to the upper with little or no roughing visible. The operator must be able to judge the exact depth of roughing necessary for the type material being roughed. It is essential that the operator should only remove the finish and grain so that short regular fibers are exposed. This present an ideal surface for a good strong bond.

Bottom Cementing

The two main types of adhesive used for bottom cementing today are neoprene and polyurethane with

the latter being the more important. The footwear manufacturer consequently has to carefully select the particular adhesive for the material he is using. The adhesive applied by hand brush. Normally 1.2" round brush used in bottom cementing. It is essential that the cement is to be allowed to completely evaporate all of the solvent content. If this is not done, the adhesive layer may not reach the full bond strength which is intended for it.

Sole Roughing

This treatment is carried out by passing the sole through a machine. A feed roll in the machine passed the sole under an abrasive roller and then beneath a brushing roller.

Sole Cementing

Polychloroprene used inside sole using hand brush.

Adhesive Drying

1) Ensure that the adhesive film is dried when the upper reaches the sole press.
2) Do not forces dry at high temperature then skinning may occur.

Heat Reactivation

The dried films of cement on both upper and sole must be hat activated before the sole is pressed on to shoe. This is often done by infrared heat or quartz halogen lamp. The adhesive films develop tackiness soles and shoes are heated at a preset temperature for a pre-determined time dwell. The sole is accurately positioned on the bottom of lasted shoe. As the sole and upper are taken from the operator has to rapidly locate the sole on the shoe bottom.

Sole Attaching Press

The cemented sole are attached to the lasted upper under pressure or "sole attaching press". This machine is hydraulically operated. The lasted upper is cemented across the lasted margin. The cemented soles are placed over the rubber pads of the machine pad box can be easily changed or adjusted when any major shape take place correct setting and pressure are important to achieving a good bond. This machine operator or dwell pressure system i.e., at low pressure the pad boxes are lifted and at high pressure the sole is pressed on to the lasted upper. Frequent checks are essential to ensure that good bonds are being obtained.

Leather Cleaning

After sole pressing, the upper is completely washed with a cleaning fluid. Which may be of a detergent or spirit solvent type? or special proprietary cleaners may be used as cleaner. This is done to remove any block marks, cement, latex; crepe may also be used to remove stubborn dirt. It adhesive is present on lasting margin it is very important to remove this adhesive using crepe rubber without erasing edge ink.

Last Slipping

The last is slipped from the shoe either manually or by machine. During last slipping care must be taken that the top line on seam and insole are not damaged on breaker.

Sock Insertion

A piece of material shaped to cover whole of part of the insole. It is inserted into the completed shoe and usually bears the maker's name and the shoe brand name. The socks may be cut from a variety of materials. Grain leather, suede leather, P.U.0 coated materials or fabrics are all used are normally selected to suit the particular shoe, sheep skin or fun pile fabric is normally used for warm lined foot wear. The style of sock will be determined by the type of foot-wear. It may be a full sock, a three quarter or a seat sock only. A backer pad of vain or fabric can be used to improve the appearance and comfort. It is important that sock is correctly in its position and securely stuck without creasing.

Final Inspection

All shoes are subjected to final inspection before they are allowed to leave the factory and they reach the customer the quality checker. Should begin the inspection by carefully reading the work ticket to familiarize himself with all the details of the style and of the particular order. The final inspector should always inspect a pair of shoes together. This is vital if he is to ensure that. The two shoes really are a pair.

Packing

This is the final operation and should be carried out very cautiously and see that the contents inside the boxes are those described on the box or carton label outside, nothing else. Packing also is very important, as far as presentation is concerned.

METHODOLOGY:

Definition of lasting process

Lasting is moulding the closed upper to the contours of the last. It is then attached to the insole. Lasting is the process of stretching the upper leather over the last and securing it to the insole with either tacks or

with adhesives, so that the leather conforms to the last contours and retain that shape when the last is removed.

Fig. 1: Lasting process.

Types of lasting process

Different types of lasting process are used in a footwear industry to make a complete shoe. In Royal Footwear Ltd, three type of lasting method is used to make footwear. These methods are:

1) Direct injection lasting process
2) Cemented lasting process
3) PU pouring lasting process

Direct injection process

The PU or thermoplastic rubber, in liquid form is injected into the closed mold (holding the upper) at high pressure. Then we get the term "Direct injection moulding" term. Then the liquid form hardens and permenantly fuses into one piece with the upper. Direct injection moulding or direct moulding points to the fact, that the soles are moulded directly onto the upper without uses of the adhesive or stitching. This is possible for the dramatic speed at which monomers polymerise to form network polyurethane a process that is so rapid, that articles may be fabricated by injecting the reacting monomers directly into a mould.High mixing speed of over 18000 RPM resulting in better grain structure and thus better physical properties.

Fig. 2: Direct injection process moulding machine.

In this process of lasting some points should be maintained. These points are:

Sole become integral part of upper: In case of direct injection process, sole becomes integral part of the upper, resulting in better bond strength as compared to other soling methods like Pouring, Stuck on etc

Better grain structure of PU

Due to higher mixing speed of over 18000 rpm as compared to pouring method, better grain structure is obtained resulting into physical and chemical properties.

Consistant quality

Injection at high pressure into the close mould results in better flow of liquid into the mould that gives better results due to least atmospheric contact and self curing of mixid liquid. Injection moulding machines used into the production of shoes are highly controlled machines in respect of temperature control, mixing pressure. therefore better and consistant results are obtained.

