PERFORMANCE OF FOUR SUITING BLENDS IN GARMENT CONSTRUCTION AND IN MAINTENANCE

Thesis for the Degree of M. A.

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Clarice Garrett

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This is to certify that the

thesis entitled

Performance of Four Suiting Blends in Garment
Construction and in Maintenance

presented by

Clarice Garrett

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Hazel B. Strahan
Major professor

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PERFORMANCE OF
FOUR SUITING BLENDS IN
GARMENT CONSTRUCTION AND IN MAINTENANCE

By

Clarice Garrett

A THESIS

Submitted to the School of Graduate Studies of
Michigan State College of Agriculture and Applied Science
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Clarice Garrett

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AN ABSTRACT

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Approved Hazel B. Strahan

PERFORMANCE OF

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The purpose of this study was to evaluate and compare specifications and initial performance characteristics of four suiting fabric blends with their performance after dry cleaning and laundering, and to evaluate and compare the appearance of jackets made from these fabrics and problems encountered in their construction.

The fabrics tested were blends of wool with orlon and with dacron; and rayon with orlon and with dacron. Identical sets of jackets, one-half of each jacket being made of a different fabric; were subjected to six dry cleanings and launderings respectively. Subjective analysis of change in appearance was made following the cleaning treatments and the results compared.

The four fabrics were analyzed in the laboratory before and after cleaning for specification and performance characteristics in accordance with standard methods and instruments of test. Specification testing included fiber identification and percentage, weight and thickness, and analysis of yarn count and structure. Tests of performance characteristics before and after cleaning included resistance to abrasion, tensile strength and elongation before and after abrasion, wrinkle recovery, dimensional change, compressibility, resilience, drapability, coefficient of friction, and colorfastness to light laundering, perspiration and crocking.

Specification analysis showed the four fabrics to be composed of similar yarns and slight differences in these characteristics were noted. Performance differences among the four control fabrics were primarily due to variations in percentage composition, weave structure, and amount of finish applied.

Both laboratory test data and subjective analysis of the jackets showed

the wool and dacron blend to be the most satisfactory of the four fabrics in appearance and performance. The rayon and orlon was the least satisfactory.

In general, the performance of the four fabrics coincided with the claims made for them. The presence of orlon in the blend added good bulking qualities, improved drapability, handle, dimensional stability, and crease recovery. Dacron contributed outstanding improvement in tensile strength, resistance to and recovery from wrinkling and retention of shape. Rayon tended to counteract certain of the synthetic fibers deficiencies and to improve the drapability and liveliness of the blended fabric. Wool, as a component fiber of the blend, contributed greater resilience, improved wrinkle recovery, and ease in handling to the finished fabric.

TABLE OF CONTENTS

Table of Contents (continued)

TABLES, CHARTS AND PLATES

TABLES, CHARTS AND PLATES (Continued)

TABLES, CHARTS AND PLATES (Continued)

INTRODUCTION

With the increased prosperity and the rise in the standard of living during the postwar period greater demands have been placed on textile materials by the consumer and for industrial end-uses. The textile industry is continuously searching for new fibers and fabrics that can be economically produced in order to meet these numerous demands. As a result fabrics of various blends have been designed and placed on the market to meet requirements for specific end-uses.

The discovery and introduction of the new synthetic fibers was a boon to the textile industry. However, the high cost of research in their development and production has limited their use. Through experimentation in combining these new synthetic fibers with the already proven fibers, it was learned that more functional and aesthetically appealing fabrics could be produced at more reasonable prices. Therefore, an increasing variety of attractive blends are continuously being produced and marketed.

Due both to the newness of the synthetic fibers, now so extensively used in blends, and to the comparatively recent introduction of blended fabrics on the consumer market, there has been insufficient research done to determine how satisfactorily these new fabrics perform in garment construction and in maintenance during wear.

Because of differences in fiber content, yarn structure, fabric geometry, and finish; the performance of one fabric blend is not indicative of another. As a result, additional research and experimental testing are necessary. Each particular type of blend must be examined for its own functionality and aesthetic properties. It is the purpose of this study to supplement the data now available on blended fabrics containing wool blended with orlon or dacron and rayon blended with either of these two synthetics.

The general objective of this study, then, was to evaluate the performance of four specific suiting-type blends in garment construction, and their performance in laundering and dry cleaning.

Specific objectives are designed:

1. To compare the four fabrics for ease in cutting, pressing, moulding for shape, and stitching during the construction of the garment.
2. To evaluate and compare construction processes such as selected types of seams, hems, buttonholes, sleeves, collars and pleats on each of the fabric blends.
3. To evaluate and compare the initial physical characteristics or specifications of the four fabrics through yarn analysis (twist, number, and type), and analysis of the fabrics for weight per square yard, thickness, compressional resilience,

coefficient of friction, tensile strength, and elongation.

4. To evaluate and compare the different fabrics in their initial performance characteristics for abrasion resistance; drapability, wrinkle recovery and colorfastness to light, laundering, and crocking.
5. To compare and evaluate the performance of these fabrics after dry cleaning and after laundering for the above characteristics.
6. Evaluation of data to serve as criteria for judging the acceptability of these fabrics for apparel end-use.

REVIEW OF LITERATURE

In the present scientific era with the continual rise in the standard of living there are numerous demands placed upon textile fabrics by the consumer end-uses. The consumer wants not only functionality, such as comfort, ease of maintenance, resistance to wrinkling, retention of shape and crease, dimensional stability, and durability but aesthetic properties, such as style, appearance, handle, color, and draping qualities as well (53). Textile manufacturers are constantly seeking newer and cheaper fibers, as well as better and more economical methods for producing moderate priced fabrics that will meet changing consumer demands. With the discovery and introduction of various new synthetic and semi-synthetic fabrics on the market the textile producers believed their problems in producing economical and suitable fabrics might be solved. However, due to the competitively high cost of these new fibers fabric manufacturers have found it impossible to produce fabrics that fulfill end-use requirements in acceptable price ranges for the average consumer. To resolve such problems and to produce versatile fabrics, the textile technologists have resorted to blending various fibers that will impart the desired characteristics to the finished fabric. Scientific blending of supplementary fibers is providing a broader base for the whole textile industry by supplying the consumer with a better or more reasonably priced product (35). The mixing together or blending of various fibers not only lowers costs, but magnifies the better qualities of the different fibers and minimizes individual differences which all fibers have (56).

Boya (7) states that the day of a pure fabric is rapidly moving into "limbo". This is the transition period into the era of blends, or engineered fabrics which will be made to satisfy a specific end-use or, at the best, a specific series of end-uses.

In the process of blending the question of selecting the proper fibers that will satisfactorily fulfill the demands for specific end-uses arises. Since the capacity, behavior, and performance of a textile product depends largely upon the inherent characteristics of the individual fibers, the content, the yarn construction, and the fabric geometry and construction; it is very important that the textile technologist have a thorough knowledge of these outstanding factors (26).

The technical technologist has learned to know the natural fibers through years of first-hand experience which include sensory impressions and results of routine test methods. While the scientist, stimulated to investigate all textile fibers by the acceptance of his own investigations, has made great progress in understanding the molecular structure of textile materials and in explaining their mechanical behavior in terms of the strength of chemical bonds and

other cohesive forces between the atoms and molecules (53).

Each fiber has some property on combination of properties which is unique. Each fiber should be used alone or in combination with other fibers where its unique characteristics give it the best chance to contribute to fabric performance. The fabric manufacturer must define what properties he wants in a particular fabric; then he must select the proper fiber or combination of fibers, then design and develop a satisfactory product through experimental blending, treatment, and finishing (53).

Since consumer demands and end-uses dictate the requirements of textile fabrics, the principal task facing the industry today is to bring functionality and aesthetic properties together in a manner that will result in the manufacture of better fabrics. In order to do this, the industry has resorted to the blending of various fibers.

Textile uses call for fibers having various combinations of properties, and it is not to be expected that any one fiber will be ideal for all uses, for each individual fiber possesses some desirable and some undesirable characteristics. Thus, one important reason for blending is the negation or absorption of any disadvantages peculiar either to natural or synthetized fibers (53).

Other reasons for producing fabrics from blends of different fibers are:

1. To obtain maximum function for some definite property--

as wrinkle resistance, dimensional stability, durability, etc.

2. To compromise on a specific functional property to get a combination of desirable properties--such as improved handle or drape, to minimize static or flammability, or to control costs.
3. To enhance fabric function by the use of a small percentage of synthetic fiber as in hosiery reinforcing, decoration yarns, etc. (50).

There is no simple prescription for the blending of textile fibers as the end-use determines the required performance characteristics (49). End-use then would determine the percentages of the component fibers in the blend.

Minimum percentages of orlon or dacron to blend with rayon or wool cannot be firmly set because there are many other variables such as yarn, fabric structure, and finishing operations that greatly modify the nature of the blend and sometimes may be as important as fiber composition (53).

However, several studies have been carried out along this phase of research and results of these studies have revealed some basic information. Extensive testing with two fabrics, a worsted and a serge, were carried on by the Textile Research Division of E. I. du Pont Nemours and Co., Inc., for the purpose of determining minimum percentages of orlon and dacron required in these blends in order to produce specific fabric properties. The following minimum percentages are based on these tests as reported by Dr. J. B. Quigg (50).

Woven fabric blends with orlon and dacron staple:

1. For resistance to and recovery from wrinkling at both normal and high humidities, the indicated minimum with wool is 50% orlon or 50% dacron, and when blended with rayon - 20% orlon or 75% dacron.
2. For retention of press, the indicated minimum with wool or rayon is 25% orlon or 25% dacron.
3. For strength, the addition of orlon adds slightly to either rayon or wool.
4. For dimensional stability to changing humidity, the indicated minimum for blends is 30% orlon.
5. For resistance to abrasion a minimum of 30% dacron for any significant increase.
6. For tensile strength the indicated minimum with wool would require 20% dacron and 60 to 70% dacron in combination with rayon.
7. For tear strength, the indicated minimum for blends with wool or rayon would be 20% dacron.

The results thus far in blended woven fabrics show that when the fabric is designed for the indicated minimum for resilience by use of orlon or dacron, the over-all functionality of the fabric will be improved (49).

In a comprehensive study recently published by Sayre and Weldon (54) regarding what mixtures of rayon, dacron, and orlon impart to a fabric, it was seen that in a fabric blend of dacron and rayon, its crease recovery value was outstanding; having a recovery of approximately 82% in the initial 15 seconds at 65% R.H. Next in order are blends with orlon and with rayon with recoveries of 65% and 50% respectively. The crease recovery value is not always directly proportional to percentages of blended fibers. This indicates that some complex inter-fiber behavior is probably involved. Twenty-five percent rayon blended with dacron yields a fabric with only a marginal loss in crease recovery as compared with all-dacron fabrics.

