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Optimization of Ponte pant production and Standard minute value estimation

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Abstract— ***Ponte pants are also known as Ponte di Roma and Ponte de Roma. It is currently in trend and is considered important part of women's wardrobe across globe. An assembly process is used to finish a product piece in textile industry including Ponte pants. Each work station is allocated restricted work fraction. Standard minute value (SMV) is used to define the time taken to finish a process while maintaining optimum productivity. In this study we have analyzed Ponte process making at Sidney Apparel, Aqaba, Jordan. Ponte pant making process utilized 35 sub processes. On proper line balancing we were able to reduce number of operators from 52 to 46 and number of helpers from 6 to 5. This reduction in manpower will be beneficial in optimizing productivity which is directly associated with profitability. SMV was calculated to be at 18.87. This SMV can be used to standardize and rate worker performance and stabilize production streak.***

Keywords— ***Standard Minute Value (****SMV), textile industry, Ponte*

I. INTRODUCTION

Ponte pants are also known as Ponte di Roma and Ponte de Roma. Initially they were made of 100% polyester fabric which felt rough to touch. Whereas now a day they are made of all the same type of fabric including polyester, rayon and spandex, although you can find rayon/spandex and rayon/nylon/spandex blends. The Ponte fiber has good color retention and durable to act as leather substitute. Ponte pants are considered modern version of elastic waist pants and are made of tightly knit fabric with a mid or heavyweight fabric with little to moderate stretch. Selection of non-polyester knits are softer, closer resembling jersey. They constitute of legging-pant hybrid dealing with a double-knit process. Double knit process utilizes set of two needles on a two needle bed. In comparison to leggings, Ponte pants are firm but more stretchable than trousers or jeans [1]. Ponte pants, leggings, dress, tunic, suit and shorts are some of commercial available products using Ponte fabric. Ponte pants are stylish and in fashion making them bestsellers in some establishments making them a proud part of owners wardrobe [2].

The use of leggings was first by men dating back to 14th century and continuing till 19th century. Girls started legging fashion since mid 20th century. Currently these are a fashion trend and widely accepted. Ponte pants has been able to carve own niche with ability to wear them casually, formally, in day or at night [3].

In apparel industry, a constant need to match ever-changing fashion, meet customer satisfaction and maintain quality and sustain profitability is there. Maintaining production efficiency and development of new production systems is a challenge which may account for survival of an industrial establishment [4][5].

The production at garment manufacturing unit involves sub assembly to reach a fully finished product. This production setup includes smaller workstations which specialize in a small fraction of work in an assembly line like setup. According to complexity and need workers or helper may be assigned [6]. The sewing process is most labor intensive and holds high priority. Division of labor at different workstations is optimized to reduce handling time, reduce defects and increasing productivity. Standard mean value is used to define the optimum time to be taken at each workstation and is measured regularly to check loss of productive time and used to rate skill of workers [7].

Must Garment Corp Ltd is an international company with more than 10,000 employees supporting the US and European market. With factories and offices in Hong Kong, USA, UK, China, Bangladesh and Bahrain, the group has a global presence with exports of over 35 million garments annually. The group has expanded its reach and the group has already established its new setup at Aqaba, Jordan and is manufacturing under Sidney Apparels. Ponte pants are their one of the prime products. This study was carried out by observing in plant strategies for Ponte pants at Sidney Apparels, Aqaba, Jordan. Textile production in small hand looms is different than the ones producing at industrial scale. The use of modern technology and sewing machines is optimized to economically large scale in modern textile industries. A systematic synchronization of process and operational parameters are required to produce a one piece of complete set of product in garment industry.

The process of balancing an assembly line is to ensure that all work stations have an equal amount of work to perform. As some operations are tough and may need more workers to complete same amount of work than other work stations. This is necessary as slowest process in assembly line will determine the number of finished products. Standard Minute Value (SMV) is calculated by adding time taken for each fraction of an operation. Maintaining SMV can lead to better productivity and profits.