PU pouring lasting system

The method of pouring the liquid mixture on an open mould. The basic principle involved in this technology is the mixing of two liquid chemicals, Polyol and Isocyanate, using a mixing head and pouring the liquid mixture at low pressure into an open type Aluminium mould, thereby PU remains in open condition for sometime. With PU pouring technology, there are two options. One, where the mixing head is stationary, and the mould holders move; these machines normally have 32, 40, 60, 90, 100 stations, as per production required, and are costly options. In other type, the mixer is moved manually, while the mould holders/ moulds remain stationary; in such a case 6, 12, 18, 24 andup to 32 stations/ moulds and is a more economic option.

Fig. 3: PU pouring Machine.

Pouring Method

Possibility of blending waste to lower cost but also result in lower quality:

Possibility of blending solid additives (such as PU waste, cork, barium sulfate and many others) with Polyol and isocyanate within the mixing chamber. Liquid mix remains in open condition resulting in lower quality:

The basic principle involved in this technology is the mixing of two liquid chemicals, Polyoland Isocyanate, using a mixing head and pouring the liquid mixture at low pressure into an open type mould, thereby PU remains in open condition for sometime.

Low pressure mixing

Mixing and pouring is done at low pressure that result in poor results as compared to direct injection process, in particular bond strength is badly effected. PU remains in open condition for sometime.

Cemented lasting construction

In this process the upper is attached to the insole by cement (this is where the name comes from). The sole is attached to the lasted upper by an adheshive method. The result is the permenant bond between three elements (upper, insole, sole). There is no stitching. Many women and children shoes along with a large number of men's dress and casual type of shoes are made following this process.Cement construction (also known as stuck on) is used for lightweight and flexible shoes and the outsole is stuck to the upper by adheshive. The key advantages of cemented shoes are that they keep their shape and last a long time if cared for properly. The disadvantages of the cementing technique is that its time consuming to produce, making the footwear slightly more expensive.

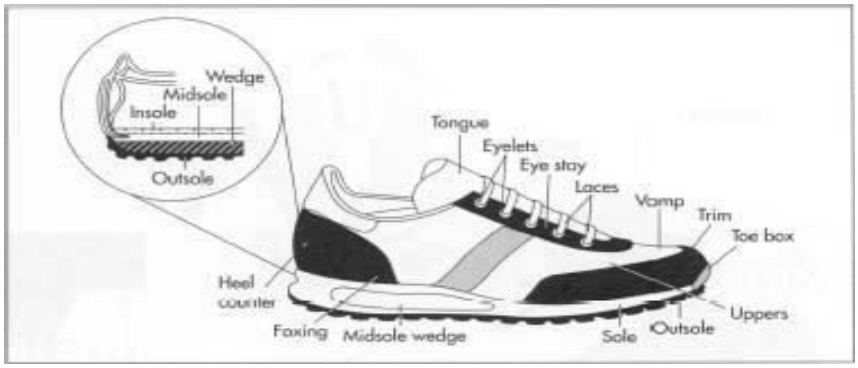


Fig. 4: Cemented lasted full shoe.

The pros and cons of this construction are given below:

Pros	Cons
Less expensive	Cannot be resoled
Much quicker production	Cheaper look
Good for casual and dress shoes	Heavier construction

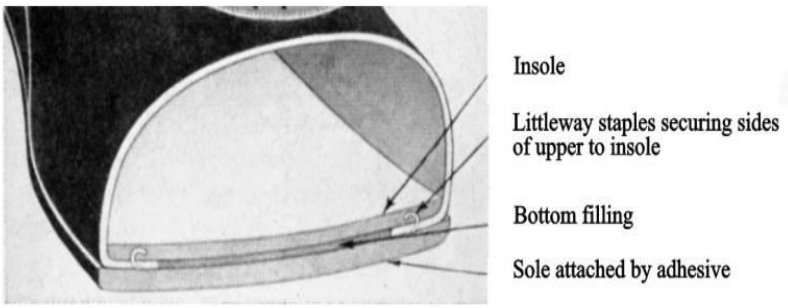


Fig. 5: Cemented lasting construction.

Operational sequences of lasting department of Royal Footwear Ltd

In Royal Footwear industry, some sequences are maintained to produce a quality product. After preparing the complete upper, upper is lasted in the lasting department. And in this department some parameters are maintained. If these parameters are not maintained properly, then the shoe is rejected as not ok product. Then the upper should not to pass for next operation.

Operational sequences of lasting department of Royal Footwear industry is given below:

SL No.	Operation Name
1	Backpart molding heating
2	Chiller mold
3	Backpart molding chilling
4	Upper storage after back part molding
5	Last management for production
6	Last management storage
7	Board lasting attach inside
8	Board lasting cementing of upper and insole
9	Toe lasting
10	Quarter lasting
11	Heel lasting
12	Lacing of shoes for lasting
13	Heat setting

Back part molding heating

i. Interface temperature 80-100 degree centri-gate temperature must be achieved
ii. Heater bases must be clean and no glue must block the airflow of the machine
iii. Correct size heaters must be used matching the size of the counter and upper

Chiller mold

Back part molds used frequently in production. So that molds must be stored in refrigerator below 5 degree celcius.

Backpart molding chilling

Interface temperature should be 40 degree celcius after existing chilling mold.