Crease recovery values are higher for orlon than rayon with blends of orlon and rayon showing a nearly linear relationship proportional to the blend composition. Blends containing major proportions of dacron are outstanding in both initial and long-term recovery from creasing. Blends of 50% orlon and 50% rayon have better crease recovery value than fabrics of all orlon or all rayon. Optimum blends with either dacron or orlon must contain major proportions of these hydrophobic fibers if they are to be effective in the blend.

Because this study by Sayre and Weldon is so pertinent to this investigation the findings are discussed at length. Rayon contributes to liveliness, thus, a significant increase in liveliness requires major proportions of rayon. Orlon provides the outstanding contribution to fabric bulk. In two-fiber component blends, the influence of each fiber is evident in almost direct proportion to its percent in the blend. Dacron has more static electricity than orlon which about equals wool. The addition of 25% rayon to the blend substantially reduced its tendency to accumulate static.

Dacron has good abrasion resistance and blends of dacron and rayon show a relationship nearly proportional to its blend composition. It is interesting to note that rayon and orlon are essentially comparable with respect to abrasion resistance on basis of equal volume. Increased proportions or orlon reduce the density of the structure to a marked degree so a smaller mass of material absorbs the energy of abrasion. A two-component fabric with 50 percent or more dacron provides significant improvement in abrasion resistance, with a three to fourfold advantage being evident at the level of 75% dacron.

Dacron is outstanding with respect to tear strength in comparison with orlon or rayon. As the two components are varied, the tear strength of the composite fabric becomes some complex function of blend composition. In a dacron and rayon blend the addition of minor proportions of rayon have little effect on the strength of the fabric but as the rayon content is increased the rate of loss of strength becomes critical. With a rayon content of 75% the tensile strength of the fabric may be lower than that of 100% rayon. Low percentages of dacron offer little gain in fabric strength. Orlon and rayon when blended with each other are interchangeable with respect to fabric strength. The tensile strengths of the fabrics reflected the same characteristics illustrated in tear strength measurements.

Sayre and Weldon found that orlon and rayon were more resistant to hole melting damage than dacron, and this resistance was carried over into blends nearly in proportion to the blend composition. Tests showed that fabric flammability is not directly related to fiber thermal properties. Dacron and orlon in a given fabric blend are comparable with respect to ignition time and ignition temperature, but dacron is normally self-extinguishing. Rayon ignites at a lower temperature as does wool, but shows a slight advantage in being slower to ignite and burn than orlon or dacron. Orlon is comparable with rayon in rate of burning.

In briefly summarizing the results of Sayres and Weldon's study it was found that dacron in blends contributes outstanding improvement in properties such as strength, abrasion resistance, crease recovery and dimensional stability. Orlon is superior to rayon in bulk, crease recovery, dimensional stability and press retention. It also provides in fabrics outstanding aesthetic value, such as softness of hand and pleasing texture. Rayon when blended with synthetic fibers as a minor component, is very compatible and is effective in counteracting certain of their deficiencies, such as static, pilling, and hole melting. Observations showed that 50 per-cent or more of the newer synthetic fibers is required for effective realization of their advantages.

In a study by Bogarty and others (4) on properties of fabrics made from blends of wool with Acrylics it was found that the thickness of these fabric blends were affected by the differences in surface hairiness. Blends of 50% wool and 50% orlon were less thick than all wool and thicker than all synthetic fabric. Increasing the synthetic content of fabric tends to result in a thinner fabric and hence one of lower thermal resistance.

The Bogarty study showed that the addition of synthetics to blends increased the wicking tendency of the fabric which affects the comfort of a fabric regarding moisture absorp-tion. Differences in the stiffness behavior are probably influenced to a much greater degree by structural effects than by any differences in fiber type or blend.

The dry crease recovery data in this same study indi-cated that the addition of increasing amounts of synthetic fibers tends to lower the crease recovery somewhat. Addi-tion of synthetics of low regain to the blend enhances the muss-resistance considerably. Some advantage in crease recovery may be gained from the use of some synthetic in a blend.

One over-all effect to be noted is that generally many of the properties evaluated do not change very greatly when up to 1/3 of the wool is replaced by synthetic. The large-scale changes come about in going from a 50/50 blend to an all-synthetic fabric. The implication in terms of these particular tests is that as much as 30% of these synthetics may be used without substantial alteration of many of the fabric properties (4).

In a study of blends containing the new man-made fibers, Dennison and Leach (10) found that it does not always increase the tenacity of a yarn to admix a higher tenacity fiber to it. In the case of a mixture of dacron and rayon, both of stock-blended staple fibers and of plied, spun yarns; the tenacities of the resultant yarns are lower than the tenacity of a plied rayon yarn made from the same rayon staple used in the mixture. A decreased tenacity seems logical in mixtures of dissimilar fibers when the fiber of higher modulus fails before the other fiber takes its proportional share of the load.

In a blend or mixture of rayon and dacron, the relatively higher Young's modulus of the rayon ply up to its breaking point causes it to carry more than its share of the load and to break at a lower total load than would a rayon yarn of the same size as the combination yarns. Such combination yarns show dimished tenacities up to concentrations of 50 percent of the dacron fiber. Dacron and orlon increase tenacity of blended fabrics containing wool as the other component. Wool seems to be strengthened almost proportionally to any percentage of these synthetic fibers blended with it. Synthetics add durability to all mixtures.

Laboratory data by Dennison and Leach indicates that dacron increases resistance to abrasion in blends with rayon, and the method of blending has an influence on the degree of improvement. The greatest improvement was noted in fabrics containing yarns having the most intimate intermingling of fibers. Fabrics of ply-blended yarns showed abrasion resistance directly proportional to the percentages of the component fibers.

The ability of a fabric to recover its shape after casual creasing is desirable in a suiting. Among the natural fibers wool leads in possession of this characteristic. Among the synthetic fibers reported in this study dacron leads in the ability to recover from wrinkling. Data developed to date show the transition of this fiber characteristic to yarn and fabric construction to be straight forward. Fabric recovery from creasing can be predicted with reasonable accuracy from the extension and recovery cycles of the primary fibers used in the blend. Percentage of work recovery of the fiber drops as the percentage elongation of the tested fiber or yarn is increased. Work recovery varies directly with the percentage content of each fiber component.

The intermixture of 50% dacron into rayon combination fabrics produces recovery from creasing at least equivalent to that produced by resin treatment. A proportional increase of recovery is shown by the content of dacron fiber in blends with wool. Combination fabrics containing dacron fibers appear to be less susceptible to adverse effects resulting from repeated dry cleaning and pressing than commercial resin treated combinations. They show little loss in the ability to recover from creasing and in combination with rayon, this ability is actually increased. Crease retention characteristics of orlon and dacron are approximately equal. Both lend this property to blends in direct proportion to the percent of synthetic fiber included.

Quigg and Dennison (53) examined two types of blended fabrics, a heavy weight suiting and a plain weave tropical suiting, in combinations of dacron and orlon with rayon and wool. The fabric characteristics examined were strength, abrasion resistance, recovery from wrinkling, ability to retain a pressed crease, flammability, and the sensitivity of certain of these properties to humidity, dry-cleaning, and laundering. They found that dacron in combination with wool or rayon increased fabric strength, abrasion resistance, press retention, wrinkle recovery, and stability to changes in relative humidity when compared with 100% wool or rayon fabrics. Orlon increased fabric strength when blended with wool. Orlon when blended with rayon or wool showed increases over a fabric of the appropriate older fiber in stability to dry cleaning, laundering and humidity changes, and in ability to retain pressed creases. Abrasion resistance and crease recovery at normal and high humidities were increased by orlon when blended with rayon.

Nuding (43) found that to produce good blends there were three different possibilities for the mixing of the textile fibers. These were: (1) raw stock blending in which two technological characteristics of the fibers must agree, (2) doubling of different singles yarns in which the strength of the yarn depends upon the elongations of the constituent yarns, (3) mixing different yarns in the fabric, as blends containing orlon and dacron with wool and rayon. In preparation of blends of fibers the properties of the constituents must be considered at every stage. Only by doing this will the best results possible be achieved. End-uses must be kept in mind throughout all stages in production of yarns and fabrics from mixtures of fibers and of fabrics by blending yarns composed of different fibers. The serviceability of the finished fabric should be considered. The blend should be judged by its behavior in spinning, processing, weaving, and especially in its ultimate uses.

Lund (30) states that the perfect blend is a random distribution of single fiber elements in two dimensions of the cross section of the yarn, and probably a random distribution of single fiber elements along the axis of the yarn. The factors that affect the intimacy of blending are the inherent physical factors of fiber size and the number of fibers in the cross-section of the yarn; and the processing factors which are controllable, such as the stage at which blending takes place and the number and type of operations which follow blending.

The subject of blending is a highly complex one. The problem of blending is more than a problem in fiber and fabric technology--it is also a problem in organic chemistry, physical chemistry, physics, engineering, biochemistry, physiology, and psychology (20).

Not only are the fiber and fabric technologists confronted with many problems in the process of blending, but the mills handling these blends face many problems. Some of these problems are: fly contamination; uneven blending; nonfugitive tints; fiber breakage; lubrication; surface effects; static of the newer synthetics; effects of deniers, lengths, and stress-strain properties. In spite of these problems and the many obstacles which arise daily, mill men have exhibited no small amount of fortitude and aptitude in coping with these problems and turning out hundreds of attractive and functional blends to meet every consumer need (17).

The coloring of the new fibers alone and in blends by practical methods and in shades which meet end-use requirements is of as much importance for success, as is the attainment of improved physical properties. The properties that make the newer synthetic fibers so valuable have contributed to the difficulty of dyeing. Their hydrophobic character, resistance to chemical agents, limited swelling properties, and smooth surfaces all make difficult the penetration and retention of dye particles. In union dyeing, one of the methods used in dyeing blends, the wool or rayon is dyed and the synthetic fiber is left white and produces attractive heather effects. Stock dyeing is also used but presents manufacturing limitations. In this procedure, the fibers are dyed separately and then blended to produce solid colors. However, volume production favors dyeing in the piece, and as a result this subject is being actively developed (9).

In a study of clothing construction processes and techniques applied to fabrics made from synthetic fibers Goldsmith and McDade (18) found that the use of both nylon and silk thread in stitching garments of dacron-wool blends gave satisfactory results, and no stitching problems were encountered. Sharp tools for pinning and cutting were necessary as a tendency to fray was noticeable.

Pressing presented the most difficult problems, as shrinking out fullness at the sleeve cap had to be done several times in order to achieve satisfactory results. This was also true in pressing seams open and in achieving a sharp crease in pleats and faced areas. Moderate pressure temperatures were necessary.

