Faculty of Engineering
Department of Textile Engineering

"Study on Work Study of Different Types of Garments''

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Bachelor of Science in Textile Engineering

Advance in Apparel Manufacturing Technology

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LETTER OF APPROVAL

July 29, 2015

To

The Head

Department of Textile Engineering

Daffodil International University

102, Shukrabad, Mirpur Road, Dhaka 1207

Subject: Approval of Industrial Attachment Report of B.Sc. in TE Program

Dear Sir

I am just writing to let you know that this report titled as **"Study on Work Study of Different Types of Garments"** has been prepared by the student bearing ID 151-23-4215, 151-23-4110 is completed for final evaluation. The whole report is prepared based on the factory data with required belongings. The students were directly involved in their industrial attachment activities and the report become vital to spark of many valuable information for the readers.

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

Yours Sincerely

Md. Mominur Rahman

Assistant Professor

Department of Textile Engineering

Faculty of Engineering

Daffodil International University

DECLARATION

We hereby declare that the work which is being presented in this thesis entitled, **"Study on Work Study of Different Types of Garments"** is original work of us, has not been presented for a degree of any other university and all the resource of materials uses for this thesis have been duly acknowledged.

Name:	**ID:**	**Signature**
Pial Roy	151-23-4215	_____
Toriqul Islam	151-23-4110	_____

This is to certify that the above declaration made by the candidate is correct to the best of my knowledge.

Supervisor:

_____

Md. Mominur Rahman

Assistant Professor

Department of TE

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ACKNOWLEDGEMENT

At first we express our heartiest thanks and gratefulness to almighty Allah for His divine blessing makes us possible to complete this project successfully.

We fell grateful to and wish our profound our indebtedness to **Md. Mominur Rahman, Assistant Professor & Assistant Proctor, Department of Textile Engineering, Daffodil International University,** deep knowledge & keen interest of our supervisor in the field of knit garments production influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant & energetic supervision, constructive criticism, valuable advice, reading many inferior draft & correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. Md. Mahbubul Haque, Professor & Head, Department of Textile Engineering, Daffodil International University.** For his kind help to finish our project & also to other faculty member & the stuff of TE department of DIU.

Finally, we must acknowledge with due respect the constant support and patient of our parents.

-The Authors

ABSTRACT

This project is on work study in different types of garments we calculate all the SMV of the operator & maximum target operation of the operator.This project work helps to We know that the SMV of the operator, Target of the maximum production, Efficiency of the operator.So If We Maintain the proper way or track on work study calculation very short time We have calculate this thesis paper Target production. We have to difference between the tops and the bottoms products of garments & we also calculate the SMV wise machine production.

Table of Contents

CHAPTER-l

1. Introduction

Work study is the critical examination of human works for increasing productivity. It is the systematic examination of the methods of carrying out activities so as to improve the effective use of resources and establish standards of performance for those activities. In this section, Sequencing of Target operations, SMV, Operation break down, work study and time study should be inspected on a routine basis for identifying, correcting and controlling of faults and increasing the productivity. To ensure the quality of the product, quality control personnel have to control quality in different section in garment industry, which are directly or indirectly involved with IE section. Eliminate wasting time to earn more product is its done by industrial engineering Department.One of the most important initial steps to start a thesis paper or research paper is the background study for it. Thebackground study for a thesis paper contains a review of the area being researched, current informationsurrounding the issue, previous studies on the topic, and relevant history on the issue.

1.1 Objectives of the Study:

- To know about SMV calculation.
- To know about work study.
- To know about capacity study.
- To know about Target.
- To Know about how much machine is needed for a complete garment production.

- To eliminate unnecessary human movements
- To make the work easier.
- To know about the operation Target.

1.2 Importance of Work Study:

By studying this thesis paper we have to learn about time utilize for the operator, by study this we can achieve maximum Target of the operator.

By Studying this thesis paper general people are learning about the they will know how to make a t- shirt and process of the t- shirt.

By studying this thesis paper Textile knowledge people are learning about the calculation of SMV, Maximum Target of the operator, Operation for the time study.

By studying about the thesis paper people are learning about the how much machine are needed for a complete garment production.

1.3 Limitations of the Study

In completing the project report, we have to work with some limitations for which we could not able to assembled vast information about this topic but we give our best effort to make this thesis paper useful. Some of those limitations are mentioned below:

- ✓ Capacity section still following some old processing system.
- ✓ We had to work within very short time.
- ✓ Lack of our knowledge and experience.
- ✓ During working hour taking data and information is very tough.
- ✓ The factory was not very well established.
- ✓ The factory doesn't follow any data maintaining system.
- ✓ when we work in our related field we face the worker who talk with them and hampered the production.
- ✓ In factory we cannot find the recent data of merchandising tack pack that's why we are not able to collect these data. So we face many problems to calculate & find the results.

CHAPTER-2

2. Literature Review

2.1. Industrial Engineering

Industrial Engineering (IE) is all close decisions - it is the building revision that recommendations the broadest exhibit of chances as far as utilize, and it is distinguished by its protection. While extra designing self-controls have a tendency to apply administrations to exceptionally point by point regions, modern architects might be begin possessed all over: from standard assembling organizations to aircrafts, from conveyance organizations to monetary foundations, from primary therapeutic manifestations to counseling enterprises, from innovative organizations to worries in the sustenance business. Industrial Engineering is the main building revision with close families to association - a few modern specialists (IEs) exchange on to compelling professions in administration. Additionally, in the event that you consider that one day you will begin and run your privately owned business, a modern designing sequencer will offer you with the best bore for this so, industrial engineering for every classified work is very important for the related field.

2.2 Flow chart of industrial Engineering:

Industrial Engineer

Negotiation with Merchandiser

If in-house accessories & fabric then do the preproduction meeting

Planning

Line balancing

Go for production based on planning

Production continuous meeting

To achieved production as planning

Production continuing (follow up)

2.3 Activities of Industrial Engineering:

- Design and improvement of planning and control system for production, inventory, quality and plant maintenance and distribution systems.
- Development of time and standards, costing and performance standards.
- Installation of wage incentive schemes.
- Design and installation of value engineering and analysis system.
- Operation research including mathematical and statistical analysis.
- Performance evolution.
- Supplier selection and evaluation.
- layout of building, machine and equipment.

2.3.1Definition Time Study:

Time study help to Define how much time is necessary for an operator to carry out the task at a defined rate of performance.

Time study tools:

A stop watch

Time study format

One pen or pencil

2.3.2 Notes on work study:

Be cordial and polite, but do not talk unnecessarily to the operator…

 Do not stand in front of the operator. Stand in a less discomforting position, such as off to the side or in the back.

 Never sit down during a time study!

 Always calculate the time study results immediately after the date gathering.

 Controversy over rating arises from a misunderstanding of what is being rated. An operator ‘s output can very only if.

 She varies her pace of work.

 Varies her method. Method includes the motion pattern, no. of motions and inter-motional delays.

When studying, the observer notes the speed at which the operator performs, and compares this mentally with the concept of the standard pace at which an operator would work if motivated to apply herself and is free from fatigue (100% operator).

2.3.3 Basic procedure of work study

There are eight steps in performing a complete work study, these are-

Select: The task to be studied.

Record: By collecting data at source and direct observation.

Examine: By challenging the purpose, place, sequence and method of work.

Develop: New methods, drawing on contribution of those concerned.

Evaluate: Results of alternative solutions.

Define: New methods and present findings.

Install: New methods and train those involved.

Maintain: Establish control procedure.

2.4 Rating

The concept of 'rating' (known in the US as 'grading') is fundamental in time study.

The ability to rate effectively distinguishes a qualified time study practitioner from a novice.

2.4.1 Definitions Rating:

Rating' is the process used by the industrial engineer to:

Compare the actual performance of the operator with his/her mental concept of normal performance. The Rating' is the numerical value used to denote the rate of working. In order to rate there must be a defined level of performance to compare with, an Average' level.

Time study professionals apply the concept of a 'standard operation'.

2.5 Procedure of work study:

Time study: This is a technique used to establish a standard time for a job or foran operation

Motion economy : This is used to analysis the motions employed by the operatorsdo the work. The principle of motion economy and motion analysis are useful in mass production or for short cycle repetitive jobs.

Value analysis: It ensure that no unnecessary costs are built into the product and ittries to provide the required functions at the minimum cost. Hence , helps to enhance the worth of the product.

Financial and nonfinancial Incentives: These helps to evolve at a rational compensation for the efforts of the workers

Production,planning and control: This includes the planning for the resources(like men , machine materials) proper scheduling and controlling production activities to ensure the right quantity , quality of the product at predetermined time and pre-established cost

Inventory control: To find the economic lot size and the recorder levels for theitems so that item should be made available to the production at the right time and quantity to avoid stock out situation and with minimum capital lock-up.

Job Evaluation: this is a technique which is used to determine the relative worthof jobs of the organization to aid in matching jobs and personnel and to arrive at sound wage policy.

Material Handling Analysis: To scientifically analysis the movement ofmaterials through various departments to eliminate unnecessary movement to enhance the efficiency of material handling.

2.5.1Activities of junior Executive in a factory

1.Co-ordinate with print/Embroidery.

2.Find out the line bottleneck & to take necessary solution.
3.Hourly operator target monitoring sheet follow up.
4.Make new style operation breakdown with SAM/SMV.
5.Discuss with PM about absenteeism on line balancing.

2.5.2 Functions of an Industrial Engineer:

Establishing the performance standards as per the standards as per the standard method.

1.To develop a sound wage and incentive schemes.
2.To aiding the development and designing of a sound inventory control, determination of economic lot size and work in process for each stage of production.
3.Development of cost reduction and cost control programmers and to establish standard costing system.

2.6 works of an Industrial Engineer:

1.Developing the simplest work methods and establishing one best way of doing the work.
2.Establishing the performance standards as per the standards as per the standard method (standard method)
3.To develop a sound wage and incentive schemes.
4.To aiding the development and designing of a sound inventory control, determination of economic lot size and work in process for each stage of production.
5.Daily line follow up
6.Daily line wise production balance
7.Daily line maintains with the main target balancing
8.Factory wise production chart follow up.

2.7 Activities of a Senior Executive in a factory:

- Line target fix up.
- Daily production report make & submit to concern person or Dept. head.
- Daily Quality statistical report make & submit to concern person or Dept. head.
- Monthly shipment FOB value report prepare.
- Monthly production FOB value report prepare.

2.8 Standard minutes (SAM or SMV) for few basic garment products

Serial Product	SAM (Average)	-	SAM (Range)
1. Crew neck T-Shirt		-	6-12
2. Polo Shirt		-	10-20
3. Formal full sleeve shirt		-	21-25
4. Formal trouser		-	35- 45
5. Sweat shirt (Hooded)		-	35-55
6. Jacket(Suit)		-	101-135

2.8.1 Bottleneck before input in line:

1. If issue is not supplied in time from M.C.D and sub store.

2. If issue comes delay.

3. Issues serial number mistake.

4. Bundling mistake.

5. Wrong issue supply.

6. Pattern problem

2.9 Bottleneck in line problem:

- Worker selection wrong.
- Wrong works flow / sequence of works.
- Non-balance allocation of elements.
- Works negligence by workers.
- Workers absenteeism.
- Machine disturbances / out of order.
- Lack of supply.
- Non-serial supplies forward from workers.
- Color shading

2.10 Way of reducing bottle neck:

- To arrange pre- production meeting in time.
- To prepare layout sheet before input in the line.
- To check fabrics and accessories before issuing in the line.
- To check pattern before supply in the line.
- To reduce excess works from workers.
- To select right workers for right works.
- To keep supply available in time.
- To maintain serial number.
- Reject garments should not forward.
- Supply should be forwarded after checking.

