Subject: Apparel Production Management

Unit 5: Batch setting and line balancing

Quadrant 1 – e-Text

Learning Objectives

The learning objectives of this unit are:

- State the significance of line balancing.
- Explain how theoretical balancing is done.
- Define the significance of skill inventory.
- Explain how initial balancing is done.
- State the significance of balance control.
- Review examples from the garment industry to illustrate concepts.
- Illustrate line balancing and control using simulation exercises.

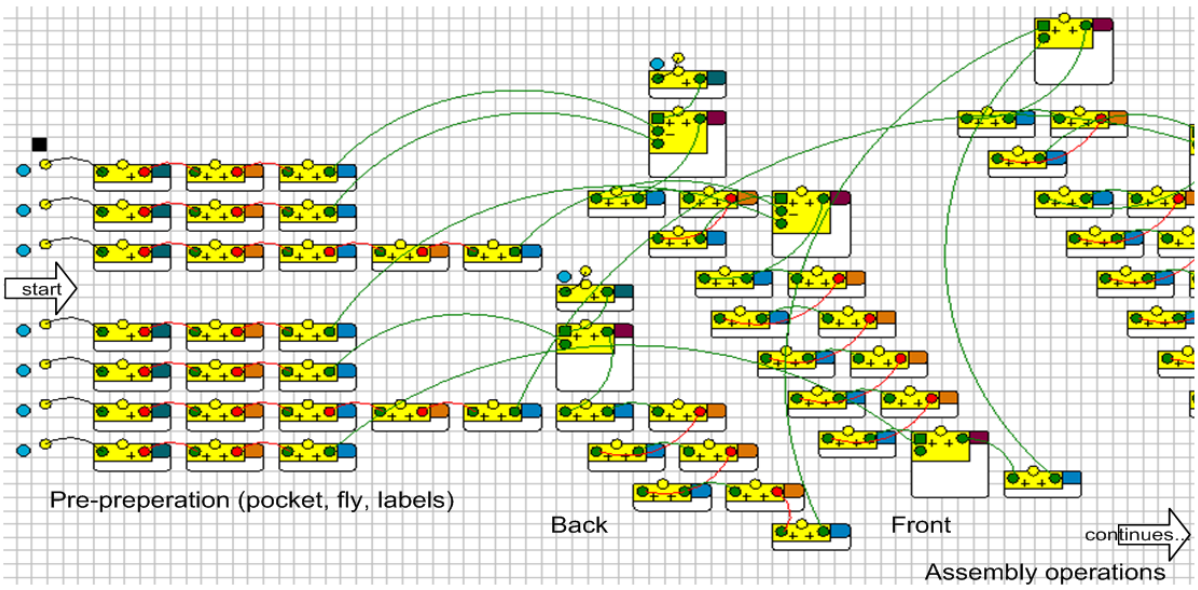
5.1 Batch Setting Process

Batch setting for apparel production

In the apparel manufacturing industry, assembly line process involve set of workstation in which specific operation are performed in a predefined sequence. The aim of assembly line balance planning in sewing lines is to assign tasks to the workstations, so that the machines of the workstation can perform the assigned tasks with a balanced loading, so that the mean absolute deviations (MAD) can be minimized.

5.2 Line Balancing

Line balancing is to set the flow through each operation to be as similar as possible, checking from time to time, to see how things are going, and making adjustments to even out the flow again.



5.3 Batch Setting Methods

Batch setting by method 1

This has the following steps.

1. Calculation of labour requirements

2. Operation breakdown

3. Theoretical balance

Calculation of labour requirements

The First step is to allocate enough people to an order to ensure that it is completed on time.

