

SHRINKAGE OF WOOL AFTER CHEMICAL TREATMENT IS EXPLAINED

Reduction Of Relaxation Shrinkage Through Pre-Washing Method Advised

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SHORTLY after the introduction of chemical shrink-resistant treatments for controlling the felting of wool it became generally recognized to the disappointment of producer and consumer alike that although the treatments inhibited the felting process, the finished wool items nevertheless still shrank on laundering. This fact has caused considerable concern in the textile industry and has been a serious deterrent to the advertising and promotion of the use of shrink-resistant woolen items.

An explanation for this paradox lies in the fact that there are two distinct types of shrinkage to which wool materials are subject. The more widely known and discussed felting shrinkage is an inherent characteristic of the wool fiber itself. Wool fibers have certain unique structural features and mechanical properties which allow the felting process to take place under normal laundering conditions. Fortunately, simple chlorination treatments will modify the predisposing elements of the fibers and thus almost completely inhibit the felting action.

The second type of shrinkage, known as relaxation shrinkage, is a characteristic of the textile structure and is not primarily related to the nature of the fibrous material. Fabrics of all types, including wool, cotton, rayon and other synthetics, are subject to relaxation shrinkage. Here the causal factors are mechanical and are inherent in the nature of the conventional manufacturing processes for ~~knit~~ knits. This is particularly true in circular knitting where considerable tension must be applied to the tubing in the knitting frame to maintain satisfactory operating conditions. Although some of the strain which occurs during knitting is recovered after the material is removed from the machine, the major portion remains in the fabric only to become evident as shrinkage in laundering. In the case of knit underwear, residual relaxation shrinkage in the finished garment may be as high as 18 percent, despite the fact that the wool has been chemically treated and will not felt.

This fact has also been of concern to the Armed Services and it is planned that all future procurements of knitted underwear will require, in addition to the application of an anti-felt treatment, the use of special processing to eliminate relaxation shrinkage. During the past several years the Quartermaster Re-

search and Development Laboratories have studied many methods for reducing the relaxation shrinkage of knitted fabrics and garments. It has been found that there are two general procedures that can be used.

One process is a continuous method in which the knit tubing is thoroughly wet out, extracted, wet spread to almost double the normal width, and dried without tension in a loop or basket dryer. Several processes of this type are now being used commercially, especially in the underwear industry. Although much more work has been done in this field with underwear than with outerwear, indications are that the process is feasible for many outerwear constructions.

The second and most effective method of eliminating relaxation shrinkage in outerwear is a slight modification of the pre-washing procedure currently practiced by the sweater industry to obtain soft finish and loft. This procedure is accomplished very simply by wetting out the tubing, extracting in a centrifugal extractor and drying in a tumbler dryer. Although the exact conditions of washing are not critical, there are certain basic aspects of the process which must be carefully watched if difficulty is to be avoided. If wetting out is done in a wash wheel, caution must be used to avoid excessive agitation which may cause surface matting of the wool. One or two minutes at a high water level in the presence of a small quantity of a wetting agent is adequate. After wetting out, the tubing should be transferred to the centrifugal extractor without any pulling. Thorough extraction is another prerequisite of the proc-

ess. Under no circumstances should incompletely extracted goods be placed in the tumbler dryer since surface matting and distortion may occur. In the tumbler, rapid drying is desirable but not essential. Too rapid or incomplete drying may cause wrinkling in some constructions. Most commercial laundry tumbler dryers are suitable for the purpose. Since a major portion of the pre-shrinking takes place in the tumbler dryer, no other type of drying can be substituted. Naturally the tubing should not be removed from the tumbler until it is thoroughly dry since any remaining moist areas will be stretched in handling. The optimum length or weight of tubing that can be handled at one time will depend upon the nature of the equipment. Most commercial washers have had experience along these lines and know the capacities of their equipment.

During the preshrinking process the individual bodies and sleeves will contract or shrink approximately 15 percent in length. Thus in order to meet the specification requirements for body and sleeve length it will be necessary to adjust the knitting machine so that an approximate length increase of 15 percent is attained. The exact percentage will vary depending on the size of yarn, gauge of machine and tightness of the stitch. Under most conditions, if a stable construction is knit, very little change will take place in the width of the bodies and sleeves during preshrinking so that no special allowance will be required for this factor. However, if the bodies are knit slack, their width will increase in preshrinking. It should be emphasized that an increase in the weight of the finished sweaters above the minimum allowed by the specification is likely to occur if no change is made in the normal method of producing these items.

Obviously there are several ways in which excessive weight yarns can be avoided. The use of finer yarns is the most logical method and is especially applicable to the jersey knit and the 3-end half cardigan. In these constructions, where relatively coarse yarns are normally used, yarns of suitable fineness can be substituted without the necessity of employing

finer grades of wool. In the case of the 4-end half cardigan, presently used yarns are quite close to the spinning limit of 50's wool. Thus it may be necessary here to utilize a 56's wool to spin a yarn fine enough to keep the weight within the required range. An alternate method which has been used with some success consists of knitting the bodies slack and depending upon preshrinking to bring the number of courses per inch up to specification requirements. In doing this the bodies will become wider in preshrinking and will have to be used either as sleeves or possibly bodies for the next size garment—depending of course upon the gauge and diameter of the machine.

When the bodies become wider the needles (or wales) count per unit length will be reduced, and obviously if a coarse gauge machine is used the final wale count is apt to be under the specification requirement. There is no hard and fast rule which can be offered to guarantee that by knitting under a specific set of conditions the finished sweater will meet specification requirements precisely with regard to dimensions, weight, and wale and course count. There is such a great variety of knitting machines in use that individual initiative must be used in establishing the exact conditions required.

In all probability a simple relationship can be established by each knitter for his machines, in which he will find that with a yarn of a given size, knit with a predetermined number of courses to a definite length on a machine of a given gauge and cylinder size, a preshrunk sweater falling within one of the size classifications of the specification will be obtained. Actually, the problem is not as complex as it seems and at least five members of the outerwear industry have already made preshrunk sweaters that have fully met all the specification requirements. To be as fair as possible in our efforts to assist the industry in the event of future procurements, the tolerances on both dimension and shrinkage have been considerably liberalized.

After the bodies or tubing have been preshrunk and returned for cutting, strict attention must be given to the calendaring, steaming and pressing operations. Here if care is not taken all of the benefits of the preshrinking operation can be offset by stretch-

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This article was specially written for the "Knitted Outerwear Times" by Dr. Weiner to aid knitwear manufacturers to understand better the provisions governing felting and relaxation shrinkage in Army and Navy specifications for shrink-resistant treated wool knitwear.

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ing the fabric. Although a certain amount of stretching can be used to help adjust to tolerances, any considerable stretching will be reflected in excessive shrinkage during laundering and will be cause for rejection. It can be judged as a working guide that each increment of stretch in finishing will result in a corresponding increment of shrinkage when the finished garment is tested.

In the event of future procurements of any of the Army's outerwear items it is strongly recommended that the individual contractor prepare one or two sample items prior to submitting a formal bid in order to be in a better position to determine the costs involved. Although it would be impossible for the Quartermaster Research and Development Laboratories to carry out testing on all such samples, their technical personnel will offer all assistance possible to individual bidders and recommend steps which may be taken to determine whether the specification requirements have been met.