



Faculty of Engineering
Department of Textile Engineering

**Application Of Industrial
Engineering In Garments
Sewing Floor**

Course Code: TE-4214 Course Title: Project (Thesis)

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LETTER OF APPROVAL

To,

The Head

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102, Shukrabad, Mirpur Road, Dhaka 1207

Subject: Approval of Project Report of B.Sc. in TE Program

Dear Sir

We are just writing to let you know that this project report titled as “Application of Industrial Engineering In Garments Sewing Floor” has been prepared by the students Md. Zahidul Islam ID.103-23-2199, Md. Momtazul Islam ID.151-23-171 is completed for final evaluation. The whole report is prepared based on the proper investigation and interruption through critical analysis empirical data with required belongings. The students were directly involved in their project activities and the report become vital to spark of much valuable information for the readers.

Therefore, it will highly appreciate if you kindly accept this project report and consider it for final evaluation.

Yours sincerely

Sharmin Akter

Lecturer

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of Sharmin Akter, Lecturer, Department of TE, and Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree.

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ABSTRACT

This project is on “Application of Industrial Engineering In Garments Sewing Floor”. Traditionally operated garment industries are facing problems like low productivity, longer production lead time, high rework and rejection, poor line balancing, low flexibility of style changeover etc. These problems were addressed in this study by the implementation of lean tools like cellular manufacturing, single piece flow, work standardization, just in time production, etc. After implementation of lean tools, results observed were highly encouraging. Some of the key benefits entail production cycle time decreased by 8%, number of operators required to produce equal amount of garment is decreased by 14%, rework level reduced by 80%, production lead time comes down to one hour from two days, work in progress inventory stays at a maximum of 100 pieces from around 500 to 1500 pieces. Apart from these tangible benefits operator multiskilling as well as the flexibility of style changeover has been improved. This study is conducted in the stitching section of a shirt manufacturing company. Study includes time studies, the conversion of traditional batch production into single piece flow and long assembly line into small work cell.

TABLE OF CONTENT

Content	Page no
CHAPTER01 Introduction	1
1.1 Activities of Industrial Engineering	3
1.2 Objectives Industrial Engineering	3
1.3 Functions of Industrial Engineering	3
1.4 Techniques of Industrial Engineering	4
1.5 IE Job Profile	5
1.5.1 Organogram of IE Department	6
1.6 Industrial Engineering	7
1.6.1 Lean Manufacturing	7
1.6.2 5S	8
1.6.2.1 5S Example	8
1.6.3 JIT	9
1.6.3.1 Objectives of JIT	9
1.6.4 KANBAN	9
1.6.4.1 Advantages of Kanban Process	10
1.6.5 KAIZEN	10
1.6.5.1 How does kaizen Work	10
1.6.5.2 Purpose of Kaizen	11
1.6.5.3 Target of Kaizen	11
CHAPTER02 Work Study	12
2.0 Work Study	13
..2.1 Father of work study	13
2.2 Distinct Discipline of Work Study	13

2.3 Work Study Procedure 14

2.4 Characteristics of Work study Engineer 15

2.5 Function of Work Study Engineering 16

2.5.1 Engineering Function..... 16

2.6 General Function... 16

2.7 Steps Involved 17

2.8 Standard Time and target Setting 18

2.9 Method Analysis..... 18

2.10 Workplace Layout... 18

2.11 Operation Sequence..... 19

2.12 Work Aids and Attachments 19

2.13 Operation Monitoring..... 19

2.14 Cycle Checks 19

CHAPTER03Method Study	22
3.0 Method Study for article of clothing tasks	23
3.1 Selection of Work to be considered.....	23
3.2 Recording of Every important truth of current strategy	23
3.3 Critical Examination of those actualities	23
3.4 Development of most handy, financial and powerful strategy	23
3.5 Installation of New techniques	24
3.6 Maintenance of the new technique and occasional checking	24
 CHAPTER04Timestudy	 25
4.0 Time Study for article of clothing tasks	26
4.1 Definition of Time Study	26
4.2 Reduce line setting time for assembly line.....	28
 CHAPTER05 Garments Sewing in Mass Production	 35
5.0 Estimation Of article of clothing generation... ..	36
5.1 Machineries utilized for Garment Sewing in Mass Production.....	37
5.2 Calculate or check machine SPI.....	38
5.3 Machines expected to make Basic T-Shirts	39
5.4 Calculate Machine necessity for article of clothing to be made in a get together line	39
 CHAPTER 06 Garments Production and Efficiency Calculation	 42
6.0 Estimation Of article of clothing generation	44

6.1 Formula for generation estimation.....	44
6.2 Calculate SAM Or SMV Of a Garment	45
6.3 Standard Minutes (SAM or SMV) for Few Basic Garment Products.....	46
6.4 Calculate productivity of a creation cluster or line	46
6.5 Standard productivity and by and large proficiency	47
6.6 The Concept of Operator's Performance Rating	48
6.6.1 Definition of Performance Rating	48
6.6.2 100% execution or Normal Performance	48
6.6.3 Characteristic of 100% Performance or Normal administrator	48
6.6.4 Accurate rating	48
6.7 Calculate Operator Worker efficiency	49
6.7.1 Efficiency estimation recipe	49
6.7.2 On-Standard Operator Efficiency	50
6.8 Use of Takt Time in Apparel Industry	50
CHAPTER 07 Thread Consumption.....	52
7.0 Calculate string utilization for articles of clothing... ..	53
CHAPTER 08 Productivity... ..	55
8.0 Productivity... ..	56
8.1 Measure Of labor productivity... ..	56
CHAPTER 09 Conclusion	58
Reference	60

Chapter: 01

Introduction of Industrial Engineering

1.0 Introduction:

Present techno financial situation is set apart by expanding rivalry in pretty much every part of economy. The desire for the clients are on the ascent and makers need to plan, and deliver well in whatever number assortment as could be expected under the circumstances (idea of financial aspects of scale is no more talked off) to take into account the requests of the clients. In this manner there is a test before the businesses to make products of right quality and amount and at opportune time and at least expense for their survival and development. This requests the expansion in beneficial effectiveness of the association. Modern Engineering will assume a significant job in expanding profitability. Different mechanical designing procedures are utilized to break down and enhance the work technique, to wipe out waste and legitimate assignment and use of assets.

Modern designing is a calling in which an information of numerical and characteristic sciences picked up by study, understanding and practice is connected with judgment to build up the approaches to use financially the materials and other common assets and focal point of nature to serve humankind.

American Institute of Industrial Engineers (AIIE) defines Industrial Engineering as follows:

Industrial Engineering is concerned with the design, improvement and installation of integrated system of men, materials and equipment. It draws upon specialized knowledge and skills in the mathematical, physical sciences together with the principles and methods of engineering analysis and design to specify, predict and evaluate the results to be obtained from such systems.

1.1 Activities of Industrial Engineering:

- i) Selection of processes and assembling methods.
- ii) Selection and design of tools and equipment.
- iii) Design of facilities including plant location, layout of building, machine and equipment.
- iv) Design and improvement of planning and control system for production, inventory, quality and plant maintenance and distribution systems.
- v) Development of time standards, costing and performance standards.
- vi) Installation of wage incentive schemes.
- vii) Design and installation of value engineering and analysis system.
- viii) Operation research including mathematical and statistical analysis.
- ix) Performance evaluation.
- x) Supplier selection and evaluation.

1.2 Objectives of Industrial Engineering:

- i) To build up techniques for enhancing the tasks and controlling the creation costs.
- ii) To create software engineers for lessening costs.

1.3 Functions of an Industrial Engineer:

- i) Developing the least complex work techniques and building up one most ideal method for taking the necessary steps.
- ii) Establishing the execution models according to the standard techniques (Standard Time).
- iii) To build up a sound wage and motivating force plans.
- iii) To helping the advancement and planning of a sound stock control, assurance of monetary part size and work in process for each phase of creation.
- iii) Development of cost decrease and cost control software engineers and to build up standard costing framework.

iv) Sound determination of site and building up an orderly format for the smooth stream of work with

1.4 Techniques of Industrial Engineering:

Method study: To establish a standard method of performing a job or an operation after thorough analysis of the jobs and to establish the layout of production facilities to have a uniform flow of material without back tracking.

- Time Study (work estimation):** This is a method used to set up a standard time for an occupation or for a task.
- Motion Economy:** This is utilized to investigations the movements utilized by the administrators take every necessary step. The standards of movement economy and movement examination are extremely helpful in large scale manufacturing or for short cycle monotonous occupations.
- Value Analysis:** It guarantees that no pointless expenses are incorporated with the item and it attempts to give the required capacities at the base expense. Consequently, upgrades the value of the item.
- Financial and non-money related Incentives:** These advances at a balanced pay for the endeavors of the specialists.
- Production, Planning and Control:** This incorporates the getting ready for the assets (like men, materials and machine) legitimate booking and controlling generation exercises to guarantee the correct amount, nature of item at foreordained time and pre-set up expense.
- Inventory Control:** To locate the monetary parcel estimate and the reorder levels for the things so the thing ought to be made accessible to the creation at the opportune time and amount to keep away from stock out circumstance and with least capital bolt up.
- Job Evaluation:** This is a system which is utilized to decide the general worth of occupations of the association to help in coordinating employments and work force and to touch base at sound wage approach.
- Material Handling Analysis:** To deductively investigation the development of materials through different offices to dispose of pointless development to upgrade the proficiency of material dealing with.

1.5 IE Job Profile [5]:

It was only two or three years back that request of a modern specialist has expanded ordinarily. Reason, an Industrial designer can complete a considerable measure to enhance execution of the organization. Be that as it may, the new understudy go out from instructive establishment (Fashion organizations) obtained constrained learning about the activity profile of an Industrial specialist. Greatest works are learnt in plant by working. There is number of devices and methods which are utilized in by mechanical architects to set up a powerful generation framework in the organization. Without having such devices prior generation directors and line bosses confronted trouble in estimating work content, article of clothing costing, and creation arranging effectively, even it was hard to settle orders. Our group has attempted to discover essential assignments those are vital for a designer, and requirements point by point comprehension of generation fields, incorporated into the accompanying. In spite of the fact that activity profile of an Industrial Engineer fluctuates organization to organization, the greater part of the activity profile fall under after rundown.

