Stitch quality control on flat bed knitting machines

by Sunil Kumar Puri

It is every knitter's dream to be able to knit panel after panel that conforms to the specified measurements. However in real life this does not happen in normal course. There are many reasons for the variation in panels in size and this results in problems for the knitter and especially for the assembly department in particular. It is possible to have slight size variation in panels knitted on one machine as well and therefore if a particular style is running on many machines simultaneously the problem can become uncontrollable and can result in total chaos in the assembly department. The main reasons attributed for this problem are: knitting speed, yarn tension, cone size, batch difference and humidity.

Knitting speed

Panels knitted on same machine with same yarn same fabric take and same stitch quality but different knitting speeds will have slight variation on the length of the knitted panel because the difference in the speed of the carriage will change the tension on the yarn that is fed in the knitting needles. The higher the speed of the knitting carriage the yarn tension will increase as it is fed to the needle. This increase in tension will result in a tighter knit or technically in a shorter stitch length. Also the fabric takedown force will work on the knitted loops as well as the loops that are being formed in knitting action will act for a lesser time period thereby resulting in a shorter loop length resulting in a panel shorter in size. With all parameters remaining fixed if only speed of the machine is increased it will result in a shorter stitch and therefore a shorter knitted panel.

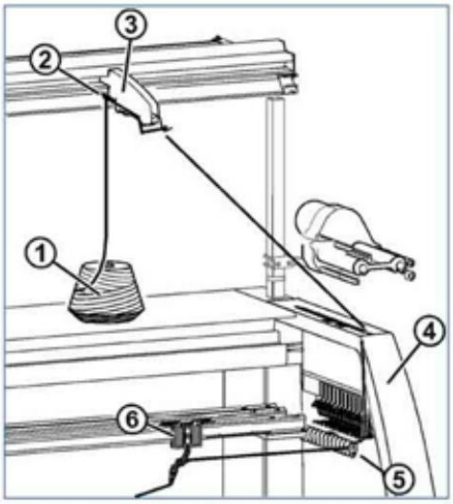

Illustration image of yarn tension *(Image source: H Stoll GmbH & Co KG)*

Yarn tension

As discussed above the yarn tension plays a major role in stitch formation. The yarn is fed to the knitting needles through a yarn feeder and passes through yarn guides yarn control device and yarn deflectors, every bend in the yarn path amounts to some further tension in the yarn. With the yarn being pulled under tension the yarn gets a bit elongated and as the stitch has been formed the tension of the yarn gets lower the yarn relaxes a bit and the stitch size reduces a little.

The knitted loops also rob and donate some yarn to the adjacent loops to make equilibrium in the forces that form the loop. The yarn tension therefore has a direct impact on the formation of the stitch and its quality. The yarn passes through the braking disks which results in the tension in the yarn, The tension keeps on increasing with every bend in the path of the yarn before it is fed in to the needles. At the point of stitch formation a lot of yarn tension gets generated by the yarn pulling action of the needles which is still multiplied by the adjacent needles. As the machine runs some yarn lint gets deposited on the disks which result in variation in yarn tension, resulting in reduction in yarn tension and thus results in size difference in the knitted panels. With the yarn tension increasing the loop size decreases in length and therefore the size of the knitted panel gets reduced. A simple remedy would be to keep the knitting speed as steady as possible.

Cone size

When the spinner or the dyer is preparing yarn cones the diameter of the drum revolves at a fixed speed whereas the diameter of the


Image Source: Shima Seiki

cone on which it is winding the yarn as well as the weight of the cone keeps on changing as yarn is wound around it, this results in variation of tension at which the yarn is wound on the cone. The size difference results because of two reasons, due to cone size as well as due to the package density. A panel knitted from more densely wound cone will result in shorter length than a panel knitted with a loosely packed cone. Even from the same cone as the cone size reduces the panel size keeps on reducing as tension changes. A simple remedy to this problem would be to make sure the cones are not wound too tightly.

Batch difference

The batch difference can make a lot of variation in panel sizes and as this is an area where a knitter can hardly take any corrective methods but for correcting the stitch length which is not an easy process. Simple remedy for this problem would be to treat the different batches differently.

Humidity

Humidity in the workplace also plays a vital role in change in the size of knitted panels as yarns behave differently with change in humidity in the work place. As the humidity increases the natural fibres which are hydrophilic in nature absorb moisture and the tension on the yarn due to the twist and winding gets reduced a bit resulting in a lengthier panel.

Stitch quality control device

A simple solution of the above-mentioned problems is to use a stitch quality control device on flat bed knitting machines. At present, the companies that offer the devices on flat bed knitting machines include Shima Seiki (Japan), Protti (Italy), Universal (Germany) and Ningbo Yuren (China). But before one starts using the devices, it's important to know how they actually work. Generally speaking, these devices keep measuring the yarn consumption by the machine course by course and when these devices notice any change in the yarn consumption the device takes corrective measures and adjusts the stitch quality settings to ensure uniform yarn consumption and therefore knitting panels with same size as desired. It shall be noted here that these devices measure the yarn consumption course by course and therefore the machines shall be programmed to a definite loop length and not a stitch quality value.

The common mistake in understanding the use of such devices is the knitter tries to use such a device but does not provide the necessarily required parameters to the machine and therefore does not achieve the desired results. For example many a knitters believe the stitch quality values are definitive stitch quality measure which is not correct. It varies from machine to machine and in fact it may not be the same for different systems on the same machine. The stitch quality on a knitting machine is set by a stitch quality step motor and the stitch quality values like 12.0, 12.1 and12.2 and so on, are the steps of succession by which the motor turns around it axis. At a value of let us say 12.0 the motor turns N degrees or radians, at 12.1 it will turn one step more, and it depends on the step motor how much more it will turn. The rotary motion of the motor is transformed to linear movement by help of a rack and pinion. To ensure the stitch quality does not alter during the course of knitting, the motors are equipped with breaks and on reversal of the carriage the motor releases the break, turns as per the instruction received from the machine CPU through relevant interface and applies breaks again before the carriage re-enters the knitting area.

The needle stitch quality value, however, does not set a particular loop length, but any loop length. In order to get same loop length at same needle stitch quality value the machine needs to be calibrated. A stitch quality control device helps a knitter in calibrating all the systems to a particular loop length. While calibrating the machine with such a device one has to check the default parameters carefully. The standard correction value or maximum allowable yarn error by default for most of the stitch quality control devices is 5% which means that stitch quality control device will ignore any variation up to 5 % in the yarn consumption during knitting. This value has to be readjusted to 1% and make stitch quality control device to work to 1% accuracy. With 5% accuracy if one is knitting a panel which is 50 cm long, one can expect an undetected variation of up to 2.5 cm, and on standard full size sweater where the length is 70 cm the undetected error can be as much as 3.5 cm which is way beyond the tolerance limit offered by any customer. Therefore it is important to set the stitch quality control device or a similar device to the desired level of correction.

Once a machine or number of machines are set to the desired level of correction, it still does not ensure that all the panels knitted on the machine will have same measurements, this correction will remove only the cause of variation set by the Stitch Quality Mechanism of the machine/machines. However earlier we discussed five more causes which can give variable results. The Dr Deaming PDCA cycle will provide us solution from this problem: once the

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