# Formulas for the determination of production in length:

Course/Minute	
<b>1. Fabric length</b> =	•••••
Course/cm	
<b>2.</b> Course/Min = No. of feeder X Cy	ylinder speed
<b>3. Stitch density</b> = Course/cm X Wa	nles/cm
No. of Wales  4. Fabric width =  Wales/cm	••••••
No. of Needle	π X Cylinder Dia X Gauge
- Wales/cm	Wales/cm

# Formulas for the determination of production in weight:

- **2. Yarn length per course** = Total needle no. of machine X Loop length
- **3. Total needle no. m/c** =  $\pi$  X Cylinder dia X Gauge =  $\pi$ DG

## Some mathematical problems and its solutions

1. Calculate the production per day in kg of a plain single jersey knitted at 30 inch diameter, 24 gauge circular machine having 96 feeders and 0.25 cm stitch length produced by 30/1's. The machine operates at 25 rpm at 70% efficiency.

## **Solution:**

Here data given,

- Machine dia = 30"
- Machine gauge = 24
- No. of feeders = 96
- Stitch length = 0.25 cm
- Yarn count = 30/1
- Machine rpm = 25
- Efficiency = 70%
- Now, length of yarn in a loop = 0.25 cm

So, Length of yarn in full course =  $\pi \times G \times D \times 0.25$  cm

$$= \pi X 24 X 30 X 0.25 cm [0.25 S.L]$$

So, Length of yarn used in a minute for producing course,

$$= 0.25 \text{ X} \pi \text{ X} 24 \text{ X} 30 \text{ X} 96 \text{ X} 25 \text{ cm} [25 \text{ RPM}]$$

We get, Production per day at 70% efficiency,

$$= \frac{0.25 \times \pi \times 24 \times 30 \times 96 \times 25 \times 60 \times 24 \times 70}{2.54 \times 36 \times 840 \times 30 \times 100 \times 2.204}$$

$$= \frac{L \times w}{W \times l} \quad ]$$

$$= 269.85 \text{ kg (Ans)}$$

Or,

RPM of cylinder X No. of feeder X $\pi$ X Cylinder dia (inch)
Production in weight =
1000 X 1000
Gauge X Loop length (mm) X tex X 60 X 24 X Efficiency X
1000
25 X 96 X π X 30 X 24 X 0.25 X 10 X 590.5/30 X 60 X 24 X 0.70
=
= 269 kg/day ( <b>ANS</b> )

- 2. Calculate the production of a single jersey circular knitting m/c per shift from the following data (assume others parameter if necessary) Here,
- Cylinder dia = 30"
- Cylinder speed = 20 rpm
- No. of feeder = 36
- No. of course per inch = 30
- Machine eff = 80%
  - 3. Determine the no. of course per cm of a fabric from the following data. This fabric is produced 1152 m per shift in a single jersey circular knitting machine.

Here,

- Knitting m/c speed = 20 rpm
- No. of feeder = 48
- Machine efficiency = 75%

## **Solution:**

Given,

• Knitting m/c speed = 20 rpm

- No. of feeder = 48
- Machine efficiency = 75%
- Length of produced fabric per shift = 1152 m
- No. of course per cm =? We know,

### Fabric production per shift,

## Example 01:

Find out the production per shift for single jersey and rib from the following data:

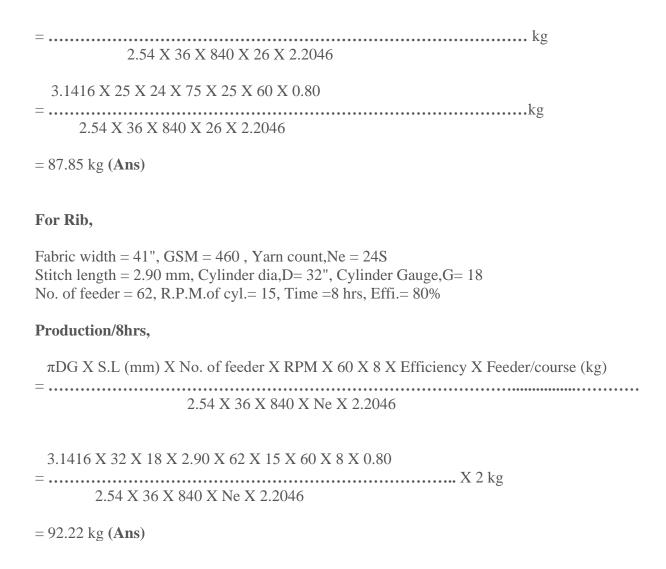
#### For single jersey,

1152 X 100 X 100

#### **Solution:**

## Production/8hrs,

πDG X S.L (mm) X No. of feeder X RPM X 60 X 8 X Efficiency



#### Example 02:

Calculate nominal production of a single jersey-knitting machine per hour from the data given:

- Machine Gauge = 24
- Machine Dia = 30 inches
- Number of Feeders = 90
- Machine RPM = 26
- Yarn Count = 24
- Stitch length = 4 mm
- Efficiency = 85%

#### **Solution:**

#### Step one

First we will calculate number of needles and number of stitches produced in one revolution. This would help us in calculating the total length of yarn consumed in one revolution.

**Number of needles** = Machine dia X Gauge X p (3.14)

- $= 30 \times 24 \times 3.14$
- = 2260 (Exact 2260.8 but needles are always in even number so we will take nearest even figure)

### Number of stitches produced in revolution

Every needle is making one stitch on every feeder because machine is producing single jersey fabric (full knit fabric).

**Number of stitches produced in one revolution** = Number of needles X Number of feeders

- $= 2260 \times 90$
- =203400

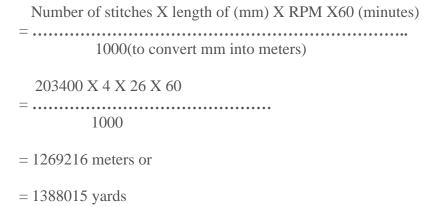
This machine is making 203400 stitches in one revolution.

#### Step Two

Length of stitch is 04 mm (stitch length is always calculated in metric system)

From this we can calculate yarn consumption in yards in one hour

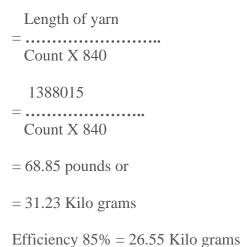
Yarn Consumption (in yards) in one hour,



## **Step Three**

In previous step we calculated quantity of yarn consumed in yards. We can easily calculate weight of this yarn while its count is known (see example 03).

## Weight of cotton yarn,



Answer: This machine can produce 26.55 Kgs fabric in one hour at 85 % efficiency

## **Essential Formula for Knitting:**

**WPI:** Wales per inch is called WPI. **CPI:** Course per inch is called CPI.

**GSM:** Grams per square meter of the fabric are called GSM.

#### **Needle calculation:**

• Single jersey circular knitting machine needle =  $\prod DG$ 

- Rib/Inter lock /Double jersey circular knitting machine needle = ∏DG×2 (two needle bed is here)
- Single bed flat knitting m/c's needle = width× gauge
- GSM = {WPI $\times$  CPI  $\times$  (39.37)2 $\times$ stitch length (mm)  $\times$ Tex /1000 $\times$  1000} g/m2
- Stitch density = (WPI × CPI) inch<sup>2</sup> = (WPC × CPC) cm<sup>2</sup>
- No of sinker = No of needle
- No Wales = No of needle
- No of course = No of feeders = No of yarn (per revolution of cylinder)
- Course per minutes = No of feeders  $\times$ cylinder rpm
- Course length = yarn required for each course. = No of needle × stitch length
   \*\*\* V bed flat knitting m/c's needle = 2× width× gauge

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Ne= 590.5 Tex
Here,
D = cylinder diameter ,G = Machine gauge ,Needle pitch = 1/G.

*** Fabric width = wale spacing ×Total no of Wales
= (1/WPI ×No of Needles) inch
= (No of Needles/WPI× 39.37) meter

*** For single jersey fabric = (\[ \subseteq \text{DG/WPI} \times 39.37 \) meter (open width)
= (\[ \subseteq \text{DG/WPI} \times 39.37 \) meter (open width)

*** For double jersey fabric = (2 × \[ \subseteq \text{DG/WPI} \times 39.37 \) meter (open width)
= (2 × \[ \subseteq \text{DG/WPI} \times 39.37 \) meter/2(Folded/Tubular width).

*** Fabric Length = Course spacing ×Total course pr hour
= {(Feeder × cylinder rpm × 60)/CPI} inch/hour
= {(Feeder × cylinder rpm × 60)/CPI × 39.37} m/hour
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