- Knowledge about various sewing creation structures
- Knowledge of an extensive variety of Sewing machine key for the association
- Time consider (Cycle timing)
- Motion examination of the assignments
- Operation isolated
- Preparation of OB (Operation declaration)
- SAM Calculation
- M/C Layout and Work station plan
- Line Set up
- Work Sampling
- Method Study (Seeing Movements of an assignment)
- WIP Control
- Line Balancing
- Capacity contemplate
- Cost estimation of a piece of attire
- Developing and Maintaining Skill Matrix
- Incentives designs

- Calculating Thread Consumption
- Work helps, Guide and Attachment
- Performance Rating

An Industrial Engineer must have learning and inclination on every gadget and procedure. Execution of all gadgets without a moment's delay isn't required. Engineer needs to go all around requested. All work look at instruments and procedure are gotten from others undertakings and executed to the bit of apparel industry. So each work ponder mechanical assembly has guaranteed advantage in case it is used enough

1.5.1 Organogram Of IE department In Far East Knitting&Dyeing Industries Ltd [5].

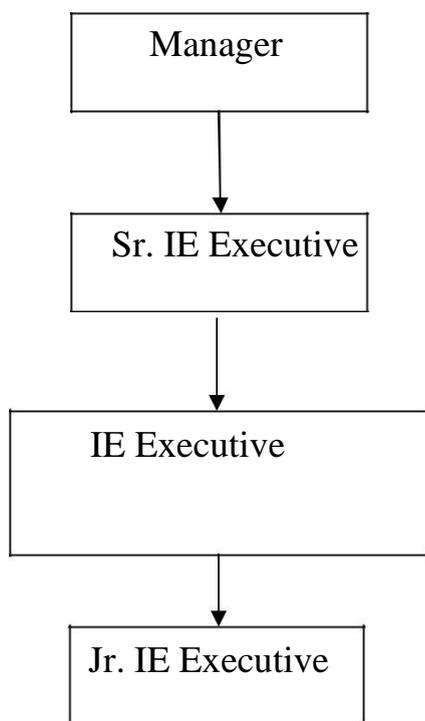


Figure 01

1.6 Industrial Engineering Tools:

- I) Lean Manufacturing
- II) 5S
- III) JIT (Just in Time)
- IV) Kanban
- V) KAIZEN

1.6.1 Lean Manufacturing:

Lean Manufacturing, additionally called Lean Production, is an arrangement of devices and philosophies that goes for the constant end of all loss in the generation procedure. The primary advantages of this are bring down creation costs, expanded yield and shorter generation lead times. All the more particularly, a portion of the objectives include:

Defects and wastage: Lessen absconds and pointless physical wastage, including abundance utilization of crude material information sources, preventable imperfections, costs related with reprocessing blemished things, and superfluous item attributes which are not required by clients

Cycle Times: Lessen absconds and superfluous physical wastage, including overabundance utilization of crude material data sources, preventable deformities, costs related with reprocessing blemished things, and pointless item attributes which are not required by clients;

Inventory levels: Limit stock dimensions at all phases of creation, especially works in-advance between generation stages. Lower inventories likewise mean lower working capital necessities;

Labor productivity: Enhance work efficiency, both by diminishing the inert time of specialists and guaranteeing that when laborers are working, they are utilizing their exertion as gainfully as could be expected under the circumstances (counting not doing superfluous undertakings or pointless movements);

Utilization of equipment and space: Utilize hardware and assembling space all the more proficiently by disposing of bottlenecks and amplifying the rate of generation however existing gear, while limiting machine downtime;

Flexibility: Can deliver a more adaptable scope of items with least changeover expenses and changeover time.

Output: Seeing that decreased process durations, expanded work profitability and disposal of bottlenecks and machine downtime can be accomplished, organizations can by and large altogether expanded yield from their current offices.

The majority of these advantages prompt lower unit generation costs – for instance, more viable utilization of hardware and space prompts bring down devaluation costs per unit

delivered, more compelling utilization of work results in lower work costs per unit created and bring down deformities prompt lower cost of merchandise sold.

1.6.2 5S:

5S speaks to 5 disciplines for keeping up a visual work environment (visual controls and data frameworks).

These are fundamental to Kaizen (constant enhancement) and an assembling procedure based "Lean Manufacturing" (squander evacuating) ideas.

5S is one of the exercises that will help guarantee our organization's survival.

1. **Sort** - All unneeded instruments, parts and supplies are expelled from the zone
2. **Set all together** - A place for everything and everything is in its place
3. **Shine** - The zone is cleaned as the work is performed
4. **Standardize** - Cleaning and distinguishing proof techniques are reliably connected
5. **Sustain** - 5S is a propensity and is constantly moved forward

Additionally - Work territories are sheltered and free of perilous or risky conditions.

1.6.2.1 5S Examples:



Figure 02

1.6.3 JIT (Just In Time):

- JIT logic implies getting the correct amount of merchandise at the ideal place and the opportune time.
- JIT surpasses the idea of stock decrease.
- JIT is a sweeping theory found on dispensing with waste.
- Waste is anything that does not include esteem.

An expansive JIT see is one that includes the whole association.

1.6.3.1 Objective of JIT:

- Produce just the items the client needs.
- Produce items just at the rate that the client needs them.
- Produce with flawless quality.
- Produce with least lead time.
- Produce items with just those highlights the client needs.
- Produce with no misuse of work, material or gear - each development must have a reason so that there is zero inert stock.
- Produce with strategies that take into account the improvement of individuals.

1.6.4 KANBAN:

KANBAN, a procedure for work and stock discharge, is a noteworthy part of Just in Time and Lean Manufacturing theory. It was initially created at Toyota during the 1950s as a method for overseeing material stream on the mechanical production system. In the course of recent decades the Kanban procedure, a profoundly proficient and viable plant creation framework, has formed into an ideal assembling condition prompting worldwide intensity.

Kanban remains for Kan-card, Ban-flag. The embodiment of the Kanban idea is that a provider, the stockroom or assembling should just convey segments as and when they are required, so that there is no overabundance Inventory. Inside this framework, workstations situated along creation lines just create/convey wanted segments when they get a card and an unfilled compartment, demonstrating that more parts will be required underway. If there should be an occurrence of line interferences, every workstation will just create enough segments to fill the compartment and after that stop. Moreover, Kanban limits the measure of stock in the process by going about as an approval to deliver more Inventory. Since Kanban is a chain procedure in which orders spill out of one procedure to another,

the creation or conveyance of segments are pulled to the generation line, as opposed to the customary conjecture arranged technique where parts are pushed to the line.

1.6.4.1 Advantages of Kanban Processing:

Gives a basic and reasonable process. Gives fast and exact data. There are low expenses related with the exchange of data. Gives snappy reaction to changes.

There is a strict limit of over-limit in procedures. Keeps away from overproduction. Limits squander.

Full control can be kept up. Agent's obligation to line laborers.

1.6.5 KAIZEN:

It's a Japanese word implies, just, Continuous Improvement.

Kai = to take a section

Zen = to make great.

Together these words intend to dismantle something with the end goal to improve it.

1.6.5.1 HOW DOES KAIZEN WORK:

Ten fundamental standards for Improvement in the perspective of KAIZEN:

1. Throw out the majority of your settled thoughts regarding how to get things done.
2. Think of how the new strategy will function not how it won't.
3. Don't acknowledge pardons. Thoroughly deny business as usual.
4. Don't look for flawlessness. A 50-percent execution rate is fine as long as it's done on the spot.
5. Correct mix-ups the minute they're found.
6. Don't spend a considerable measure of cash on enhancement.

7. Problems allow you to utilize your mind.
8. Ask "why" no less than multiple times until the point that you locate a definitive reason.
9. Ten individuals' thoughts are superior to anything one person's.
10. Enhancement knows no restriction.

1.6.5.2 PURPOSE OF KAIZEN:

Kaizen exercises center around each task and process with the end goal to include esteem and dispose of waste.

Process: is the grouping of tasks expected to plan and make an item.

Task: is one movement performed by a solitary machine or individual on that item.

1.6.5.3 TARGET OF KAIZEN:

Items (Quantity, Rejects and so on.)

Gear (Changeover, Utilization, Breakdown)

Human (Communication, Awareness, Stillness)

Procedures (Waiting Time, Bottleneck, Line Balancing, VCS)

Framework (QC, Specification, Infection).

Chapter: 02

Work Study

2.0 Work study:

Work think about is a precise strategy of technique investigation work estimation and setting of time standard that can be guarantee the most noteworthy efficiency by the ideal utilization of labor, hardware and material.

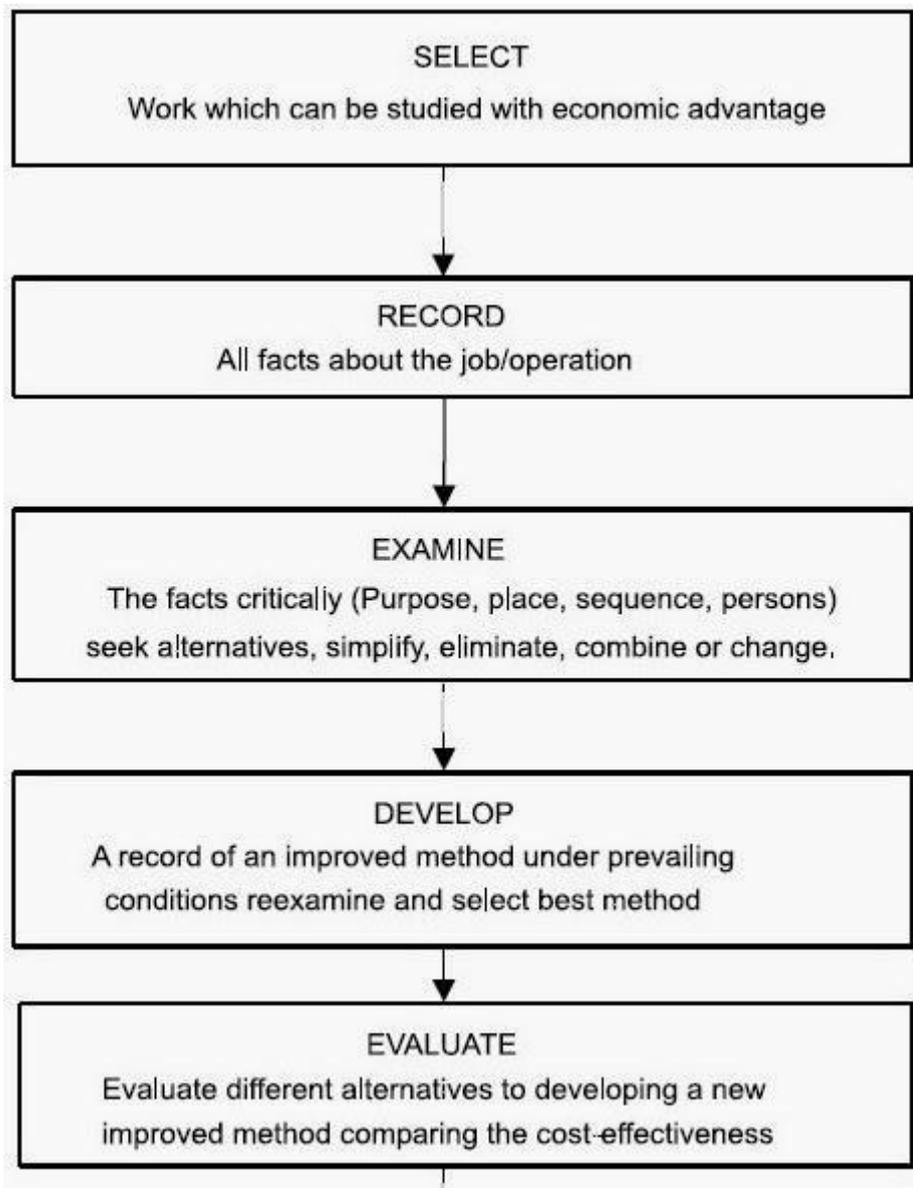
2.1 Father of work study:

FW (Frederic Winslow) tailor who is known as the dad of logical administration is the organizer of work ponder. Amid Second World War USA required numerous arms in brief time. At that point Mr. FW Tailor connected work contemplate idea to make many arm in brief time and got a huge outcome. His thoughts were produced as the worked for different firms and work ponder is being utilized all over. Presently it is circuit is getting to a great extent step by step.