- To alert when bundling (maintain serial number)
- By improving method.
- By improving workers performance.
- By reducing sewing burst.

CHAPTER-3

3. Experimental Details

By capacity study we can calculate the how many time required to complete the buyers order. By capacity study we calculate the exact production & it helps how many machines and operators are needed for making garments. Here we given bellow the all the data of our factory.

3.1Product Details:

Figure: 3.1.1.1 T- shirt (kid)

3.1.1:Mesurment details of T-SHIRT:

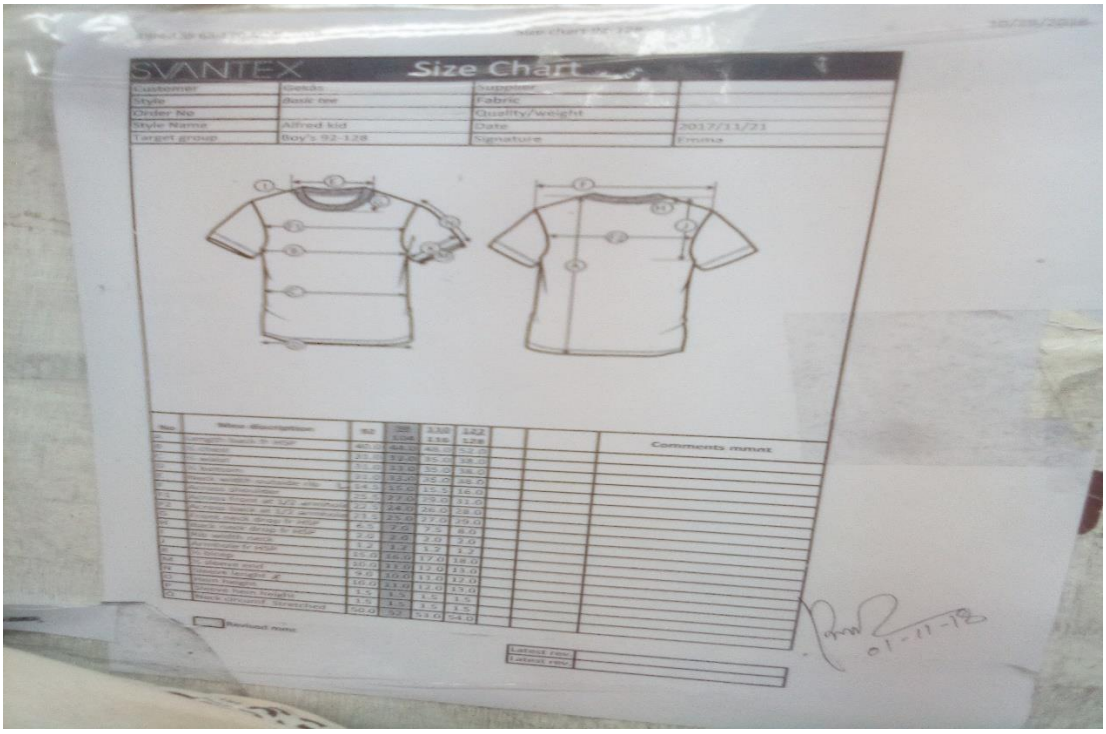


Figure 3.1.2.1: Measurement details

Buyer order this garments four different sizes (S, M, L & XL). For length from HPS for each individual sizes is for S- 40cm, M-44cm, L-48cm, XL is for 52cm. Neck rib width outside rib is for S is 14.5cm, M-15cm, L-15.5cm, XL-16cm. here we see that 0.5cm distance of the neck rib outside Sleeve length for S-10cm,M-11cm, L-12cm, XL-13cm.Half chest for S is 31cm, M-33cm, L-35cm, XL-38cm . Across Shoulder for S is 25.5cm, M-27cm, L-29cm, XL-31cm.

3.1.2 Operation Bulletin for T-shirt

3.1.3.1 Table: Operation Bulletin

RADIX LTD						
OP NO.	MACHINE	OPERATION DESCRIPTION	SMV	AML	TGT/operation	OP TGT
1	HP	BACK & FRONT PART MATCH	0.27	1	222	222
2	OL4	SHOULDER JOIN &CUT	0.45	2	133	280
3	OL4	NECK JOIN &CUT	0.24	1	250	250
4	HP	NECK STITCH CUT & OPEN	0.45	2	133	267
5	SNLS	NECK CLOSE TUCK	0.26	1	231	231
6	OL4	NECK SERVISING	0.27	1	222	222
7	FLMC	BACK NECK PIPING JOIN CUT	0.26	1	221	231
8	SNLS	BACK NECK PIPING EDGE CLOSE TUCK & CUT	0.28	1	214	214
9	FLMC	FRONT NECK TOP STITCH	0.27	1	222	222
10	SNLS	BACK NECK TOP STITCH	0.32	1	188	188
11	HP	BODY MARK FOR LABEL	0.25	1	240	240

		JOIN				
12	SNLS	MAIN & SIZE LABEL MAKE	0.3	1	200	200
13	SNLS	MAIN & SIZE LABEL JOIN	0.29	1	207	207
14	FLMC	SLEEVE HEM	0.26	1	231	231
15	HP	SLEEVE PAIR & CUT	0.26	1	231	231
16	HP	BODY TO SLEEVE MATCH	0.27	1	222	222
17	OL4	SLEEVE JOIN	0.4	2	150	300
18	SNLS	SLEEVE INNER TUCK	0.5	2	120	240
19	OL4	SIDE SEAM	0.6	2	100	200
20	HP	STICKER REMOVE & FOLD	0.27	1	222	222
21	FLMC	BOTTOM HEM	0.24	1	250	250
22	HP	CHECK & THERAD CUT	0.24	1	250	250
23	SNLS	SLEEVE OUTTER TUCK	0.27	1	222	222
24	HP	FINAL THREAD CUT	0.4	2	150	300
	Total		10.08	40		202(Target)

Here 3.1.3.1 table shows that, wehave need 10.08 min to make a polo shirt & 40 machine is needed in

this process. Total 40 manpower is necessary. where 10 helper & 30 operators are needed. By following this table, we can produce 202 pcs of garments per hour.

3.1.4 Summary of Operation

3.1.4.1 Table: Summary

MC:	**SNLC**	**O/L4**	**FLMC**	**SB**	**Total Mc**	**HP**	**Operator**	**24**	**Target HR**
SMV:	2.44	2.52	0.82	0.33	6.11 SMV	3.97 SMV	Helper	16	85%
QTY:	9	10	3	2	24 QTY	16 QTY	TTL S.M.V	10.08	202

Here 3.1.4.1 table shows that, SNLS machine SMV is 2.44, OL4 SMV is 2.52, FLMC SMV is 0.82, SB SMV is 0.33. Total Machine SMV is 6.11.SNLS SMV is 2.44, OL4 SMV is 2.90, FLMC is 0.82, SB SMV is 0.33. Total machine SMV is 6.11. 24 operators and 16 helpers is needed in this process. Machine for the operator of capacity study of polo shirt. Target is 202 pcs per hour is 85% target for the operator.

By use this formula we find actual Target HR,

SMV = B.T+ allowance/ 60Where

Basic time= Observed time X Rating/ 100,

Allowance= Relaxation allowance + Contingency +m/c delay allowance.

Target=60/SMV*Manpower

Here, Total SMV=10.08

Manpower=24

Target = (60/10.08)×24 = 142 pcs per hour

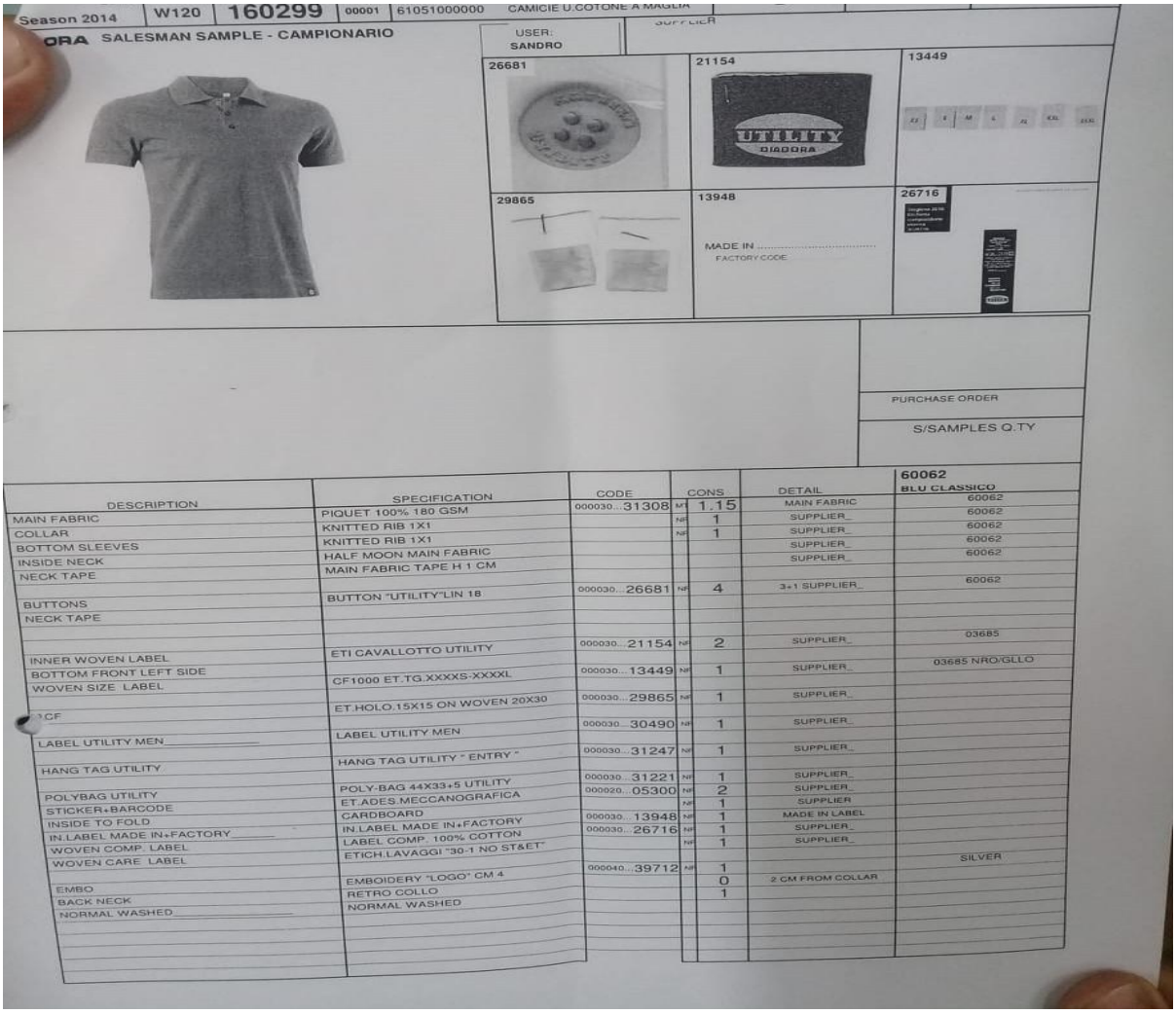
3.2 Line 2 capacity study of polo shirt:

We need to calculate the SMV for the data of the cycle time. For capacity study we work with a the top level of the garment then we calculate the bottom label of the garments. Now we start our work with T- shirt capacity study calculating.