II. OBJECTIVE OF PROPOSED RESEARCH WORK

1. To determine line balancing
2. To determine operational sequence of the manufacturing process of Ponte Pant
3. To develop the target of the manufacturing process
4. To increase the productivity of the company
5. To make proper distribution of SMV
6. To make better utilization of man, machine and materials

III. METHODOLOGY

This study was carried out at Sidney Apparels, Aqaba, Jordan to study the production strategies and methods described in literature. Any deviation from set procedures and methods in actual use were analyzed. Complete process of Ponte pant was studied. Line balancing for optimized production was attempted for maximum efficiency at each work station. Areas were identified for implementation of work aids or for machinery usage.

Structure of a Ponte Pant:

A Ponte pant consists of waistband, front pockets, back pockets, hem. Generally fabrics used included polyester, rayon and spandex or blends of these. A double knit process ensures stretch but tough feeling fabric. Other forms including skirts, jackets, and shorts are available too but the plant under study dealt with Ponte pants for women.

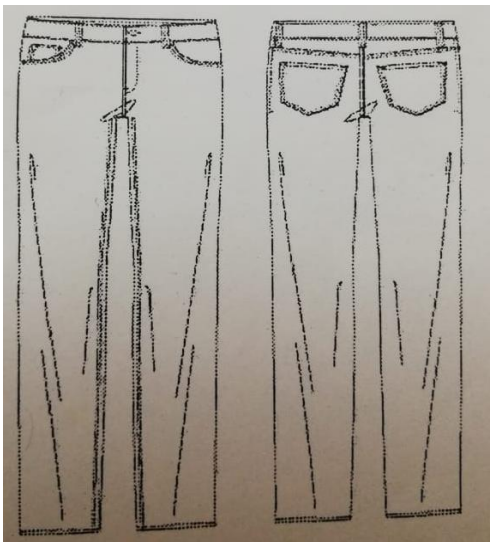


Figure 1: Outline of a Ponte Pant.

Making process of a Ponte pants

Material movement in the plant in general was as follows:

Store
↓
Sampling
↓
Cutting
↓
Sewing
↓
Finishing
↓
Warehouse /Shipment

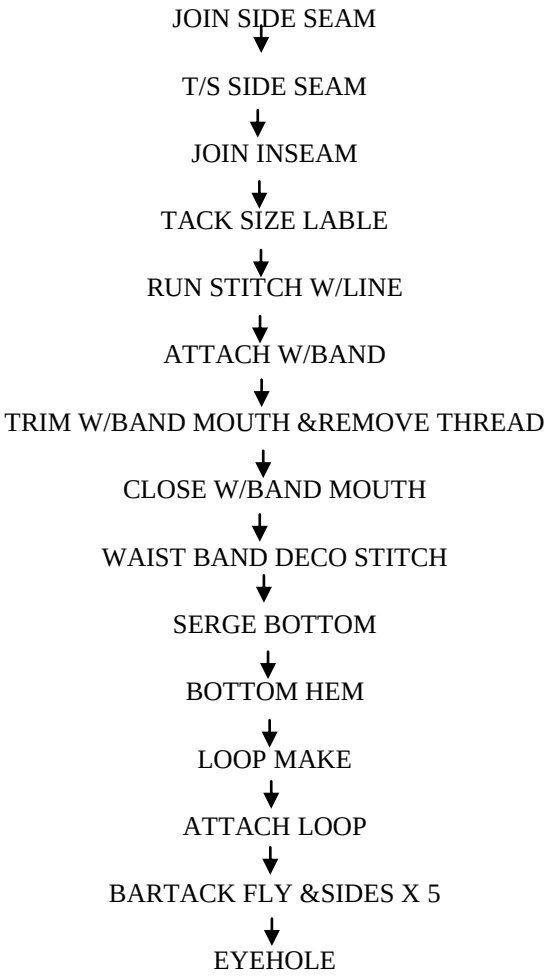
Flow chart of Back section of Ponte pants:

JOIN BACK YOKE
↓
TIGHT STITCH YOKE
↓
SERGE PKT
↓
HEM BACK PKT
↓
MARK BACK PKT PLACEMENT
↓
CREASE BACK PKT
↓
ATTACH BACK POCKET
↓
2ND STITCH BACK PKT
↓
JOIN BACK RISE
↓
TIGHT STITCH BACK RISE
↓
BAR TAK BACK PKT

Flow chart of Front section of Ponte Pant:

HEM COIN PKT
↓
ATTACH COIN PKT ON FACING
↓
ATTACH FACING TO BODY
↓
TOP STITCH
↓
SERGE R/L FRONT RISE & FLY
↓
ATTACH & TOP STITCH L/ FLY TO L/FRONT
↓
ATTACH ZIPPER TO S/FLY & TIGHT STICH J STITCH
↓
ATT R/FLY TO ZIPPER & ATT R/FRONT
↓
TACK & TIGHT STITCH FRONT RISE

Flow chart of Assembly section:



IV. **RESULTS**

A complete study of the process layout at the production line was carried out. It was observed that at various workstations man power allocation was not optimum. Process layout was modified and line balancing was carried out.

Table 1 Process layout and line balancing before and after study:

	Process		without line balancing	without line balancing	After line balancing	After line balancing
			Number of operators	Number of Helpers	Number of Operators	Number of Helpers
	Back Section					
1	Join Back Yoke	OL5T	1		1	
2	Tight stitch yoke	FOA	1		1	
3	Serge PKt	OL3T	1		1	
4	Hem pack Pkt	SNLS	1		1	
5	Mark Back pkt Placement	TABLE		2		1.5
6	Crease Back Pkt	IRON		2		1.5
7	Attached Back pkt	SNLS	3		3	
8	2nd stitch back pkt	SNLS	3		2.75	
9	Join back rise	OL5T	1		1	
10	Tight Stitch back rise	FOA	1		1	
11	Bar Tak Back pkt	BRTK	2		2	
	Sub total		14	4	13.75	3

	Front Section					
12	Hem Coin Pkt	SNLS	1		1	
13	Attached Coin Pkt on Facing	SNLS	1		1	
14	Attached facing to body	OL5T	1		1	
15	Top stitch	DNLS	2		1.25	
16	Serge R/L Front Rise & fly	OL3T	1		1	
17	attach & top stitch L/fly to L /Front	SNLS	1		1	
18	Attached Zipper to S/Fly & T/S J stitch	SNLS	1		1	
19	Att R fly to zipper & att R/Front	SNLS	1		1	
20	Tack & Tight Stitch front rise	SNLS	1		1	
	Sub total		10		9.25	
	Assembly Section					
21	Join Side seam	OL5T	3		2.25	
22	Tight Stitch Side seam	SNLS	1		1	
23	Join Inseam	OL5T	3		1.75	
24	Tack Size label	SNLS	1		1	
25	Run stitch	OL3T	1		1	
26	Attach waist band	KANSAI	4		4	
27	Trim waistband mouth and remove thread	TABLE		1		1
28	close waist band mouth	SNLS	4		4	
29	Waist band deco stitch	SNLS	1		1	
30	Serge bottom	OL3T	1		1	
31	Bottom Hem	SNLS	3		2.5	
32	loop make	FL LOOP	1		0.5	
33	Loop attach	LOOP	2		1.25	
34	Bartack Fly & Sides	BRTK	2		1.25	
35	Eye hole	eyehole	1		0.5	
	Sub total		28	1	23	1
	Total		52	5	46	4

Prior to study line balancing was not proper. Before study 52 operators and 5 helpers were needed for completion of complete process. But after study and proper line balancing we were able to reduce the manpower by 6 operators and 1 helper. For the same operation 42 operators and 4 helpers were needed now. For time study, an observer needs to be trained and observations of time study can be used to rate skill of workers. The significance of time study lies in the maintenance of worker performance. It may be extended to large number of operation cycles as per desired accuracy. After a basic time has been calculated i.e. time taken to complete an operation; allowances for workers recovery from operational fatigue are added to achieve standard time.

