

Terry Towels – Classification, Designing & Manufacturing Technology **Prof. Tushar C. Patil, CTF, MPSTME**

Abstract:

Terry towels are often very complex with yarns of different types and colors, in combination with various loop pile and flat structures. Towels are subject to changing fashions, and the market is constantly demanding new designs with improved fabric characteristics important to the consumer such as softness and absorbency. In satisfying these requirements, the content and structure of terry towels are critical decisions determining the resulting quality. This review of the terry classification, designing and production will be of interest to academicians and industry personnel as a basis for understanding the steps in producing a high quality woven terry fabric.

Introduction - History of terry weaving:

The name “terry” comes from the French word “tirer” which means to pull out, referring to the pile loops which were pulled out by hand to make absorbent traditional Turkish toweling. Latin “vellus”, meaning hair, has the derivation “velour”, which is the toweling with cut loops. In research conducted on terry weaving by the Manchester Textile Institute, it was concluded that original terry weaving was likely the result of defective weaving. The research indicates that this development occurred in Turkey, probably in Bursa City, one of the major traditional textile centers in Turkey. Terry weaving construction is considered a later development in the evolution of woven fabrics. Terry toweling is still known as "Turk Fabric", "Turkish Toweling" or "Turkish Terry"

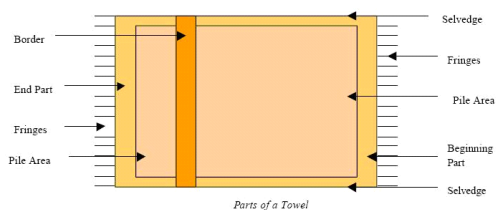
Terry pile is a class of warp pile structures also known as the Turkish toweling in which certain warp ends are made to form loops on the surface of the fabric. Only one series of weft threads are used, whereas the warp consist of two series of threads namely ground warp produces ground cloth with the weft from which the loops formed by the pile warp and, the firm foundation structure terry cloth is really a combination of two cloths.

Terry towels are used for bathing purpose because of their water absorption properties. Piles are formed on one or both sides by the variable periodic movement of the reed or cloth fell position, mostly over three picks. Figure shows the pile formation in terry fabrics with the three-pick principle. According to this principle, the first two picks are beaten up by the short movement of the reed

some distance before the cloth fell position. In the third pick, the reed makes an exact movement, and all three picks are carried up to the cloth fell position. During this movement, the three picks slide between the ground warp yarns. The pile warp yarns move forward together with three picks and take on the pile form. The distance's' shown in Figure 1 corresponds to the pile length. It can be adjusted on terry weaving machines to obtain different pile heights. If piles are to be formed on the surface of a terry fabric, the pile warp yarns must be over the third and first picks; similarly, if the piles are too formed on the back side of a terry fabric, then the pile warps must be under the third and first picks. Terry fabrics must be produced at a certain weight per square meter, using mostly 100% cotton yarns as weft-, ground- and pile warp yarns. Certain yarn counts, such as Ne20/2, Ne24/2, Ne16/1 1), and warp density are used by factories producing terry fabrics. After the ground and pile warp yarns are prepared and drafted as one ground and one pile warp yarn.

Parts of terry towel:

These are the pile area, fringes, beginning and end part, selvedge, border. Every towel does not have to contain all of these parts. The pile area is considered the toweling part of the towel. Fringes are tied or an untied tasseled part of ground warps and pile warps which are left unwoven at the beginning and the end edges of the towel. The beginning and end sections are the tightly woven areas of a towel which come before or after the pile fabric part and prevent this pile area from unraveling. They are woven without pile loops, in a flat weave construction. The selvedge contains fewer number of warp ends than the pile area, for example 90 comparing to 4000 total warp ends, woven without pile as a flat weave and has the purpose to reinforce the towel sides



Basics of terry weaving:

The principle of terry weaving is originated in France in 1841 by John Bright. Terry cloth is defined as 'a warp pile fabric having un-cut loops on both the sides. A fabric made from ground and pile is in the form of loops such as in bath towels and bath mats. Among pile fabrics, terry fabrics are woven by a special weaving "terry motion". Figure shows the cross-section of pile formation for 3-pick terry;

in which two picks are first beaten up to a determined distance from the fabric fell. Third pick is then beaten up against the fell together with the two preceding picks. Weft thereby slips along tensioned ground warps. The pile warp ends now form new piles.