2.2 Distinct discipline of work study:

- Method think about, which is worried about the orderly manner by which the errands is completed, and
- Work estimation, which is worried about the time and exertion required to do the errand.

2.3 Work study procedure:



Work think about is a precise activity methodology. There are numerous articles to be examined methodically to complete the most temperate outcome. The strategy will be proceeded with well ordered for view. We should see the underneath.

- **Select:** Select the assignment to be considered.
- **Record:** Record or gather every important datum about the assignment or process.
- **Examine:** analyze the record realities basically, "the reason for the action, where it is played out, the arrangement in which it is done, the individual who is doing it and by which it is finished".
- **Developing:** Develop the most monetary strategy and drawing as suitable procedure on the commitment of those concerned (administrators, director, laborers and others expert).
- **Evaluate:** Evaluate the outcome accomplished by the new enhanced technique contrasting the cost viability of the chose new strategy with the present technique for execution.
- **Define:** characterize the new technique and the related time and present it to every one of those concerned, either verbally or in composing, utilizing exhibits.
- **Install:** introduce the new strategy, preparing those included, as a concurred practice with the designated time of task.
- **Maintain:** keep up the new standard practice by checking the outcomes and contrasting them and the first target.[5]

2.4 Characteristic of work study engineer:

A work think about specialist should be taught, master, savvy, certain, individual nobility and legitimate. Points of interest beneath

Earnestness and Honest:

The work contemplate individual must be true and legit just if is the situation will he she gain the certainty and regard of those with whom he or she will work.

Energy:

He she should be extremely enthusiastic about the activity, have faith in the significance of what he or she is doing and have the capacity to transmit eagerness to the general population indirect.

Class/Diplomacy:

Class is managing individuals originates from understanding them and not wishing to hurt their inclination by unkind or negligent word, notwithstanding when these might be advocated. Without

advocated no work think about individual will get much of anywhere.

Great Appearance:

The individual must be flawless clean and look productive. This will rouse certainty among the general population with whom he or she needs to work.

Fearlessness:

This can just accompany great preparing and experience of applying work think about effectively. The work contemplate expert must have the capacity to face top administration, bosses or specialists with regards to his assessment and finding, and to do as such so that will regard and not give offense.

2.5 Function Of Work Study Engineering:

2.5.1 Engineering Function:

Technique Study: Space condition, Equipment, Machine connection, Element examine, Effective and ineffectual time isolation, Handling and development, Contingency, Improve specialist execution, Find better method for work, Reduce inadequate time and Increasing needling time, Selling better strategy to other people.

Work Measurement: Cycle check, Observed time, Rating, BMV, and SMV, Production examine, Time consider, setting time standard and inspecting.

General Sewing Data(GSD): Method think about and create inside GSD coding time by lessening pointless errand through technique consider.

Breakdown and Layout: Operation breakdown, Time setting, Process grouping, tight and free stream, Incentive or No motivator design, Operation and laborers determination.

Utilization: All quantifiable trims like Thread, String, Tape, Webbing, Binding, Grosgrain, and Velcro. Versatile, Z-Band/straight, texture and other like.

Figuring: Feeding time, Produced time, Efficiency, Target setting, profitability hole, Individual execution and limit, Potential pieces, Required creation days/hours/laborers, Contingency, AQL,OQL, Accuracy and sure dimension, Cost breakdown point, Ratio, Load go, Sewing time, Effective time, BPT, HPT,LPT,BMV,SMV.

2.6 General Function:

1. **SMV and Production Plan:** SMV estimation and refresh creation plan.
2. **Incentive Package:** Analysis and control generation plan as higher execution level.

3. **Reporting:** Efficiency, Performance, Capacity, Production articulation, Earning

proclamation, Comparison, Factory/line limit, Incentive figuring and administration key data as required.

4. **Keeping History:** Standard information, Product, Earning, Efficiency, Performance, Progression, Target and target proficiency examination.

5. **Data Centralization:** Control and centralization of all information crosswise over units.

6. **Save Material:** Protection to abuse of trims quantifiable like's strings. String, Binding, Tape, Velcro, Elastic, Z-band, Webbing, Grosgrain and so on and countable preferences catch eyelet, Stopper, Puller, Zipper and so forth.

7. **Multi Experience:** Basic quality strategy and acknowledgment level, Basic upkeep, Cutting, Marker, Pattern, Sample and pressing/shipping technique.

8. **Reserved Expert:** To help other people segment where required as held master.

9. **Motivation:** Training, Job offices, Life institutionalization and procedures introduction.

2.7 STEPS INVOLVED:

1. Analyze each style to determine its requirement for production.

2. Style Analysis is based on:

- Firm's quality standards
- Amount of labor required
- Available equipment
- Volume to be produced
- Expected "throughput time"

3. Style requirements are determined through analysis of samples and specifications

4. Apparel Engineers are concerned with:

- Number, complexity and sequence of Operations
- Equipment Required
- Time and Skill Required

5. Operation Breakdown: Work in each style is broken down into operations

An operation B/down is sequential list of all the operations that involved in assembling a garment used to establish the workflow for each style.

6. Apparel engineers study each operation to improve its effectiveness and efficiency and to establish methods to ensure a consistent performance by operators and consistent products.

2.8 Standard Time and Target Setting:

Numerous organizations don't utilize standard time frameworks; target setting depends on mystery and experience. Foundation of Standard occasions and the advancement of the best strategy to make is indispensably vital to enhance profitability. Each organization that desires to contend later on must understand this. This diagram obviously outlines the advantages to manufacturing plant proficiency if standard occasions and all around created strategies are utilized.

2.9 Method Analysis:

The majority of the organizations are utilizing poor strategies, administrators are left to set up most ideal approach to carry out the activity, settle on the quantity of blasts of sewing, collapsing and unfurling of parts, pointless coordinating and extra dealing with, these movements add to the time it takes to fabricate the article of clothing and ought to be dispensed with. Strategy study can be executed in a generation framework whether it is in-house

or on the other hand on an agreement premise. Appropriate technique investigation can enhance profitability by in any event 15%.

2.10 Workplace Layout:

The administration needs to fit however many machines in the processing plant as could be expected under the circumstances, decreasing the extension for strategies enhancement. The space between machines is inadequate much of the time.

A decent work environment design will wipe out pointless movements and weariness bringing about generous increment in the proficiency of the administrator.

Simply take a gander at the image close by and think how productively you will have the capacity to work 8 hours daily sitting in that act.

2.11 Operation Sequence:

A portion of the creation divisions work without a legitimately arranged or composed activity grouping. This is a basic advance in article of clothing creation and an error or carelessness at this stage can result into enormous misfortunes later as far as administrator time, work substance and quality.

2.12 Work Aids and Attachments:

Utilization of work helps and connections is inadequate. Numerous new and modest connections and organizers are in effect consistently created, it is imperative that these advancements are known to guarantee a program of steady enhancement. Numerous new and modest connections and organizers are by and large ceaselessly created, it is indispensable that these advancements are known to guarantee a program of consistent enhancement.

2.13 Operator Monitoring:

A large portion of the organizations reviewed don't have the way to build up their execution against standard, so they have no clue where they stand. There are no legitimate estimations so their

proficiency levels are, best case scenario a figure,

it is difficult to see how they will have the capacity to keep on contending except if they have appropriate controls set up, and have built up efficiency enhancement projects to push ahead later on.

2.14 Cycle Checks:

A basic strategy went for building up administrator potential against their genuine execution, this should be possible by generally unpracticed work think about faculty and is an incredible guide to industrial facility execution enhancement. None of the organizations perform cycle checks. The outline

underneath demonstrates the correlation between plants in Group A (with work consider office) and Group B (without work study division) on different parts of clothing creation.

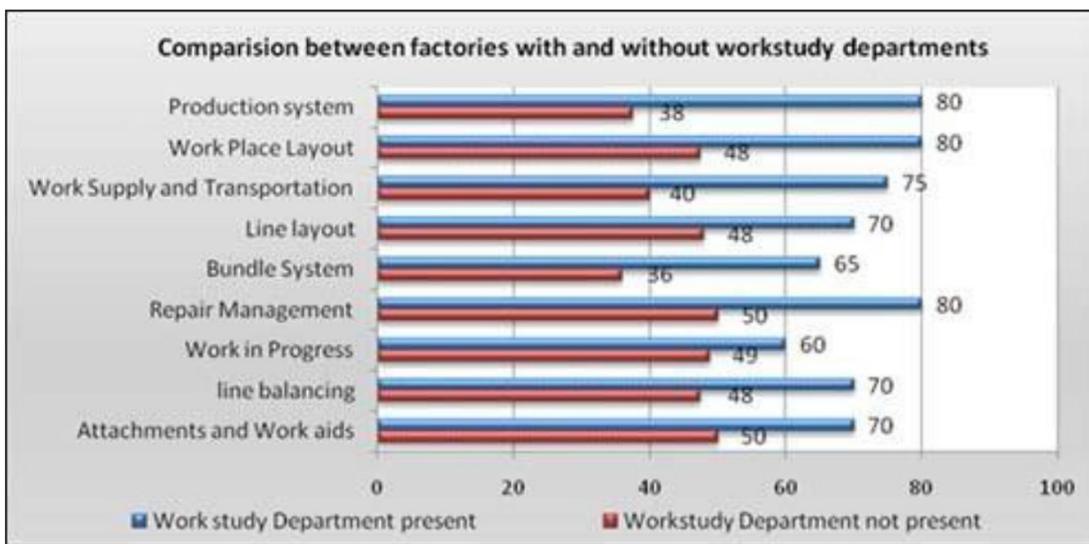


Table 01

Taking a gander at the examination appeared underneath clearly bunch An industrial facilities are more profitable than the gathering B manufacturing plants. This reality is additionally reinforced when the general processing plant overview results are looked at. The manufacturing plants in gathering A have a joined score of 61% for generally speaking execution though production lines in gathering B accomplished a score of just 48%.

