Production balance in spinning mills

Dr. H.R.Sheikh, professor, Emeritus, Textile Institute of Pakistan.

Entrepreneurs must fulfill many important requirements in order to set up viable yarn manufacturing plants. Some of these requirements are selection of most suitable site and machinery combination, economic size of the unit and operational flexibility. However, once the plant has been installed and commissioned, spinning managers endeavour to achieve the required product quality at standard output rate. Therefore, it is necessary to maintain production balance between preparatory, spinning and winding stages and ensure the following parameters:

- No section of any winding machine should be out of production due to shortage of yarn supply from the ring spinning shed.
- Similarly, the ring spinning frame or any back process machine should not be idle due to shortage of feed material.
- There should not be an excessive stock of yarn, roving, sliver and blowroom laps, as accumulation of material at any processing stage may lead to temporary stoppage of the back process machine.
- Machines should not be operated at maximum speed in order to consume the accumulated stock of back process materials.

1. Economic size of the spinning unit

The installed capacity of spindles for an economic size unit has progressively increased in Pakistan. During the eighties a spinning mill with an installed capacity of about 14000/15000 spindles was considered to be an economic unit. However with the commencement of World Free Trade Regime (W.T.O) the textile industry of Pakistan is facing multiple challenges. The textile and clothing products can find access in the international export market only on the basis of the required quality and competitive price. With an escalation in the prices of all inputs, currently, a spinning unit with an installed capacity of about 20160 spindles is considered to be an economic unit. This would require installation of 40 Ring Spinning Frames with 504 spindles each.

2. Production program ring spinning

Assuming that the installed capacity of the spinning mill is 20,160 spindles comprising of 40 Ring Spinning Frames, the daily production will depend upon the production program. A typical production program for ring spinning machines is tabulated below.

Nominal yarn count				
Particulars	**10**	**16**	**20**	**30**
Actual count (Ne)	10.20	16.20	20.20	30.20
Spindle speed (RPM)	11,000	16,000	16,800	17,500
Twist factor	4.2	4.2	4.2	4.25
Turns per inch	13.41	16.91	18.88	23.36
OPS 100% (ozs per spindle shift)	20.43	14.84	11.19	6.3
Efficiency %	88	92	92	93
Actual OPS	17.98	13.65	10.30	5.86
Production per Ring Frame per day – (504 Spindles) in Lbs.	1699.11	1289.93	973.35	553.77
Allocation of ring frame	2	6	20	12
Daily production count-wise (in Lbs.)	3398.22	7739.58	19467	6645.24
Total Daily Production = 37250.04 Lbs.				

$$\text{Average Yarn Count} = \frac{10.2\times3398.22+16.2\times7739.58+20.2\times19467+30.2\times6645.24}{37250.04}$$

$$= \frac{753962.67}{37250.04} = 20.24 \text{ Ne}$$

2.1. Simplex frames

For the supply of roving to the ring shed operating in accordance with the above production program two types of roving hanks have been selected. Roving hank of 0.80 for yarn counts of 10.20 Ne and 16.20 Ne. and roving hank of 1.0 for yarn counts of 20.20 Ne and 30.20 Ne. The number of hanks of roving is generally kept as small as possible. The objectives are to facilitate balancing of production, implementation of colour scheme and elimination of mixed yarn production. On the basis of the foregoing assumptions, the number of Simplex frames required to supply roving to be ring shed are calculated as follows:

Actual yarn count			
Particulars	10.2 & 16.2	20.2 & 30.2	Remarks
Daily yarn production (LBS)	11, 137.80	26,112.24	
Production required from simplex frames with 3% waste in ring spinning.	11,471.93	26,895.61	
Hank of roving	0.8	1.0	
Twist factor and turns per inch	0.85/0.76	1.0/1.0	
Flyer speed (RPM)	1,100	1,100	
Delivery in inches per minute	1,447,37	1,100	
100% production per spindle per day (LBS)	86,15	52.38	
Actual production /spindle/day	73.23	44.52	Efficiency = 85%
No. of simplex frames spindles required	156.66	604.12	
No. of simplex frames required	1.31	5.03	Simplex frame with 120 spindles each.
Total number of Simplex frames = 6.34 or 7.0			

2.2 Drawing frames (2 Passage)

Assuming waste of 0.50 % at the roving stage, production required from the Drawing Frames works out as:

11471.93+26895.61) × 1.005 = 38367.54×1.005 = 38559.38 LBS

Linear Density of finished sliver = 70 grains per yard = 0.119

Delivery speed of Drawing Frames = 400 MPM.

Production of one set of Drawing Frame (double delivery) per day at 85 % efficiency equals to:

$$\frac{400\times1.0936\times60\times24\times0.85\times2}{0.119840} = 10712.82 \text{ LBS.}$$

$$\text{Number of Drawing Frames (Finisher) required } \frac{38559.38}{10712.82} = 3.6 \text{ say 4 sets.}$$

Assuming linear density of sliver at Breaker Drawing Frame is equal to 70 grains per yard, delivery speed equal to 400 MPM and waste at the Finisher Drawing Frames at 0.25 %, production required from Breaker Drawing Frames works out at 38559.38×1.0025 = 38655.78 LBS.

