CAUSES OF BARRE

The varied and diverse causes of barré can generally be summed up in one word - INCONSISTENCY. An inconsistency that leads to barré can originate in one or more of the following categories:

! fiber quality/raw material management,
! yarn formation/supply management,
! knitting processes, and
! preparation and dyeing techniques

Fiber Quality/Raw Material Management

1. Failure to control fiber diameter (micronaire or denier) from laydown to laydown.
2. Too high a C.V. of micronaire in the laydown for a given mill's opening line blending efficiency.
3. Failure to control the fiber color in the mix (grayness Rd, yellowness +b).
4. Failure to control maturity/fineness in a laydown
5. Most, if not all, fiber barré can be controlled by the above four items; however, under certain unusual circumstances, it may be beneficial to also select mixes using ultraviolet reflectance information for each bale of cotton.

Micronaire

Average micronaire must be controlled within a laydown and from laydown to laydown. Controlling average micronaire in the laydown may not be sufficient to completely eliminate barré. Other micronaire related causes of barré are:

! > 0.2 difference in micronaire.
! > 0.1 change in mix-to-mix average micronaire.
! > 12.0 % CV of micronaire within the laydown.

It may be necessary to change the laydown averages periodically to make use of all the bales in the warehouse. This must be done slowly with no more than a 0.1 change in mix-to-mix averages. Figure 1 shows acceptable changes in micronaire from laydown to laydown.

No barré from micronaire differences should show in knitted fabrics when yarns are mixed on the knitting machine from consecutive laydowns. However, if laydowns vary more than 0.1 micronaire, for example laydowns #1 (4.3 mic.) and #6 (4.6 mic.) in Figure 1, then barré is much more likely to occur.

Figure 2 shows a high CV% in the micronaire for bales within a laydown. The laydown shown has 24 bales with an average of 4.1 micronaire and a CV% of 17.7. The change in micronaire from bale to bale is more than a 0.1 change. Also, the CV% is more than 12.0% and would probably result in barré.

Figure 2: Results of Changing the Micronaire Average too Rapidly
Max +/- 1.0 mic

CASE STUDY IN BARRE

A 100% cotton, ring-spun single jersey style T-shirt is knitting in production with a yarn that does not have a barré problem. This style has been knitting for numerous days and no more of the yarn is available for creeling on the machine as the yarns are knitting out. Some yarn packages are “skinners” and others are full five-pound packages. The machine is 24-inch diameter with 80 feeds.

When the new yarn is creeled onto one of the 80 positions, the mixing of yarn shipment dates begins to take place. For this discussion, we will assume that this new yarn will cause barré when mixed with the old yarn. Once all positions are knitting the new yarn, there will be no barré. How many rolls of fabric will have barré when both these yarns are present in the rolls?

If the knitter is making 50 pound rolls, then each yarn package will supply 1/80th of the 50-pound roll or 0.625 pounds of yarn. Therefore, the new yarn will make 8.0 rolls of fabric with barré (5-pound package divided by 0.625 pounds per package for a 50 pound roll).

It is important to realize that while this new package is knitting, other old yarn positions on the creel are also being replaced by new yarns. By the time the first new package has knitted out, all feeds will be using the new yarn. When the last old package is replaced and all positions have new yarn, the barré will disappear.

Often, many machines will be knitting the same style. If ten machines are knitting this style and are using the old yarn and new yarns are placed on these 80 feed machines, then the total number of rolls knitted with barré will be 80. A total of 4,000 pounds of fabric will be made with barré. If the style in question weighs 5.8 ounces per linear yarn, then a total of 11,035 yards of fabric will be made. Further, if it can be assumed that each yard of fabric can make 1.2 shirts, then a total of 13,240 defective T-shirts will be made. This is 1,103 dozen garments. If the cost per shirt is $2.05 per unit, then a loss of $27,142 plus is realized.

If open-end yarn was used for this case study instead of ring-spun yarns, then 8-pound packages of yarn could be used. This would result in 128 rolls containing 6,400 pounds and 17,655 yards of fabric. From this, 21,186 T-shirts (1766 dozens) would have been made. Based on a cost per shirt of $1.86, the loss would be $39,405. The result is that bigger packages mean bigger losses.