A report delivered by Hamilton (20) to the International Association of Clothing Designers gave significant facts and recommendations that should be known and followed by cutting, sewing and finishing departments handling dacron fabrics. Much of the material reported was based on the experience of Witty Bros., a clothing manufacturing firm.

It was found that dacron materials blended with other fibers should be shrunk and/or refinished to prevent later shrinkage of the non-dacron fibers. Garment patterns must be designed for exact final measurements as dacron does not shrink in pressing but allowances need to be made for lack of resilience to insure a comfortable fit. Cutting machines should be operated at a lower speed than for fabrics made of natural fibers as high-speed cutting may result in fusing and pulling. Use of dacron or silk thread with the smallest possible size needles and a light tension was recommended. For all pressing operations heat should be kept low because the fiber is affected by heat. Bare irons should be kept from direct contact with the fabric. Steam may be used but must be controlled to prevent shining the cloth.

The attributes of fiber blends are many, but much remains to be done. At the present time there are many research and developmental projects under way by individual manufacturers and research laboratories seeking to improve fiber properties and their use. Improvements in products and expansion of markets must inevitably result in the benefit to man.

METHODS AND PROCEDURES

For this study four different fabric blends, commonly used in men's and women's ready-to-wear apparel were chosen. Two were blends containing wool and typical of fabrics used in winter clothing and two were blends containing rayon typically used in summer apparel. The two fabrics containing wool had the same fiber percentages. However, the synthetic fiber in fabric I was orlon and in fabric II was dacron. Both fabrics III and IV contained different percentages of viscose rayon blended with different percentages of orlon and dacron respectively.

All fabrics were of plain weave structure except the rayon and orlon (III), which was of a crepe weave. They differed in color and price range.

The performance characteristics of the fabrics during construction procedures were determined on a subjective basis and included shaping, molding, ease of handle, and ease of pressing.

Specification analysis of the fabrics consisted of: chemical and microscopic analysis to determine percentages and fiber content, determination of weight and cost per square yard, width, thickness, and yarn count. Yarn analysis included determination of type of yarn, size, direction, and amount of twist.

Performance characteristics of the fabrics in the original state and after one, three, and six dry cleanings and a corresponding number of launderings consisted of laboratory tests for resistance to abrasion, tensile strength before and after abrasion, wrinkle recovery, dimensional change, compressibility, compressional resilience, drapability, coefficient of friction, elongation before and after abrasion, colorfastness to light, laundering, perspiration and crocking.

All laboratory test procedures conformed to the specifications of the American Society for Testing Materials Standards on Textile Materials, 1953 (1), under standard conditions of 65% ± 2% relative humidity and 70° ± 2° Farenheit.

The cutting chart for the test specimens will be found in the Appendix page 131.

Testing Procedures

Fiber identification

Verification of the fiber content of each fabric blend was determined by microscopic analysis, burning, chemical, and fiber identification stain tests.

Weave structure

Weave structure was determined with the use of a magnifying lens.

Cost per square yard

The cost per square yard of each fabric was determined by the following formula:

$$\frac{36" \times 36" \times \text{cost of the fabric per running yard}}{36" \times \text{width of fabric in inches}} = \text{cost per square yard}$$

Width per square yard

Each fabric was laid out smooth on a horizontal surface without tension in either direction. Five different measurements, uniformly distributed along the full length of each piece, were taken and the arithmetical average recorded as the average width.

Weight per square yard

Five specimens two inches square with no two specimens having the same warp or filling yarns, were taken from each fabric, conditioned and weighed on a Becker Chainomatic Analytical Balance. The average weight in grams of the five specimens was recorded. The following formula was used for computing the weight per square yard:

$$\frac{45.71 \text{ x weight of samples in grams}}{\text{Area in inches}} = \text{ounces per square yard}$$

The weight was computed on the original fabric and specimens withdrawn after the terminal laundering and dry cleaning.

Thickness

The thickness of the fabrics was computed on the Schiefer Compressometer. The readings were taken when the presser foot of the compressometer exerted one pound pressure per square inch upon the fabric and was allowed to rest ten seconds. Readings were recorded in inches. Nine determinations were averaged to calculate the original thickness of the fabrics and after withdrawal following 1, 3, and 6 launderings and dry cleanings.

Yarn count

A micrometer was used to determine the number of yarns per inch. The yarn count of warp and filling respectively was recorded as the arithmetical average of ten determinations, so spaced that no count included the same set of yarns.

Yarn number

The Universal Yarn Numbering Balance was used to determine the yarn number. Thirty-six inch lengths of the spun yarns were weighed and the average of ten determinations each for both warp and filling was calculated and recorded as yarn size.

Twist per inch and direction of twist

The direction and number of twists per inch were determined on an Alfred Suter Twist Tester. For single yarns of spun fibers a 10-inch gauge length with a 3-gram deflection load was used. The yarn was completely untwisted and then retwisted to its original length thus recording twice the number of twists on the counter for the 10 inches tested so this result was divided by 20 to obtain the average number of turns per inch. An average of ten determinations each for both warp and filling was calculated to determine the twist per inch.

For the ply yarns the 10-inch gauge and 3-gram deflection load was used. The twist was completely removed from the yarn and the number of turns divided by ten to determine the number of twists per inch of the ply. The average of

ten determinations was computed and recorded as twist per inch.

The twist of each component yarn of the ply was determined separately. When the ply was completely untwisted the yarn or yarns not being tested were clipped and secured in order to prevent any untwisting. Each component yarn in turn was tested using a 5-inch gauge length with a deflection load of 3 grams.

For single yarns of spun rayon the yarn was untwisted and then retwisted to its original length with the counter result divided by twice the length of the yarn employed.

Tensile strength

Tensile or breaking strength was determined by the ravelled-strip method on the Scott Tensile Strength Machine in accordance with the standard test procedure of the A. S. T. M. Ten dry and wet determinations each were taken for warp and filling of the original fabrics and fabrics withdrawn after the terminal laundering and dry cleaning. Averages and percentage change from the original were calculated and reported.

Elongation

Elongation of warp and filling yarns for each fabric was obtained by an autographic recording attachment on the Scott Tensile Strength Machine simultaneously with the determination of tensile strength. An average of the results for ten specimens each was recorded as the elongation of warp and filling yarns respectively for each fabric. Averages were determined and the stiffness of the fabric computed as the geometric mean of the warp and filling (square root of the product of warp times filling).

Wrinkle recovery

The Monsanto Wrinkle Recovery Tester was used to determine the ability of the fabrics to recover from creasing or wrinkling. Test specimens of 1.5 cm. x 4 cm. for both warp and filling with the longer dimension representing the direction of the test were conditioned for a minimum of four hours. The test specimen was then placed between the metal leaves of the specimen holder so that one end was flush with the longer metal leaf. The exposed end of the fabric was folded back so that the end fell on the horizontal guide line of the shorter metal leaf. The metal holder was then inserted in a plastic press and placed under a load of one and one-half pounds for five minutes. The specimen holder was then removed from the press and mounted on the wrinkle recovery tester so that the protruding fabric was aligned with the vertical center line on the outer disc of the tester. The fabric was allowed to recover for five minutes, being kept in alignment with the guide line by periodic adjustments. At the end of the recovery period the fabric recovery value was read directly from the calibrated scale in degrees. Five determinations were taken for both warp and filling of the original fabric and fabrics withdrawn after 1, 3, and 6 launderings and dry cleanings. Averages were calculated for each five specimens and recorded as the wrinkle recovery value.

Drapability

An improvised drapemeter, set up according to the simplified variation of test by Skinkle and Moreau, was used for measuring the drape or handle of the fabrics. The apparatus consisted of two ring stands supporting a horizontal bar. Three 2-1/2" paper clamps were hung from the horizontal rod. Attached to another ring stand was a clamp holding a millimeter ruler in a position 100 millimeters below the jaws of the paper clamps.

Specimens 100 x 250 millimeters were used for the test with the shorter dimension parallel to the set of yarn being evaluated. Each specimen was folded back on itself with the face of the fabric on the convex side and placed in the clamp about 1/4" below the top edges of the fabric. The specimens were allowed to hang for 2 minutes, then the millimeter scale was moved to the concave side just touching the fabric edges and the chord length read and recorded. Three determinations were made on both warp and filling of the original fabric and fabrics withdrawn after 1, 3, and 6 launderings and dry cleanings.

Compressibility

The compressibility of a fabric specimen is the ratio of the rate of decrease in thickness at a pressure of one pound per square inch to the standard thickness (55). All determinations were made on the Schiefer Compressometer and the following formula was used in calculating the compressibility: $\frac{\Delta t}{T} = C$ where Δt equals thickness at 0.5 lb. pressure per square inch minus thickness at 1.5 lbs. pressure per square inch, and T equals standard thickness.

Compressional resilience

The compressional resilience of a fabric is the amount of work recovered from the specimen when the pressure is decreased from 2.0 to 0.1 pounds per square inch and expressed as a percentage of the work done on the fabric when the pressure is increased from 0.1 to 2.0 pounds per square inch (55). All determinations were made in accordance with the method of test specified by Schiefer for the Schiefer Compressometer. The readings for each of 8 different pressures were recorded for three different specimens and then averaged.

Coefficient of friction

The coefficient of kinetic friction between two fabrics is the ratio of the force, applied parallel to the surfaces, required to cause one to slide over the other at a uniform speed to the force holding them together (14). Three determinations, both warpwise and fillingwise, were made for each fabric against eight different fabrics. All determinations were made on a Friction Meter in accordance with the method of test described in A.S.T.M. (1).

An average of the three determinations was calculated and recorded as the coefficient of friction of the fabrics against the various other fabrics.

Abrasion resistance

Resistance to abrasion was determined on the United States Testing Company Abrasion Machine. Two specimens 4.5" x 6.5" were abraded in the direction of the longer dimension, simultaneously. At regular intervals the machine was stopped and the lint removed from the specimens. The abrading was done with 320 Aloxite Metal Cloth, having an area of contact with the specimen of 4" x 0.44" (61).

Ten specimens, five with the longer dimension in the direction of the filling, were abraded for determining (1) first sign of wear, arbitrarily defined as discoloration; (2) first yarn break; (3) hole, defined as the breaking of two yarns at right angles to each other. After these determinations were made for each fabric, a constant number of double abrasion strokes was established for the warp and the filling, in order that the strength of the fabrics could be compared after the same amount of wear. The constant numbers chosen were within the maximum and minimum range of double strokes for all fabrics abraded to first yarn break and hole. Specimens from each fabric were abraded in the direction of the warp and in the direction of the filling to the established constant numbers. The specimens were then cut into three 1-1/2 inch strips for determination of the tensile strength after abrasion.