Upper storage after back part molding

i. Store molded upper in clamp or rack immediately after removing from chiller mold
ii. Uppers must not be stacked on top of each other
iii. Maintain upper shape by placing uppers correctly in rack

Last management for production

1. Operators must remove dirt, cement, etc. prior to returning or loading lasts to production line
2. All damaged lasts must be repaired or replaced
3. Lasts must not be used as a hammering tool
4. To ensure all lasts are clean, undamaged and in good condition

Last management storage

1. All storage racks must be clearly marked showing last model and size
2. Last inventory must be kept, posted and app-lied
3. Last inventory must show the last code and stock of lasts by size

Board lasting attach insole

1. No staples or nails to be used for attachment
2. Insole position maximum 2mm from toe edge
3. Printing side of insole must be visible

Board lasting cementing of upper and insole

1. Adhesive must be applied between 10 and 15 mm wide to upper lasting margin

2. Cementing must cover marked lasting line
3. Minimum 15mm lasting allowance cemented
4. No metal clip brushes or tooling should be used

Toe lasting

1. Toe lasting machine cycle time for final pressing must be minimum 4 second
2. Tongue must tucked inside under lacing
3. Bomb sight must be used to align upper in machine
4. Lasted upper must reach marked line
5. Upper must be lasted in pairs

Quarter lasting

1. Uppers must be lasted medial (inside) quarter first
2. Side lasting margin correctly follows the insole lasting margin line
3. Outside counter must be level between lateral and medial side

Heel lasting

1. Heel must be pressed in seat lasting machine for minimum of 4 second
2. Operator must check each pair for heel height on a measuring platform
3. Heel lasting margin correctly follows the insole lasting margin line
4. Heel must be centered and fit to back height pin

Lacing of shoes for lasting

1. Holding frame must be used to secure shoes for lacing
2. Use correct lacing hook to tighten lace
3. Tongue must be under lacing
4. Tongue must be straight
5. Eyelets must be parallel

Heat setting

1. Heating setting 70-80 degree centrigate temperature at top of shoe
2. Upper must fit tight to last

Description of articles of Royal Footwear Ltd

In Royal footwear Ltd, three type of footwear mainly produced. These are PU pouring lasted shoe, Cemented constructed shoe, Direct injected shoe. These three type constructed shoes are produced in this industry. The examples of these constructed shoes are given below:

Shoe construction method	Article name
1. Direct injection process	Aqua 50 Men
	Aqua 100 JR
	TS 700 JR
	In many adult
2. PU pouring construction	Jhon
	Marco
3. Cemented construction	Ezee Cash

Controlling parameters of articles in lasting department

1. Direct injection process

a) Aqua 50 Men

Controlling parameters which are controlled in the lasing department to inject thermoplastic rubber to complete the shoe are given below:

1. Pressure: 45 (+/- 5) bar
2. Temperature: 185/190 degree celcius
3. Temperature tolerance: +/- 10 degree celcius
4. Injection temperature: 185/190 degree celcius
5. Injection temperature tolerance: +/- 10 degree celcius

Instructions which are followed to complete the shoe are given below:

1. Compound suppliers finished injection recommendations as respected
2. Machine settings must respect posted compound molding requirements
3. Pressure should be 45 (+/- 5) bar
4. Injection temperature 185/190 degree celcius

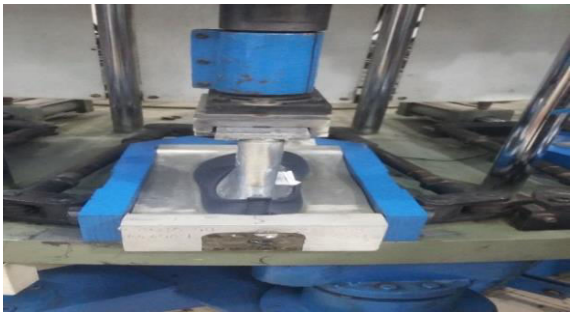


Fig. 6: Aqua 50 men directly injected by TPR.

Check points to maintain the quality of shoe are -

1) Flash
2) Toe height
3) Back height
4) Off centre
5) Pinch mark
6) Sole crack
7) Upper tear
8) Incorrect deco stitch
9) Short injection

b) Aqua 100 JR

Controlling parameters which are controlled in the lasing department to inject thermoplastic rubber to complete the shoe are given below:

1. Injection pressure: 40 (+/- 5) bar
2. Injection temperature: 180/185/190 degree celcius
3. Injection temperature tolerance: (+/- 10)

Instructions which are followed to complete the shoe are given below:

1. Compound suppliers finished injection recommendations as respected
2. Machine settings must respect posted compound molding requirements
3. Injection pressure: 40 (+/- 5) bar

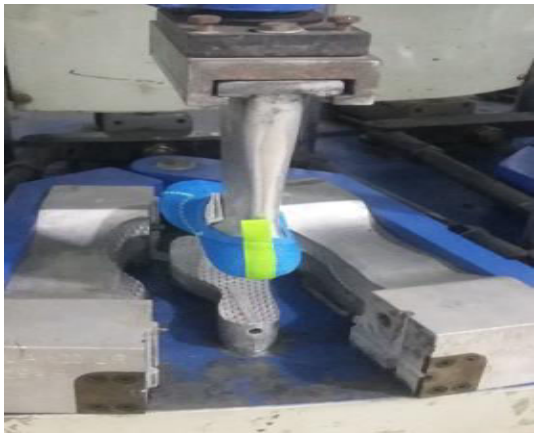


Fig. 7: Aqua 100 JR directly injected by TPR.

Check points to maintain the quality of the shoe are -

1. Flash
2. Toe height
3. Back height
4. Off centre
5. Pinch mark
6. Sole crack
7. Upper tear
8. Incorrect deco stitch
9. Short injection

c) TS 700 JR

Controlling parameters which are controlled in the lasing department to inject thermoplastic rubber to complete the shoe are given below:

1. Injection pressure: 50 bar
2. Tolerance: +/- 10 bar
3. Holding pressure: 40 bar
4. Tolerance: +/- 10 bar
5. Injection temperature: 170/175/180 degree celcius
6. Temperature tolerance: +/- 10 degree celcius

Instructions which are followed to complete the shoe are given below

1. Compound suppliers finished injection recommendations as respected
2. Machine settings must respect posted compound molding requirements
3. Injection pressure 50 bar
4. Holding pressure 40 bar
5. Injection temperature 170/175/180 degree celcius

Fig. 8: TS 700 JR directly injected by TPR.