The best methods to reduce the possibility of this catastrophe are listed below:

1. When mixing yarn shipment dates of only one week, try to reduce the number of machines using the old and new yarns.
2. As more machines are expending the old yarn, consolidate the old packages to fewer machines. This means removing the yarns from one creel and using them on other machines that are still knitting the old yarn.
3. Knit dye lots from a single machine if possible.
4. When a roll is known to have mixed yarns, a laboratory dyeing should be done on a swatch from the roll to determine if barré is present. If not, then proceed as normal. If barré is present, then the roll should be processed in shades that are not known to be barré sensitive or prepared with more aggressive chemistry.

CONCLUSIONS

It is evident that barré is a problem that results from inconsistencies and is a result of poor management of fiber, yarn, and/or related knitting processes. The spinner, the knitter, and the dyer must communicate and work as a team to reduce the potential for barré to occur. A well planned and executed system of monitoring the spinning, knitting, dyeing, and finishing systems in the mill can provide for defect free fabrics.

IDENTIFICATION OF BARRE

The first step in a barré investigation is to observe and define the problem. Barré can be the result of physical causes that can usually be detected, or it can be caused by optical or dyeability differences that may be nearly impossible to isolate in the fabric. Barré analysis methods that help to discriminate between physical barré and barré caused by other reasons include Flat Table Examinations, Light Source Observation, and the Atlas Streak Analyzer.

Flat Table Examination

For a visual barré analysis, the first step is to lay a full-width fabric sample out on a table and view both sides from various angles. Generally, if the streaky lines run in the yarn direction that is in the course direction, apparent color differences can be seen by looking down at the fabric in a direct visual line with the yarn or course direction, and the defect can be positively identified as a barré defect. Viewing the fabric with a light source in the background will show if the barré is physical.

Light Source Observation

After completing an initial Flat Table Examination, a Light Source Examination may provide further useful information. Full width fabric samples should be examined under two surface lighting conditions, ultraviolet (UV) and fluorescent light. Observations that should be made while viewing under lights are:

1. the frequency and width of the barré,
2. whether the streaks are dark or light, and
3. the total length of pattern repeat.

Ultraviolet light, commonly referred to as "black light," allows the presence of mineral oils to be more easily detected, due to their radiant energy (glow). When observed under UV light, fabrics with streaks that exhibit glow suggest improper or insufficient preparation. A change in composition or content of oil/wax by the spinner or knitter without appropriate adjustments in scouring can create this problem. Fluorescent lighting simulates the mode of observation that is common to most inspection tables in mills and will highlight whether the barré is perceivable in an industry quality control setting.

PHYSICAL BARRÉ ANALYSIS

When the cause of barré is determined or presumed to be physical in nature, physical fabric analysis should be done. Physical barré causes are generally considered to be those which can be linked to yarn or machine differences. Methods of physical barré analysis include fabric dissection, microscopy, and the Roselon Knit Extension Tester.

Fabric Dissection

To perform accurate fabric dissection analysis, a fabric sample that contains several barré repetitions is required. First, the barré streak boundaries are marked by the placement of straight pins and/or felt markers. Individual yarns are removed from light and dark streak sections, and twist level, twist direction, and cut length weight determinations are made and recorded. For reliable mean values to be established, data should be collected from at least two light/dark repeats. After compilation of yarn information, the numbers can be compared individually to adjacent yarns as well as by groupings of light and dark shades.

Microscopy

Microscopic examination is useful for verifying yarn-spinning systems. Yarns from different spinning systems can have different light reflectance and dye absorption properties resulting in barré when mixed. Ring-spinning produces yarn that is smooth with all fibers twisted in a tight helix. Open-end spinning produces yarn with wrapper fibers that form a belt around the diameter of the yarn at irregular intervals. Air jet spinning produces yarn with more wrapper fibers that form a continuous spiraling band around the inner fibers that are more parallel to the axis of the yarn. Microscopy can also reveal a shift in loop formation in knitted fabrics when twist direction (S and Z) differences are present.