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Practically observation of standard Minute Value of T-shirt

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Abstract: *This research project is based on calculation of standard minute value of T-shirt. An experimental investigation for the distribution of SMV for each and every operation require for making a T-shirt and provides a clear and details concepts for determining line balancing, machine requirements, man power allocation for setting a definite target within a reasonable efficiency. This project is a details discussion and distribution of SMV which will assist to minimize SMV by having a better synchronization with man, machine, materials and methods to achieve higher efficiency.*

Keywords: Line balancing, SMV, T shirt, Machine synchronization**.**

1. Introduction

A T-shirt (or T shirt, tee-shirt, or tee) is a style of shirt. A T-shirt's defining characteristic is the T shape made with the body and sleeves. It is normally associated with short sleeves, a round neck line known as a "crew neck", and no collar.

Typically made of cotton fibers knitted in a jersey stitch, they have a distinctive soft texture compared to woven shirts. The majority of modern versions have a body made from a continuously woven tube, on a circular loom, so that the torso has no side seams. The manufacture of T-shirts has become highly automated, and may include fabric cutting by laser or water jet.

The T-shirt evolved from undergarments used in the 19th century, through cutting the one-piece "union suit" underwear into separate top and bottom garments, with the top long enough to tuck under the waistband of the bottoms. With and without buttons, they were adopted by miners and stevedores during the late 19th century as a convenient covering for hot environments.

As slip-on garments without buttons, they originally became popular in the United States when they were issued by the U.S. Navy during or following the Spanish–American War of 1898. These were a crew-necked, short-sleeved, white cotton undershirt to be worn under a uniform. It became common for sailors and Marines in work parties, the early submarines, and tropical climates to remove their uniform "jacket", wearing (and soiling) only the undershirt. [1]

They soon became popular as a bottom layer of clothing for workers in various industries, including agriculture. The T-shirt was easily fitted, easily cleaned, and inexpensive, and for those reasons it became the shirt of choice for young boys. Boys' shirts were made in various colors and patterns. By the Great Depression, the T-shirt was often the default garment to be worn when doing farm or ranch chores, as well as other times when modesty called for a torso covering but conditions called for lightweight fabrics [1].

A V-neck T-shirt has a V-shaped neckline, as opposed to the round neckline of the more common crew neck shirt. V-necks were introduced so that the neckline of the shirt does not stand out when an outer shirt is worn over it, thus reducing or eliminating the visible cloth above the outer shirt of a crew neck shirt.

The ready-made garment (RMG) sector is the life-blood of Bangladesh economy achieving higher export growth every year. The sector is now the largest contributor not only to overseas trade but also to the national economy.

Bangladesh textiles and RMG industry comprises 1,55,557 units – 1,48,000 handlooms units, 3,284 mechanized primary textile units, 5150 export-oriented readymade garments manufacturing units and 273 garments washing-dyeing units. The sector is a major foreign exchange earner for Bangladesh contributing 77 percent to the country's net exports. At the end of the fiscal year 2011, total export of Bangladesh garments was worth US$ 23 billion, a 43 percent increase over the previous year, accounting for almost 25 percent of the GDP (gross domestic product) [1].

A growing number of chief purchasing officers (CPOs) in European and apparel companies are scrutinizing their sourcing strategies, as margin and supplier capacity pressure building over the last several years has caused them to search for the next performance improvement opportunity.

While China is starting to lose its attractiveness in this realm, the sourcing caravan is moving on to the next hot spot. With Bangladesh having developed a strong position among Europeans and US buyers, many companies are already eager evaluate the future potential. However, the lure of competitive prices, available capacities and suppliers capacities offered is being cautiously weighed against a prevailing insecurity created by the challenges inherent in Bangladesh's Ready-Made Garments (RMG) market [2].

Today's business climate for clothing manufacturers requires low inventory and quick response systems that turn out a wide variety of products to meet customers demand. It is especially in the apparel industry that managers are trying to develop their current systems or looking for new production techniques in order to keep pace with the rapid changes in the fashion industry.

Therefore, to develop a new system, good observation is needed. However to observe real manufacturing systems is very expensive and sometimes cumbersome.

The rapid rate at which the whole process takes place, the interaction between workers, and the different transition times between workers make it increasingly more difficult for a human being to make correct decisions regarding how fast each operator should work in order to continue the process, while at the same time keeping productivity high and throughput at an acceptable level [3].

Construction of a quality garment requires a great deal of know-how, a lot of coordination and schedule management. Clothing manufacturing consists of a variety of product categories, materials and styling. Dealing with constantly changing styles and consumer demands is so difficult. Furthermore, to adapt automation for the clothing system is also so hard because, beside the complex structure also it is labor intensive. Therefore, garment production needs properly rationalized manufacturing technology, management and planning [4]. In garment production, until garment components are gathered into a finished garment, they are assembled through a sub-assembly process. The production process includes a set of workstations, at each of which a specific task is carried out in a restricted sequence, with hundreds of employees and thousands of bundles of sub-assemblies producing different styles simultaneously [5]. The joining together of components, known as the sewing process which is the most labor intensive part of garment manufacturing, makes the structure complex as the some works has a priority before being assembled [6].