3.2.1 Polo Shirt product details:

3.2.1.1 Figure: polo shirt

Merchandising Tech pack:



Season 2014 | W120 | 160299 | 00001 | 61051000000 | CAMICIE U.COTONE A MAGLIA

DIADORA SALESMAN SAMPLE - CAMPIONARIO

USER: SANDRO

SUPPLIER

26681 | 21154 | 13449

29865 | 13948 | 26716

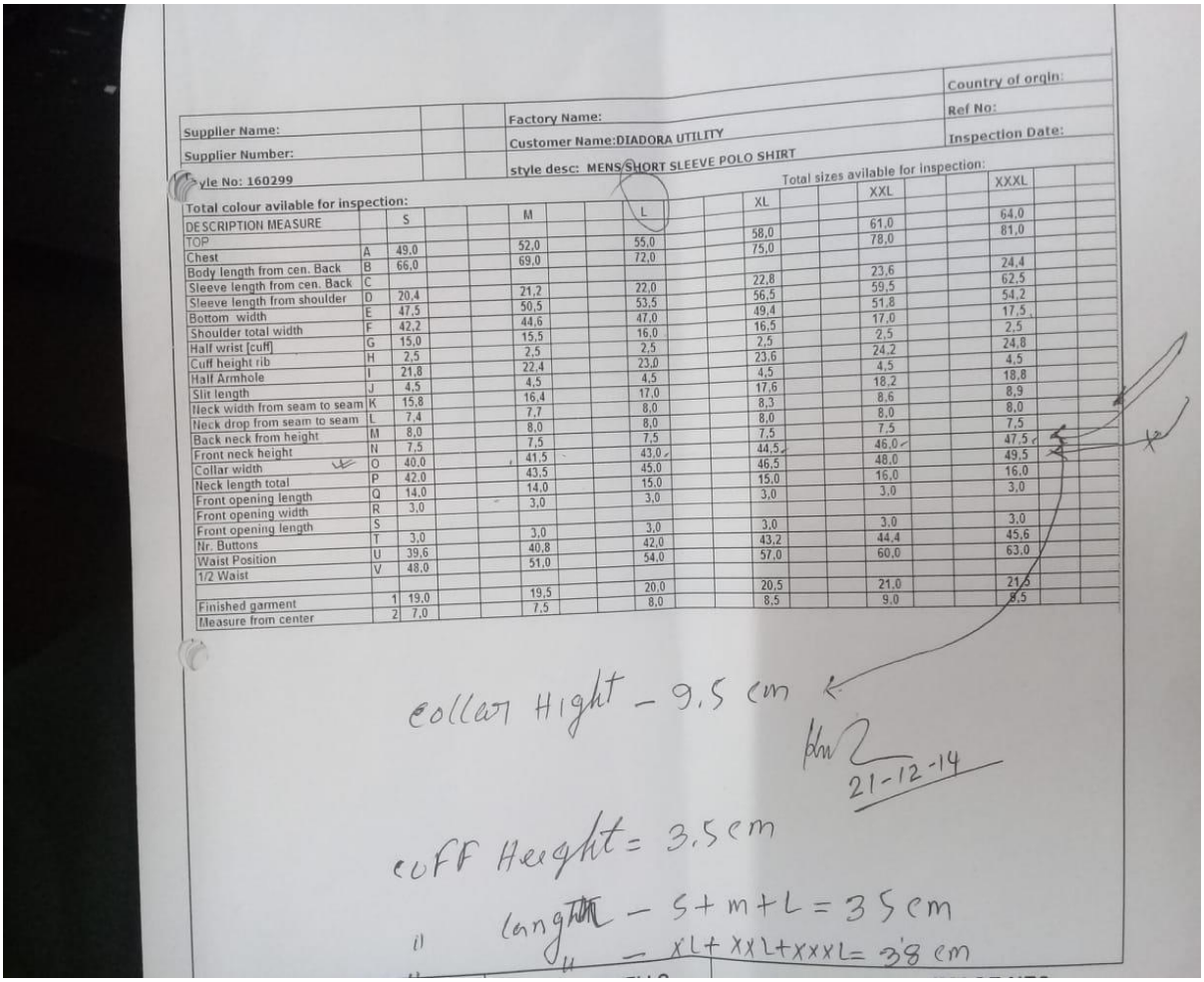
MADE IN .....
FACTORY CODE

PURCHASE ORDER

S/SAMPLES Q.TY

DESCRIPTION	SPECIFICATION	CODE	CONS	DETAIL	60062 BLU CLASSICO
MAIN FABRIC	PIQUET 100% 180 GSM	000030...31308	MT 1.15	MAIN FABRIC	60062
COLLAR	KNITTED RIB 1X1		NR 1	SUPPLIER_	60062
BOTTOM SLEEVES	KNITTED RIB 1X1		NR 1	SUPPLIER_	60062
INSIDE NECK	HALF MOON MAIN FABRIC			SUPPLIER_	60062
NECK TAPE	MAIN FABRIC TAPE H 1 CM			SUPPLIER_	60062
BUTTONS	BUTTON "UTILITY"LIN 18	000030...26681	NR 4	3+1 SUPPLIER_	60062
NECK TAPE					
INNER WOVEN LABEL	ETI CAVALLOTTO UTILITY	000030...21154	NR 2	SUPPLIER_	03685
BOTTOM FRONT LEFT SIDE	CF1000 ET.TG.XXXXS-XXXXL	000030...13449	NR 1	SUPPLIER_	03685 NRO/GLLO
WOVEN SIZE LABEL	ET.HOLO.15X15 ON WOVEN 20X30	000030...29865	NR 1	SUPPLIER_	
CF	LABEL UTILITY MEN	000030...30490	NR 1	SUPPLIER_	
LABEL UTILITY MEN	HANG TAG UTILITY " ENTRY "	000030...31247	NR 1	SUPPLIER_	
HANG TAG UTILITY	POLY-BAG 44X33+5 UTILITY	000030...31221	NR 1	SUPPLIER_	
POLYBAG UTILITY	ET.ADES.MECCANOGRAFICA	000020...05300	NR 2	SUPPLIER_	
STICKER+BARCODE	CARDBOARD		NR 1	SUPPLIER	
INSIDE TO FOLD	IN.LABEL MADE IN+FACTORY	000030...13948	NR 1	MADE IN LABEL	
IN.LABEL MADE IN+FACTORY	LABEL COMP. 100% COTTON	000030...26716	NR 1	SUPPLIER_	
WOVEN COMP. LABEL	ETICH.LAVAGGI "30-1 NO ST&ET"		NR 1	SUPPLIER_	
WOVEN CARE LABEL					SILVER
EMBO	EMBOIDERY "LOGO" CM 4	000040...39712	NR 1		
BACK NECK	RETRO COLLO		0	2 CM FROM COLLAR	
NORMAL WASHED	NORMAL WASHED		1		

3.2.2 Measurement Details of polo shirt :



Supplier Name: | Factory Name: | Country of orgin:
Supplier Number: | Customer Name:DIADORA UTILITY | Ref No:
Style No: 160299 | style desc: MENS SHORT SLEEVE POLO SHIRT | Inspection Date:
Total colour avilable for inspection: | Total sizes avilable for inspection:

DESCRIPTION MEASURE		S	M	L	XL	XXL	XXXL
TOP					58,0	61,0	64,0
Chest	A	49,0	52,0	55,0	75,0	78,0	81,0
Body length from cen. Back	B	66,0	69,0	72,0			
Sleeve length from cen. Back	C				22,8	23,6	24,4
Sleeve length from shoulder	D	20,4	21,2	22,0	56,5	59,5	62,5
Bottom width	E	47,5	50,5	53,5	49,4	51,8	54,2
Shoulder total width	F	42,2	44,6	47,0	16,5	17,0	17,5
Half wrist [cuff]	G	15,0	15,5	16,0	2,5	2,5	2,5
Cuff height rib	H	2,5	2,5	2,5	23,6	24,2	24,8
Half Armhole	I	21,8	22,4	23,0	4,5	4,5	4,5
Slit length	J	4,5	4,5	4,5	17,6	18,2	18,8
Neck width from seam to seam	K	15,8	16,4	17,0	8,3	8,6	8,9
Neck drop from seam to seam	L	7,4	7,7	8,0	8,0	8,0	8,0
Back neck from height	M	8,0	8,0	8,0	7,5	7,5	7,5
Front neck height	N	7,5	7,5	7,5	44,5	46,0	47,5
Collar width	O	40,0	41,5	43,0	46,5	48,0	49,5
Neck length total	P	42,0	43,5	45,0	15,0	16,0	16,0
Front opening length	Q	14,0	14,0	15,0	3,0	3,0	3,0
Front opening width	R	3,0	3,0	3,0			
Front opening length	S				3,0	3,0	3,0
Nr. Buttons	T	3,0	3,0	3,0	43,2	44,4	45,6
Waist Position	U	39,6	40,8	42,0	57,0	60,0	63,0
1/2 Waist	V	48,0	51,0	54,0			
Finished garment Measure from center	1	19,0	19,5	20,0	20,5	21,0	21,5
	2	7,0	7,5	8,0	8,5	9,0	9,5

collar Hight – 9.5 cm

21-12-14

cuff Height = 3.5 cm

length – S+M+L = 35 cm

– XL+XXL+XXXL = 38 cm

3.2.2.1 Figure: Measurement Details of Polo Shirt

3.2.3 Operation Bulletin for polo shirt:

3.2.3.1 Operation Bulletin

RADIX LTD						
OP NO.	MACHINE	OPERATION DESCRIPTION	SMV	AML	TGT/operation	OP TGT
1	HP	FRONT & BACK PART MATCH	0.27	1.0	222	222
2	OL4	1ST SHOULDER JOIN	0.30	1.0	200	200
3	HP	PLACKET IRON	0.40	1.0	150	150
4	OL4	PLACKET SERVICING	0.33	1.0	182	182
5	OL4	PLACKET JOIN	0.35	1.0	171	171
6	SNLS	PLACKET 1/16 TOP STITCH	0.32	1.0	188	188
7	SNLS	NECK RIBB TUCK	0.30	1.0	200	200
8	HP	NECK RIBB REVERCE	0.30	1.0	200	200
9	SNLS	NOSE TUCK	0.60	2.0	100	200
10	HP	BODY FOLD	0.30	1.0	200	200
11	OL4	NECK RIBB JOIN	0.32	1.0	188	188
12	FLMC	NECK TOP STITCH	0.30	1.0	200	200
13	SNLS	M&S LABEL JOIN	0.32	1.0	188	188
14	HP	CHECK & THREAD CUT	0.24	1.0	250	250
15	HP	BODY MARK FOR SNAP BUTTON ATTACH	0.26	1.0	231	231

16	SB	SNAP BUTTON ATTACH	0.35	1.0	171	171
17	SB	SNAP BUTTON ATTACH (2)	0.35	1.0	171	171
18	FLMC	SLEEVE HEM	0.27	1.0	222	222
19	HP	SLEEVE PAIR & CUT	0.27	1.0	222	222
20	HP	SLEEVE TO BODY MATCH	0.27	1.0	222	222
21	OL4	SLEEVE JOIN	0.40	2.0	150	300
22	HP	BODY FOLD & THREAD CUT	0.27	1.0	222	222
23	SNLS	SLEEVE INNER TUCK & POINT TUCK	0.50	2.0	120	240
24	SNLS	CARA LABEL MAKE	0.28	1.0	214	214
25	SNLS	ELASTIC JOIN WITH RUFFEL	0.75	2.0	80	160
26	HP	RUFFEL TO BODY MATCH	0.25	1.0	240	240
27	OL4	RUFFEL TO BODY JOIN	0.60	2.0	100	200
28	OL4	SIDE SEAM WITH CARE LABEL	0.60	2.0	100	200
29	HP	BODY FOLD & THREAD CUT	0.30	1.0	200	200
30	FLMC	BOTTOM HEM	0.32	1.0	188	188
31	HP	CHECK & THREAD CUT	0.32	1.0	188	188
32	SNLS	SLEEVE OUTTER TUCK	0.27	1.0	222	222
33	HP	FINAL THREAD CUT	0.40	2.0	150	300

TOTAL			**11.68**	**40**	123 (Target)

Here 3.2.3.1 table shows that,We have need 11.68 min to make a polo shirt & 40 machine is needed in this process. Total 40 manpower is necessary. where 14 helper & 26 operators are needed. By following this table, we can produce 123 pcs of garments per hour.