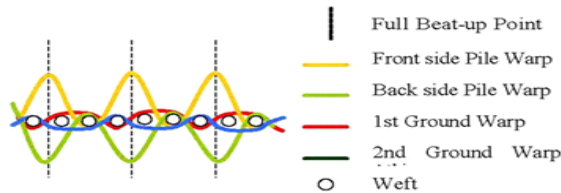


Figure – Cross-section of pile formation for 3-pick terry

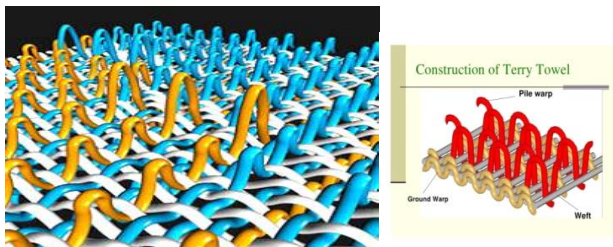


Figure – Terry Pile Structure

Classification of Terry Towels:

The classification of towels can be made according to weight, production, and pile presence on fabric surfaces, pile formation, pile structure, and finishing. These classifications are shown in Table given below.

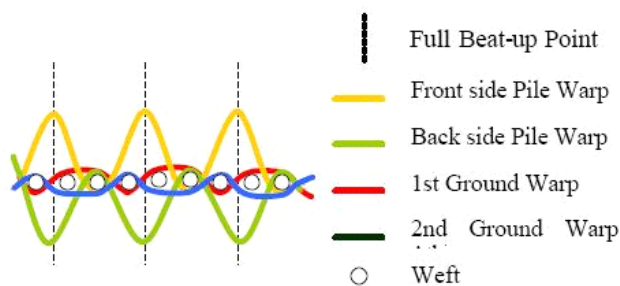
In velour towels pile loops on one side of the fabric are sheared in order to give a smooth cut velvet appearance. Uncut loops of the fabric are sheared in order to give a give the best absorbency, whereas velour gives a luxurious velvety hand. A towel with appliqués is embellished with additional pieces of decorative fabric in a motif which is stitched onto the towel Two-pick terry towels which were woven for bathrobe end-use have lost their importance today due to instability of the loops. Five or more pick terry towels are rarely produced because they need to be beaten for each pile twice. They need to be beaten for each pile twice. And four-pick terry towels. As one sided pile toweling has low water absorbing capacity, it is only used for special purposes such as a limited number of bathrobes. Furthermore weaving one sided pile terry with few or no defects is difficult. In two sided pile terry both sides are covered with pile, whereas all the irregularities are visible in one sided terry fabric as one side is bare without pile. Towels are divided into groups according to end use and size as bath towels, hand towels, face towels, fingertip towels, kitchen towels and washcloths

Table-1: Classification of terry towel according to weight, Production Style, Finishing, weft count per Pile loop and pile presence on fabric surface.