Work-think about is the need of great importance and the opportunity has already come and gone that the business stalwarts comprehend its significance and its commitment to benefit.

Chapter: 03
Method Study

3.0 Method Study for article of clothing tasks:

Strategy ponder is to a greater degree a precise way to deal with occupation structure than an arrangement of strategies. It is characterized as the orderly chronicle and basic examination of existing and proposed techniques for doing work, as a methods for creating and applying simpler and more powerful strategies and diminishing expenses. The technique includes methodically following six stages:

3.1 Selection of work to be considered: Most tasks comprise of numerous discrete occupations or exercises. The main stage is to choose those employments to be examined that will give the best returns for the time spent. For instance, exercises with the best degrees for development, those causing postponements or bottlenecks or those subsequent in high expenses.

3.2 Recording of every important truth of current strategy: Method consider utilizes formal procedures to record the succession of exercises, the time connection between various assignments, the development of materials, and the development of staff. There are numerous strategies utilized in technique ponder.

3.3 Critical examination of those actualities: This is the most critical stage in technique contemplate. It is utilized to basically look at the present technique by looking for answers to questions:

- The reason for every component
- The put
- The succession
- The individual
- The implies

3.4 Development of the most handy, financial and powerful strategy: This stage is utilized to build up another and better technique for executing the undertaking, by considering the aftereffects of basic examination. The new technique is created by a blend of totally taking out a few exercises, joining a few sections, changing the grouping of a few exercises and by improving the substance of others.

3.5 Installation of new technique: This progression includes venturing dealing with the progressions and guaranteeing that everyone included comprehends the progressions included. At the end of the day they comprehend the new technique, which is doing what, the distinctions contrasted with the old strategy and urgently the purpose behind the changes. Preparing is a critical piece of this stage especially if the new strategy includes radical changes. Giving altered gear, segments and formats may likewise be included.

3.6 Maintenance of new technique and occasional checking: Monitoring of how successful the new strategy is and how staff have adjusted is imperative. One angle that is once in a while neglected is to check what impact the new strategy has on different exercises. For example, it might be that while the new strategy is effective in killing a bottleneck in a specific region, the bottleneck has moved somewhere else simultaneously. By intermittent checking the new technique and its belongings, administration can guarantee that general proficiency is enhancing as opposed to deteriorating.[1]

Chapter: 04

Time Study

4.0 Time Study for article of clothing tasks:

4.1 Definition of Time Study:

Time examine is a technique for estimating work for account the seasons of playing out a specific particular undertaking or its components did under determined conditions. An administrator does same activity (assignment) for the duration of the day. Time ponder help to characterize how much time is important for an administrator to complete the errand at a characterized rate of execution.

Time think about devices:

- A stop observe
- Time contemplate arrange
- One pen or pencil

The most effective method to direct Time Study

An activity cycle comprises of material dealing with, situating and adjusting parts, sewing, trimming strings and tying and unfastening a package. So in the time think about arrangement, separate entire undertaking into different components as indicated by the movement groupings of the task. For instance, in activity 'neckline run line', assignment components might be I) get board to sew first crease, ii) swing neckline to sew second crease, iii) swing neckline to sew third crease iv) check work and arrange and v) sitting tight for next pieces.

Stage 1: Preparation

- Ready with stationeries like time ponder design, stop watch (advanced one) and pencil
- Select one task for Time contemplate
- Tell the administrator that you are going measure time he/she taking to carry out the activity.
- Observe the task painstakingly and separate activity into components.
- Fill the fundamental data in the time examine arrange. Like machine classification, guide or connection utilized.

Stage 2: Time catching:

Presently measure the time taken for finishing every component of the task cycle by the administrator. Time ought to be caught in short order. Also, catch component timing for successive 5 activity cycles. Amid information catching just note down perusing (see following table-1) of the stop watch and later ascertain component timing. On the off chance that you found any anomalous time in any components record time amid time consider and later dispose of that perusing. Or then again you catch time for one more cycle. Strange time might be happened because of bobbin change, string break, control cut or quality issues.

3: Calculation of Basic time:

From the Reading (R) figures time taken for every component for each of the five cycles just by

Time Study Sheet											
Sheet No: 02						M/c Details: SNLS					
Operation No: run stich collar						Attachment used: N/A					
Fabric: poplin						With/Without UBT? With UBT					
Garment: Full sleeve shirt with single pocket						Style No.: #5075 (Arrow)					
Element Breakdown										Foreign Elements	
Cycle	p/u and stich 1st line		stich 2nd line		stich 3rd line		che ck and dispose		waiting		Description
	T	R	T	R	T	R	T	R	T	R	
1		5		9		12		21		27	
2		31		38		41		49		49	
3		55		58		60		71		76	
4		82		86		89		95		95	
5		102		105		107		110		110	
Summary											

Table-02 Step

deducting past Reading from basic perusing. Entirety up times of five cycles for every component. Note, in the event that you dispose of any perusing than all things considered no. of cycles will be four. Ascertain normal component times. This normal time is called essential time. (In the accompanying table-2 it is noted as normal time).

Time Study Sheet													
Sheet No: 02												M/c Details: SNLS	
Operation No: run stitch collar												Attachment used: N/A	
Fabric: poplin												With/Without UBT? With UBT	
Garment: Full sleeve shirt with single pocket												Style No.: #5075 (Arrow)	
Element Breakdown											Foreign Elements		
Cycle	p/u and stitch 1st line		stitch 2nd line		stitch 3rd line		check and dispose		waiting		T	R	Description
	T	R	T	R	T	R	T	R	T	R			
1	5	5	4	9	3	12	9	21	6	27			
2	4	31	7	38	3	41	8	49	0	49			
3	6	55	3	58	2	60	11	71	5	76			
4	6	82	4	86	3	89	6	95	0	95			
5	7	102	3	105	2	107	3	110	0	110			
Summary													
Total Time	28		21		13		37		11				
Abnormal time									11				
No of cycle	5		5		5		5		5				
Avg Time	5.6		4.2		2.6		7.4		0				
Rating	100		100		100		100		100				
Normal Time	5.6		4.2		2.6		7.4		0				
Allowances	2		29		29		20		0				
Standard T	5.712		5.418		3.354		8.88		0				
S.A. Time (min)									0.3894				
											Allowances: PF&D and M/c delay		
											M/c delays:		
											SNLS= 9%		
											DNLS=14%		
											O/L 3T=7% 4T=9%		
											ST=11%		
Note: T stands for Time and R stands for Reading													

Table-03 Step

4: Calculation of Standard time:

To change over essential time to ordinary you need to increase it with administrator execution rating. Here for instance, rating has been taken 100%. Presently you have include stipends for machine remittances, exhaustion and individual needs and so forth. Add machine remittance just to those components where machine is running and weakness and individual needs to all components. Presently we got standard time for every component in short order. Entirety up all essential time and convert seconds into minutes. This is standard minutes or SAM.

4.2 Reduce line setting time for assembly line:

Engineers and production managers always look for a way to improve factory’s labor productivity. But

they look over things that lower labor productivity. “Higher line setting time” is one of the most

visible reasons at present that reduces factory’s overall productivity. When it takes longer time for setting a line, most of the operators sit idle. That means operators are not utilized in producing garment and operator productivity falls resulting high labor cost. Following piece of article will help you to reduce line time. I have seen factories where 1.5 to 2 days is spent in line setting for woven tops. When line supervisor and engineers are asked why they are taking that much time to set a 40 machines line, they give dozen of reasons. Whatever reasons line supervisor have, is the root cause for the delay. Reasons may vary time to time or style to style. Let’s discuss main points that cause longer time for line setting.

1. Factory starts loading new style to the line once all operators get free from the previous style.
2. Frequent change in line planning.
3. All trims have not been approved or not yet sourced. Until required trims are sourced all operation can’t be started.
4. Few garment components has been sent outside for printing or embroidery but did not received on time.
5. Supervisor did not fully assess the operation sequence or skill requirement for each operation.
6. Operators were not present in the initial operations or critical operations.
7. Quality issue, supervisor not able to give suitable operator for the critical operation
8. Maintenance guy do not able set machine quickly. Replacement of machine, setting guides and attachment takes longer time than it should be.
9. Planning for larger bundle size. At the first day of line setting if bigger bundle size is used then it will take huge amount of time to reach bundle at the last operator.

Now it becomes simple, to start working on reducing line setting time. Work on the above reasons and eliminate them prior to starting of line setting. Once you know the reason you can resolve it. In the following list few remedies has been explained:

DAILY LINE WISE PRODUCTION & EFFICIENCY REPORT

Date : 15.12.2011

IE	LINE	ORDER NO	STYLE NAME	BUYER	FROM DAY	Blown Paper	Blown OP	PRESENT OP	PRESENT HELPER	TOTAL WORKER	WORK HOUR (hrs)	OT WORK (hrs)	TOTAL TARGET	TARGET ADPT(%)	OT PROM	WIP OR NEXT CR	CHRT	LINE EFF	FLOOR EFF	REMARKS	APR	APN TR	
TANVIR AHMED	1	117280	SS R NKT SHIRT	TT	3	100	0.09	13	11	5	4	16	10	1000	1050	1050	1500	60%		Per Min Output			
	2	119151	SS R NKT SHIRT	TT	2	80	0.10	13	9	12	11	21	10	800	464	464	600	22%		1.0			
	3	119397	SS POLO	TT	6	30	0.45	31	18	18	22	36	10	300	200	200	400	25%		25%	LINE 1 WITHOUT BUDGE LBL PROD.		
	4	119222	SS R LADIS NKT SHIRT	TT	6	110	0.13	15	14	15	13	29	10	1100	286	286		13%		Hourly Output			
	5	119151	SS R NKT SHIRT	TT	2	100	0.10	13	14	14	11	29	10	1000	1100	1100	800	35%		62			
			TOTAL			0.87	85	66	64	61	130	50	4200	3110	3110								
ABDUR ROB	6	2658	LS JACKET	SO	2	100	0.17	19	17	9	4	26	13	1300	927	927	400	47%		A			
	7	1439	TANK TOP	SO	18	200	0.08	10	10	13	10	23	10	2000	1850	1850	200	64%					
	8	2658	LS JACKET	SO	3	110	0.20	19	17	11	34	13	3	1430	943	943	300	43%		40%			
	9	3354	MARISA TOP	SO	4	70	0.16	24	13	16	13	29	13	910	510	510	800	22%		Hourly Output			
	10	7642	BOLERO	SO	4	60	0.19	23	11	15	18	26	13	780	614	614	500	35%		76			
			TOTAL			0.80	95	68	70	56	138	62	6420	4844	4844								
RONI	11	0227	SS R NKT SHIRT	SO	3	100	0.11	19	11	4	18	15	13	1300	500	500	1200	30%		Per Min Output			
	12	119616	SS POLO	TT	3	50	0.24	21	14	18	16	32	10	500	200	200	1200	15%					
	13	119222	SS R LADIS NKT SHIRT	TT	5	70	0.13	15	15	10	13	25	10	700	500	500	1000	26%		30%			
	14	119582	SS R NKT SHIRT	TT	4	140	0.09	11	11	4	5	15	10	1400	800	800	1000	46%		Hourly Output			
	15	119745	SS R NKT SHIRT	TT	3	140	0.11	13	11	6	12	17	10	1400	700	700	1200	45%		S2			
			TOTAL			0.68	79	62	42	64	104	53	5300	2730	2730								
RONI	16	326200	TANK TOP	HM	4	170	0.09	15	12	5	5	17	10	1700	1688	1688	1000	78%		Per Min Output			
	17	0227	SS R NKT SHIRT	SO	3	110	0.11	19	13	12	18	25	10	1100	700	700	700	31%					
	18	7642	BOLERO	SO	12	70	0.19	23	15	18	17	33	10	700	550	550	500	32%		35%	LINE 19 NKT SHIRT PROBLE LINE 20 CARE LBL		
	19	1439	TANK TOP	SO	2	120	0.08	10	10	12	10	22	10	1200	853	853	1000	31%		Hourly Output			
	20	303810	SS R NKT SHIRT	HM	9	120	0.13	19	12	11	12	23	10	1200	250	250	800	14%		80.62			
			TOTAL			0.59	86	62	58	62	120	50	5900	4031	4031								
WALULIAH	21	84089	LS HENLY	GS	2	22	0.17	22	10	10	14	20	13	286	173	173	1000	11%		Per Min Output			
	22	84112	SS V NKT SHIRT	GS	7	113	0.17	19	16	14	15	30	10	1130	750	750	1500	43%					
	23	84112	SS V NKT SHIRT	GS	5	96	0.17	19	19	18	15	37	10	960	620	620	1500	26%		0.6	LINE 21 24 NEW ORDER		
	24	303810	MARISA TOP	HM	1	41	0.16	24	15	12	10	27	10	410	103	103	1000	6%		Hourly Output			
	25	303810	SS R NKT SHIRT	HM	12	141	0.07	12	10	3	3	13	10	1410	416	416	800	22%		39	LINE 22,23,25 INPUT PROB		
			TOTAL			0.74	95	70	57	57	127	53	4195	2062	2062								

Figure 06

LINE	ORDER NO	STYLE/NAME	BUYER	PRDN DAY	Hourly Target	Blown SAH	Blown OP.	PRESENT OP.	PRESENT HELPER	TOTAL WORKER	OT HOUR	TOTAL TARGET	TARGET ACC'D (%)	OT PRDN	WIP OF NETOR	LINE EFFI	FLOOR EFFI	REMARKS	AWM	APTR
26	3364	SS R-NK	SO	11	35	0.15	21	20	16	11	35	10	950	438	200	18%				
27/A	787243	LACE TANK TOP	HM	9	280	0.06	13	13	6	8	21	10	2600	2723	800	76%				
27/B	8301-31-806	SS R NKT SHIRT	CA	44	170	0.08	13	13	3	16	10	1700	1385	1000	66%					
28	TW-32	SS POLO	TS	7	110	0.22	23	18	22	40	13	1450	1054	400	45%					
29/A	787242	LACE TANK TOP	HM	9	270	0.05	10	13	5	18	10	2700	2080	2080	1000	69%	56%			
29/B	539851	SS R NKT SHIRT	HM	9	200	0.10	16	14	8	22	10	2000	1838	200	200	84%				
30/A	787062	SS R NKT SHIRT	HM	45	220	0.09	14	14	8	22	10	2200	1961	800	800	80%				
30/B	539851	LECORA	HM	6	200	0.10	14	14	8	10	22	2000	1464	800	1484	67%				
31/A	331543	MARISHA TOP	HM	5	130	0.16	24	22	16	10	38	10	1300	1027	800	43%				
		TOTAL			1.02	148	141	94	91	235	93	17080	13970	13970						
32	539872	LS R NKT SHIRT	HM	3	140	0.11	16	14	15	12	29	10	1400	248	500	9%				
33	328200	TANK TOP	HM	4	232	0.08	15	12	14	9	26	10	2320	800	800	26%				
	846620	MARISHA																		
34	331543	LS R NKT SHIRT	HM	1	140	0.16	24	16	12	10	28	10	1400	30	1538	2%				
35	787041	SS R NKT SHIRT	HM	4	150	0.11	16	12	16	12	28	10	1500	750	1000	29%				
	8301-31-808-802	TANK TOP	CA	1	120	0.08	13	14	3	17	10	1200	750	2000	2000	35%				
35	787041	LACE TANK TOP	HM	3,1	120	0.08	13	14	3	17	10	1200	750	2000	2000	35%				
	787243				0.54	84	68	60	12	128	50	7820	2578	2578						
		TOTAL																		
37/A	787242	LACE TANK TOP	HM	62	233	0.06	13	12	8	8	20	10	2330	1846	1846	1000	55%			
37/B	295,980	LACE TANK TOP	HM	55	233	0.06	13	12	8	8	20	10	2330	1587	1100	47%				
38/A	437230	TANK TOP	HM	26	225	0.06	12	12	3	15	10	2250	2001	2001	700	80%				
38/B	787,243	LACE TANK TOP	HM	9	210	0.06	10	11	3	14	10	2100	1752	1000	1752	1000	75%			
39/A	303810	SS R NKT SHIRT	HM	14	236	0.09	13	12	9	9	21	10	2360	1063	600	40%				
39/B	331543	MARISHA TOP	HM	3	100	0.16	24	16	11	10	27	10	1000	658	658	39%				
40/A	326200	TANK TOP	HM	34	210	0.08	15	11	10	9	21	10	2100	722	500	28%				
40/B	813480	TANK TOP BODY	HM	8	220	0.11	17	14	10	10	24	10	2200	1805	1905	400	83%			
41/A	117759	TANK TOP	JC STORE	5	150	0.07	11	12	9	9	21	10	1500	350	350	700	12%			
41/B	813480	TANK TOP BODY	HM	5	210	0.11	17	14	9	10	23	10	2100	1575	600	75%				
42	119970	SS R NKT SHIRT	JC STORE	2	120	0.11	15	12	8	13	20	10	1200	870	500	48%				
		TOTAL			0.74	160	138	88	92	225	110	21470	14209	14209						
43	813490	TANK TOP BODY	HM	1	60	0.11	13	12	4	3	16	10	600	450	3000	31%				
44	787243	LACE TANK TOP	HM	4	220	0.06	13	11	11	8	22	10	2200	1602	400	44%				
45	2067333	SS R NKT SHIRT	AHL	1	100	0.08	12	10	11	9	21	10	1000	226	1400	9%				
46	TW-30	SS VNK POLO	TS	1	80	0.22	23	22	20	22	42	13	1040	700	400	28%				
47	813480	TANK TOP BODY	HM	1	90	0.01	17	16	12	10	28	10	900	651	1200	3%				
		TOTAL			0.48	78	71	58	52	129	53	5740	3529	3529						
SAGOR																				
ANKUR																				
RIPON																				
SUMI																				
Batal																				
Khurshid																				
Anjan																				
Badal																				
Akhter																				
Rabul																				

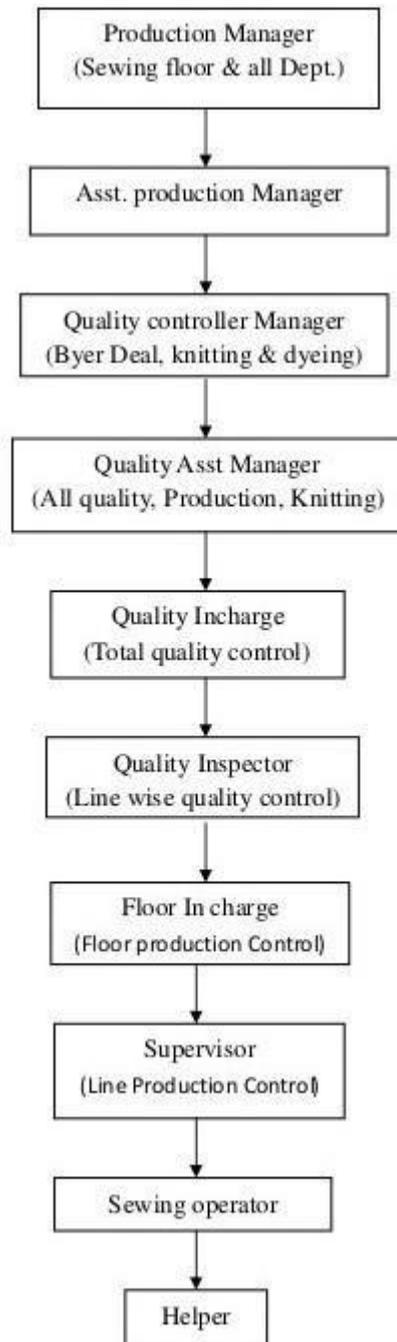
Courtesy By Industrial Engineering Dept

Figure 07

Chapter: 05

Garments Sewing in Mass Production

5.0 Sewing segment Organogram[5]:



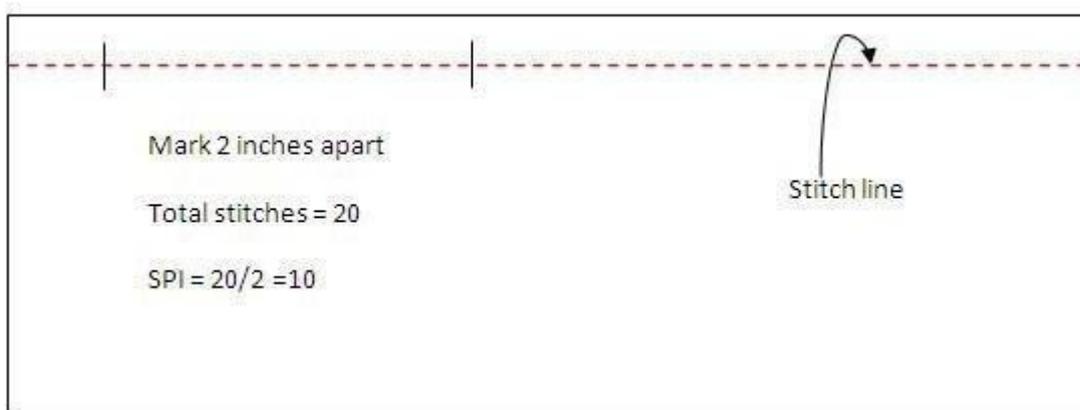
5.1 Machineries utilized for Garment Sewing in Mass Production:

The vast majority of the garments we wear are sewn by sewing machines. There are a few sorts of sewing machines used to make our garments. At the point when piece of clothing making was industrialized, researchers created mechanical power driven sewing machines to address the issues of large scale manufacturing. Self-loader and completely programmed machines were created in various stages. Machines are arranged depending of crease types, number of needle utilized, fasten classes, table bed and so on. In the accompanying rundown the vast majority of the machine those are utilized in article of clothing making.