Dimensional change

Areas of 12" x 12" were marked with thread on each piece of fabric before they were subjected to dry cleaning and laundering. Three measurements warpwise and three measurements fillingwise were made on each fabric to the nearest 1/16" after the first, third, and sixth dry cleaning and corresponding launderings.

The average of the three measurements recorded for both warp and filling at the specified periods, was recorded as the dimensional change in inches of the various fabrics.

Colorfastness to light

Colorfastness to light was determined by the use of the Atlas Fade-Ometer. Specimens were subjected to light exposure for periods of 20, 40, 60, 80, 100, and 120 hours respectively and classed according to the classification in Commercial Standard CS59-44 (46).

Colorfastness to crocking

Six specimens, 2" x 5" with the longer dimension in the direction of the warp, were tested for colorfastness to crocking on the Crock Meter. A two-inch square of bleached, unstarched, cotton cloth was fastened to the finger extending from the movable top arm of the machine and then rubbed back and forth against the fabric specimen, attached to the base of the machine, for a total of ten times (20 strokes) under a constant load of 32 ounces, at the rate of two strokes per second. Three of the specimens were tested against a dry cotton

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cotton square, and three against a wet cotton square. The cotton cloth was then removed and the degree of discoloration rated as less than, equal to, or greater than that corresponding to Munsell neutral 7.0, and classed in accordance with the classification in Commercial Standard CS59-44 (46).

Colorfastness to perspiration

Two specimens (2" x 4") were tested for colorfastness to perspiration. A piece of composite test cloth of the same dimensions was wet in the same solution as the test specimen and both rolled together with the fabric specimen on the inside and the face side against the composite test cloth. One specimen was wet in an alkaline solution and the other in an acid solution. Each roll was then placed in a glass tube, leaving one-third of each roll projecting, the other two-thirds of the roll being protected from evaporation. The tubes were than placed in an oven maintained at a temperature of $100^{\circ} \pm 2^{\circ}$ Farenheit, and allowed to remain until dry, and then removed from the oven. The degree of discoloration of the test cloth, if any, was rated by comparing it with Munsell neutral 7.0, and reported as colorfast to perspiration in accordance with the classification in Commercial Standard CS59-44 (46).

Colorfastness to laundering

Two specimens of each fabric 2" x 4" with the longer dimension running in the direction of the warp were tested for colorfastness to laundering in an Atlas Launder-Ometer.

A 1-inch square piece of composite test cloth was sewed to the face side of each fabric specimen. The specimen to be tested was than placed in a pint jar to which was added 300 ml. of a solution containing 0.5 percent of neutral soap in soft water heated to $100^{\circ} \pm 2^{\circ}$ Farenheit. The jar was then placed in the machine, which was half-filled with water at $100^{\circ} \pm 2^{\circ}$ Farenheit, and the machine operated for 30 minutes. The specimen was then removed from the jar, rinsed in three changes of water at $100^{\circ} \pm 2^{\circ}$ Farenheit, rolled in an absorbent towel, and air dried. The colorfastness to laundering reported is in accordance with the classification in Commercial Standard CS59-44 (46).

Dry cleaning procedure

The fabrics were dry cleaned and pressed in a commercial establishment in East Lansing. A petroleum base cleaning fluid was used. The fabrics constituted a part of a regular cleaning load and were pressed on a steam press. Specimens were withdrawn for testing following the first, third, and sixth dry cleaning.

Laundering procedure

The laundering procedure simulated that of ordinary household laundering. The fabrics were laundered in an automatic tumbler-type washing machine with neutral soap flakes added. The fabrics were removed from the washer, spread out on a flat surface and partially dried. They were then ironed with an ordinary steam iron, first in the direction of the filling, then in the direction of the warp until the fabric was dry. Specimens for testing were withdrawn after the first, third, and sixth laundering cycles.

Jacket construction procedure

Vogue pattern No. 7698 was used for all of the jackets. The paper pattern was fitted to the writer and necessary alterations were made.

Using the altered pattern a jacket in muslin was cut and fitted for any other necessary alterations. The fitted muslin was then used as a pattern for cutting the four jackets from the various fabrics.

Three-fourths inch seam allowances were made for all seams except the shoulder and underarm seams where one inch to one and one-fourth inches were allowed.

All seams, darts, pockets, crossmarks, and buttonholes were carbon marked on the wrong side of the fabric. All seams were then stay stitched and crossmarks, buttonholes, and pockets were marked by machine basting.

The darts were stitched and pressed with a steam iron. The pocket welts were stitched, turned, and pressed, and the pockets set in. All side-seams of the jacket backs were bound, and the jacket parts were then stitched together and the seams pressed open.

Hymo, that had been previously shrunk, was used for the front interfacings, collar interfacings, and shoulder areas of both front and back. One-fourth inch pre-shrunk no-twist cotton tape was stitched to the outer edge of the front interfacings and collar interfacings so that the edge fell along the carbon marked seam lines. The seam allowances on the interfacings were then cut away about one-sixteenth inch inside the stitching line leaving the tape to be caught in the seam when stitching the facings to the front of the jackets. Collar interfacings were done likewise. The interfacings were pinned to the jacket fronts and the lapels shaped by applying padding stitches. Collars were also shaped by the use of padding stitches.

The three types of buttonholes used were namely: machine made, regular bound or patch type, and corded or tuck-strip. The front facings were then attached, turned, and pressed. The collars were stitched on next, followed by setting-in the sleeves. Bias strips of cotton-flannel were used in the sleeve and jacket hems. Rayon crepe was used in making the pocket pouches.

All jackets were unlined. Mercerized cotton thread was used for all stitching.

Evaluation of jackets

The jackets were judged and rated by a panel of four people for general appearance and fit and specified construction details evaluated. The instruction sheet for the judges and the sheets listing the criteria for judging the jackets are to be found on pages 111 through 116.

Pressing of the jackets

The pressing of the jackets during construction was done with a steam iron on a padded ironing board, sleeve and seam boards, and tailor's hams.

Pleat retention

Three specimens (15" x 30" the narrower dimension in the direction of the warp) were hemmed with the use of seam tape and sent to a commercial pleating company for pleating. One specimen of each fabric was kept for purposes of comparison, one was subjected to six dry cleanings and the other likewise to six launderings. Subjective comparisons were made after the first, third, and sixth dry cleaning and corresponding laundering.

DISCUSSION OF RESULTS

Analysis of Fabric Specifications

In analyzing the various fabrics for their respective fiber content both the warp and filling yarns in Fabric I were of wool and orlon; in fabric II of wool and dacron; in fabric III of rayon and orlon; and in fabric IV of rayon and dacron. The two wool blends bore labels stating their fiber percentage content, but no percentages were stated for the other two.

Through chemical analysis it was found that fabric I was 45 percent wool and 55 percent orlon, which substantiated the information on the label. This was also true for fabric II which was a blend of 45 percent wool and 55 percent dacron. Chemical analysis revealed fabric III as a blend of 55 percent rayon and 45 percent orlon; and fabric IV as a blend of 60 percent rayon and 40 percent dacron.

All of the fabrics were of plain weave except the rayon and orlon which was of a crepe weave.

In general, color was obtained by separate dyeing of the fibers constituting the various blends. However, in the wool and dacron fabric microscopic analysis indicated that some of the dacron fibers had been dyed. In the other three fabrics the orlon and dacron contained no dye indicating the staple was probably dyed prior to blending.

Fabric I, "Lorette" of wool and orlon was purchased from the J. W. Knapp Company of Lansing at $2.98 per yard. Fabric II, "Tropical" of wool and dacron was purchased from Susquehanna Mills at $3.39 per yard. Fabric III, "Chattertwist" of rayon and orlon was purchased from South Carolina Mills at $1.98 per yard and fabric IV, of rayon and dacron was purchased from Robbins Mills at $2.05 per yard.

When fabric cost per square yard was calculated there was less difference in price than their purchase price per linear yard indicated. Based on cost per square yard, the fabrics remained in the same price order with exception of the rayon and orlon and the rayon and dacron, in which their price position was reversed.

Table I

COMPARISON OF FABRIC COST

Fabric Code	Fiber Content	Width (in.)	Price per Linear Yard	Price per Square Yard
I	Wool & orlon	59.44	$2.98[1]	$1.81
II	Wool & dacron	60.80	3.39[2]	2.01
III	Rayon & orlon	45.00	1.98[1]	1.58
IV	Rayon & dacron	61.50	2.05[2]	1.20

[1]Retail price
[2]Mill price

<u>Width</u>

Fabric III, the rayon and orlon, was 45 inches wide and the other three approximately 60 inches in width.

Weight per square yard

Significant weight differences indicated the wool and orlon to be the lightest of the four fabrics. It weighed approximately 5 ounces per square yard, while the two dacron blends weighed approximately 6 ounces and the rayon and orlon 5-1/2 ounces per square yard. The differences in weights were due essentially to variation in yarn count and the finish applied to the different fabrics.

Standard thickness

The difference in thickness among the four fabrics was negligible and did not parallel differences in weight per square yard. In order of thickness, the wool and dacron fabric was lowest, then the rayon and dacron, followed by

Table II

FABRIC ANALYSIS

Fabric	Fabric Content	Thickness[1] in inches	Weight per Square Yard	Yarn Count[2] per Inch Warp	Filling
I	Wool - 45% Orlon - 55%	.0213	4.95 oz.	51.4	30.3
II	Wool - 45% Dacron - 55%	.0202	5.98 oz.	55.5	48.3
III	Rayon - 55% Orlon - 45%	.0293	5.54 oz.	53.0	45.7
IV	Rayon - 60% Dacron - 40%	.0209	5.88 oz.	68.0	54.5

[1]Average of 8 determinations
[2]Average of 10 determinations

the wool and orlon. While the rayon and orlon was the thickest, it was lighter in weight than either of the two dacron blends. This may be attributed essentially to its different weave structure.

Yarn count

The warp yarn count in each fabric was 7 to 14 yarns greater than its filling count. In the two wool blends the warp and filling yarn counts were well balanced, but less well balanced than the two rayon blends. The rayon and dacron showed the greatest difference between its warp and filling count. However, this difference did not affect its performance as much as the lesser difference between warp and filling count in the rayon and orlon fabric affected its performance.

Yarn analysis

The yarns used in each of the four fabrics were of high twist, ranging from 14 to 27 turns per inch. Ply yarns were used in both warp and filling for each fabric except the wool and orlon. It was woven of singles both warpwise and fillingwise. All ply yarns were of S-twist.

The warp yarns varied little from the filling yarns in the amount of twist; thereby indicating the use of similar yarns for both warp and filling. All singles yarns were of Z-twist. The singles used in the wool and orlon fabric had less twist than the singles comprising the ply yarns used in the other fabrics.

The ply yarns in both dacron blends contained approximately the same amount of twist, but those in the rayon and orlon fabric contained 3 less turns per inch. The singles yarns used in the rayon and orlon were somewhat higher in twist as is typical in crepe weaves.