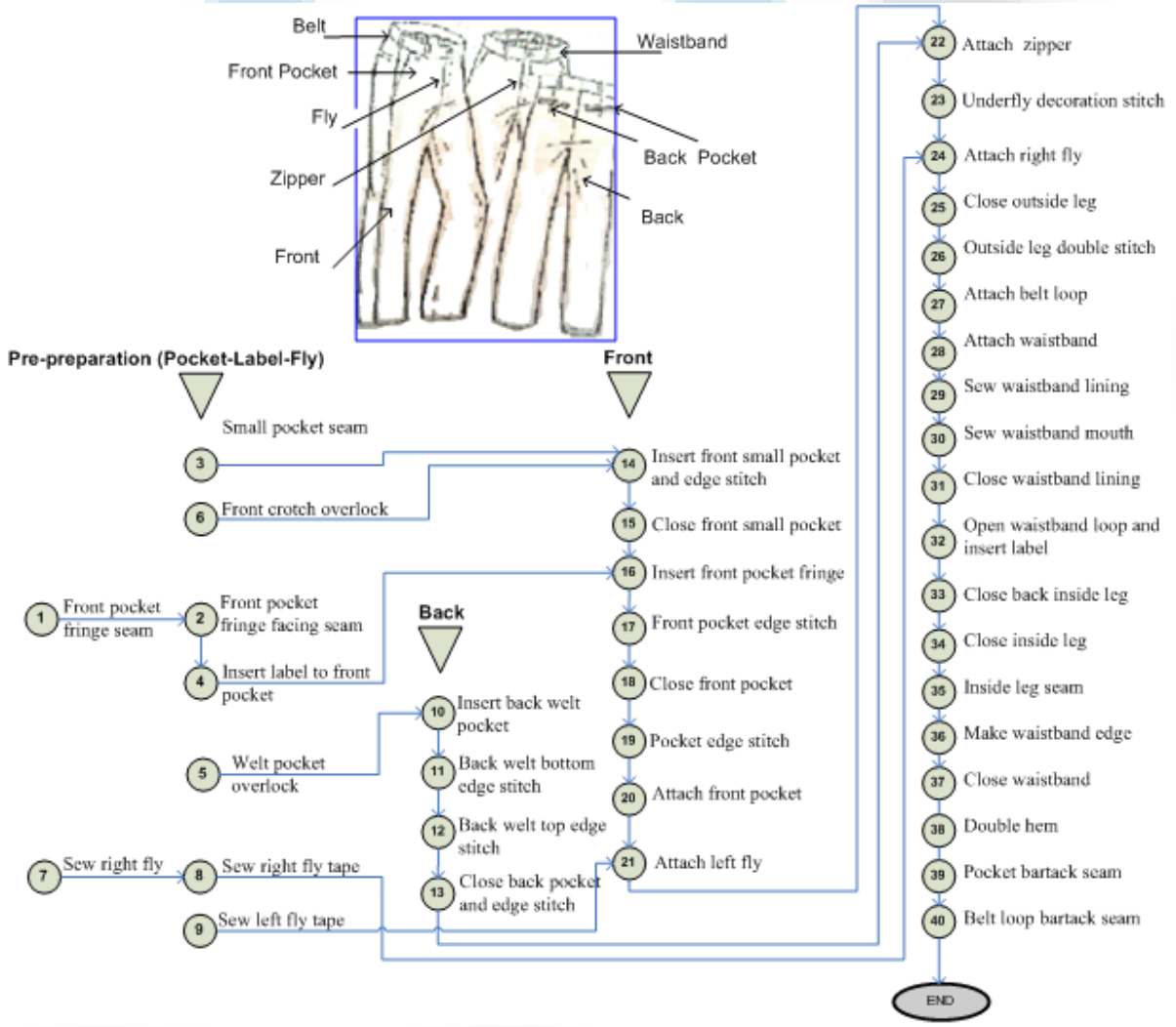
The work content of one garment multiplied by the number in the order gives the work content of the order. The time in which it must be completed is divided into the work content of the order, to give the required output in standard hours per hour. The current figures of attendance utilisation and performance are required. Floaters are required to cover for absenteeism and problems of balancing. Calculation of this sort is not exact and it is usually good enough to decide upon the number needed purely on the basis of absenteeism.

Required output in SM/hour: (size of the order*work content per garment)/time in hours

Labor required: Required output in SM/hour/60*predicted utilization *predicted performance *predicted attendance.