Check points to maintain the quality of the shoe are

a) Flash
b) Toe height
c) Back height
d) Off centre
e) Pinch mark
f) Sole crack
g) Upper tear
h) Incorrect deco stitch
i) Short injection
j) Pair match (Vamp length and medial height)
k) Outsole quality (No PVC burn)
l) Bonding gap
m) Back pinch and counter pinch distance.

d) In many adult

Controlling parameters which are controlled in the lasing department to inject poly vinyl chloride to complete the shoe are given below:

1. Injection pressure: 70 bar
2. Holding pressure: 50 bar
3. Pressure tolerance : +/- 10 bar
4. Injection temperature: 180/185/192 degree celcius
5. Tolerance: +/- 10 degree celcius

Instructions which are followed to complete the shoe are given below:

a. Compound suppliers finished injection recommendations as respected
b. Machine settings must respect posted compound molding requirements
c. Injection pressure 70 bar
d. Holding pressure 50 bar
e. Injection temperature 180/185/192 degree celcius

Fig. 9: In many adult injected by poly vinyl chloride.

Check points to maintain the quality of the shoe are

1. Flash
2. Toe height
3. Back height
4. Off centre
5. Pinch mark
6. Sole crack
7. Upper tear
8. Incorrect deco stitch
9. Short injection
10. Cleaniness/ Color migration
11. Inside bump/ wrinkle
12. Bonding gap
13. Stitching problem

2. PU Pouring construction

A. John

Controlling parameters which are controlled in the lasing department to pouring PU to complete the shoe are given below

- Pressure: 60 bar
- Tolerance: (+/- 10) bar
- Temperature: 80 Degree Celsius

Fig. 10: John Sandal.

Check points to maintain the quality of the shoe are

- Short injection
- Upper tear
- Sole crack
- Bonding gap

B. Marco

Controlling parameters which are controlled in the lasing department to pouring PU to complete the shoe are given below:

- Pressure: 60 bar
- Tolerance: (+/- 10) bar
- Temperature: 80 Degree Celsius

Fig. 11: Marco sandal.

Check points to maintain the quality of the shoe are

- Short injection
- Upper tear

- Sole crack
- Bonding gap

3. Cemented construction:

Ezee cash

Controlling parameters which are controlled in the lasing department to complete the shoe are given below:

- Pressure: 50 bar
- Tolerance: (+/- 10) bar
- Temperature: 90 Degree Celsius

Fig. 12: Ezee cash shoe.

Check points to maintain the quality of the shoe are

- Short injection
- Upper tear
- Sole crack
- Bonding gap
- Shank point check
- Zipper point check

Lasting rejection data of different articles of Royal Footwear Ltd

Rejection data of all articles from May month to September is collected. After collecting the rejection data, the all data is analyzed. The data is analyzed and also represented in the graph. Then the graph and result of all data is discussed.

Article Name: Aqua 50 men, Month: May, Date: 01/05/2017-31/05/2017

Week	Production(pair)	Rejection(pair)
1st	14050	195
2nd	14220	200
3rd	14165	180
4th	14506	205
5th	13860	185
Total:	70801	965

Month: June, Date: 01/06/2017-30/06/2017

Week	Production(pair)	Rejection(pair)
1st	14400	170
2nd	15100	165
3rd	13300	130
4th	16200	140
5th	14100	135
Total:	73100	740

Month: July, Date: 01/07/2017-31/07/2017

Week	Production(pair)	Rejection(pair)
1st	16100	150
2nd	14200	140
3rd	14700	145
4th	15300	130
5th	14900	135
Total:	75200	700

Month: August, Date: 01/08/2017- 30/08/2017

Week	Production(pair)	Rejection(pair)
1st	16300	140
2nd	16795	135
3rd	17300	127

4th	16050	125
5th	17200	120
Total:	83645	647

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	15350	110
2nd	16270	95
3rd	17100	115
4th	16795	87
Total:	65465	407

Article Name:Aqua 100 JR, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	10700	90
2nd	11205	95
3rd	10300	97
4th	11706	105
5th	12350	110
Total:	56261	497

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	12301	70
2nd	12795	75
3rd	13140	86
4th	12735	90
5th	12100	95
Total:	63071	416

Month: July, Date: 01/07/2017 to 30/07/2017

Week	**Production**(pair)	**Rejection**(pair)
1st	12105	91
2nd	13195	95
3rd	11767	80
4th	10359	81
5th	11336	85
Total:	58762	432

Month: August, Date: 01/08/2017 to 30/08/2017

Week	Production(pair)	Rejection(pair)
1st	12306	75
2nd	13175	76
3rd	11916	73
4th	10905	70
5th	10395	65
Total:	58697	359

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	13395	70
2nd	13916	75
3rd	14536	73
4th	13560	65
Total:	55407	283

Article Name:TS 700, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	4800	96
2nd	4700	90
3rd	4600	95

4th	4770	86
5th	4010	80
Total:	22880	447

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	5100	105
2nd	5175	96
3rd	5216	96
4th	5100	80
5th	4700	88
Total:	25291	465

Month: July, Date: 01/07/2017 to 30/07/2017

Week	Production(pair)	Rejection(pair)
1st	5220	85
2nd	5100	80
3rd	5310	91
4th	5341	87
5th	4800	79
Total:	25771	422