Weight	Production	Finishing	Weft Pick Count per Pile Loop	Pile Presence on Fabric Surfaces
Very heavy (>550 g/m ²)	Woven	Velour Towel	Two-pick Terry	One side pile
Heavy (450-550 g/m ²)	Weft Knitted	Prompted Towel	Three-pick Terry	Both sides pile
Medium (350-450 g/m ²)	Warp Knitted	Towel with Embroidery	Four-pick Terry	
Light (250-350 g/m ²)		Towel with appliques	Five-pick Terry	
			Six-pick Terry	
			Seven (or more)-pick Terry	

Terry Designing:

Terry towels are woven as 2, 3, 4, 5 or more pick terry weaves. The most common type is 3-pick terry toweling. The cross section of a toweling through the Warps are divided into two systems as shown in Figure 3, pile warps and ground warps, whereas wefts consist of only one system. In basic Turkish Toweling, front side and back side pile warps and 1st and 2nd ground warp ends form a 2/1 rib weave with each other. The rib weaves which is formed by the pile warps is one pick ahead of the rib weave which is formed by ground warp ends. Warps are ordered throughout the fabric width 1:1 or 2:2 piles and ground warps. In 1:1 warp order each ground warp end is followed by a pile warp end while in 2:2 warp order each two ground warp ends are followed by two pile warp ends. In Figures 3a and 3b, the weave notation of 3 weft pile basic Turkish toweling is given in 1:1 and 2:2 warp orders



The cross-section of a towel through the warp

As is seen from the weave diagrams in Figures a and b shown below, the shedding of the ground warps are not synchronized with that of the pile warps. By this, the

number of interlacing throughout the warp increases, and this strengthens the fabric. As it has been mentioned before terry towels can have pile loops on one or both faces. Different types of terry weave which have pile on one face and both faces

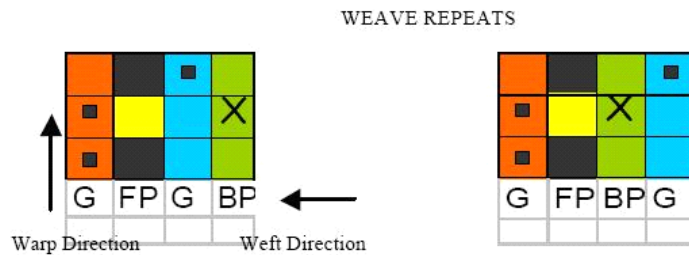


Figure a Basic 3-pick Terry Weave in 1:1 Warp Order

Figure b Basic 3-Pick Terry Weave in 2:2 Warp Order

Terry fabrics are often very complex with different colored warp ends in combination with loop patterns. They are subject to changing fashions, and the market is constantly demanding new qualities and designs. The rapid development of electronics has enabled fabric designers to produce completely different patterns. Via a servo motor, the beat-up position for each pick, and, thus the type of terry and the pile height can be freely programmed from one pick group to another. In this way nearly 200 different loose pick distances, and hence the same number of pile heights, can be programmed in any order. For example, three- and four-pick terry and even fancy types of terry can be combined in the same fabric. This gives the fabric designer a broad range of patterning options and the weaving engineer the weaving structure for improving fabric performance, because transition from one pattern element to the next can be woven with greater precision. With these capabilities, a new patterning method, called sculptured terry, has been developed. At each full beat -up, two pile loops of different heights can be formed in the filling direction. The secret of this method of pattern formation lies in the fact that two loose pick groups formed at distances corresponding to the pile heights are beaten up to the cloth fell together. For two short loops the pile yarns are woven into both loose pick groups and for one large loop into the second loose pick group only. The greatest challenge is to develop a basic weave which results in neat loops without excessive friction between warp and filling at full beat -up. The solution is found in a special seven pick weave combined with full beat -ups at the sixth and seventh pick. In this way, a second pile height is also formed in filling direction, making sculptured patterning possible by the difference in pile height in warp and filling direction.

In Figure a terry towel pattern which is produced with this technique is shown. A requirement for this kind of pattern formation is a freely programmable sley traveling on a rapier weaving machine. Microprocessor control allows the loose pick distance to be terry pattern achieved by weaving two different heights of loops programmed easily and individually for each pick. The loop formation system with full electronic control lets you alter the height of the loop by accompanying the electronic weft ratio variator device on jacquard looms to program different weft ratios like 3-pick terry, 4-pick terry and so. By this method, different heights of loops can be achieved in the same shed.