The singles used in the wool and orlon were equivalent in size to the ply yarns used in the other three fabrics. The singles yarns used in all of the ply yarns varied little in size, with the exception of those used in the rayon and dacron which were slightly finer. This was indicated by the higher warp and filling count of this fabric.

Table III

YARN ANALYSIS

Fabric	Yarn Type (spun)	Twist per Inch[1] Warp	Twist per Inch[1] Filling	Direction of Twist	Yarn Number[2] Warp	Yarn Number[2] Filling
I	Singles	13.6	14.0	Z	13.6	12.9
II	Ply	20.7	20.8	S	12.5	12.8
	Singles	16.0	17.2	Z	12.5/2	12.8/2
III	Ply	17.75	18.12	S	13.44	12.62
	Singles	27.1	20.7	Z	13.4/2	12.6/2
IV	Ply	20.2	20.9	S	15.4	15.4
	Singles	22.9	25.9	Z	15.4/2	15.4/2

[1]Ply yarns - 10 determinations
Singles yarns - 20 determinations
[2]Ten determinations

Finishes

The finish applied to the fabrics was not revealed by the converters. However, a comparison of the appearance of the fabrics before and after dry cleaning and laundering indicated that a crease-resistant finish had been applied to all of the fabrics and a water-repellent finish to the wool and dacron suiting. The wool and dacron appeared to have the heaviest finish with the others ranking as follows: the rayon and dacron as second, the wool and orlon as third, and the rayon and orlon with the least amount of finish. No mention was made by the mill or distributor as to the functional character or permanence of the finish used.

ANALYSIS IF PERFORMANCE CHARACTERISTICS OF THE INITIAL FABRICS

According to the specification analysis of the four fabrics, they differed in fiber content, weight, thickness, yarn count, type, size, and amount of yarn twist. Thus, the performance of these four fabrics would be expected to show some variation.

Tensile strength

The wool and orlon ranked lowest among these four fabrics in dry and wet breaking strength, both warpwise and fillingwise. This may be due to the fact that this fabric was composed of single yarns, while the other three contained ply yarns. The breaking strength of this fabric was similar to that of the rayon and orlon as there was only one pound difference in dry warp and filling strength determinations and 2 to 4 pounds difference in the wet determinations. This fact would indicate that the orlon content tended to stabilize the other fibers with which it was blended. Both wet and dry warp strength was greater than filling strength and may be attributed to differences in yarn count. Differences between wet and dry strength determinations were quite uniform indicating a well blended fabric.

Of the four fabrics, the wool and dacron had the highest breaking strength in both directions. The close relationship between the wet and dry determinations in both warp and filling indicated thorough blending and balanced strength. The difference in wet and dry strength was only six pounds. Because of the yarn count of this fabric one might expect appreciable variance between warp and filling strength. This slight difference of six pounds was probably due partly to the dacron content, and partly to the finish. From the standpoint of tensile strength this fabric ranks as the best of the four.

Table IV

TENSILE STRENGTH AND ELONGATION OF ORIGINAL FABRICS

Fabric No.	Fabric Composition	Tensile Strength in Pounds [1]				Elongation in Per-cent [1]			
		Warp		Filling		Warp		Filling	
		Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
I	W-O	49.7	35.9	38.0	28.1	41.6	44.6	38.9	42.7
II	W-D	88.2	82.6	76.4	71.0	63.8	71.3	61.2	66.5
III	R-O	50.9	39.5	38.9	30.4	13.7	17.6	20.9	21.2
IV	R-D	60.5	48.0	48.9	41.9	33.4	25.2	39.4	31.0

[1]Average of 10 determinations

The warp of the rayon and orlon fabric had a higher tensile strength than the filling, due to its higher yarn count. The wet-dry strength relationship in the warp indicated wet strength to be four-fifths of dry warp strength, and wet filling strength to be three-fourths that of its dry strength. The differences between wet and dry determinations were the same for the warp as for the filling. The stabilizing effect of the orlon blended with the rayon is indicated in the wet and dry strength ratio.

The rayon and dacron was second highest in breaking strength in these four fabrics. As in the wool and dacron, its strength may be due both to its dacron content as well as finish. There was greater variance between the dry and wet warp strength determinations than the dry and wet filling determinations. However, the wet-dry relationships were fairly constant. Wet warp strength was 80 percent of its dry strength, and wet filling strength was 85 percent of its dry strength. This indicated uniformity or thorough blending of the fibers. The fact that warp strength was greater than filling strength was due to the higher yarn count in the warp.

<u>Tensile strength after abrasion</u>

Since the warp yarns were subjected to 500 double strokes of abrasion and the filling yarns were abraded only 300 double strokes; comparison of warp and filling strength following abrasion is not feasible.

After abrasion, the wool and orlon showed a greater loss in strength warpwise than any of the other fabrics. This higher loss may be due to differences in the type and the amount of twist in the yarns. This wool and orlon fabric showed a loss of 50 percent of its warp strength. Loss was 10 percent greater when dry. This was comparable to the wet-dry strength relationship in the original fabric. There

Table V

WARP TENSILE STRENGTH BEFORE AND AFTER ABRASION[1]

Fabric	Dry Strength in Pounds[2]		Percent Change	Wet Strength in Pounds[2]		Percent Change
	Original	After Abrasion		Original	After Abrasion	
I	49.7	21.2	-57.4	35.9	19.0	-47.2
II	88.2	45.6	-48.3	82.6	42.0	-49.2
III	50.9	30.6	-38.0	39.5	25.4	-35.8
IV	60.5	40.2	-33.6	48.0	37.4	-22.1

[1]500 double strokes
[2]Average of 10 determinations

was little difference in warpwise loss of strength between the two fabrics containing wool. However, in comparing the two orlon blends, the wool and orlon showed a much greater loss in strength than the rayon and orlon indicating that the wool was less resistant to abrasion than rayon. This was likewise true in comparing strength loss for the two fabrics containing dacron.

After warpwise abrasion, the wool and dacron blend lost approximately 7 percent less of its strength than the wool and orlon blend. However, the wool and dacron fabric lost one and one-half times as many pounds calculated on dry strength determinations and approximately twice as many based on wet determinations; as the wool and orlon blend. The wool and orlon blend and the rayon and dacron blend showed the greatest variation between wet and dry determinations of

Table VI

FILLING TENSILE STRENGTH BEFORE AND AFTER ABRASION[1]

Fabric	Dry Strength in Pounds[2] Original	Dry Strength in Pounds[2] After Abrasion	Percent Change	Wet Strength in Pounds[2] Original	Wet Strength in Pounds[2] After Abrasion	Percent Change
I	38.0	35.2	- 7.4	28.1	26.6	- 5.3
II	76.4	60.2	-12.2	71.0	51.4	-27.6
III	38.9	9.0	-76.8	30.4	10.6	-51.6
IV	48.9	43.4	-11.2	41.9	38.0	- 9.3

[1]300 double strokes
[2]Average of 10 determinations

strength loss. However, both of the dacron blends still had good warp strength after abrasion--approximately 40 pounds or more. The rayon and orlon fabric had 25 wet and 30 pounds dry strength while the wool and orlon had only 19 and 21 pounds respectively in wet and dry strength after abrasion.

Fillingwise, the wool and orlon blend lost the least amount of strength after abrasion of the four fabrics, retaining about 93 percent of its original strength. Based on wet-dry strength averages, the wool and dacron fabric lost four times as much of its strength fillingwise as the wool and orlon fabric. Of the four fabrics the rayon and orlon blend lost the greatest amount of strength; with a filling loss 25 percent greater for dry than wet determinations. This loss may be due to the shortness of the staple which abraded more readily in the dry state and to greater adherence of the fibers in the wet state. The filling wet-dry strength relationships in the wool and orlon blend and the rayon and orlon blend varied from the others in that there was a greater loss in strength in the dry determinations than in the wet determinations. In terms of fiber content, one might have expected greater loss in wet determinations than dry. However, not enough work had been done to satisfactorily explain why dry determinations in blends frequently show greater losses than wet determinations (26).

Elongation

With one exception the percent elongation in wet strength determinations was greater than dry in both warp and filling. This exception was the rayon and dacron blend which had greater elongation in the dry determinations for both warp and filling, which is contrary to expected elongation. The extent of elongation was greater for the fabrics containing wool than for those containing rayon (see Table IV, page 42).

Elongation after abrasion

The elongation results after abrasion, were both erratic and often contradictory to the expected pattern of elongation change in all of the fabrics except the wool and dacron blend, which followed somewhat the same pattern of tensile strength loss after abrasion. There was loss in all elongation determinations except the wet filling of the wool and orlon, and the wet determinations in warp and filling of the rayon and dacron blend. The wool and dacron fabric showed the greatest

Table VII

WARP ELONGATION BEFORE AND AFTER ABRASION[1]

Fabric	Dry Elongation in Percent		Percent Change	Wet Elongation in Percent		Percent Change
	Original[2]	After Abrasion[3]		Original[2]	After Abrasion[3]	
I	41.6	13.8	-67.0	44.6	19.2	-57.2
II	63.8	50.6	-20.0	71.3	44.0	-38.3
III	13.7	10.5	-23.2	17.6	15.3	-12.7
IV	33.4	27.0	-18.9	25.2	29.8	+18.2

[1]500 double strokes

[2]Average of 10 determinations

[3]Average of 5 determinations

loss in elongation warpwise and the rayon and orlon the greatest elongation increase fillingwise. The rayon and orlon was weakest in comparison with the other fabrics. This was due

Table VIII

FILLING ELONGATION BEFORE AND AFTER ABRASION[1]

Fabric	Dry Elongation in Percent		Percent Change	Wet Elongation in Percent		Percent Change
	Original[2]	After Abrasion[3]		Original[2]	After Abrasion[3]	
I	38.9	37.4	- 3.9	42.7	45.7	+ 7.2
II	61.2	53.4	-12.7	66.5	51.4	-22.7
III	20.9	8.5	-59.0	21.1	11.4	-53.6
IV	39.4	21.0	-46.7	31.0	31.6	+ 1.7

[1]300 double strokes

[2]Average of 10 determinations

[3]Average of 5 determinations

not only to its rayon content but loss of orlon fibers during abrasion.

Wrinkle recovery

There were no appreciable differences in the warp and filling wrinkle recovery values in any of the four fabrics. In most instances the filling had slightly higher wrinkle recovery values than the warp.