Month: August, Date: 01/08/2017 to 31/08/2017

Week	Production(pair)	Rejection(pair)
1st	5226	70
2nd	5316	75
3rd	5156	79
4th	5236	65
5th	5000	68
Total:	25934	357

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	5310	70
2nd	5340	65
3rd	5410	60
4th	5200	63
Total:	21260	258

Article Name:In Many Adult, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	6100	85
2nd	6200	80
3rd	6138	95
4th	6210	86
5th	5410	80
Total:	30058	426

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	6516	95
2nd	6420	90
3rd	6310	94
4th	6535	83
5th	6300	75
Total:	32081	437

Month: July, Date: 01/07/2017 to 30/07/2017

Week	Production(pair)	Rejection(pair)
1st	4880	85
2nd	4536	70

3rd	4310	74
4th	4216	65
5th	4020	60
Total:	21962	354

Month: August, Date: 01/08/2017 to 31/08/2017

Week	Production(pair)	Rejection(pair)
1st	7200	70
2nd	7316	71
3rd	7120	65
4th	7410	60
5th	7005	61
Total:	36051	327

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	7445	64
2nd	7310	65
3rd	7550	60
4th	7225	55
Total:	29530	244

Article Name: John, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	2010	25
2nd	2225	30
3rd	2185	33
4th	2195	31
5th	1804	24
Total:	10419	143

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	2184	20
2nd	2285	25
3rd	2310	24
4th	2295	27
5th	2004	22
Total:	11078	118

Month: July, Date: 01/07/2017 to 30/07/2017

Week	Production(pair)	Rejection(pair)
1st	2410	30
2nd	2480	35
3rd	2560	25
4th	2610	34
5th	2100	20
Total:	12160	144

Month: August, Date: 01/08/2017 to 31/08/2017

Week	Production(pair)	Rejection(pair)
1st	2410	30
2nd	2560	35
3rd	2480	25
4th	2510	34
5th	2410	28
Total:	12370	152

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	2510	34
2nd	2420	35

3rd	2640	30
4th	2580	28
Total:	10150	127

Article Name: Marco, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	3005	70
2nd	3105	75
3rd	3095	71
4th	3120	73
5th	3010	72.5
Total:	15335	361.5

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	3120	65
2nd	3210	69
3rd	3280	60
4th	3275	64
5th	3080	60
Total:	15965	318

Month: July, Date: 01/07/2017 to 30/07/2017

Week	Production(pair)	Rejection(pair)
1st	3310	61
2nd	3340	60
3rd	3270	60
4th	3390	50
5th	3310	55
Total:	16620	286

Month: August, Date: 01/08/2017 to 31/08/2017

Week	Production(pair)	Rejection(pair)
1st	3410	61
2nd	3490	50
3rd	3400	40
4th	3200	38
5th	3100	41
Total:	16600	230

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	3550	50
2nd	3510	45
3rd	3680	41
4th	3610	42
Total:	14350	178

Article Name: EZEE, Month: May, Date: 01/05/2017 to 30/05/2017

Week	Production(pair)	Rejection(pair)
1st	1000	30
2nd	908	31
3rd	950	20
4th	980	25
5th	940	22
Total:	4778	128

Month: June, Date: 01/06/2017 to 30/06/2017

Week	Production(pair)	Rejection(pair)
1st	1120	40
2nd	1105	42
3rd	1135	28

4th	1140	20
5th	1190	25
Total:	5690	155

Month: July, Date: 01/07/2017 to 30/07/2017

Week	Production(pair)	Rejection(pair)
1st	1210	43
2nd	1235	49
3rd	1240	45
4th	1250	48
5th	1070	20
Total:	6005	205

Month: August, Date: 01/08/2017 to 31/08/2017

Week	Production(pair)	Rejection(pair)
1st	1220	40
2nd	1290	45
3rd	1140	35
4th	1240	38
5th	1050	22
Total:	5940	180

Month: September, Date: 01/09/2017 to 30/09/2017

Week	Production(pair)	Rejection(pair)
1st	1165	25
2nd	1270	22
3rd	1305	27
4th	1327	30
Total:	5067	104

RESULTS AND DISCUSSION:

After collecting the rejection data varies article such as sample-01 (Aqua 50), sample-02 (Aqua 100 JR), sample-03 (TS-700), sample-04 (In many Adult), sample-05 (Jhon), sample-06 (Marcro), sample-07 (Ezee) articles in the lasting department, the data is analyzed. And based on the all data graphical representation of all articles for May to September Months is drawn. This graph of all rejection data for all articles is given below:

Sample 1 (Aqua 50)

The rejection data and graphical representation of the article (aqua 50) from May month to September is given below:

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	70801	965	1.3%
June	73100	740	1%
July	75200	700	0.93%
August	83645	647	0.77%
September	65465	407	0.62%
Total	368211	3459	0.93%

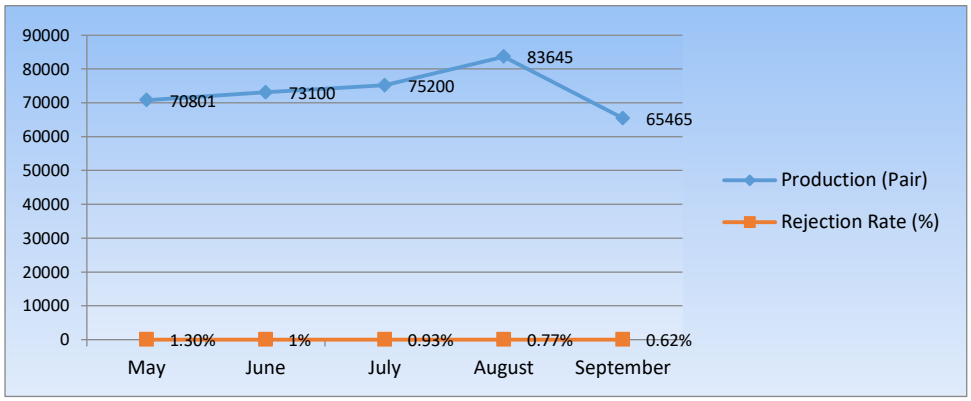


Fig. 13: Graphical representation of rejection data for sample Aqua 50.