3.2.3.2: Summary of Operation

3.2.3.2.1 Table: Summary

MC:	**SNLC**	**O/L4**	**FLMC**	**SB**	**Total Mc**	**HP**	**Operator**	**26**	**Target HR**
SMV:	**3.34**	**2.90**	**0.89**	**0.70**	**7.83**	**3.85**	**Helper**	**14**	**60%**
QTY:	**11**	**10**	**3**	**04**	**26**	**14**	**TTL S.M.V**	**11.68**	**123**

Here 3.2.3.2.1 table shows that, the total SMV of machine is 7.83. SNLS SMV is 3.34, OL4 SMV is 2.90, FLMC is 0.70, SB SMV is 0.70. 26 operators and 14 helpers is needed in this process. Machine for the operator of capacity study of polo shirt. Target is 123 pcs per hour is 60% target for the operator.

By following this formula,

SMV = BT+ allowance/ 60

Where, Basic time= Observed time X Rating/ 100

Target=60/SMV*manpower

Here, Total SMV=11.68

Manpower=26

Target = (60/11.68)×26 = 133 pcs per hour

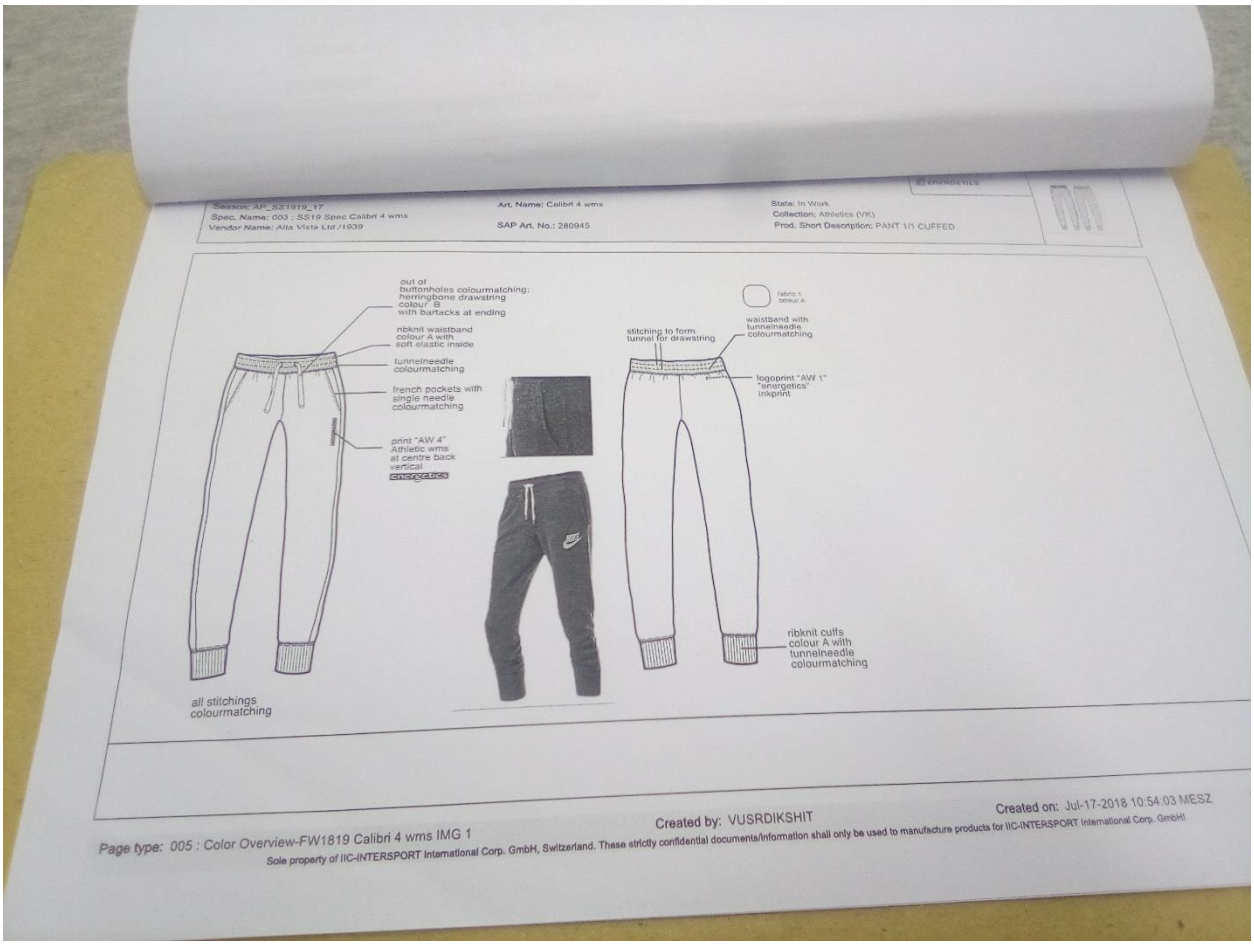
3.3 Line3 capacity study of Long Cuff pant of Radix:

By capacity study we can calculate the how many time required to complete the buyers order. By capacity study we calculate the exact production & it helps how many machines and operators are needed for making garments. Here we given bellow the all the data of our factory.

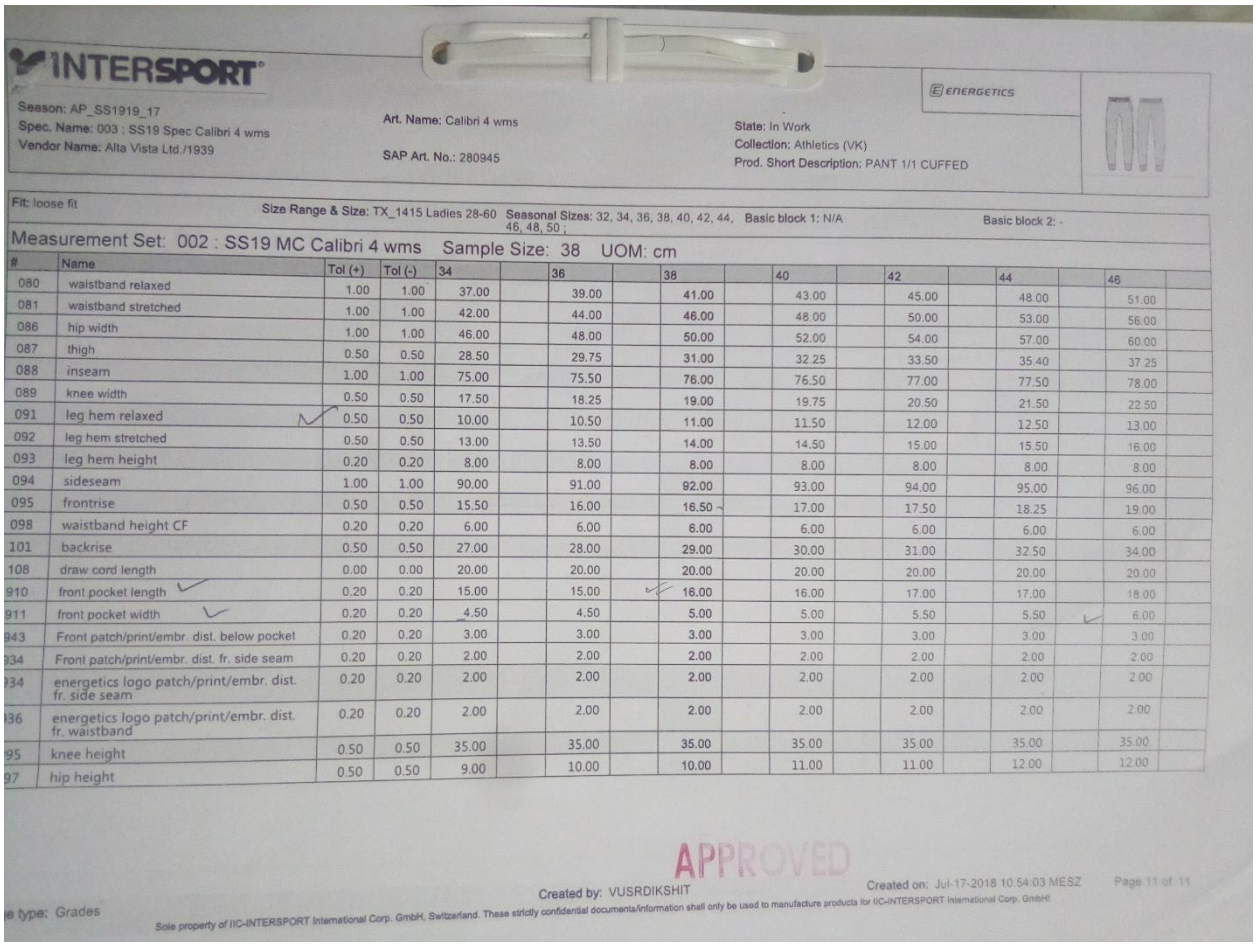
3.3.1 Details of Long Cuff Pant :

3.3.1.1Figure: Long cuff pant

Merchandising Tack Pack:


Spec. Name: 003 : SS19 Spec Calibri 4 wms
Vendor Name: Alta Vista Ltd /1939
Art. Name: Calibri 4 wms
SAP Art. No.: 280945
State: In Work
Collection: Athletics (VK)
Prod. Short Description: PANT 1/1 CUFFED
out of buttonholes colourmatching: herringbone drawstring colour B with bartacks at ending
ribknit waistband colour A with soft elastic inside
tunnelneedle colourmatching
french pockets with single needle colourmatching
print "AW 4" Athletic wms at centre back vertical
all stitchings colourmatching
stitching to form tunnel for drawstring
waistband with tunnelneedle colourmatching
logoprint "AW 1" "energetics" inkprint
ribknit cuffs colour A with tunnelneedle colourmatching
Page type: 005 : Color Overview-FW1819 Calibri 4 wms IMG 1
Created by: VUSRDIKSHIT
Created on: Jul-17-2018 10:54:03 MESZ
Sole property of IIC-INTERSPORT International Corp. GmbH, Switzerland. These strictly confidential documents/information shall only be used to manufacture products for IIC-INTERSPORT International Corp. GmbH

3.3.2 Measurement Details of long Cuff pant:



INTERSPORT®

ENERGETICS

Season: AP_SS1919_17
Spec. Name: 003 : SS19 Spec Calibri 4 wms
Vendor Name: Alta Vista Ltd./1939

Art. Name: Calibri 4 wms
SAP Art. No.: 280945

State: In Work
Collection: Athletics (VK)
Prod. Short Description: PANT 1/1 CUFFED

Fit: loose fit
Size Range & Size: TX_1415 Ladies 28-60 Seasonal Sizes: 32, 34, 36, 38, 40, 42, 44, 46, 48, 50 ; Basic block 1: N/A
Basic block 2: -