The wool and dacron had the highest wrinkle recovery value of the four fabrics. This corresponds to its lower rate of compression. The wool and orlon ranked second highest in wrinkle recovery, but showed more difference between its warp and filling recovery values than either the rayon and dacron blend or the wool and dacron. In the two dacron fabrics there were differences of only one and two degrees respectively between warp and filling. This is indicative of their excellent performance and substantiates the claims made for dacron in its ability to recover from wrinkling. The fact that the two fabrics with wool content exhibited higher wrinkle recovery values than the other two fabrics was undoubtedly due to the long recognized characteristic ability of wool to recover from wrinkling. According to Powers the recovery angle of a fabric must be 100 degrees as measured on the Monsanto Wrinkle Recovery Tester, for the fabric to be commercially acceptable (48). Each of the fabrics in this study qualify as better than the commercially acceptable angle of recovery.

Compressibility

The two fabrics containing dacron had lower rates of compression than the two fabrics with orlon. The two dacron fabrics were smooth, hard, and firm to the touch; whereas, the two orlon blends had a thicker and softer hand. The difference in the compressibility of these fabrics may be partially due to the heavier crease-resistant finish given the dacron blends. The rayon and orlon fabric had the highest rate of compression of the four fabrics under investigation. Undoubtedly this was partially due to its crepe weave construction. The wool and orlon compressed less readily but more similarly than the other three fabrics.

Table IX

PERFORMANCE CHARACTERISTICS OF THE ORIGINAL FABRICS

Fab. No.	Fab. Composition	Wrinkle Recovery[1] (degrees)		Compressibility (sq. in./lb.)	Compressional Resilience[2] (percent)	Drapability[3]
		Warp	Filling			
I	W-O	136	142	.080	26.6	52.4
II	W-D	153	155	.057	38.3	54.4
III	R-O	127	136	.099	22.3	62.4
IV	R-D	132	133	.069	31.3	56.0

[1]Average of 5 determinations
[2]Average of 9 determinations
[3]Average of 3 determinations

Compressional resilience

Although compressional resilience showed considerable variation among the fabrics, each showed a direct relationship to the corresponding wrinkle recovery value for that fabric. The two dacron blends were not only highest in compressional resilience but had correspondingly higher wrinkle recovery values. The two orlon blends were lower in both compressional resilience and in recovering from wrinkling.

Drapability

The drapability values of the two wool blends and the rayon and dacron were similar. The rayon and orlon were definitely more drapable, but this fabric differed from the others in finish and in weave construction. However, both of the rayon blends showed better drapability than the two containing wool. According to Kaswell, the blending of rayon with other fibers, which drape poorly because of their lack of liveliness, produces a more flexible and more drapable fabric. Also, fabrics which have a rather firm weave have less drapability than those with looser weaves (26). Both of these statements are applicable to the fabrics investigated in this study as both of the dacron blends were much stiffer and more compactly woven than the other two fabrics.

Coefficient of friction

There was little difference shown between the fabrics in their coefficient of friction values when tested against eight different fabrics. They showed higher friction values fillingwise against the nylon knit, rayon satin, and orlon, but higher friction values warpwise against rayon crepe, cotton, and plain weave nylon.

Colorfastness to light

Each of the fabrics rated class 4 in colorfastness to light except the wool and dacron which was rated as class 2. It showed no appreciable change in color after 20 hours exposure in the Fade-Ometer, but considerable change in color was noted after 40 hours with continued loss in color in the following 20-hour intervals of exposure. The other three fabrics showed no appreciable color change after 80 hours exposure, but slight fading after 120 hours exposure.

Table X

COLORFASTNESS CLASS OF ORIGINAL FABRICS

Fabric No.	Fabric Composition	To Light[1]	To Laundering[2]	To Crocking[2]		To Perspiration[2]	
				Dry	Wet	Acid	Alkaline
I	W-O	4	1	4	4	3	3
II	W-D	2	1	4	4	3	3
III	R-O	4	1	4	3	3	3
IV	R-D	4	1	4	4	3	3

[1]Average of 2 determinations
[2]Average of 3 determinations

Colorfastness to crocking

All fabrics rated class 4 in colorfastness to both wet and dry crocking except the rayon and orlon fabric which was rated class 3 to wet crocking. However, none showed appreciable discoloration of the white cloth in the crocking tests. Only the one showed a slight discoloration on the white cloth but it disappeared after scrubbing.

Colorfastness to perspiration

All of the fabrics were quite resistant to discoloration from normal perspiration, rating class 4 in the tests. This indicated there was no appreciable change in color or staining of the test cloth and these fabrics may be expected to give excellent service where color resistance to normal perspiration is important.

Colorfastness to laundering

There was no appreciable change in color or staining of the white cloth shown by any of the fabrics after being subjected to this test. All were rated as class 1 in their colorfastness to laundering. This indicated that each of the fabrics would give satisfactory performance in careful home or commercial laundering.

FABRIC PERFORMANCE AFTER DRY CLEANING AND LAUNDERING

Dimensional change

There was negligible dimensional change in any of the fabrics by either method of cleaning, which was undoubtedly due to their orlon and dacron content as well as to the stabilizing finishes used.

Weight per square yard

None of the fabrics showed any significant change in weight after either method of cleaning.

The wool and orlon showed a slight increase after each testing period in both dry cleaning and laundering. The greatest weight increase occurred in the first three dry cleanings and in the first laundering. Although the increase was less after the sixth dry cleaning than the third it still showed a slight increase over its original weight. There was less increase in the third laundering than the first and negligible change in the next three launderings indicating that the maximum effect from laundering occurred during the first laundering. In dry cleaning, the greatest change occurred in the first three. The terminal increase in weight was 4 percent greater in laundering than in dry cleaning.

The wool and dacron showed a slight decrease in weight in both cleaning methods. The larger decrease, however, occurred in dry cleaning indicating that the dry cleaning fluid removed more of the finish than laundering.

Table XI

CHANGE IN WEIGHT OF FABRICS AFTER DRY CLEANING[1]

Fabric Number	Fabric Composition	Weight in Grams[2] Original	After 1 D. Cl.	Percent Change	After 3 D. Cl.	Percent Change	After 6 D. Cl.	Percent Change
I	W-O	.4328	.4453	+2.9	.4580	+5.8	.4423	+2.2
II	W-D	.5233	.5119	-2.2	.4978	-4.9	.5019	-4.1
III	R-O	.4848	.5028	+3.7	.4932	+2.4	.4773	-1.6
IV	R-D	.5161	.5161	+0.3	.5053	-1.8	.5062	-1.6

[1]Average of 5 determinations
[2]Twenty square inches

There was a slight increase in weight in the rayon and orlon blend in the first three dry cleanings, but regained to approximately its original weight in the last three dry cleanings. The only increase occurred in the first three launder-

Table XII

CHANGE IN WEIGHT OF FABRICS AFTER LAUNDERING[1]

Fabric Number	Fabric Composition	Weight in Grams[2] Original	After 1 Laund.	Percent Change	After 3 Laund.	Percent Change	After 6 Laund.	Percent Change
I	W-O	.04328	.4634	+7.1	.4568	+5.5	.4581	+5.8
II	W-D	.5233	.5184	-0.9	.5233	0	.5197	-0.7
III	R-O	.4848	.4813	-0.5	.4966	+2.4	.4566	-5.8
IV	R-D	.5146	.5144	-0.04	.5279	+2.6	.5071	-1.5

[1]Average of 5 determinations
[2]Twenty square inches

ings, with a decrease of 6 percent during the last three launderings. This indicated that the laundering procedure was more severe on this fabric than dry cleaning.

Minor change in the weight of the rayon and dacron fabric was noted in the first two testing periods of dry cleaning and laundering, but its weight was approximately the same as originally after the terminal cleaning in either method. This fabric showed little or no effect from either method of cleaning.

Thickness

The changes in thickness for the four fabrics were negligible in so far as any apparent difference in handle or appearance.

The two wool blends showed approximately 4 percent greater increase during the six launderings than in dry cleaning; indicating that in both cleaning methods some of the finish was lost permitting the wool to become more lofty.

Table XIII

CHANGE IN THICKNESS OF FABRICS AFTER DRY CLEANING

Fabric Number	Fabric Composition	Thickness in Inches[1]						
		Original	After 1 D. Cl.	Percent Change	After 3 D. Cl.	Percent Change	After 6 D. Cl.	Percent Change
I	W-O	.0213	.0223	+4.7	.0233	+9.4	.0231	+8.4
II	W-D	.0202	.0218	+7.9	.0222	+9.9	.0222	+9.9
III	R-O	.0293	.0297	+1.4	.0281	-4.1	.0277	-5.5
IV	R-D	.0209	.0219	+4.6	.0217	+3.7	.0219	+4.6

[1]Average of 9 determinations

The rayon and orlon showed erratic changes with an increase of 5.5 percent in thickness during six dry cleanings and a 2.4 percent loss in a corresponding number of launderings.

There was no significant change in thickness in the rayon and dacron after either dry cleaning or laundering.

Table XIV

CHANGE IN THICKNESS OF FABRICS AFTER LAUNDERING

Fabric Number	Fabric Composition	Thickness in Inches[1]						
		Original	After 1 Laund.	Percent Change	After 3 Laund.	Percent Change	After 6 Laund.	Percent Change
I	W-O	.0213	.0239	+12.2	.0241	+13.3	.0240	+12.7
II	W-D	.0202	.0219	+ 8.4	.0221	+ 9.4	.0230	+13.9
III	R-O	.0293	.0279	- 4.8	.0279	- 4.8	.0286	- 2.4
IV	R-D	.0209	.0213	+ 1.8	.0217	+ 3.6	.0218	+ 4.1

[1]Average of 9 determinations

Yarn count

There was negligible change in yarn count warpwise or fillingwise in any of the fabrics during either method of cleaning. This paralleled the insignificant shrinkage changes in these fabrics.

Tensile strength

The wool and orlon increased in tensile strength both warpwise and fillingwise during dry cleaning, with the dry filling increase twice that of the dry warp. The wet tensile strength determinations showed approximately the same increase. During laundering a loss in strength occurred in the dry determinations, with the dry filling losing approximately two and one-half times as much strength as the dry warp. The wet warp determinations showed an increase in strength of 2.5 percent after the terminal laundering and the wet filling a slightly greater increase.

Table XV

TENSILE STRENGTH IN POUNDS AFTER DRY CLEANING[1]

Fabric Number	Fabric Composition	Dry: Original	Dry: After 6 D. Cl.	Dry: Percent Change	Wet: Original	Wet: After 6 D. Cl.	Wet: Percent Change
Warp							
I	W-O	49.7	51.3	+3.2	35.9	37.1	+3.4
II	W-D	88.2	82.0	-7.0	82.6	80.9	-2.1
III	R-O	50.9	39.7	+0.6	39.5	39.7	+0.5
IV	R-D	60.5	45.6	+1.7	48.0	45.6	-5.0
Filling							
I	W-O	38.0	40.3	+6.1	28.1	29.1	+3.6
II	W-D	76.4	69.3	-9.3	71.0	67.1	-5.5
III	R-O	38.9	35.9	-7.7	30.4	29.5	-3.0
IV	R-D	48.9	49.2	+0.6	41.9	39.1	-6.7

[1] Average of 10 determinations

The wool and dacron showed a decrease in strength in all determinations in both cleaning methods. The 7 percent loss in dry warp strength after six dry cleanings was 6 percent greater than after six launderings. Similarly, the dry filling strength loss was 3 percent greater after dry cleaning than after laundering. After dry cleaning wet warp strength was 98.7 percent of dry and the wet filling strength was 97 percent of its dry strength. The greater loss after six dry cleanings indicated that dacron was more affected by dry cleaning than laundering.