In this sample May month rejection 1.3% and September month rejection 0.62%. Finally reduces this percentage 0.68%.

The rejection data and graphical representation of the article (aqua 100) from May month to September is given below:

Sample 2 (Aqua 100 JR)

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	56261	497	0.87%
June	63071	416	0.65%
July	58762	432	0.73%
August	58697	359	0.61%
September	55407	283	0.51%
Total	292198	1987	0.68%

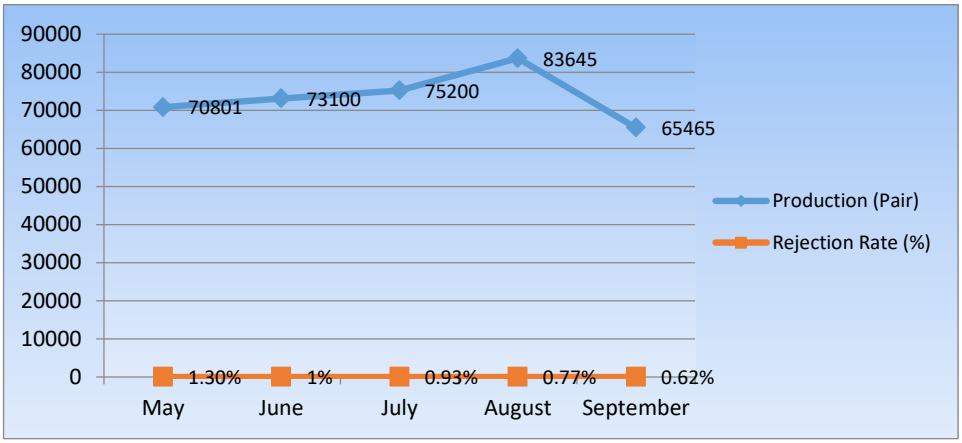


Fig. 14: Graphical representation of rejection data for sample Aqua 100.

In this sample May month rejection 0.88% and September month rejection 0.51%. Finally reduces this percentage 0.37%.

Sample 3 (TS-700)

The rejection data and graphical representation of the article (TS 700) from May month to September is given below -

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	22880	447	2%
June	25291	465	1.8%
July	25771	422	1.6%
August	25934	357	1.3%
September	21260	258	1.2%
Total	121136	1949	1.6%

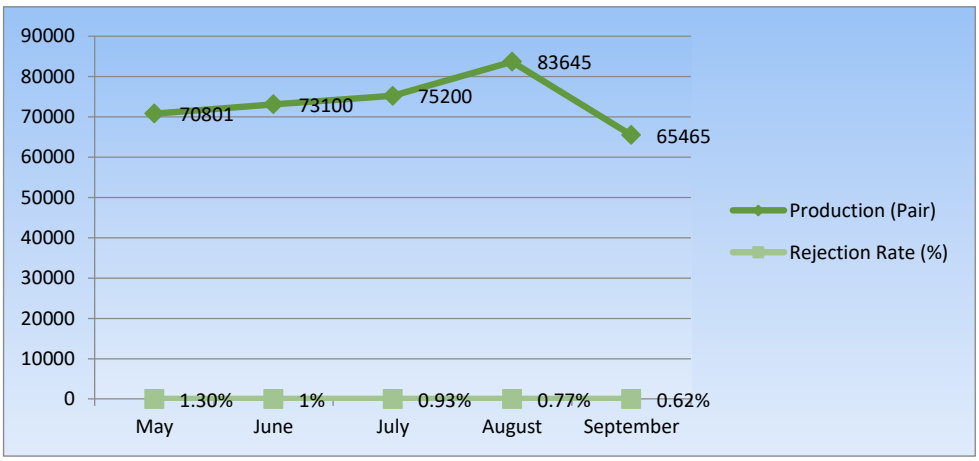


Fig. 15: Graphical representation of rejection data for sample TS 700.

In this sample May month rejection 2% and September month rejection 1.2%. Finally reduces this percentage 0.8%.

Sample 4 (In many Adult)

The rejection data and graphical representation of the article (In many Adult) from May month to September is given below:

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	30058	426	1.4%
June	32081	437	1.3%
July	21962	354	1.6%
August	36051	327	0.9%
September	29530	244	0.82%
Total	149682	1788	1.19%