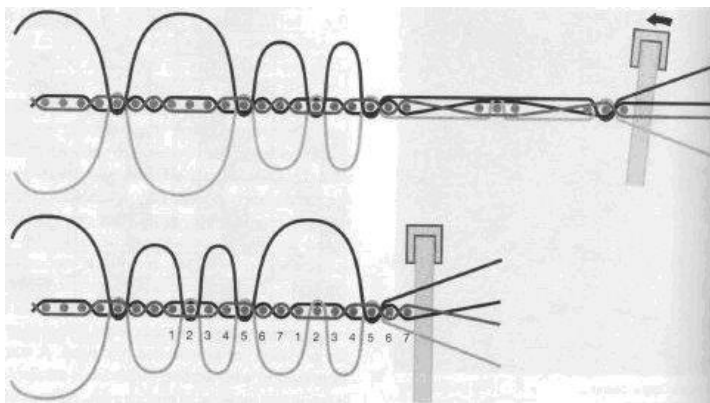


Figure – Designing in terry weave

Terry Weaving:

The production of terry fabrics is a complex process and is only possible on specially equipped weaving machines. Three yarn systems are woven in the terry loom compared to the two system types of traditional weaving: Ground warp, pile warp and weft. The two warps are processed simultaneously: the ground warp, with tightly tensioned ends and the pile warp with lightly tensioned ends. A special weaving method enables loops to be handled with the lightly tensioned warp ends on the surface. Ground warps and pile warps are unwound separately, warped onto two different section beams and sized separately. The processes they undergo show some

Steps of Terry Weaving:

The components of an air- jet terry weaving machine are seen. The pile warp ends are let off from the pile warp beam (2), guided through the measuring unit (3), then join with ground warp ends which are let off from ground warp beam (1) and guided through the whip roll. Next, the two warp systems are threaded through the drop wires, the headless, reed and with the control of cloth take up

(6) are wound onto cloth roll after weaving(7). Positive controlled whip roll for ground warp (5) determines the length of ground warp to be let off, while terry motion (4) assures integration among pile and ground warp let off and cloth take up.