- Single/multi needle mechanical lockstitch sewing machine with or without trimmer
- Blind fasten machine/Chain sewing machine.
- Flat bolt machine (chamber quaint little inn)
- Over bolt machine (3 strings/4 strings and 5 strings)
- Single/twofold needle chain join machine
- Zigzag flatbed sewing machine.
- Button join sewing machine.
- Button opening sewing machine
- Feed of Arm sewing machine
- Bar attaching machine.
- Hemstitch machine.
- Pin tucking machine.
- Smocking machine/Automatic multi needle shirring machine
- Collar and sleeve turning and blocking machine and squeezing machine
- Shoulder cushion joining machine

5.2 Calculate or check machine SPI:

The shortened form of SPI is Stitches per inch. In the Metric System it is communicated as Stitch per centimeter (SPC). It is anything but difficult to gauge SPI of the machine or crease. To gauge it, take a texture swatch of 12 inch X 2 inch. Sew the texture length insightful in a solitary burst with current SPI setting. At first utilize differentiate string for bobbin and needle string. Take out the sewed texture and lay on a level table. Evacuate all wrinkles if present on the crease line by hand. Presently, take one estimating tape, put it on the line on the above texture test and stamp line 2 inches separated. See the accompanying figure.



Presently include number of aggregate fastens between those two lines. Gap add up to number of lines by 2. The outcome is the SPI of that machine or crease. For SPC estimation is taken in centimeters. In the event that your SPI necessity is less or more than the current machine SPI at that point turn SPI controller appropriately (for essential machines). In the wake of setting check SPI again in the comparable strategy. When you get right SPI on the example at that point proceed for generation.

Example: In the above figure, the aggregate check of the fastens is 20 (in 2 inch hole). So SPI will be 10.

5.3 Machines expected to make Basic T-Shirts:

Three kinds of machines are by and large utilized for making Basic Tee (Crew Neck) in large scale manufacturing. Machines are Lock fasten (Single Needle), over edge (Over bolt) and level bolt (Flat bed or Cylinder bed). Inside the machine types there are different innovation levels. An equivalent machine is shared for various tasks when work content is not as much as pitch time and machine type is same for the two activities.

In the accompanying table a machine necessity plan or format has been appeared for generation of 800 Tee shirts in 8 hours move. Machine types and machine prerequisite in every task has been likewise given in the accompanying table.



Figure 08: Basic T-Shirt

5.4 Calculate Machine necessity for article of clothing to be made in a get together line.

Pursue the accompanying strides to appraise what number of machines and what kinds of machines you have to make your piece of clothing in a sequential construction system. The essential data you have to figure number of machines are -

1. Daily generation target – it implies what number of pieces you need to fasten every day.
2. Number of hours in a move – what number hours you intend to work every day
3. SMV of every activity – Standard minutes for every task

4. Present proficiency of the manufacturing plant (on the off chance that you don't mindful about present plant effectiveness, utilize half productivity). Effectiveness is required in light of the fact that generation will relies upon how productively laborers may carry out their activity.

Stage 1: Operation breakdown – Select an article of clothing for which you need to figure machine prerequisite. Investigation the activities required to sew the piece of clothing and rundown down tasks in a spread sheet in a succession. For instance, see activity separate of a Crew neck Tee in following table.

Stage 2: Identify machine type – Observe what fasten class has been utilized in the activities and as indicated by those select machines against every task.

Stage 3: SMV of every task – record SMV or standard minutes at right section of machine type. SMV is the most essential part to compute machine prerequisite. You can utilize SAM of every task from your database. In the event that you don't have database for standard minutes, ascertain.

Stage 4: Calculate Theoretical machine prerequisite – Set your generation focus for the day (8 hours move). Precedent 400 pieces for each line. Utilize present productivity dimension of the plant. Furthermore, now, ascertain machine prerequisite utilizing the accompanying equation. It is called as ascertained machine number. Since equation gives you part of machine however in genuine you can't ready to utilize division of machine.

$$=(\text{Target amount in pieces} * \text{singular task SMV}) / (\text{8 hrs.} * \text{60 minutes} * \text{desired effectiveness})$$

$$=(A * C) / (B * 60 * D)$$

Stage 5: Physical machine necessity – Now essentially round off the machine number. Or on the other hand you can club tasks those utilization comparable machine class. To do activity "Serge edge" half machine is required and the task "sew side crease with mark" required 1.4 machines. So can utilize first 4TOL machine to do the second occupation. Henceforth you can lessen the machine number and increment machine use.

Example: Operation release for Tee Shirt (Crew Neck) [5]

Production target/day (8 hours) =400 pieces		Shift hours = 8 hours or 480 minutes		Plan on Efficiency =50%	
Opr. No.	Description	Machine Type	SMV	No. of Calculated M/c	Round off Machine No.
1	Make Neck Rib & Run stitch	SNLS	0.55	0.9	1
2	Join shoulders	4TOL	0.45	0.8	1
3	Insert Neck Rib	SNLS	0.45	0.8	1
4	Serge Margin	4TOL	0.31	0.5	1
5	Top stitch on Neck rib	3TFL	0.34	0.6	1
6	Attach Sleeve	4TOL	0.78	1.3	1
7	sew side seam with labels	4TOL	0.84	1.4	1
8	Hem sleeves	3TFL	0.68	1.1	1
9	Bottom Hem	3TFL	0.56	0.9	1
	TOTAL		4.96	8.27	9

Table 04 Operation bulletin for Tee Shirt (Crew Neck)

It is constantly less demanding to comprehend an image than just depiction. Step by step instructions to make a T-shirt can be clarified ordinarily however understudies learnt it totally when they see it in the generation floor. A procedure stream outline gives them the rationale how tasks pursue succession in a steady progression.

A sewing procedure stream outline has been portrayed in the accompanying figure to control students how a T shirt is being made in a mass generation framework. It is accepted that T shirt has neck tape (self-predisposition tape). The procedure stream is additionally demonstrating the grouping of tasks

that is for the most part being pursued. Some industrial facility may have a marginally shifted arrangement. A group neck T shirt has six parts – Front, Back, Neck rib or Collar, Neck tape and two sleeves. In the figure, on the best four areas of the piece of clothing segment have been appeared. The bolts demonstrate the stream of activities and inside the red circles task arrangement number and name of the tasks has been composed.

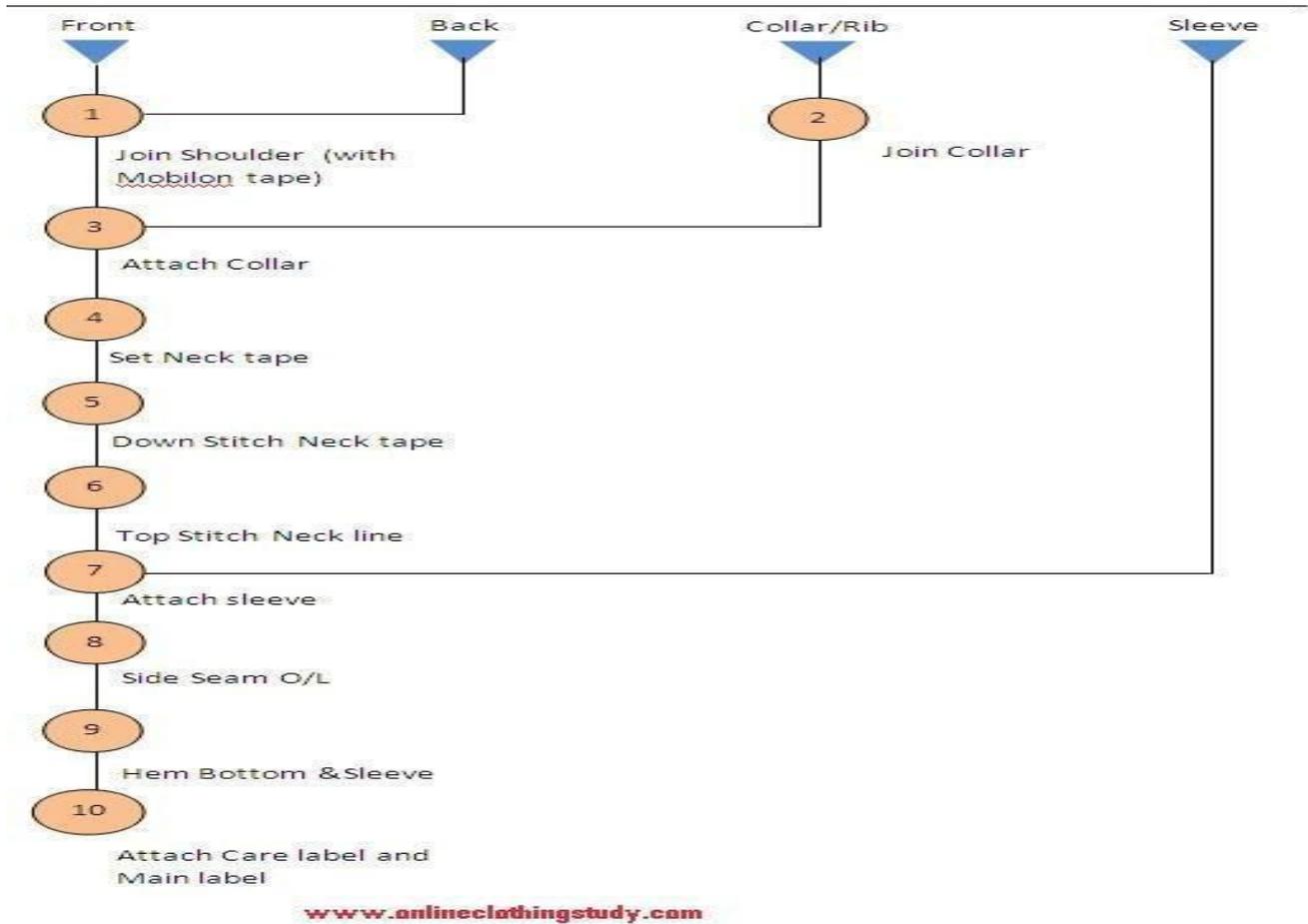


Figure 09: Sewing Process flow for T-Shirt

Chapter: 06

**Garments Production and Efficiency
Calculation**

6.0 Estimation Of article of clothing generation [5]:

On the off chance that one of the guests made this inquiry that how to assess creation of a style from the line.