Measurement Set: 002 : SS19 MC Calibri 4 wms Sample Size: 38 UOM: cm

#	Name	Tol (+)	Tol (-)	34	36	38	40	42	44	46
080	waistband relaxed	1.00	1.00	37.00	39.00	41.00	43.00	45.00	48.00	51.00
081	waistband stretched	1.00	1.00	42.00	44.00	46.00	48.00	50.00	53.00	56.00
086	hip width	1.00	1.00	46.00	48.00	50.00	52.00	54.00	57.00	60.00
087	thigh	0.50	0.50	28.50	29.75	31.00	32.25	33.50	35.40	37.25
088	inseam	1.00	1.00	75.00	75.50	76.00	76.50	77.00	77.50	78.00
089	knee width	0.50	0.50	17.50	18.25	19.00	19.75	20.50	21.50	22.50
091	leg hem relaxed	0.50	0.50	10.00	10.50	11.00	11.50	12.00	12.50	13.00
092	leg hem stretched	0.50	0.50	13.00	13.50	14.00	14.50	15.00	15.50	16.00
093	leg hem height	0.20	0.20	8.00	8.00	8.00	8.00	8.00	8.00	8.00
094	sideseam	1.00	1.00	90.00	91.00	92.00	93.00	94.00	95.00	96.00
095	frontrise	0.50	0.50	15.50	16.00	16.50	17.00	17.50	18.25	19.00
098	waistband height CF	0.20	0.20	6.00	6.00	6.00	6.00	6.00	6.00	6.00
101	backrise	0.50	0.50	27.00	28.00	29.00	30.00	31.00	32.50	34.00
108	draw cord length	0.00	0.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
910	front pocket length	0.20	0.20	15.00	15.00	16.00	16.00	17.00	17.00	18.00
911	front pocket width	0.20	0.20	4.50	4.50	5.00	5.00	5.50	5.50	6.00
943	Front patch/print/embr. dist. below pocket	0.20	0.20	3.00	3.00	3.00	3.00	3.00	3.00	3.00
934	Front patch/print/embr. dist. fr. side seam	0.20	0.20	2.00	2.00	2.00	2.00	2.00	2.00	2.00
934	energetics logo patch/print/embr. dist. fr. side seam	0.20	0.20	2.00	2.00	2.00	2.00	2.00	2.00	2.00
936	energetics logo patch/print/embr. dist. fr. waistband	0.20	0.20	2.00	2.00	2.00	2.00	2.00	2.00	2.00
95	knee height	0.50	0.50	35.00	35.00	35.00	35.00	35.00	35.00	35.00
97	hip height	0.50	0.50	9.00	10.00	10.00	11.00	11.00	12.00	12.00

APPROVED

Created by: VUSRDIKSHIT
Created on: Jul-17-2018 10:54:03 MESZ
Page 11 of 11

e type: Grades

3.3.2.1 Figure: Measurement Details of long pant

3.3.3Operation bulletin for long cuff Pant (Bottom) Radix:

3.3.3.1 Operation Bulletin

RADIX LTD					
OP NO.	MACHINE	OPERATION DESCRIPTION	SMV	AML	TGT/operation
1	HP	FRONT & BACK PART MATCH	0.25	1.0	240
2	OL4	1ST SHOULDER JOIN & CUT	0.29	2.0	207
3	SNLS	MAIN & SIZE LABEL JOIN	0.26	1.0	231
4	OL4	CONTRAST PIPING JOIN &CUT	0.30	2.0	200
5	FLMC	NECK PIPING JOIN	0.30	2.0	200
6	HP	CHECK & THREAD CUT	0.28	1.0	214
7	SNLS	2ND SHOULDER TUCK	0.30	1.0	200
8	OL4	2ND SHOULDER JOIN	0.29	2.0	207
9	SNLS	NECK OUTTER TUCK	0.27	1.0	222
10	FLMC	SLEEVE HEM	0.28	1.0	214
11	HP	SLEEVE PAIR & CUT	0.27	1.0	222
12	HP	SLEEVE TO BODY MATCH	0.25	1.0	240
13	OL4	SLEEVE JOIN	0.40	2.0	150
14	SNLS	CARE LABEL STITCH	0.30	1.0	200
15	OL4	SIDE SEAM WITH CARE LABEL	0.60	3.0	100
16	HP	STICKER REMOVE & BODY FOLD	0.28	1.0	214
17	FLMC	BOTTOM HEM	0.24	1.0	250
	HP	CHECK & THREAD CUT	0.25	1.0	240
18	SNLS	SLEEVE INNER TUCK	0.26	1.0	231
19	SNLS	SLEEVE OUTTER TUCK	0.26	1.0	231
20	HP	FINAL THREAD CUT	0.30	2.0	200
	Total		12.30	28	152

Here 3.3.3.1 table shows that, We need 12.30 min to make a polo shirt & 28 machine is needed in this process. Total 40 manpower is necessary. where 8 helper & 20 operators are needed. By following this table, we can produce 152 pcs of garments per hour.

3.3.3.1 Summary of operation table:

3.3.3.1.1 Table: Summary

MC:	**SNLC**	**O/L4**	**DNLS**	**FLMC**	**SB**	**Total Mc**	**HP**	**Operator**	**26**
SMV:	6.34	2.27	0.29	5.89	0.70	12.30	2.58	Helper	12
QTY:	9	10	1	6	2	28	14	TTL S.M.V	12.30

Standard minute value is defined as the time which is allowed to perform a job satisfactorily. Normally it is expressed in minute value. The full elaboration of SMV is Standard Minute Value. By this table we see that the SNLC SMV is 6.34, OL4 SMV is 2.27, DNLS SMV is 0.29, FLMC SMV is 5.89, SB SMV is 0.70. Total machine SMV is 12.30. Here the 65% target is achieved, which is 152 pcs production per hour.

By using this formula we calculate all this,

SMV = BT+ allowance/ 60

Where,

Basic time= Observed time X Rating/ 100

Allowance= Relaxation allowance + Contingency allowance + Machine Delay.

Target=60/SMV*manpower

Here, SMV is 12.30

Manpower=26

Target=60/12.30*26=126 pcs per hour

3.4 Line4 Capacity of short pant:

By capacity study we can calculate the how many time required to complete the buyers order. By capacity study we calculate the exact production & it helps how many machines and operators are needed for making garments. Here we given bellow the all the data of our factory.

3.5.1 Short pant product details:

Figure 3.5.1.1 short pant

3.5.2 Measurement details Of Short pant:

3.5.2.1 Figure: Measurement details of short pant

3.5.3: Operation bulletin short pant of Radix:

3.5.3.1 Operation Bulletin

RADIX LTD						
OP NO.	MACHINE	OPERATION DESCRIPTION	SMV	AML	TGT/operation	OP TGT
1	OL4	FRONT RISE JOIN	0.30	1.0	200	200

2	OL4	BACK RISE JOIN WITH CARE LABEL	0.30	1.0	200	200
3	SNLS	CARE LABEL STITCH	0.26	1.0	231	231
4	OL4	SIDESEAM	0.60	2.0	100	200
5	HP	STICKER REMOVE	0.27	1.0	222	222
6	HP	ELASTIC SIZEWISE CUT	0.26	1.0	231	231
7	DNLS	ELASTIC RING MAKE & MARK	0.29	1.0	207	207
8	SNLS	W/B STITCH	0.30	1.0	200	200
9	HP	JOIN PSN MARK	0.27	1.0	222	222
10	BH	DRAWISTING HOLE	0.29	1.0	207	207
11	HP	GUIDE CUT & THREAD CUT	0.28	1.0	214	214
12	SNLS	ELASITC TUCK WITH W/B	0.60	2.0	100	200
13	FLMC	W/B MOUTH SERVICING	0.44	2.0	136	273
14	OL4	W/B SERVICING &MARK	0.32	1.0	188	188
15	HP	FULSE TUCK REMOVE	0.45	2.0	133	267
16	SNLS	W/B TUCK WITH BODY	0.60	2.0	100	200
17	OL4	W/B JOIN	0.45	2.0	133	267
18	OL4	INSEAM	0.30	1.0	200	200
19	FLMC	LEG HEM	0.40	2.0	150	300
20	HP	CHECK & THREAD CUT	0.35	2.0	171	343
21	FLMC	DRAWISTING MAKE & CUT	0.27	1.0	222	222
22	HP	DRAWISTING INSERT	0.30	1.0	200	200
23	SNLS	DRAWISTING MOUTH TUCK	0.30	1.0	200	200
24	SNLS	DRAWISTING MIDLLE TUCK	0.28	1.0	214	214

25	HP	FINAL THREAD CUT	0.40	2.0	150	300
	Total		8.88	34	172	

Here 3.5.3.1 table shows that, We need 8.88 min to make a polo shirt & 34 machine is needed in this process. Total 40 manpower is necessary. where 14 helper & 20 operators are needed. By following this table, we can produce 172 pcs of garments per hour.

3.5.3.1 Summary of operation table:

MC	**SN LC**	**O/L4**	**DNLS**	**FLMC**	**SB**	**Total Mc**	**HP**	**Operator**	**23**	**Target HR**
SMV:	2.34	2.27	0.29	0.89	0.70	6.30	2.58	Helper	11	75%
QTY:	8	8	1	3	02	23	11	TTL S.M.V	8.88	172

Standard minute value is defined as the time which is allowed to perform a job satisfactorily. Normally it is expressed in minute value. The full elaboration of SMV is Standard Minute Value. By this table we see that the SNLC SMV is 2.34, OL4 SMV is 2.27, DNLS SMV is 0.29, FLMC SMV is 0.89, SB SMV is 0.70. Here the 75% target is achieved, which is 172 pcs production per hour. By using this formula,

SMV = BT+ allowance/ 60Where,

Basic time= Observed time X Rating/ 100

Allowance= Relaxation allowance + Contingency allowance + Machine Delay

Target=60/SMV*manpower

Here, SMV=10.08, Manpower=23

Target=60/8.88*23=155 pcs per hour

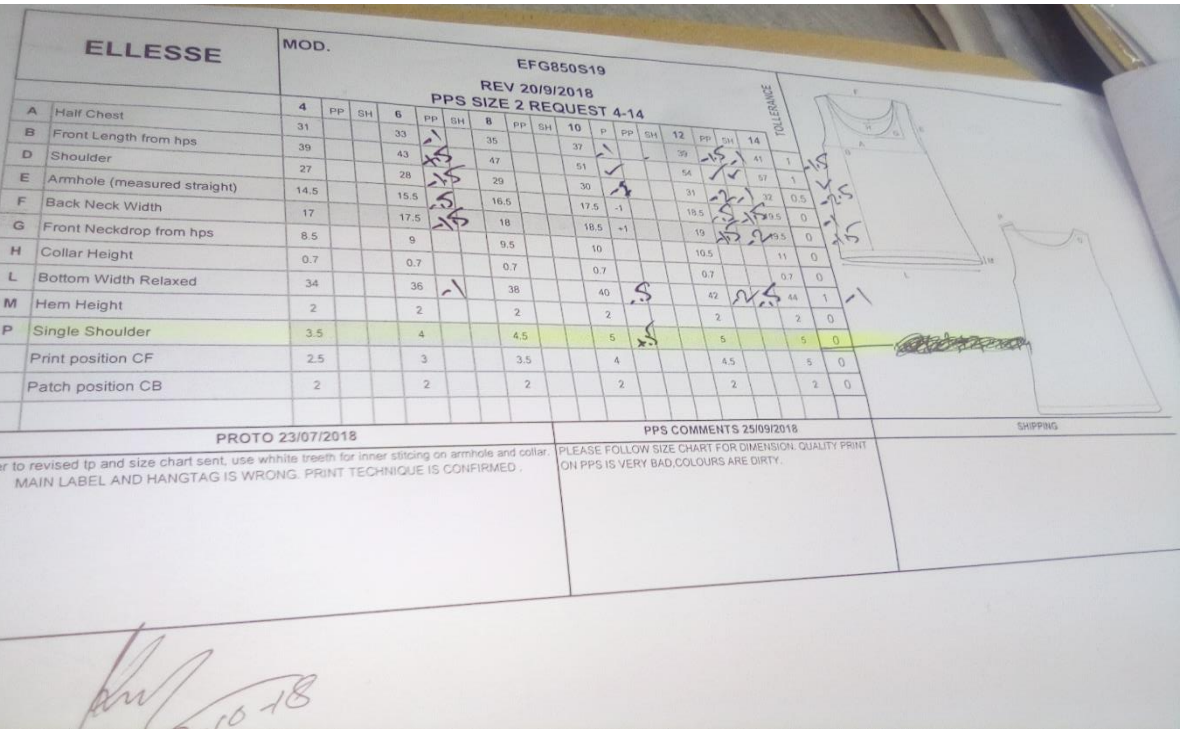
3.6 Line5Capacity study of Kid T shirt (ELLESSE):

Capacity study of Kid T shirt we calculate at first the line 4 SMV. Then we need to follow up all the data for capacity study. For capacity study we perform the best performance of all the operator for their work. We need every moment to calculate they start their work to end of the work.