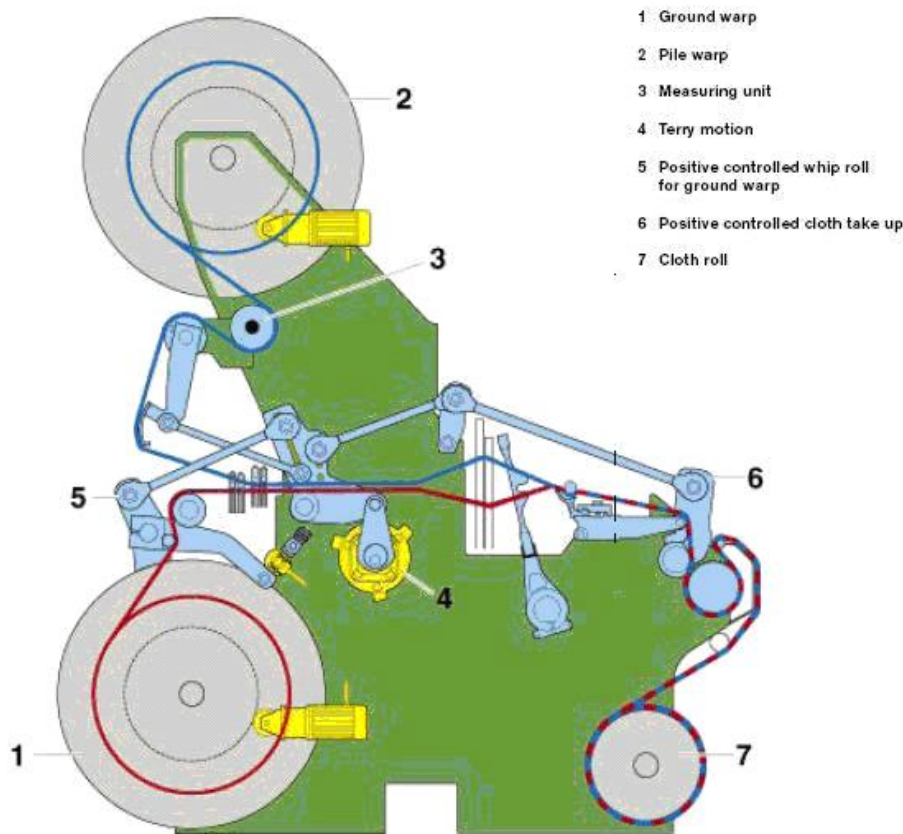


Figure – Terry weaving Machine

Mechanism of pile formation:

The formation of pile loops in terry weaving depends upon the creation of a gap between the fell of cloth and two successive picks. The length of this gap can be altered and adjusted according to the requirement of height of loops, to form this gap two succeeding picks are beaten up short of the true cloth fell forming a temporary false fell this achieved by the terry motion.

In terry fabric manufacturing two sheets of warp threads run simultaneously of which one is kept under normal tension and other is kept under loose tension. The threads normal tension warp sheet are ground and threads of loose tension warp sheet are for pile the sequence of operation during weaving for pile formation in 3- picking is given below

- Insertion of first pick as per the design with loose beating
- Allow a predetermined gap near the fell of the cloth

- Insertion of second pick following the first pick is loose beating
- Insertion of third pick with heavy beating and brings all the three pick to the fell of the cloth

Pile formation by using this mechanism is based on the principle of a stable and precise shifting of the beat-up point. Using this principle the fabric is shifted towards the reed by means of a positively controlled movement of the whip roll 6 and a terry bar together with the temples on the beat-up of the fast pick. The sturdy reed drive is free of play. It provides the necessary precision for the beat-up of the group of picks.

A compact, simplified whip roll system with the warp stop motions arranged on two separate levels improves handling and has a decisive influence on reducing broken ends. Due to a drastic reduction in the number of mechanical components the amount of maintenance required is reduced. With the help of electronics the precision of measuring the Length of pile yarn is improved. This leads to a better fabric quality due to constant pile height and fabric weight. The weaving process is so exact that precise mirrored patterns are possible and velour weavers experience minimal shearing waste. The tension of the ground and pile warps are detected by force sensors and electronically regulated. In this way warp tension is kept uniform from full to the empty warp beam. To prevent starting marks or pulling back of the pile loops the pile warp tension can be reduced during machine standstill.

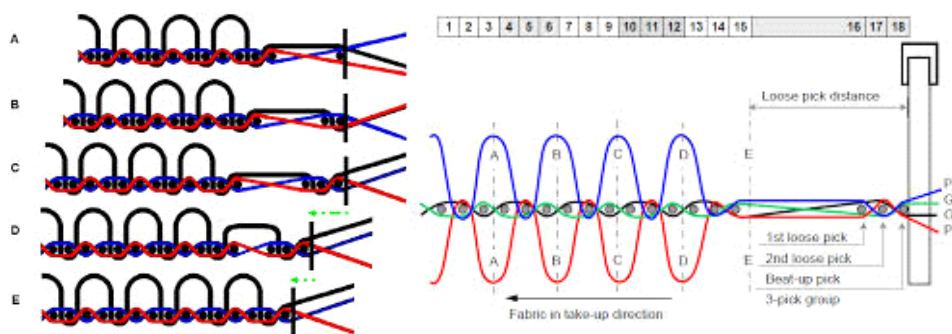


Figure - Mechanism of pile formation

Conclusion:

Terry towel is one of the integrated products of the textiles. Besides the yarn quality and the finishing parameters, designing and manufacturing techniques are also plays the vital role in construction of quality parameters of terry towels. This review of the terry characteristics, specifications, production, and performance

will be of interest to academicians and industry personnel as a basis for understanding the steps in producing a high quality woven terry fabric.

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