The tensile strength of the rayon and orlon was only slightly affected by dry cleaning or laundering. In the wet filling determinations there was a slight decrease as a result of both dry cleaning and laundering. However, the wet filling determinations showed a 5 percent increase after laundering and a 3 percent decrease after dry cleaning. Since rayon normally is much weaker when wet, it is evident that the blending of orlon with rayon improves its wet strength.

Table XVI

TENSILE STRENGTH IN POUNDS AFTER LAUNDERING[1]

Fabric Number	Fabric Composition	Dry			Wet		
		Original	After 6 Laund.	Percent Change	Original	After 6 Laund.	Percent Change
Warp							
I	W-O	49.7	48.3	-2.8	35.9	36.8	+2.5
II	W-D	88.2	87.9	-0.3	82.6	82.0	-0.7
III	R-O	50.9	50.5	-0.8	39.5	39.0	+1.3
IV	R-D	60.5	64.5	+6.6	48.0	47.4	-1.3
Filling							
I	W-O	38.0	36.5	-6.6	28.1	28.5	+3.6
II	W-D	76.4	72.0	-5.8	71.0	67.1	-5.5
III	R-O	38.9	37.6	-3.3	30.4	32.0	+5.3
IV	R-D	48.9	50.5	+3.3	41.9	40.4	-3.6

[1] Average of 10 determinations

The rayon and dacron showed a minor increase in tensile strength in dry determinations and slight decrease in wet determinations after both cleaning methods. However, the tensile strength after the six launderings was slightly greater than after similar dry cleanings. The dry warp increased about twice as much in strength as the dry filling. After the six dry cleanings the wet filling showed three times the decrease in strength of the wet warp. The dacron content in this fabric did not improve the wet strength of the rayon as much as the orlon improved strength in the rayon and orlon blend.

Tensile strength after abrasion

Warpwise, the wool and orlon lost almost one and one-half times as much strength in six launderings as in six dry cleanings. The warp retained approximately one-half of its original strength after dry cleaning and one-third of its original strength after laundering. Dry strength of the warp was 90 percent of its wet strength after either cleaning method. Fillingwise, dry strength was 93 percent of its original strength after six dry cleanings and 86 percent after six launderings. Wet filling strength was 93 percent of its original strength after either cleaning process. There was greater loss of strength from abrasion on the new or uncleaned wool and orlon specimen than on the one which was dry cleaned and even greater loss on the laundered specimen. This indicated that during laundering the fibers were loosened due to loss of its resin finish, and the fabric became more susceptible to the rubbing action.

Table XVII

TENSILE STRENGTH OF ORIGINAL AND DRY CLEANED FABRICS AFTER ABRASION[1]

Fab. No.	Fab. Composition	Dry: Orig.[2]	Dry: After Abrasion	Dry: Percent Chg.	Dry: After 6 D. Cl.	Dry: Percent Chg.	Wet: Orig.[2]	Wet: After Abrasion	Wet: Percent Chg.	Wet: After 6 D. Cl.	Wet: Percent Chg.
Warp[3]											
I	W-O	49.7	21.2	-57.4	23.4	-53.0	35.9	19.0	-47.2	20.2	-43.7
II	W-D	88.2	45.6	-48.3	38.0	-56.9	82.6	42.0	-49.2	40.6	-50.8
III	R-O	50.9	30.6	-38.0	31.4	-36.4	39.5	25.4	-35.8	28.2	-28.6
IV	R-D	60.5	40.2	-33.6	35.4	-41.5	48.0	37.4	-22.1	31.2	-35.0
Filling[3]											
I	W-O	38.0	35.2	- 7.4	35.2	- 7.4	28.1	26.6	- 5.3	26.4	- 6.1
II	W-D	76.4	60.2	-21.2	64.2	-16.0	71.0	51.4	-27.6	55.6	-21.8
III	R-O	38.9	9.0	-76.8	17.0	-56.3	30.4	10.6	-51.6	13.4	-44.3
IV	R-D	48.9	43.4	-11.2	45.6	- 6.7	41.9	38.0	- 9.3	37.4	-10.7

[1]Warp, 500 double strokes; filling, 300 double strokes
[2]Average of 10 determinations
[3]Average of 5 determinations

The wool and dacron blend showed slightly greater deterioration in laundering than in dry cleaning. After dry cleaning, wet warp strength was 89 percent of the dry and after laundering was 87 percent of dry strength. This fabric retained but 46 percent of its original strength after dry cleaning and only 39 percent after laundering. There was also a greater loss of strength fillingwise in the laundered specimens than in the dry cleaned specimens.

The rayon and orlon showed greater loss from abrasion in the filling than in the warp even though the warp samples received almost twice as many abrasion strokes as the filling. The wet determinations showed less decrease in strength than the dry determinations which, of course, is not typical of rayon in the wet state. It was the orlon content which improved its wet strength. There was greater strength loss from abrasion in the uncleaned specimens of the fabric than in the dry cleaned specimens. This was also true of the other orlon blend. Some change in the finish evidently occured during the dry cleaning process which apparently bound or fused the fibers together and thereby minimized the action of the abradant on the orlon fibers. It was loss of orlon fibers which was thought to be the cause of such significant strength loss in the abraded control fabric. This fabric retained slightly more than 60 percent of its original warp strength after either method of cleaning, but retained only 33 to 55 percent of its original strength fillingwise. After laundering and dry cleaning warp and filling strength was somewhat better balanced than before cleaning.

In all determinations the rayon and dacron showed considerably greater decrease in strength after laundering than after dry cleaning. Wet warp strength was 84 percent of dry warp strength after dry cleaning and 98 percent after

Table XVIII

TENSILE STRENGTH OF ORIGINAL AND LAUNDERED FABRICS AFTER ABRASION[1]

Fab. No.	Fab. Composition	Dry					Wet				
		Orig.[2]	After Abrasion	Percent Chg.	After 6 Laund.	Percent Chg.	Orig.[2]	After Abrasion	Percent Chg.	After 6 Laund.	Percent Chg.
Warp[3]											
I	W-0	49.7	21.2	-57.4	14.6	-70.8	35.9	19.0	-47.2	12.8	-64.4
II	W-D	88.2	45.6	-48.3	36.6	-65.3	82.6	72.0	-49.2	35.6	-56.9
III	R-0	50.9	30.6	-38.0	29.6	-41.8	39.5	25.4	-35.8	24.2	-38.8
IV	R-D	60.5	40.2	-33.6	25.8	-57.3	48.0	37.4	-22.1	23.6	-50.8
Filling[3]											
I	W-O	38.0	35.2	- 7.4	32.8	-13.7	28.1	26.6	- 5.3	26.4	- 6.1
II	W-D	76.4	60.2	-21.2	53.8	-30.4	71.0	51.4	-27.6	53.0	-25.4
III	R-O	38.9	9.0	-76.8	14.6	-62.5	30.4	10.6	-51.6	12.0	-47.3
IV	R-D	48.9	43.4	-11.2	42.4	-13.3	41.9	38.0	- 9.3	36.2	-13.6

[1] Warp 500 double strokes, filling 300 double strokes
[2] Average of 10 determinations
[3] Average of 5 determinations

laundering. The dry cleaned fabric retained 60 percent of its original warp strength after abrasion while the laundered specimen retained only 46 percent of its original strength. After dry cleaning the filling retained 91 percent of its original strength as compared to 86 percent after laundering. The reason for the greater strength loss after laundering was due to greater loss of finish in laundering.

Elongation

The wool and orlon increased in elongation after either method of cleaning. The wet warp increase in elongation was 6 percent more than the dry warp elongation increase after dry cleaning. The dry filling increase was 2 percent more than increase in the wet filling determinations. The dry warp increased 2 percent more in elongation than the dry filling after dry cleaning. Elongation change in the warp after laundering was equivalent to change after dry cleaning. Increase in filling elongation was almost 5 times as great in wet as in dry determinations. Wet filling elongation increase was almost twice that of the warp but dry warp elongations increased 3 times as much as dry filling elongation.

Table XIX

PERCENT ELONGATION AFTER DRY CLEANING

Fabric Number	Fabric Composition	Dry			Wet		
		Original	After 6 D. Cl.	Percent Change	Original	After 6 D. Cl.	Percent Change
Warp[1]							
I	W-O	41.6	47.7	+14.7	44.6	53.8	+20.5
II	W-D	63.8	65.3	+ 2.3	71.3	67.6	- 5.4
III	R-O	13.7	20.8	+13.7	17.6	20.8	+18.5
IV	R-D	33.4	42.8	- 8.4	25.2	42.8	+69.5
Filling[1]							
I	W-O	38.9	43.7	+12.4	42.7	47.3	+10.9
II	W-D	61.2	58.7	- 3.9	66.5	61.0	- 8.3
III	R-O	20.9	19.6	- 4.6	21.1	24.6	+16.2
IV	R-D	39.4	24.3	-38.4	31.0	32.9	+ 6.1

[1]Average of 10 determinations

The wool and dacron fabric showed rather erratic changes in elongation. There was an increase after laundering and in the dry warp determinations after dry cleaning. Loss occurred in the other determinations after dry cleaning. Meredith states that, in general, strong fibers have relatively low breaking extensions (41). However, the wool and dacron fabric in this study was highest in breaking strength and had greatest elongation but showed the least elongation change of the four fabrics after cleaning. Dry warp determinations showed about four times as much increase in elongation after laundering as after dry cleaning. Wet determinations in the warp showed some loss in elongation after dry cleaning but a gain after laundering. Filling determinations revealed less elongation after dry cleaning and slight increase after laundering.

The rayon and orlon fabric was the lowest in elongation of any of the four fabrics in both methods of cleaning. There was 14 to 18 percent increase in elongation for all determinations except the dry filling, where a small loss was noted. This fabric showed erratic changes which did not follow normal expectancy of change in elongation or tensile strength.