3.6.1product details of Kid T-shirt (ELLESE) :

3.6.1.1 Figure: kid T-shirt (ELLESE)

3.6.3 Measurement Details of Kid T- shirt(ELLESE) of RediX:



ELLESSE

MOD. EFG850S19

REV 20/9/2018

PPS SIZE 2 REQUEST 4-14

		4	PP	SH	6	PP	SH	8	PP	SH	10	P	PP	SH	12	PP	SH	14	TOLERANCE
A	Half Chest	31			33			35			37				39			41	
B	Front Length from hps	39			43			47			51				54			57	
D	Shoulder	27			28			29			30				31			32	
E	Armhole (measured straight)	14.5			15.5			16.5			17.5				18.5			19.5	
F	Back Neck Width	17			17.5			18			18.5				19			19.5	
G	Front Neckdrop from hps	8.5			9			9.5			10				10.5			11	
H	Collar Height	0.7			0.7			0.7			0.7				0.7			0.7	
L	Bottom Width Relaxed	34			36			38			40				42			44	
M	Hem Height	2			2			2			2				2			2	
P	Single Shoulder	3.5			4			4.5			5				5			5	
	Print position CF	2.5			3			3.5			4				4.5			5	
	Patch position CB	2			2			2			2				2			2	

PROTO 23/07/2018

r to revised tp and size chart sent, use whhite treeth for inner stitcing on armhole and collar. MAIN LABEL AND HANGTAG IS WRONG. PRINT TECHNIQUE IS CONFIRMED .

PPS COMMENTS 25/09/2018

PLEASE FOLLOW SIZE CHART FOR DIMENSION. QUALITY PRINT ON PPS IS VERY BAD,COLOURS ARE DIRTY.

SHIPPING

3.5.3.1Figure: Measurement Details of KID product

3.5.4 Operation Bulletin Table for ELLESE T- shirt Of Redix:

RADIX LTD						
OP NO.	MACHINE	OPERATION DESCRIPTION	SMV	AML	TGT/operation	OP TGT
1	HP	PlacketFusing lay	0.30	1.0	200	200
1	OL4	Placket Servicing	0.30	1.0	200	200
1	OL4	Placket join	0.30	1.0	200	200
1	SNLS	Placket Close	0.40	2.0	150	300
1	SNLS	Placket 1/16 T/S	0.32	1.0	188	188
1	SB	Snap Button	0.33	2.0	182	364
1	HP	Snap Button Mark	0.30	1.0	200	200
1	HP	FRONT & BACK MATCH	0.29	1.0	207	207
2	OL4	SHOULDER JOIN &CUT	0.40	2.0	150	300
3	OL4	NECK RIB JOIN (FOLDER)	0.25	1.0	240	240
4	HP	NECK RIB CUT	0.24	1.0	250	250
5	HP	EXTRA STITCH OPEN	0.40	2.0	150	300
6	SNLS	NECK CLOSE TUCK	0.25	1.0	240	240
7	OL4	NECK OVERLOCK (SERVICING)	0.27	1.0	222	222
8	FLMC	BACK TAPE PIPING & CUTTING	0.25	1.0	240	240
9	SNLS	BACK TAPE PIPING CLOSE &EXCESS CUT	0.28	1.0	214	214
10	SNLS	BACK NECK T/S WITH L/B	0.35	1.0	171	171
11	FLMC	SLEEVE HEM	0.27	1.0	222	222
12	HP	SLEEVE PAIR	0.28	1.0	214	214
13	HP	BODY TO SLEEVE MATCH	0.75	3.0	80	240
14	OL4	SLEEVE JOIN	0.40	2.0	150	300
15	HP	BODY FOLD & THREAD CUT	0.27	1.0	222	222
	Total		10.08	29	202	

Here 3.5.4.1 table shows that, We have need 10.08 min to make a polo shirt & 29 machine is needed in this process. Total 40 manpower is necessary. where 14 helper & 26 operators are needed. By following this table, we can produce 123 pcs of garments per hour.

3.5.4.1Summary of Operation Table:

3.5.4.1.1 Table: Summary

MC:	**SNLC**	**O/L4**	**FLMC**	**SB**	**Total Mc**	**HP**	**Operator**	**29**	**Target HR**
SMV:	6.44	0.44	1.82	0.33	8.10 SMV	3.97 SMV	Helper	13	85%
QTY:	8	6	8	3	24 QTY	16 QTY	TTL S.M.V	10.08	202

3.5.4.1.1 Table shows that, Final capacity of the operator of this factory is 85% is the 202 pcs per hour.By this table we see that the SNLC SMV is 6.44, OL4 SMV is 0.44, FLMC SMV is 1.82, SB SMV is 0.33. Here we calculate the total SMV and finally we got these value. Standard minute value is defined as the time which is allowed to perform a job satisfactorily. Normally it is expressed in minute value. The full elaboration of SMV is Standard Minute Value.

SMV = BT+ allowance/ 60Where,

Basic time= Observed time X Rating/ 100

Allowance= Relaxation allowance + Contingency allowance + Machine Delay.

Target=60/SMV*manpower

Here, SMV=10.08, Manpower=29

Target=60/10.08*29=172 pcs per hour

We use all the formula then we find our results.

Above all this we calculate the data for three top and two bottom products of our garments. Then we calculate all the data for above lines.

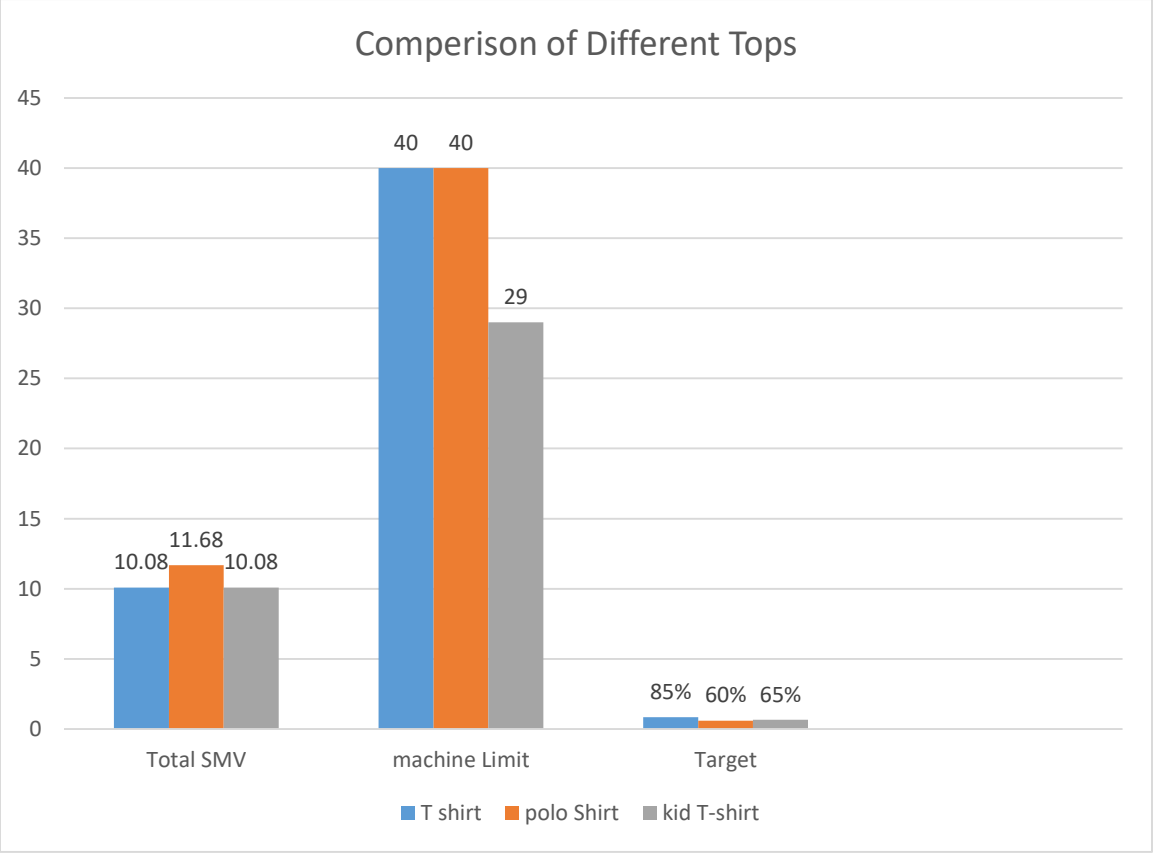
CHAPTER-4

4.0 Discussion of Results

As we collect data from different section, now we would like to discuss and analyze the data here and make a result on the basis of those data.

4.1Compression of different Tops:

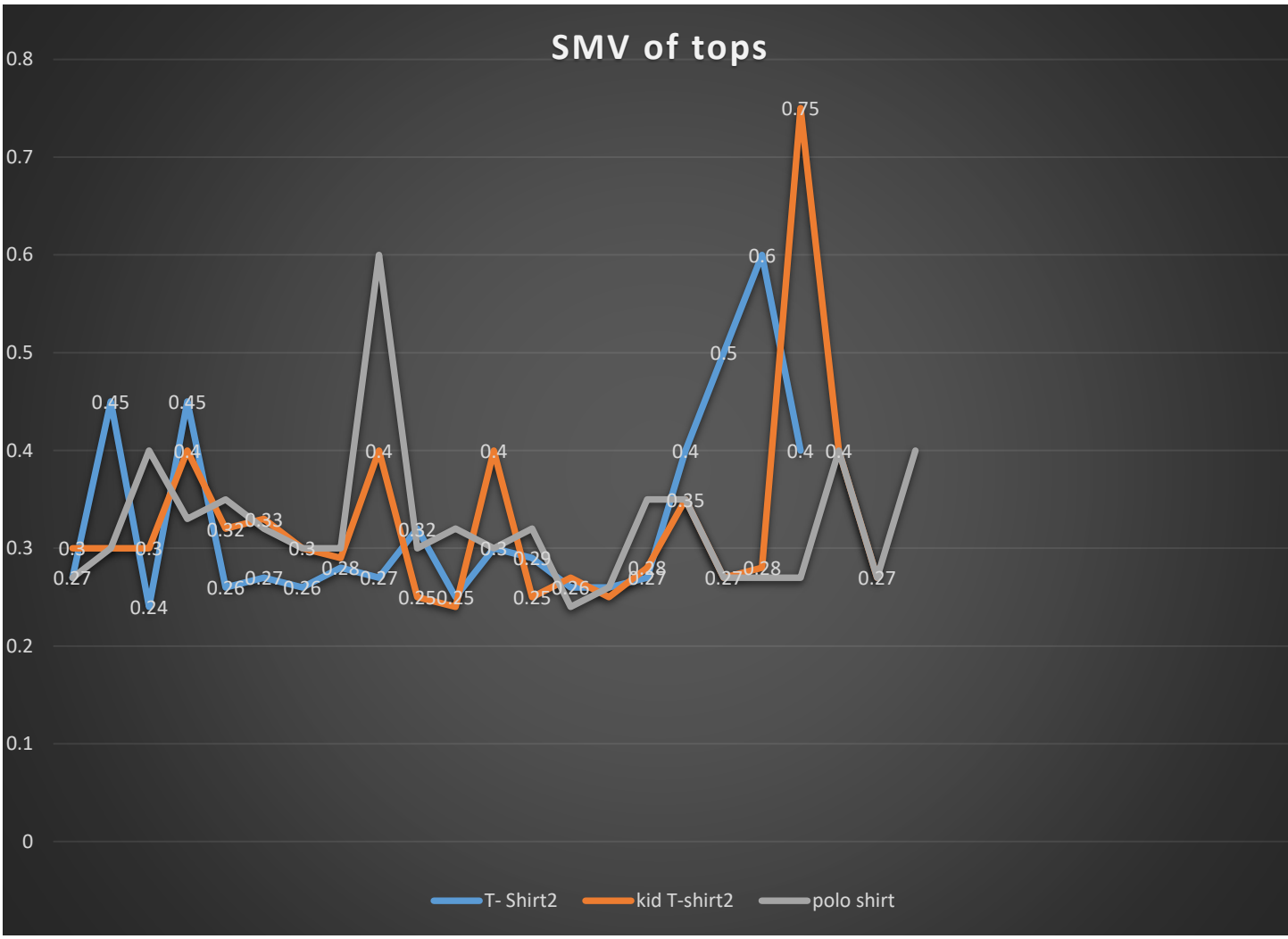
4.1.1 Graph: Compression of Tops



Here we see that the maximum production of this factory is T- shirt per hour calculation. By this graph SMV of maximum value is 11.68 which is for polo shirt, machine needed for the t shirt and polo shirt is same which value is 40, and machine needed for Kid t- shirt is 29.Target is for highest 85% for t- Shirt & polo shirt 60%.

4.1.3 T- Shirt 40 Operator SMV Calculate For T- Shirtpolo (TOP):

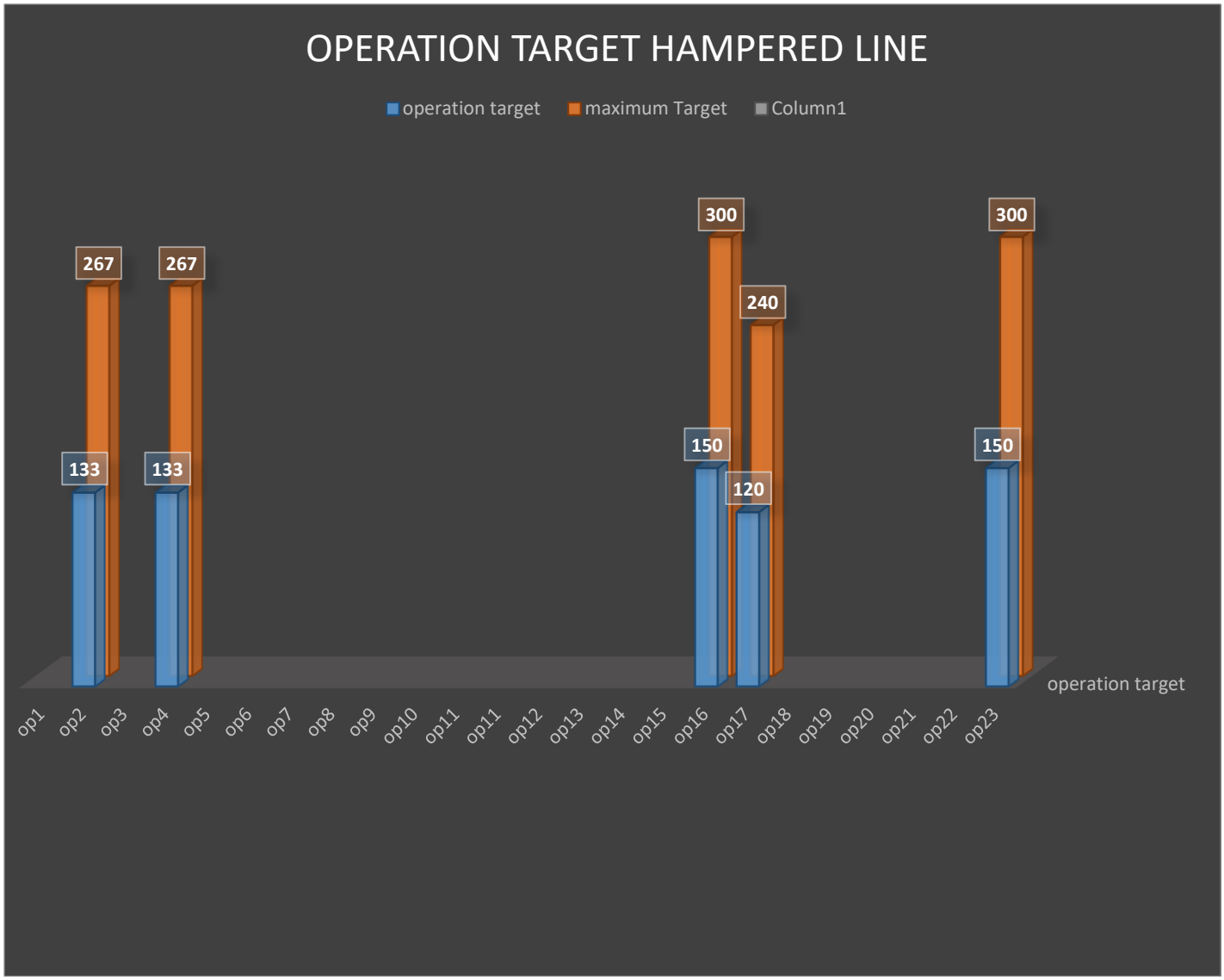
4.1.3.1 Graph: T-shirt polo shirt & kid T-shirt SMV



Here this graph SMV of the operator is given on the first table 1 data of the T- shirt. Here we shown the maximum to the lower label of SMV of the 40 operator. 40 operator SMV are shownon this graph for T- shirt making. Here the graph shows that the highest number of SMV is 0.60.Lowest SMV of the operator is 0.24.

4.1.3.2 operator production Target:

4.1.3.2.1 Graph: Target Operation Hampered

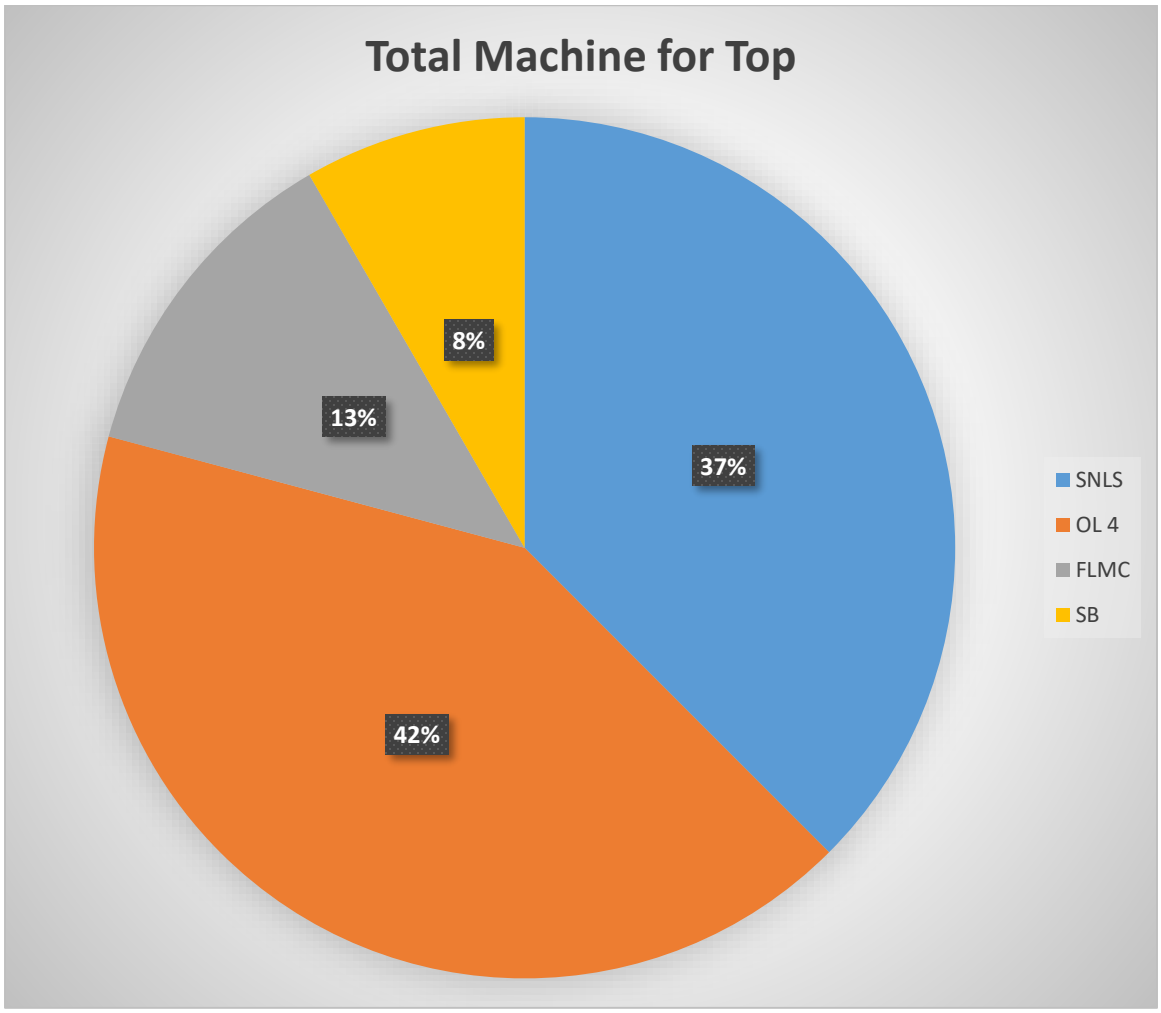


Graph 2: Maximum Target operation Per Hour

Here, we see that the T- shirt operator production target. In this line we will see that the second line of the production target is very much high. The value is 267.Operator does not fill up the target. The operator maximum target is 133. Number 4 operator shows that here value is 133.And operator number 23 also hampered the production loss. The lowest value for the operator is 120.They does not fill up their maximum output of production.