Table 2 Standard Minute Value (SMV) calculation

		Average cycle time in seconds	Performed SMV
	Back Section		
1	Join Back Yoke	21.1	0.42
2	Tight stitch yoke	21.96	0.44
3	Serge PKt	18.72	0.37
4	Hem pack Pkt	19.38	0.39
5	Mark Back pkt Placement	24.76	0.5
6	Crease Back Pkt	28.52	0.57
7	Attached Back pkt	50.12	1

8	2nd sticth back pkt	44.52	0.89
9	Join back rise	21.74	0.43
10	Tight stitch back rise	20.06	0.4
11	Back trak Back pkt	34.92	0.7
	Front Section		
12	Hem Coin Pkt	11.32	0.23
13	Attached Coin Pkt on Facing	21.24	0.42
14	Attached facing to body	21.98	0.44
15	Top stitch	16.76	0.34
16	Serge R/L Front Rise & fly	20	0.4
17	attach & top stitch L/fly to L /Front	21.34	0.43
18	Attached Zipper to S/Fly & T/S J stitch	22.2	0.44
19	Att R fLY to zipper & att R/Front	21.96	0.44
20	Tack & Tight stitch front rise	21.1	0.42
	Assembly Section		
21	Join Side seam	50.56	1.01
22	Tight stitch Side seam	25.1	0.5
23	Join Inseam	36.46	0.73
24	Tack Size label	22.56	0.45
25	Run stitch	23.04	0.46
26	Attach waist band	68.08	1.36
27	Trim waistband mouth and remove thread	20.8	0.42
28	close waist band mouth	66.78	1.34
29	Waist band deco stitch	23.16	0.46
30	Serge bottom	22.52	0.45
31	Bottom Hem	38.44	0.77
32	loop make	14.58	0.29
33	Loop attach	18.8	0.38
34	Bartack Fly & Sides	17.72	0.35
35	Eye hole	11.3	0.23
			18.87

Time study is a very flexible technique, suitable for a wide range of work performed under a wide range of conditions, although it is difficult to time jobs with very short cycle times (of a few seconds). Because it is a direct observation technique, it takes account of specific and special conditions but it does rely on the use of the subjective process of rating. However, if properly carried out it produces consistent results and it is widely used. Additionally, the use of electronic data captures devices and personal computers for analysis make it much more cost effective than previously.

Ponte pants are in demand across nations and forms a major product of Sidney Apparels, Aqaba, Jordan. Ponte fabric can be used to design skirts, shorts, jackets or shirts. In this study Ponte pants has been analysed. In an assembly line number of operations vary according to design and style. This in turn affects SMV of the various operations at different work stations. The results have been presented in the tables 1 and 2. A total of 35 operations are needed to completely stitch a Ponte pant. Before study it was observed that total manpower of 57 (52 operators and 5 helpers) was needed. On proper line balancing it was observed that total manpower of 50 (46 operators and 4 helpers) can do the same job without affecting productivity. SMV of 18.87 was observed for the Ponte pant under study. Various studies have studied parameters for process optimization including reworks [8], defects in sewing area [4], effect of work aids[5], technological delays [9], modification of production process [10], deviation from standard operating procedure [11], non performance time [7], design change [12]. As this study was limited in time and scope, further study to achieve increase in efficiency and production are possible.

V. CONCLUSIONS

The present study is based on effective layout for Ponte pant and uses line balancing to reduce manpower and calculate SMV. During the study it was observed that by using work aids workers were able to deliver higher output in bottom hem operation, pocket tightening operation, pocket crease operation, pocket marking and reduction in downtime as well as handling time. As the study was restricted in time and scope, it may be further extended to each operation at production line. Standard operating procedures were in place but in absence of proper checks they were not being used to full efficiency. By using monitoring and research we can enhance production to optimum level.

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