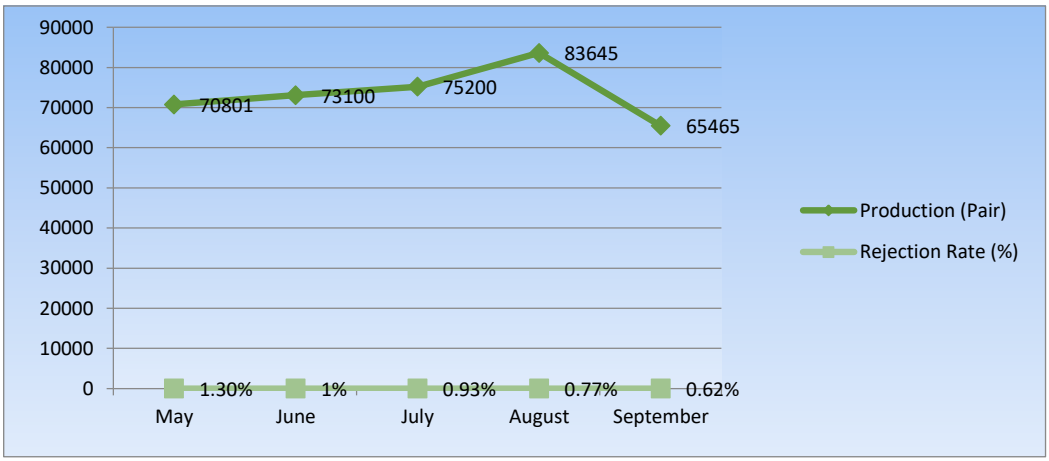


Fig. 16: Graphical representation of rejection data for sample in many Adult.

In this sample May month rejection 1.4% and September month rejection 0.82%. Finally reduces this percentage 1.2%.

Sample 5 (Jhon)

The rejection data and graphical representation of the article (John) from May month to September is given below:

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	10419	143	1.3%
June	11078	118	1.06%
July	12160	144	1.18%
August	12370	152	1.22%
September	10150	127	1.25%
Total	56177	684	1.2%

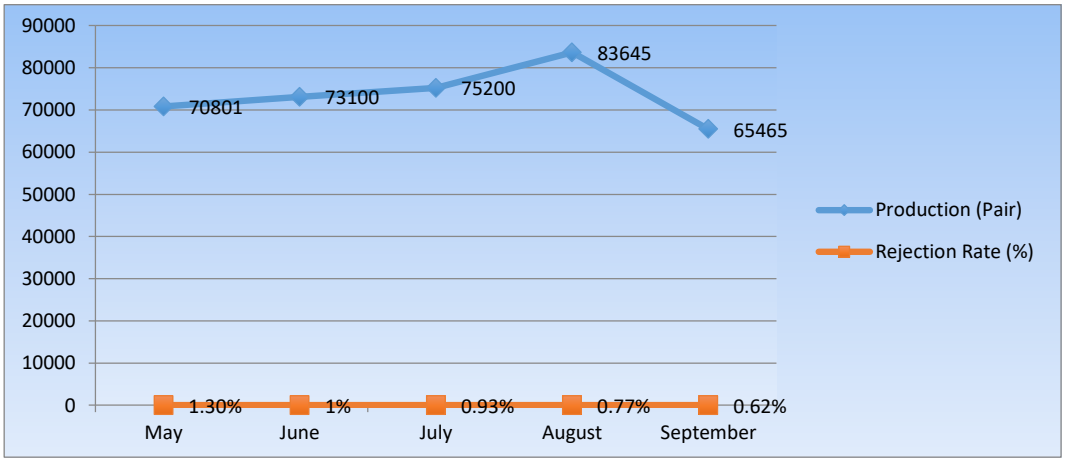


Fig. 17: Graphical representation of rejection data for sample John.

In this sample May month rejection 1.3% and September month rejection 1.25%. Finally reduces this percentage 0.05%.

Sample 6 (Marcro)

The rejection data and graphical representation of the article (Marco) from May month to September is given below:

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	15335	361.5	2.3%
June	15965	318	2%
July	16620	286	1.7%
August	16600	230	1.38%
September	14350	178	1.24%
Total	78870	1373.5	1.74%

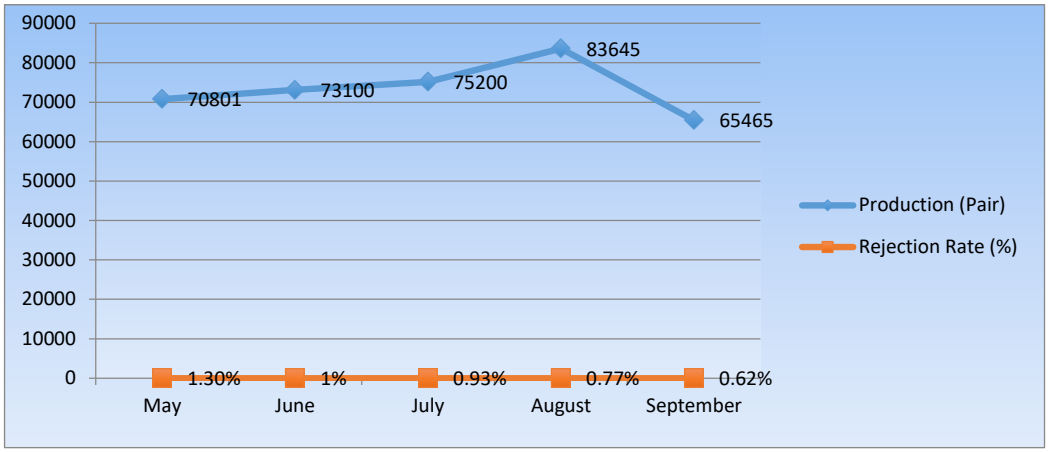


Fig. 18: Graphical representation of rejection data for sample Marco.

In this sample May month rejection 2.3% and September month rejection 1.24%. Finally reduces this percentage 1.06%.