4.3.3Total Machine needed for Top:

4.3.3.1 Pie Chart: Total Machine

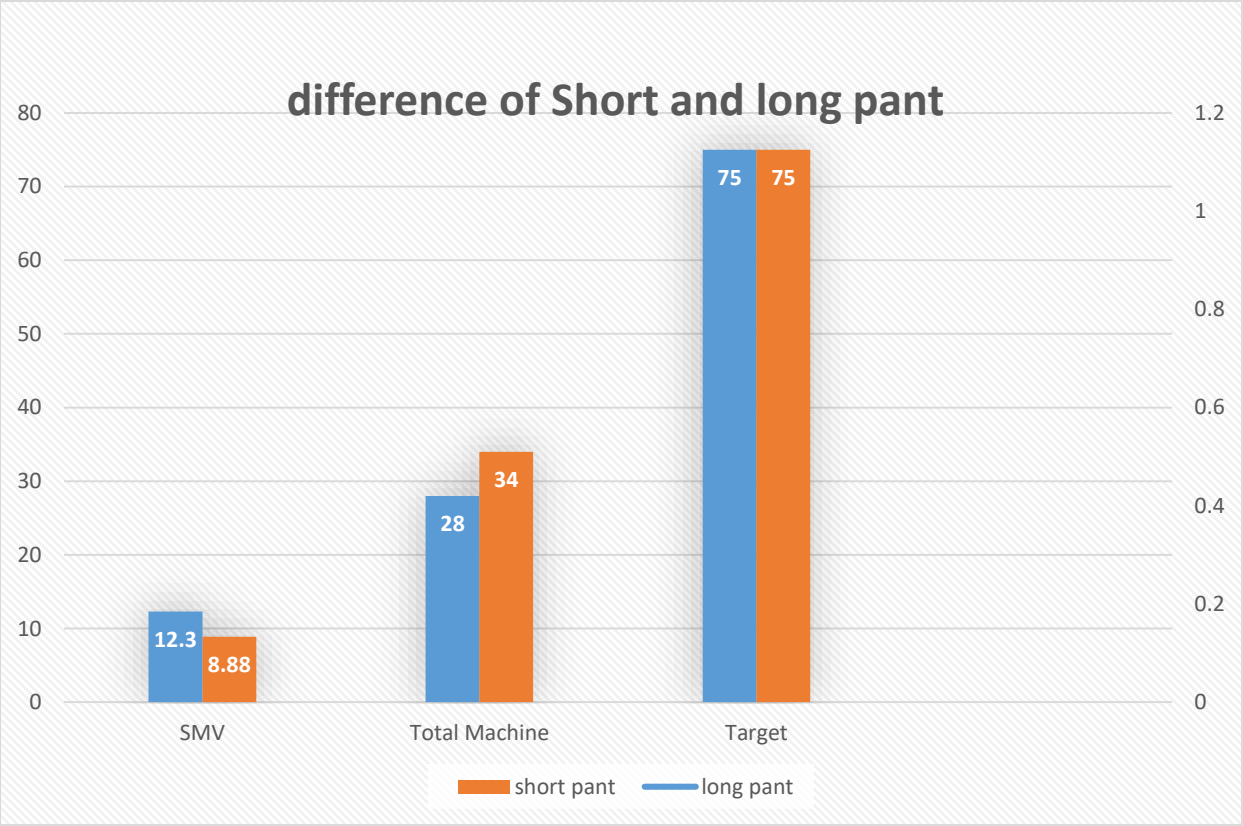


Here4.3.3.1 pie graph we see that, 42% highest no. of OL4 machine needed for T-shirt shirt making process. Second highest number machine is 37% SNLS.SB machine needed for only 8% of total machine.

4.2Comparison among Different Bottom:

Here we collect data from different section, now we would like to discuss and analyze the data here and make a result on the basis of those data. Then utilize the data of the different bottom products.

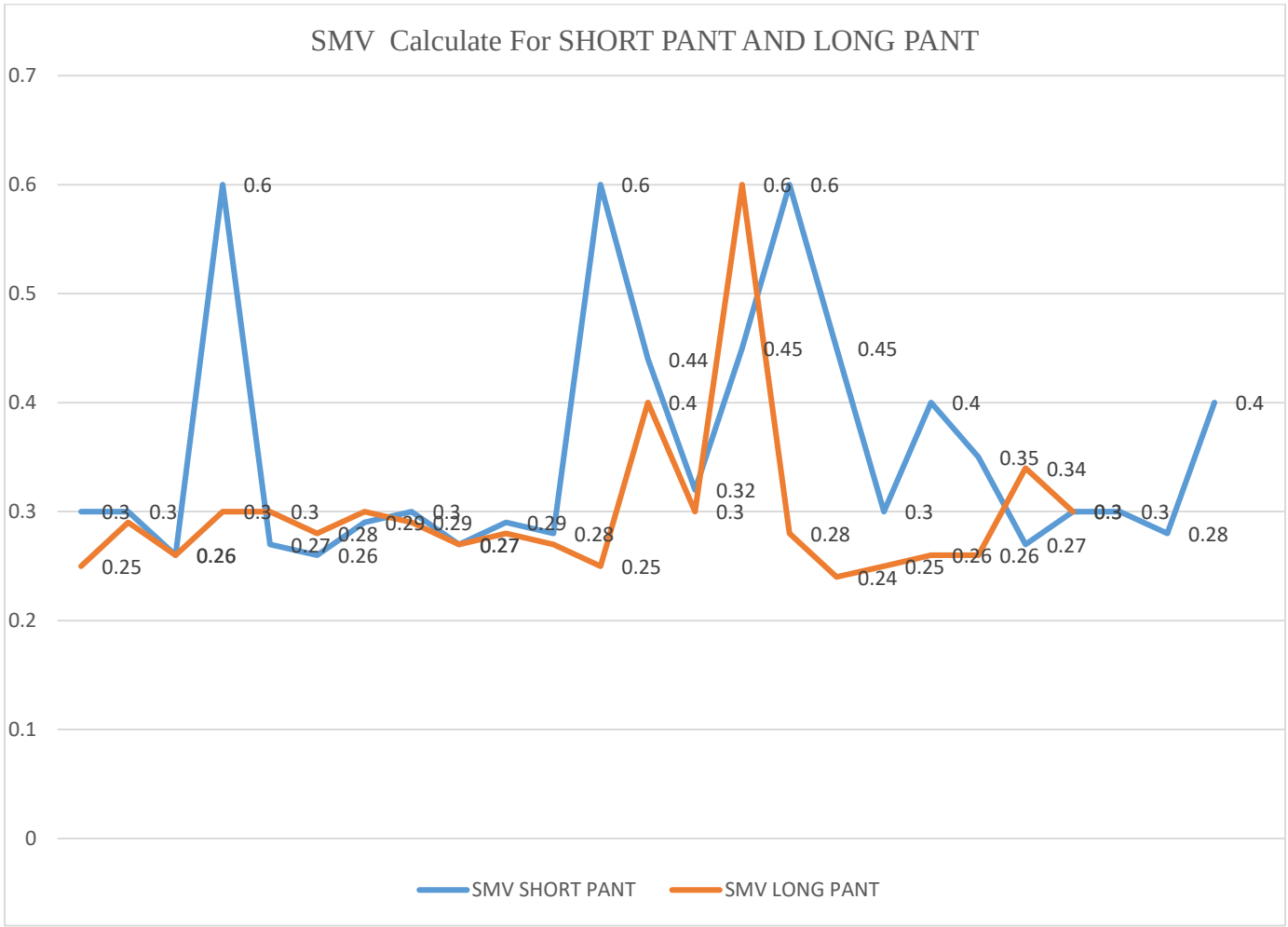
4.2.1 Graph:



Here 4.2.1 in this graph we see that SMV Needed for long pant is high which is 12.30 & SMV need for Short pant is 8.88. Accumulative machine limit is high for short pant. Target is same for both which is 75%.

4.2.2 operator SMV Calculate for bottom part:

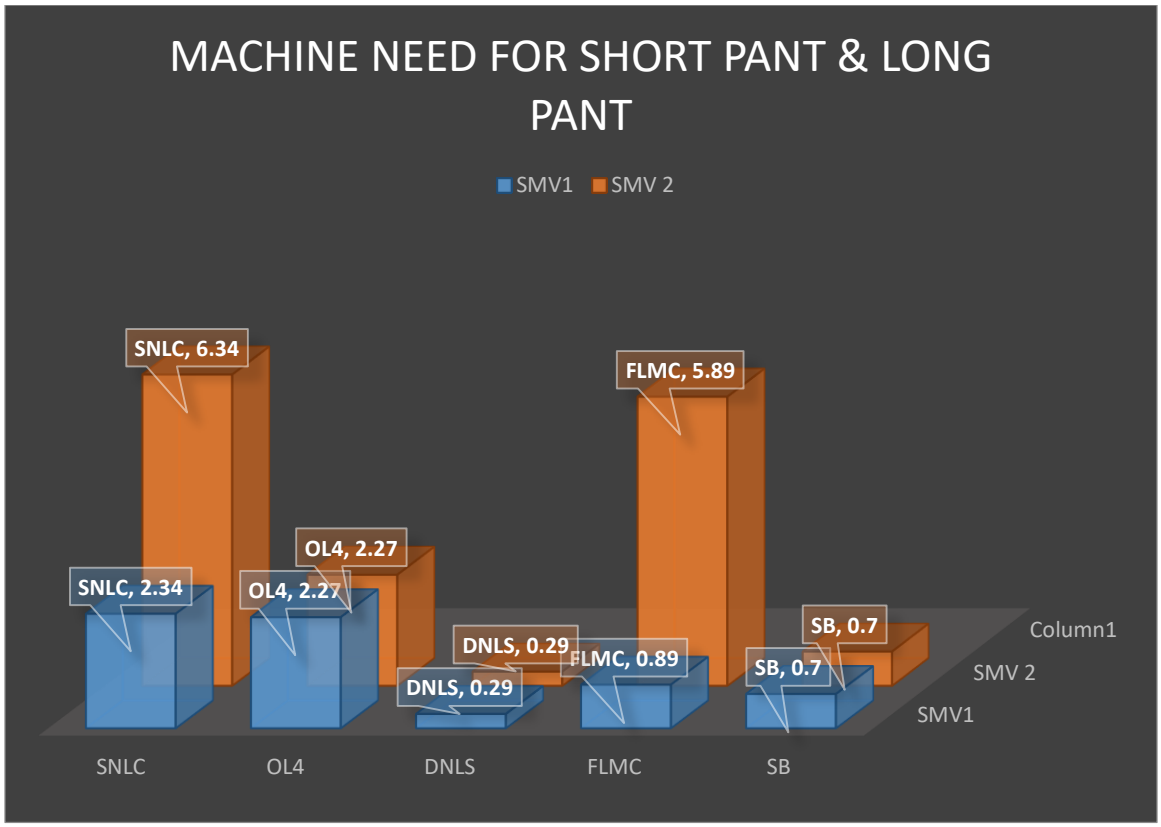
4.2.2.1Graph: SMV Calculate for short pant



Graph 4.2.2.1 shows that operator wise SMV calculate for short pant. Here this graph we see that .60 is the highest number of SMV of the operator. 0.45 is the medium range of SMV of the operator. The lowest value of the operator SMV is 0.27.

4.2.3 Total machine need for Bottom part:

4.2.3.1 Graph:



In this graph 4.2.3.1 we see that the bottom part machine need. In bottom part machine need for SNLC is the highest value which is 6.34. then the second-high machine need for FLMC is the value is 5.89 is for long pant. The quantity of the machine for long pant SNLS is 9 and the OL4 thread machine needed is high and the value is 10. For short pant, we see that SNLC and OL4 machine quantity is same the value is 8. SNLC machine value is high SMV for Short pant which is 2.34.

CHAPTER-5

Conclusion:

Industrial Engineering is an important and essential part of any apparel Industry. We learn all the implementations of the process which we have studied the theoretically.After doing the project work we have learned about how many machine is needed for a complete garment & how many operator is needed to make a garments & also maximum target of the operator. We calculate data from graph they are-

- Average Target is for Tops highest 85% for t- Shirt & polo shirt 60%.
- The average highest number of SMV is 0.60 & average lowest SMV of the operator is 0.24.
- graph we see that SMV Needed for long pant is high which is 12.30 & SMV need for Short pant is 8.88
- SMV of maximum value is 11.68 which is for polo shirt.
- The operator maximum target is 133. This is the maximum target of operational from the operation data.
- Average SMV needed for making a T- shirt is 10.08.

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