It is a critical inquiry, since it is the fundamental learning about creation administration and every who are working underway must realize how assessed generation is figured.

Following article will elucidate you the computation method:

Creation implies add up to number of article of clothing pieces delivered by administrators in a line/cluster at a given time (for instance: 8 hours day time). Generation is likewise named as day by day yield. To gauge creation following data is fundamental.

1. Standard permitted minutes (SAM) of the article of clothing. It implies how much time is required to make one finish piece of clothing including recompenses.
2. How numerous administrators are working in the line?
3. How numerous hours line will work in multi day?
4. Average Line proficiency level?
5. Total break time for lunch and tea.

6.1 Formula for generation estimation [5]:

Every day creation = Total man minutes accessible in multi day/SAM * Average Line productivity
Total accessible man-minutes = Total no. of administrators X Working hours in multi day X 60

Assume, SAM of the piece of clothing is 20 minutes, 30 administrators line, works 8 hours move day. Line works at normal half effectiveness. Administrators get add up to 45 minutes for lunch and coffee break.

In this way, Total accessible man minutes = $30 \times (8 \times 60 - 45) = 13050$ minutes

Day by day evaluated creation = $13050/20 * \text{half} = 326$ pieces

You can expect above yield from that line if everything is gone well. You can see the generation of a line is specifically relative to the line effectiveness; no. of administrators and working hours. What's more, generation is switch corresponding to the article of clothing SAM. On the off chance that effectiveness of a line expands you can expect higher creation. Essentially if SAM of style lessens at that likewise you can expect higher yield.

Components that hamper generation:

Any of the accompanying can diminish generation of sequential construction system. So to get evaluated yield, you need to go up against the accompanying territories.

1. Machine separate
2. Imbalance line (WIP control)
3. Continuous bolstering to the line
4. Quality issues
5. Individual administrator execution level.
6. Operator non-attendance.

6.2 Calculate SAM Or SMV Of a Garment [1]:

SAM or Standard Allowed Minute is utilized to gauge undertaking or work substance of an article of clothing. This term is broadly utilized by mechanical designers and generation individuals in the article of clothing fabricating industry. For the estimation of expense of making a piece of clothing SAM esteem assumes a vital job. In past researchers and clothing professionals researched on how much time to be permitted to carry out an occupation when one pursues standard strategy amid doing the activity. As per the examination ponder minute esteem has been characterized for every development expected to achieve a vocation. Engineered information is accessible for every development. General Sewing Data (GSD) has characterized set of codes for movement information for SAM figuring. There is additionally different strategies through which one can figure SAM of a piece of clothing without utilizing engineered information or GSD.

Both technique has been clarified in the accompanying.

Technique 1-Using engineered Data:

In this technique 'foreordained time standard' (PTS) code are utilized to build up 'Standard Time' of a piece of clothing or other sewing items.

Stage 1: Select one task for which you need to figure SAM.

Stage 2: Study the movements of that task. Remain by side of an administrator (experienced one) and see the administrator how he is getting along it. Note all development utilized by the administrator in completing one finish cycle of work. See painstakingly again and recheck your note if all development/movement are caught and rectify. (for instance movements resemble - get parts one hand or two hand, adjust part on table or machine foot, realign handles, and so on.)

Stage 3: List down all movement successively. Allude the manufactured information for TMU (Time

estimating unit) values. For manufactured information you can allude GSD (without permit utilization of GSD code denied yet for individual utilize and concentrate one can allude GSD code and TMU

esteems) or Sewing Performance Data table (SPD). Presently you got TMU esteem for one task (for

instance say it is 400 TMU). Convert add up to TMU into minutes (1 TMU=0.0006 minute). This is called as Basic Time in minutes. In this model it is 0.24 minutes.

Stage 4: Standard permitted minutes (SAM) = (Basic moment + Bundle recompenses + machine and individual remittances). Include package stipends (10%) and machine and individual recompenses (20%) to essential time. Presently you got Standard Minute esteem (SMV) or SAM. $SAM = (0.24 + 0.024 + 0.048) = 0.31$ minutes.

6.3 Standard Minutes (SAM or SMV) for Few Basic Garment Products [5]:

Would anybody be able to appraise SAM (standard permitted minute) of an article of clothing without seeing as well as breaking down the piece of clothing? No. It isn't conceivable. To assess SAM you need to examine the piece of clothing deliberately and check diverse components that influence the SAM. SAM of an item shifts as indicated by the work content or basically as indicated by number of tasks, length of creases, texture types, sewing exactness required, sewing innovation to be utilized and so forth.

Yet at the same time huge numbers of us ask for rough SAM esteems for fundamental items, similar to Tee Shirt, Formal shirt, Formal pant or coat. An expected SAM helps in scope quantification of the production line, ascertaining necessity of apparatuses and even gauges CM (cut and make) costing of a piece of clothing.

Standard minutes (SAM) of couple of fundamental items have been recorded down with its SAM go as indicated by work content variety. In genuine cases piece of clothing SAM may go outside of the limit depending the above components. This rundown will be refreshed time to time including more items.

Table 07 SAM of couple of essential items

6.4 Calculate productivity of a creation cluster or line [5]:

Like individual administrator productivity, proficiency of a creation line or clump or area is critical for a processing plant. Every day line productivity demonstrates the line execution. To figure proficiency of a line for multi day, you will require following information (data) from the line manager or line recorder.

	Product	SAM (Average)	SAM Range
1	Crew neck T-Shirt	8	6 to 12
2	Polo Shirt	15	10 to 20
3	Formal Full sleeve shirt	21	17 to 25
4	Formal trouser	35	30-40

5	Sweat Shirt (Hooded)	45	35 to 55
6	Jacket(Suit)	101	70 to 135
7	Women blouse	18	15 to 45
8	Bra	18	16 to 30

Table 05 SAM Range of Different Product

1. Number of administrators – what number of administrators worked in the line in multi day
2. Working hours (Regular and additional time hours) – how long every one of the administrators worked or how long the line keep running in multi day
3. Production in pieces – what number pieces are created or add up to line yield by the day's end
4. Garment SAM – What is correct standard moment of the style (piece of clothing)

When you have above information you need to compute following utilizing above data -

1. Total minutes delivered by the line: To get add up to created minutes increase generation pieces by SAM
2. Total minutes gone to by the all administrators in the line: Multiply number of administrators by every day working hours.

Presently, figure line productivity utilizing following equation:

Line effectiveness = Total minutes created by the line/add up to minutes gone to by all administrators For instance, allude following table. Information count equation has been given on the header line of the table.

6.5 Standard productivity and by and large proficiency:

Productivity of a line or an individual administrator is ascertained by utilizing following equation.

$$\text{Proficiency (\%)} = \text{Total minutes created/Total minutes went to at work} * 100$$

The above equation gives us generally speaking proficiency of the administrator or a line.

Administrators, who work in the line entire day go to 480 minutes (move hours), however they don't generally sew pieces of clothing. Part of time, administrators sit tight for work because of outside reasons or they do off-standard employments (tasks) in the 480 minutes span. Reasons resemble sitting tight for work, machine separate, control disappointment, line setting, meeting, non-accessibility of trims and adornments. All these off-norms lessen administrator's genuine execution (productivity level).

At the point when administrators are not taking a shot at standard employments they are just not creating any articles of clothing or any minutes. That is the reason to know administrator's real execution on the on standard occupations; administrator's proficiency is exhibited as on-standard effectiveness.

Recipe for ascertaining on-standard is same however gone to time. If there should arise an occurrence of by and large proficiency estimation add up to delivered minutes is partitioned by aggregate gone to minutes at work. In any case, for the on-standard effectiveness figuring complete delivered minutes is separated by aggregate gone to minutes at on-standard employments. Allude to the accompanying equation.

On-standard Efficiency (%) = Total minutes created/Total minutes went to for on standard jobs*100

6.6 The Concept of Operator's Performance Rating:

6.6.1 Definition of Performance Rating:

Rating is an emotional correlation of any condition or movement to a benchmark, in view of our experience. While the mechanics of time ponder record the time an undertaking took, applying a rating will decide the time an errand should take.

6.6.2 100% execution or Normal Performance

The idea of 100% execution is a basic component of time study and execution measures. Ordinary execution is the rate of yield which qualified laborers will accomplishes without over-effort over the working day filters given they know and hold fast to the indicated strategy and given they are persuaded to put forth a concentrated effort to the work. This execution is meant as 100% on standard rating and execution scales.

A slower is execution rate, which will deliver less pieces every hour, is recorded as a rate underneath 100%. A quicker execution rate that produces more pieces every hour is recorded as more prominent than 100%.

6.6.3 Characteristic of 100% Performance or Normal administrator

- Fluid movements decisively
- No false begins or duplications
- Consistent, composed, compelling beat
- No squandered activities or work
- Attention focused on the errand

6.6.4 Accurate rating

To enhance precision in rating an administrator, eyewitness must -

- Has learning of the activity and the predetermined strategy or standard working methods for that

undertaking.

- Concentrates on administrator movements
- Is caution to bobbles, waverings, and other lost movements these are only from time to time or missing in 100% execution.
- Eliminates or overlooks intrusion or occasions not in the administrator's control.
- Avoids a tainting predisposition while watching quick and moderate administrators in progression
- Knows that expanding the quantity of cycles watched builds exactness.

6.7 Calculate Operator Worker efficiency [5]:

In clothing assembling, abilities and aptitude of a sewing administrator is being exhibited in "Productivity" term. An administrator with higher proficiency delivers a bigger number of articles of clothing than an administrator with lower productivity in a similar time allotment. At the point when administrators work with higher effectiveness, fabricating cost of the industrial facility goes down.

Besides, plant limit is assessed by the administrator proficiency or line effectiveness. Subsequently, proficiency is one of the for the most part utilized execution estimating instruments. So how would you ascertain administrator effectiveness in manufacturing plant? To ascertain administrator proficiency you will be required standard minutes (SAM) of the article of clothing and tasks your administrator is making. Utilize following equation and figure administrator effectiveness.