Furthermore, since sewing process is labor intensive; apart from material costs, the cost structure of the sewing process is also important. Therefore, this process is of critical importance and needs to be planned more carefully [7]. As a consequence, good line balancing with small stocks in the sewing line has to be drawn up to increase the efficiency and quality of production. An assembly line is defined as a set of distinct tasks which is assigned to a set of workstations linked together by a transport mechanism under detailed assembling sequences specifying how the assembling process flows from one station to another. In assembly line balancing, allocation of jobs to machines is based on the objective of minimizing the workflow among the operators, reducing the throughput time as well as the work in progress and thus increasing the productivity. Sharing a job of work between several people is called division of labor. Division of labor should be balanced equally by ensuring the time spent at each station approximately the same. Each individual step in the assembly of product has to be analyzed carefully, and allocated to stations in a balanced way over the available workstations. Each operator then carries out operations properly and the work flow is synchronized. In a detailed work flow, synchronized line includes short distances between stations, low volume of work in process, precise of planning of production times, and predictable production quantity [8].

Overall, the important criteria in garment production is whether assembly work will be finished on time for delivery, how machines and employees are being utilized, whether any station in the assembly line is lagging behind the schedule and how the assembly line is doing overall [9] [10]. To achieve this approach, work-time study, assembly line balancing and simulation can be applied to apparel production line to find alternative solutions to increase the efficiency of the sewing line [11].

Since the late 1970s, the RMG industry started developing in Bangladesh primarily as an export-oriented industry and the domestic market for RMG has been increasing fast due to increase in personal disposable income and change in life style. The sector rapidly attained high importance in terms of employment, foreign exchange earnings and its contribution to GDP. Since buyer comes to this region for the lowest labor price ($0.11 per shirt for Bangladesh, $0.26 for India, $0.79 for Srilanka), the quality of the garments, efficiency and productivity of Bangladesh RMG sector remain ignored even in the tough competitive market. Factories in Srilanka operate at 80% - 90% of efficiency, whereas in Bangladesh, according to some experts, productivity is between 35% and 55% of efficiency with very few exceptions. For the RMG sector in Bangladesh, productivity alone can make a difference between life and death [12].

2. Materials

2.1 Material used:

1) single jersey (Hundred percent cotton,lycra)
2) Pattern paper
3) Measuring Tape
4) Scissors
5) Pencil
6) Eraser
7) Curve Ruler
8) Stop watch
9) Calculator etc.

3. Method

3.1 Operation sequence

Sewing step 1: Place front and back pieces together with right sides facing. Match the pieces up at the shoulder and pin them if you want. Here they are surged together. Before I had serge I would sew the seam, then zigzag the edges together because I don't like unfinished edges.

Sewing step 2: Pin the top center of the sleeve to the shoulder seam.

Pin the front and back edges of the sleeve seam. This is kind of difficult to show in a photo

Sewing step 3: Fold the shirt so the front and back line up and the sleeve edges line up. Starting at the sleeve hem edge, and all at once, sew the sleeve edges together, then the front and back together at the sides. Do both sides

Sewing step 4: Sewing the neckband on is explained here in T-shirt

Sewing step 5: Fold the sleeve edges and bottom edge up once and stitch in place. I have a "why you don't need a free arm to sew hems of small sleeves".

3.2 Line Balancing of T-Shirt Manufacturing Process for 180 Pieces per Hour

Operation no.	Operation	No. of M/C
01	Shoulder joining-(O/L)	1
02	Over locking of lining-(O/L)	1
03	Neck piping-(O/L)	1
04	Neck joining-(O/L)	1
05	Neck overclocking-(O/L)	1
06	Sleeve hem-(F/L)	1
07	Sleeve joining-(O/L)	2
08	Side joining-(O/L)	3
09	Side top stitch-(F/L)	2
10	Side tuck cuff-(SNLS)	1
11	Neck top stitch-(F/L)	1
12	Bottom hem (F/L)	1
Total		16

Table 1: Line Balancing of T-Shirt

3.3 SMV study for a T-shirt

No.	Operation	Average Cycle time (sec)	Estim ated SMV
01	Shoulder joining	13.09	0.30
02	Over locking of lining	10.90	0.25
03	Neck piping	13.09	0.30
04	Neck joining	15.27	0.35
05	Neck overclocking	13.09	0.30
06	Sleeve hem	13.96	0.32
07	Sleeve joining	26.18	0.60
08	Side joining	34.90	0.80
09	Side top stitch	26.18	0.60
10	Side tuck cuff	26.18	0.60
11	Neck top stitch	15.27	0.35
12	Bottom hem	15.27	0.35
TOTAL SMV			5.12

Table 2: SMV of T-Shirt

4. Result & Calculation

SMV means standard minute value. It is a numerical value which is represented the standard time of a process or operation in a standard environment for standard worker. To convert cycle time to normal or basic time we have to multiply it with operator performance rating. Here for example, if rating 100%. Now we have add allowances for machine allowances, fatigue and personal needs etc. Add machine allowance only to those elements where machine is running and fatigue and personal needs to all elements. Now we got standard time for each element in seconds. Sum up all elemental time and convert seconds into minutes. This is Standard Minute Value (SMV).

Let,

Cycle time = 5.12 minute

Performance Rating = 80%

Bundle allowance, M/C allowance & Personal allowance = 20%

SMV or Standard minute

= Normal or Basic time + Allowance%

= [Cycle time (minute) x Performance rating %)] +Allowance %

= [5.12 x 80/100] + Allowance%

= 4.096 + [(20 x 4.096)/100]

= 4.096+0.8192

= 4.9152 Minute

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