5 Interpreting and Applying the USTER® *STATISTICS*

The USTER® *STATISTICS* manual consists of several parts, each addressing a specific quality aspect in the sequence from fiber to yarn. The different sections are arranged according to spinning system and raw material composition or yarn style. Each section is subdivided into distinct quality attributes (e.g. mass variation, tensile properties, etc.) which are measured with different USTER® instruments. A measurement can consist of several individual parameters. Mass variation, for instance, includes CV_m and the between-sample variation CV_{mb}. These parameters are presented in graphical form. The origin of the samples processed to establish the raw data is illustrated by a pie chart. These pie charts are provided with each quality attribute but not with each parameter because the measurements were performed simultaneously on the same samples. A register is provided for quick reference to the sections of interest and after leafing through the pages a couple of times, you will find it easy to work with the USTER® *STATISTICS*.

The most important element of the USTER® *STATISTICS* are the nomograms with the percentile curves. The width of the percentile curves intentionally imposes certain restrictions on accuracy – a subtle reminder of the pronounced variability of most textile measurements. Depending on the quality parameter displayed on the ordinate (vertical or y-axis), the curves are plotted over staple length, process stage, yarn count, or defect category and the abscissa (horizontal or x-axis) is calibrated accordingly. The x-axis should be the starting point of any analysis. The percentile curves refer to the percentage of the total world production which equals or exceeds the measurement value given for a particular yarn or fiber description. An example:

The coefficient of variation of the yarn mass of an Ne 30 (Nm 50, 20 tex) 100% combed cotton ring-spun yarn for knitted fabrics has an evenness of CV_m = 13%. A vertical line drawn from the x-axis at Ne 30 intersects with the horizontal line drawn from the y-axis at 13% right at the 75th percentile line. Hence, 75% of all Ne 30 combed cotton ring-spun yarns produced worldwide have a CV_m of 13.0% or better. Vice versa, 25% of the total world production of comparable Ne 30 yarns exhibit a CV_m higher than 13%.

The 50th percentile curve, commonly referred to as the 50% line, corresponds to the median. In general terms, the median is the middle number when the measurements in a data set are arranged in ascending (or descending) order, i.e. 50% of all observations exceed this value and the other 50% lie below. Depending on whether the frequency distribution of a given quality parameter is symmetric or skewed, the median may or may not be different from the mean.

In some instances, adjacent percentile curves fell very close together. To avoid the formation of a solid red block, both the 25% line and 75% line were omitted, thus maintaining the clarity of the illustration.

The nomograms in the fiber properties section as well as the ones in the fiber-to-yarn and yarn quality sections for combed cotton ring-spun yarns comprise two independent sets of percentile curves. The two sets of curves each characterize a distinct cluster or isolated population within the same graph. We will look at the cotton fiber properties first to explain the reasons for this differentiation: The horizontal position of the split point at a staple length of 30...31 mm marks the approximate center of the transition zone from both short and medium-staple cottons on one hand to long and extra long-staple cottons on the other. With that transition, several factors change fundamentally. These factors include genetic, botanical, and physiological differences, agricultural methods, environmental influences, harvesting and ginning practices, all of which have a decisive impact on fiber properties. On the yarn side, things are much simpler. Here, the division between Ne 41 (Nm 70, 14 tex) and Ne 47 (Nm 80, 12.5 tex) indicates the yarn count threshold for using longer staple, high-grade cottons with an overall superior fiber quality, for increasing comber noil extraction, and for modifying the overall processing conditions accordingly. Selecting higher quality cotton fibers and adjusting the processing conditions is necessary to raise the spin limit towards the finer counts. Naturally, in the fiber-to-yarn nomograms for combed roving, the two clusters occur as well. The curves had to be split at exactly the same position on the yarn count axis. The graphs provide an opportunity to study these effects of raw material selection and processing.