6.7.1 Efficiency estimation recipe:

Productivity (%) = [Total minute created by an administrator/Total moment gone to by him *100]

Where,

Add up to minutes delivered = Total pieces made by an administrator X SAM of the activity [minutes]

Add up to minutes went to = Total hours dealt with the machine X 60 [minutes]

Precedent: An administrator was completing a task of SAM 0.50 minutes. In a 8 hours move day he creates 400 pieces. So as per the proficiency figuring equation, that administrator's general effectiveness

$$= (400 \times 0.50)/(8 \times 60) * 100\%$$

$$= 200/480 * 100\%$$

= 41.67%

6.7.2 On-Standard Operator Efficiency:

Administrator productivity can be communicated in more particular courses, as 'On-Standard Efficiency' rather 'generally effectiveness'. An administrator might go to all hours in a move yet on the off chance that he has not been given on-standard work to do in all hours, he won't have the capacity to deliver minutes according to his ability and expertise level. For this situation, to know administrator's on-standard proficiency following recipe is utilized.

Administrator on-standard productivity (%) = Total moment created/Total on-standard moment went to *100%

Where,

Add up to minutes delivered = Total pieces made by an administrator X SAM of the activity [minutes]

Add up to on-standard moment went to = (Total hours worked – Loss time) x 60 [minutes]

Model: An administrator was completing a task of SAM 0.50 minutes. In a 8 hours move day he delivers 400 pieces. Administrator was inactive 'sitting tight for work' for 30 minutes and his machine separated for 15 minutes in hours move. So as indicated by the effectiveness ascertaining recipe, that administrator's on-standard proficiency

$$= (400 \times 0.50) / \{480 - (30 + 15)\} * 100\%$$

$$= 200 / 435 * 100\%$$

$$= 45.98\%$$

The above model clears up that if an administrator sits inert amid move hours his general proficiency will go down.

6.8 Use of Takt Time in Apparel Industry [5] [1]:

Takt time is the permissible occasions to deliver one item at the rate of clients' interest. This isn't the equivalent as process duration, which is the typical time to finish a task on an item (which ought to be not exactly or equivalent to TAKT time).

Takt time is the figured pace of generation dependent on the normal speed at which the client is purchasing an item or administration. The equation is net accessible time to create per day and age separated by client request per day and age. For instance when,

Net accessible time = 4500 minutes/move (10 administrators add up to man-minutes)

Client request = 500 pieces/move

Takt time = $(4500 \div 500) = 9$ minutes/piece

Imperative things to be noticed that,

Takt time can't be estimated with a stop watch.

Takt time isn't the time it takes to play out an undertaking.

Takt time is just lessened or expanded by changes underway interest or net accessible time to work.

Takt is utilized to in Garment Production

As the definition says, it is the interest of client or essentially request of following procedures. To set a generation sequential construction system takt time is taken as a base to decide work substance to be given to every administrator in the line.

Takt time is a critical device for Lean Line or One Piece Flow Production.

For instance, request from generation line is 60 pieces for every hour. In one hour you had just 3600 seconds. So takt time for the line will be 60 seconds/pieces (3600 seconds/60 pieces). Along these lines, you realize that your objective of creation. As indicated by this objective and piece of clothing work content (assume men's full sleeve shirt) you need to decide what number of administrator ought to be taken to set the line. How about we accept SAM of the shirt is 20 minutes or 1200 seconds. In one minutes every administrator has just 60 seconds. So to deliver a pieces in 60 seconds, add up to number of administrator required $1200/60 = 20$ nos. (Think about that every administrator works at 100% productivity.)

You need to disseminate all tasks inside 20 administrators. All activities will have distinctive work content. So to even out work content every administrator will get work of around 60 seconds work content. For this, couple of administrators will do different tasks low work content.

Chapter: 07

Thread Consumption

7.0 Calculate string utilization for articles of clothing [3]:

There is a standard equation for deciding string utilization. In the recipe you will get increasing variables as per machine type and sewing classes. To characterize string utilization you simply need to duplicate crease length with elements. In this manner, one can assess add up to prerequisite of string for making an articles of clothing. In any case, genuine string utilization for a unit length of crease relies upon numerous components. Preferences

1. Stitch Classes
2. Stitches per inches (SPI)
3. Thickness of the crease (texture thickness)
4. Thread strain
5. Thread tally (thickness of sewing string)

So I will encourage you to ascertain article of clothing string utilization by your own. You can create increasing component as indicated by your item classes and prerequisite utilizing following basic advances.

Stage 1: To figure string proportion, you require sewing machine, texture and sewing string that will be utilized for mass generation. For texture and string you can take comparable thickness and same string check on the off chance that real isn't accessible.

Stage 2: Sew a crease of 12 cms in length and remove 10 cms crease from it by trimming 1 cm from the two edges.

Stage 3: Unravel both needle string and bobbin string from the crease. Expel pleat from the disentangled string and measure its length in cm. By and large it will be higher than the crease length. Presently discover the duplicating factor by isolating string length with crease length. Expect unwound needle string length is 12.5 cm at that point needle string increasing variable is $12.5/10$ or 1.25. Utilizing this technique you can discover any sorts of machines' string utilization factors.

Stage 4: Once you have utilization factors then it is anything but difficult to ascertain add up to string utilization. Measure crease length of all activities of the article of clothing and get string necessity by duplicating string utilization factor. Include string wastage 5% for the string that trim out from every finish of crease.

For snappy reference you can pursue the accompanying string utilization proportions. Source: Coats string utilization manage.

Thread Consumption Ratios					
Stitch Class	Description	Total Thread Usage (cms per cm of seam)	No. of Needles	Percentage of Needle Threads	Percentage of Loper / Under (incl. cover) Threads
301	Lockstitch	2.5	1	50	50
101	Chainstitch	4.0	1	100	0
401	2-Thread Chainstitch	5.5	1	25	75
304	Zig-Zag Lockstitch	7.0	1	50	50
503	2-Thread Overedge stitch	12.0	1	55	45
504	3-Thread Overedge stitch	14.0	1	20	80
512	4-Thread Mock-safety stitch	18.0	2	25	75
516	5-Thread Safety stitch	20.0	2	20	80
406	3-Thread Covering stitch	18.0	2	30	70
602	4-Thread Covering stitch	25.0	2	20	80
605	5-Thread Covering stitch	28.0	3	30	70

Note: The above ratios are arrived at with a stitch density of 7 stitches per cm (18 stitches per inch). Changes in stitch density will change the ratios marginally.

Table 06 Thread consumption

If we want to refer readymade thread consumption factors then go to the following links.

Coats thread consumption bulletin or American & Efird Inc., thread consumption.

Chapter: 08

Productivity

8.0 Productivity [1]:

The meaning of Productivity is given as "Yield" contrasted with "Information".

As indicated by Marsh, Brush (2002) in his article Journal of mechanical innovation, profitability is a proportion of the productivity and adequacy to which hierarchical assets (inputs) are used for the making of items as well as administrations (yields). Efficiency estimation is both a proportion of info usage and an appraisal with respect to regardless of whether input use is becoming quicker than yield.

On account of a piece of clothing fabricating industrial facility, "yield" can be taken as the quantity of items made, while "input" is the general population, apparatus and processing plant assets required to make those items inside a given time span. The way to practical enhancements in yield – in "profitability" – is to guarantee that the connection among information and yield is appropriately adjusted. For instance, there is little to be picked up from an expansion in yield in the event that it comes just because of a noteworthy increment in information. In fact, in a perfect circumstance, "input" ought to be controlled and limited while "yield" is amplified.

Higher profitability gives more items from a similar number of individuals, in a similar time allotment. This thusly enhances "overhead recuperation" identified with manufacturing plant costs, for example, power and fuel, since overheads are settled inside that time allotment. Thus, the more items created in a given time allotment the less overhead distribution per item, which, thusly, decreases the expense of every individual thing and in this manner enhances focused edge.

Dr. Bheda in his book "Overseeing Productivity in the Apparel Industry" clarified the distinctive methods for estimating efficiency. Profitability can be communicated from numerous points of view yet generally efficiency is estimated as labor efficiency, machine efficiency or esteem efficiency. These three terms can be characterized as-

- Labor efficiency - Output per worker (coordinate +indirect) in a given time span (in pieces)
- Machine efficiency - Output per machine in a given time span (in pieces)
- Value efficiency - Total estimation of yield in a given time span.

8.1 Measure Of labor productivity [5]:

Definition:

Most essentially, efficiency is the proportion among yield and sources of info.

Inside a processing plant, mechanical designers or industrial facility directors and line bosses measure the quantity of pieces of clothing created by a line of sewing machine administrators in a particular time span. For the most part production line works 10 to 12 hours every day. Add up to creation (yield pieces) of a

line and aggregate work associated with delivering those pieces is required to ascertain work

efficiency. See following precedent,

Accept that

Add up to generation in day = 1200 pieces

Add up to work (administrator + helpers) = 37

Working time = 600 minutes (10 hours)

In this way, Labor profitability per 10 hours is = Total pieces created / add up to work input = $(1200/37)$
Pieces = 32.4 pieces.

Another profitability measure is work proficiency, which is an examination of the time spent working gainfully to the aggregate time spent at work. These measurements are proper for breaking down and contrasting the profitability of a specific creation line or industrial facility that turns out particular attire items. Be that as it may, looking at profitability levels crosswise over items or working lines can be troublesome in light of the fact that the benchmarks

Contrast starting with one piece of clothing then onto the next. Estimation of work effectiveness is demonstrated as follows. Consider above information.

SAM (Standard permitted minutes) of the article of clothing = 8.9

Minutes delivered by each work = $(32.4 \text{ pieces} \times 8.9) = 288$ minutes Available minutes was 600

In this way, Labor productivity = $(\text{Produced minutes} / \text{accessible minutes}) = (288/600 \times 100)\% = 48\%$

To analyze profitability evaluates crosswise over items, processing plants, or even ventures, financial analysts characterize work efficiency as the creation esteem included that every specialist produces. For this situation, work efficiency measures up to the estimation of creation isolated by work input. The estimation of creation is for the most part estimated as esteem included, equivalent to the gross estimation of offers short the estimation of obtained data sources, for example, texture, trim, and vitality. Work input is estimated by aggregate work hours. Work efficiency would thus be able to be evaluated at the national, total dimension and for particular ventures in an economy.

Chapter: 09

Conclusion

Conclusion

Mechanical designing is an imperative and fundamental piece of any clothing industry. We take in every one of the executions of the procedures which we have contemplated hypothetically. It gives us a chance to contrast the hypothetical information and reasonable actualities and consequently build up our insight and abilities. This venture additionally gives us a chance to grow our insight into material organization, creation arranging, acquirement framework, generation process, and apparatuses and instruct us to alter with the modern life.

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