Sample 7 (Ezee)

The rejection data and graphical representation of the article (Ezee) from May month to September is given below:

Month	Production (Pair)	Rejection of Pair	Rejection Rate (%)
May	4778	128	2.67%
June	5690	155	2.72%
July	6005	205	3.4%
August	5940	180	1.8%
September	5067	104	2.05%
Total	27480	772	2.58%

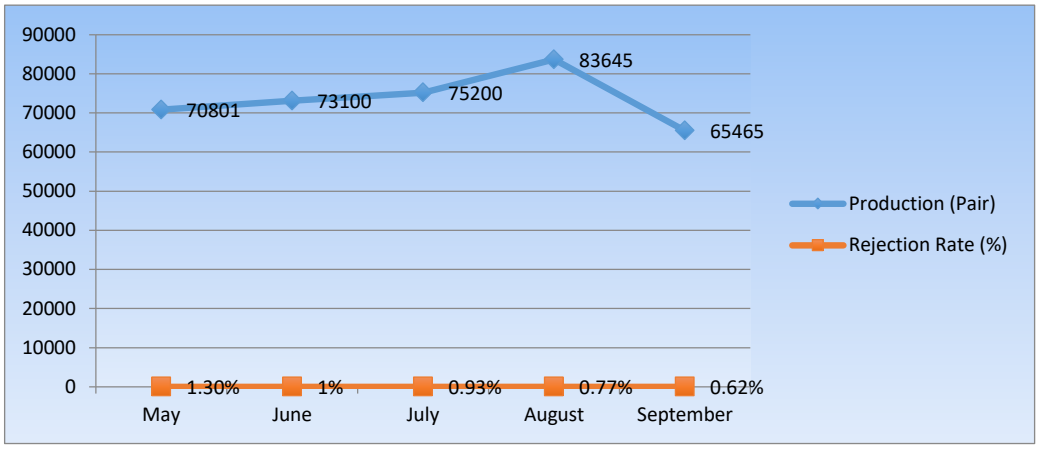


Fig. 19: Graphical representation of rejection data for sample Marco.

In this sample May month rejection 2.67% and September month rejection 2.05%. Finally reduces this percentage 0.62%. From the above graph, we can see that rejection in the lasting department is increasing with the increment of the production of the individual article. And we also see that the rejection of shoe is also decreasing from May month to September month.

From the analysis, it has been found that how the rejection of the footwear is occurred in the lasting department and also tried to control the rejection of the shoe. Analyze Sample-01 (Aqua 50), Sample-02 (Aqua 100 Jr), Sample-03 (Ts-700), Sample-04 (In Many Adult), Sample-05 (Jhon), Sample-06 (Marcro), Sample-07 (Ezee) and collect 6 months (May to September) rejection data and the graphical representtation is giving below

Sample Name	Total Production (Pair)	Total Rejection (Pair)	Total Rejection Rate (%)	Remarks
Sample-01 (Aqua 50)	368211	3459	0.93	Bonding gap, upper tear, sol ecrack
Sample-02 (Aqua 100 Jr)	292198	1987	0.68	Bonding gap, upper tear, sol ecrack
Sample-03 (Ts-700)	121136	1949	1.6	Bonding gap, upper tear, sol ecrack
Sample-04 (In Many Adult)	149682	1788	1.19	Bonding gap, upper tear, sol ecrack
Sample-05 (Jhon)	56177	684	1.2	Bonding gap, upper tear, sol ecrack
Sample-06 (Marcro)	78870	1373.5	1.74	Bonding gap, upper tear, sol ecrack
Sample-07 (Ezee)	27480	772	2.8	Bonding gap, upper tear, sol ecrack

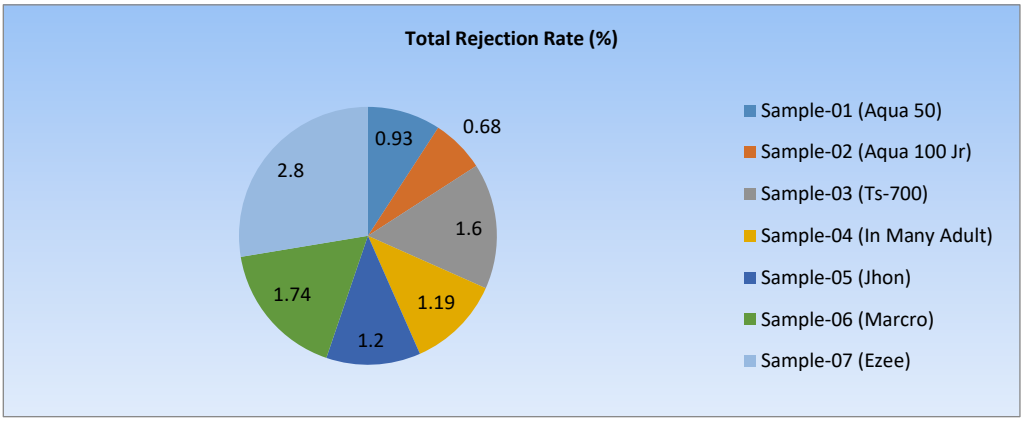


Fig. 20: Presentation of total rejection data.

CONCLUSION AND RECOMMENDATIONS:

In this research, rejection data of lasting department is collected and analyzed. And the graphical representation of the data is also visualized. A conclusion is made about the rejection rate of different type footwear for six months. Finally, I tried to make develop a rejection rate for lasting department of footwear industry. Analyzed May month average rejecttion rate all sample 1.69% and October month less rejection rate 1.44%. Finally rejection data reduces 0.25%.

1) Development of how to control rejection of footwear in lasting department.
2) As there is no survey for calculating rejection of the footwear in lasting department in Footwear industry, so the survey could repeat after a certain period to see the changes of the rejection rate.

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CONFLICTS OF INTEREST:

The author's affirms that there are no potential conflicts of interest in the article's publication

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