Production of one Drawing Frame (Breaker) = 10712.82 LBS.

$$\text{Number of Drawing Frames (Breaker required)} = \frac{38655.78}{10712.82} = 3.61 \text{ say 4 sets.}$$

2.3. Cards

Assuming waste at the Breaker Drawing Frames at 0.25 %, production required from the cards works out at = 38655.78×1.0025 = 38752.419 LBS.
Linear density of card sliver = 70 grains per yard = 0.119.
Delivery speed = 145 MPM. Efficiency of card = 86 %.

$$\text{Production of card per day} = \frac{145\times1.0936\times60\times24\times0.86}{0.119\times840} = 1964.54 \text{ LBS}$$

$$\text{Number of cards required} = \frac{38752.419}{1964.54} = 19.73 \text{ or say 20 cards}$$

Usually 2 extra cards will be installed to add flexibility to the carding process and take care of stoppage of any card for replacement of old wire.

2.4. Blowroom

Daily production required from Blow Room Line @ 7 % waste at the carding stage 38752.419 × 1.07 = 41465.09 LBS.
Production required per hour = 1727.71 LBS = 783.68 KG.
If Chute Feed System is not provided, number of scutchers required is calculated as follows:
Diameter of Lap Roller = 9 inch.
Speed of Lap Roller = 15 RPM.
Linear density of Lap = I LB/yard, Efficiency = 85 %
Hank of Lap = 0.00119

$$\text{Production per scutcher per day} = \frac{TT\times9\times15\times60\times24\times0.85}{36\times0.00119\times840} = 14431.68 \text{ LBS}$$

$$\text{Number of scutchers required} = \frac{41465.09}{14431.68} = 2.87 \text{ or say 3 scutchers.}$$

2.5 Cotton Required.

The quantity of cotton required per day can be calculated is shown in the next column:

2.6. Auto – cone winding machines

Cotton required per day @ 7 % waste in Blow Room = 41465.09 × 1.07 = 44367.65 LBS.

Number of cotton bales required (375 LBS each) is equal to:

$$\frac{44367.65}{375} = 118.3 \text{ or say 119 bales.}$$

The ring cops produced on the Ring Spinning Frames are not marketable. In order to produce cones which are marketable, winding of ring cops is carried out on Auto-Cone Winding Machines.

The number of winding machines required is calculated as follows:

Nominal/Actual Yarn Count				
Particulars	10/10.2	16/16.2	20/20.2	30/30.2
Daily production (LBS)	3398.22	7739.58	19467	6645.24
Winding speed (MPM)	1000	1050	1100	1200
Operating efficiency	85%	85%	85%	85%
Production per drum per day (LBS)	156.23	103.28	86.78	63.32
No. of drums required	21.75	74.94	224.33	104.95

Total number of drums required = 21.75+74.94+224.33+104.95 = 425.97

Number of winding machines required (60 drums each) is equal to:

$$\frac{425.97}{60} = 7.0995 \text{ or say 7 machines.}$$

Summary

Process wise number of machines calculated above for achieving production balance are summarized below:

a. Ring Spinning Economic Unit = 20,160 spindles, 40 Ring Spinning Frames, 504 spindles each.
b. Simplex Frames, 7 Roving Frames, 120 spindles each.
c. Drawing Frames, (2 Passage), 4 Double Delivery Drawing Frames.
d. Carding Machines, 22 cards.
e. Blow Room, cleaning Line of machines with Chute Feed System or 3 Single Process Scutchers.

It may also be pointed out that leading textile machinery manufacturers are marketing modern state of the art machines with operating speeds higher than those used in the foregoing calculations. Many entrepreneurs would like to install these machines at their Spinning Mills, and above mentioned machinery combinations are determined by the financial resources and the investment capabilities of the respective entrepreneurs as well as presently installed spinning mills in Pakistan.

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Italian technology serving Iranian textile producers: A winning alliance

Iran has been one of the most prominent markets for Italy's textile machinery manufacturers. The sales of Italian textile machinery to Iran during the first 9 months of 2009 (most updated figures) amounted to 16 million Euros, ranking Iran fifth overall among Asian markets for Italy's textile machinery industry.

The type of machinery requested has changed partially, with a growing interest for finishing machinery. During the period from January to September 2009, sales of Italian machinery to Iran were distributed as follows: finishing machinery 46% of total, other machinery 16%, weaving machines 13%, spinning machines 11%, accessories 11%, knitting machines 3%. The mounting share of finishing machines highlights a continuing surge in qualitative levels for Iranian textile production, which has been increasingly offering products with greater added value.

The ever-growing interest on the part of Iranian companies for Italian finishing machinery has prompted ACIMIT (Association of Italian Textile Machinery Manufacturers) and ICE (Italian Trade Commission), in partnership with the Iranian Textile Association, to promote a technology check-up for Italian textile companies operating in the finishing sector. To this end, during the second half of 2009, an Italian expert in the sector visited 10 local textile manufacturers to pinpoint any technology gaps, simultaneously identifying possible solutions by Italian textile machinery manufacturers. The data collected was gathered in brief information files and distributed to each Iranian company visited. The files portray an overview of the existing situation, indicating possible technology solutions.

This technology check-up represents yet another moment of synergy between Italy's textile machinery manufacturers and Iran's textile and garments industry, and is an integral part of an intense promotional campaign being promoted by ACIMIT and the ICE in the Iranian market over many years now. The technology check-up thus served as a natural follow-up to the technology symposiums which took place in February 2009 in Teheran and Isfahan.◆