Floaters + operators = labor

Operation Breakdown



The job must be broken down into operations of equal size. The operation breakdown includes element description from method study, standard time of each operation and type of machinery required. Special work aids and attachments should also be mentioned on it.

This table displays the operation breakdown for the back section for a pair of jeans.

Sl. no.	Operations	M/C Type	SMV
1	pocket hemming	APH	0.07
2	pocket o/l	3T O/L	0.3
3	pocket creasing	ADPC	0.4
4	pocket attaching	APS	0.74
5	second stitch @ back pocket	SNLS	0.65
6	back yoke attach	FOA	0.41
7	back rise join	FOA	0.24
8	size label attach	SNLS	0.2

Theoretical operation balance

The number of element should match the number of people calculated in labour requirement. The alternate arrangement in theoretical balancing includes putting operators in parallel, operators in series, method / construction changes and work place improvements. Pitch time is the theoretical operation time; each operator should take for a planned balanced line.

It is calculated as: (SAM value of a style) / (No. of operator required to meet the target).

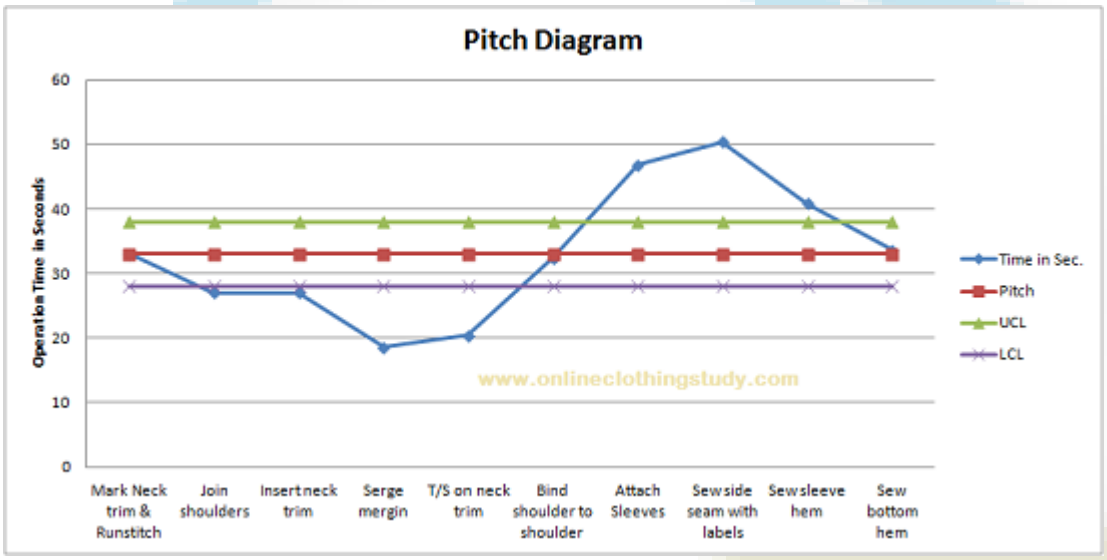
Batch setting by method 2

The Operation Bulletin is prepared which includes one column for calculated machine requirement and another column for actual machine requirement as shown in the chart.

Calculated machine, which is calculated requirement mostly come in fraction. Secondly you have to allocate correct number of machines to get output as per hourly target. Where work content is high (greater than Pitch) you plan for more than one machine for the same operation. When do you add one machine more and share work with other operation (machine) depends on work content and it is decided by Upper and Lower control limits

Upper limit is calculated by adding 10 Percentage to 15 Percentage of the basic pitch time and minus 10-15 Percentage to calculate lower limit. Standard limit is +/-10 Percentage. In the following diagram, UCL and LCL have been drawn considering +/- 15 Percentage of Pitch time.

This Pitch diagram is drawn with operation time, Pitch, UCL and LCL. Blue line shows basic time in seconds. When Blue line will remain within UCL and LCL i.e. +/- 15Percentage limit, one machine is considered for those operations.



When basic time of an operation is above upper limit 2 machines will be assigned for that operation, e.g. attach sleeve, sew side seam with label and sew sleeve hem.

Example

7680 skirt must be made in two weeks each of 40 hrs. Predicted attendance is 90Percentage, predicted utilization 85Percentage, predicted average piece work performance on standard 95 BSI. Sam of the garment is 10 min. Performance of floater 50 BSI.

Let us **Calculate** the following:

a) Required output in SAM/hour

b) No. of labour required

c) No. of floaters required

d) No. of operator required

e) Pitch time for operation. What is the significance of pitch time in line balancing?

Answer

a) Required output in SM/hour: (size of the order*work content per garment)/time in hours

= 960 SM/hour

b) Labour required: Required output in SM/hour/60*1/predicted utilization *1/predicted performance*1/predicted attendance

=22 labour

c) Floater = 4

d) Operator + Floater = Labour

22-4 = 18 operators

e) Pitch time= (SAM value of a style) / (No. of operator required to meet the target)

= 10/18 if three lines.

= .55 min

Pitch time is the theoretical operation time; each operator should take for a planned balanced line. It is calculated as:

(SAM value of a style) / (No. of operator required to meet the target)

5.4 Process of Line Balancing

Line Balancing has three steps. (1) Batch setting (2) Initial Balance (3) Balance Control

Initial balance
The expected performance of the people available must be taken from the skill inventory, in order to man the line in a way that smoothens out the potential variations in output between the stations shown in the theoretical balance. It is usual to select 'floaters' at this stage, which will help to cope with absenteeism and imbalance

Operator skill inventory
This database maintains the record of each operator, who can do what operation and at what rating. It is very important to keep this database updated as over the time operator acquires skills for new operations as well as improve performance in the existing operations.

Allocation of operators

Allocation also depends on type of balance required.

1. One approach of allocation is to find the closest match between operator performance required and operator performance available. This type of allocation results intrinsic balance of line.

2. Another approach of allocation is to utilize the operators in operations they can do best. This approach results dynamic balance of line.

Let's understand this from this example:

Operation	SAM	Machine	Target	Operator performance required
A. Collar attaching	1.5	SNLS	40 pcs.	100%
B. Cuff attaching	1.2	SNLS	40 pcs.	80%
C. Band hemming	1.0	SNLS	40 pcs.	66%

For the three operations: collar attaching, cuff attaching and band hemming, the SAM, Machine required, target output and operator performance required is displayed.

Displayed here is the operator skill inventory chart for Sita, Urmila, Rita and Savita, for operation A, B and C.

	Sita	Urmila	Rita	Savita
For Op A	70%	105%		140%
For Op B	80%		100%	
For Op C	120%	70%	100%	70%

When operator allocation, with intrinsic and dynamic balancing is done for the three operations, the results are different as shown here.

Operation	Intrinsic Balance	Dynamic Balance
A. Collar attaching	Urmila	Savita

B. Cuff attaching	Sita	Rita
C. Band hemming	Savita	Savita+Rita

For Intrinsic balance total three operators are allocated, with closest performance available. For operation A, 100 Percentage operator is needed and closest available is Urmila (105 Percentage). For dynamic balancing only two operators are allocated, total performance needed is 246 Percentage (100 + 80 + 66). Savita and Rita together (100 + 140) Percentage can match the requirement. Here operators are allocated to the operations they can do the best. The dynamic balance results in better operator utilisation but it is comparatively difficult to maintain.

5.5 Balance control

Balance control is perhaps the most vital skill in a supervisor, with its objective to maintain the highest output and not just to keep people busy. To set the flow through each operation to be as similar as possible checking from time to time to see how things are going and making adjustments to even out the flow again. All grid station will produce the same amount per unit time in a balanced production system.

5.6 Conclusion

To summarize, in this unit, you have seen the importance of initial balance, and ways to allocate and utilize operators to get the optimum balance that is required. Balance control is perhaps the most vital skill that is required of a supervisor.