The rayon and dacron blend showed greater change in elongation following dry cleaning than laundering. All dry determinations showed a decrease, while all wet determinations registered an increase in elongation. Change in elon-

Table XX

PERCENT ELONGATION AFTER LAUNDERING

Fabric Number	Fabric Composition	Dry: Original	Dry: After 6 Laund.	Dry: Percent Change	Wet: Original	Wet: After 6 Laund.	Wet: Percent Change
Warp[1]							
I	W-O	41.6	48.7	+17.0	44.6	52.2	+17.0
II	W-D	63.8	69.1	+ 8.4	71.3	77.3	+ 8.4
III	R-O	13.7	15.8	+14.9	16.6	20.6	+16.9
IV	R-D	33.4	32.5	- 2.5	25.2	41.5	+64.5
Filling[1]							
I	W-O	38.9	41.0	+ 5.4	42.7	53.4	+24.0
II	W-D	61.2	61.4	+ 0.3	66.5	68.6	+ 3.2
III	R-O	20.9	20.2	- 0.2	21.1	24.0	+13.6
IV	R-D	39.4	26.7	-32.2	31.0	31.5	+ 1.4

[1]Average of 10 determinations

gation paralleled the respective changes in tensile strength. When there was a decrease in strength there was an increase in elongation, and with an increase in tensile strength there was decrease in elongation.

Elongation after abrasion

The elongation after abrasion of the wool and orlon fillingwise showed decreases from 50 to 75 percent after both methods of cleaning. Greater loss in warp elongation occurred in dry than in wet determinations. The average warp elongation loss of the dry cleaned specimen was 88 percent of the uncleaned fabric. Elongation after laundering increased for all determinations except the dry filling which was 7 percent less. Filling elongation increase of the dry cleaned specimen was four times greater than elongation of the uncleaned fabric specimen after abrasion.

Table XXI

PERCENT ELONGATION OF ORIGINAL AND DRY CLEANED FABRICS AFTER ABRASION[1]

Fab. No.	Fab. Composition	Dry Orig.[2]	Dry After Abrasion	Dry Percent Chg.	Dry After 6 D. Cl.	Dry Percent Chg.	Wet Orig.[2]	Wet After Abrasion	Wet Percent Chg.	Wet After 6 D. Cl.	Wet Percent Chg.
Warp[3]											
I	W-O	41.6	13.8	-67.0	16.1	-61.2	44.6	19.2	-57.2	23.3	-47.8
II	W-D	63.8	50.6	-20.6	39.1	-38.6	71.3	44.0	-38.3	47.9	-32.8
III	R-O	13.7	10.5	-23.2	12.0	-12.6	17.6	15.3	-12.7	15.2	-13.4
IV	R-D	33.6	27.0	-18.9	25.3	-24.1	25.2	29.8	+18.2	31.2	+21.0
Filling[3]											
I	W-O	38.9	37.4	- 3.9	39.4	+ 1.3	42.7	45.7	+ 7.2	47.9	+12.4
II	W-D	61.2	53.4	-12.7	60.3	- 1.5	66.5	51.4	-22.7	58.6	-11.9
III	R-O	20.9	8.5	-59.0	14.2	-32.1	21.1	9.8	-53.6	14.8	-30.0
IV	R-D	39.4	21.0	-46.7	26.3	-33.2	31.0	31.6	+ 1.7	33.4	+ 7.3

[1]Warp 500 double strokes, filling 300 double strokes
[2]Average of 10 determinations
[3]Average of 5 determinations

The rayon and orlon also showed decreased elongation in all determinations for the laundered and dry cleaned specimens. However, there was greater warp loss in elongation in the uncleaned specimen than the specimens after either method of cleaning. Fillingwise, wet and dry elongation loss was 25 and 13 percent more after cleaning. Warpwise, similar loss occurred after both methods of cleaning. Fillingwise, the laundered fabric showed 10 percent greater loss in elongation than the dry cleaned fabric.

Table XXII

PERCENT ELONGATION OF ORIGINAL AND LAUNDERED FABRICS AFTER ABRASION[1]

Fab. No.	Fab. Composition	Dry					Wet				
		Orig.[2]	After Abrasion	Percent Chg.	After 6 Laund.	Percent Chg.	Orig.[2]	After Abrasion	Percent Chg.	After 6 Laund.	Percent Chg.
Warp[3]											
I	W-O	41.6	13.8	-67.0	10.5	-74.7	44.6	19.2	-57.2	14.3	-68.0
II	W-D	63.8	50.6	-20.6	36.6	-42.6	71.3	44.0	-38.3	37.8	-33.0
III	R-O	13.7	10.5	-23.2	12.2	-11.3	17.6	15.3	-12.7	15.1	-14.2
IV	R-D	33.6	27.0	-18.9	23.3	-31.5	25.2	29.8	+18.2	25.3	- 4.4
Filling[3]											
I	W-O	38.9	37.4	- 3.9	35.6	- 8.5	42.7	45.7	+ 7.2	43.3	+ 1.5
II	W-D	61.2	53.4	-12.7	50.1	-18.1	66.5	51.4	-22.7	58.1	-12.7
III	R-O	20.9	8.5	-59.0	12.2	-41.7	21.1	9.8	-53.6	12.4	-41.3
IV	R-D	39.4	21.0	-46.7	25.2	-36.2	31.0	31.6	+ 1.7	28.2	- 8.7

[1]Warp 500 double strokes, filling 300 double strokes
[2]Average of 10 determinations
[3]Average of 5 determinations

The elongation changes in the rayon and dacron were erratic. The wet determinations of the dry cleaned specimens showed increased elongation and loss in tensile strength. However, after laundering both wet and dry determinations indicated some loss in elongation.

Wrinkle recovery

After six dry cleanings and launderings, improvement over original recovery from creasing was seen in both the warp and filling for each fabric investigated in this study.

The wool and orlon blend showed better wrinkle recovery after the first, third, and sixth dry cleaning. The warp showed 11 percent increase after the first and third launderings and an 18 percent increase in recovery from wrinkling after six launderings. Fillingwise, the wool and orlon showed an equivalent terminal increase of 12 percent after either cleaning method. Filling wrinkle recovery after the first and third dry cleaning and laundering was slightly better. The warpwise recovery value for the dry cleaned wool and orlon was 150 degrees and 159 degrees fillingwise; a 10 percent increase warpwise and 15 percent increase fillingwise over respective initial values. The wrinkle recovery values of the laundered specimen was 161 degrees warpwise and 159 degrees fillingwise; a warp increase of 18 percent and filling increase of 12 percent over their initial recovery values.

The wool and dacron displayed erratic changes in wrinkle recovery during both cleaning processes. During the first dry cleaning there was similar decrease warpwise and fillingwise. After three dry cleanings there was a slight increase in warp recovery but after the sixth dry cleaning its recovery value was still below its original recovery. Fillingwise, recovery change occurred in the first dry cleaning and remained unchanged in the subsequent dry cleanings. However, after the terminal dry cleaning warp wrinkle recovery was 4 percent greater and filling recovery was 3 percent greater than initially. Warpwise, the wool and dacron showed progressive recovery from wrinkling in laundering with a terminal increase of 5 percent. On the other hand, the filling showed slight loss in recovery following the first and third laundering. By the final laundering it had increased 4 percent over its initial wrinkle recovery.

Table XXIII

WRINKLE RECOVERY IN DEGREES OF DRY CLEANED AND LAUNDERED FABRICS[1]

Fab. No.	Fab. Composition	Warp					Filling				
		Orig.	After 6 D. Cl.	Percent Chg.	After 6 Laund.	Percent Chg.	Orig.	After 6 D. Cl.	Percent Chg.	After 6 Laund.	Percent Chg.
I	W-O	136	150	+10.3	161	+18.4	142	159	+12.0	159	+12.0
II	W-D	153	159	+ 3.9	161	+ 5.2	155	160	+ 3.2	161	+ 3.9
III	R-O	127	145	+14.2	156	+22.8	136	150	+10.2	143	+ 5.2
IV	R-D	132	158	+19.7	153	+15.9	133	149	+12.0	160	+20.3

[1]Average of 5 determinations

The dry cleaned and laundered rayon and orlon specimens showed wrinkle recovery improvement both warpwise and fillingwise. There was one-third greater recovery after laundering in the direction of the warp. In the filling the greater increase occurred during the first cleaning interval in both cleaning methods. Terminally, the dry cleaned specimens had improved twice as much in wrinkle recovery as the laundered specimens.

The rayon and dacron fabric improved in wrinkle recovery both in dry cleaning and in laundering. Warp wrinkle recovery in dry cleaning was 25 percent greater than in laundering. In the filling there was greater recovery after laundering. Warp recovery values increased 20 and 16 percent respectively after six dry cleanings and launderings. Wrinkle recovery in the filling showed corresponding increases of 12 percent after dry cleaning and 20 percent after laundering.

Compressibility

The wool and orlon had slightly less resistance to compression after dry cleaning than its control. The greatest increase in compressibility of the wool and orlon was noted after the first dry cleaning and after the third laundering. However, during the last three dry cleanings and launderings compressibility tended to approximate its original compressibility value.

The wool and dacron showed the greatest change in compressibility of any of the fabrics after either cleaning method. Increase in compressibility was progressive during dry cleaning, but irregular during laundering. The wool and dacron showed 3 percent greater compressibility after the terminal laundering than the terminal dry cleaning.

Rayon and orlon showed irregular changes in compressibility after either method of cleaning. During laundering the greatest change took place in the last three cleanings. There was an equivalent increase in compressibility terminally in both cleaning procedures.

There was increased compressibility in the rayon and dacron after both cleaning methods. Compressibility was appreciably greater (17 percent) after six dry cleanings than after comparable launderings. The dry cleaned rayon and dacron specimen compressed 33 percent more readily than the laundered specimen of this fabric.

Table XXIV

COMPRESSIBILITY AND COMPRESSIONAL RESILIENCE OF THE DRY CLEANED AND LAUNDERED FABRICS

Fab. No.	Fab. Composition	Compressibility[1]					Compressional Resilience in Percent[1]				
		Orig.	After 6 D. Cl.	Percent Chg.	After 6 Laund.	Percent Chg.	Orig.	After 6 D. Cl.	Percent Chg.	After 6 Laund.	Percent Chg.
I	W-O	.080	.092	+ 1.5	.080	0	26.6	19.3	-27.4	20.0	+24.8
II	W-D	.057	.095	+66.7	.097	+70.2	38.3	21.0	-44.1	23.6	-37.5
III	R-O	.099	.114	+15.1	.114	+15.2	22.3	19.6	- 1.2	27.3	+ 2.2
IV	R-D	.069	.096	+39.1	.084	+21.8	31.3	18.0	-42.4	31.6	+ 1.0

[1] Average of 9 determinations

Compressional resilience

The wool and orlon blend improved in compressional resilience by 5 percent after the first dry cleaning. However, after three dry cleanings its resilience had decreased 34 percent, but after the sixth dry cleaning this fabric had recovered to 73 percent of its original resilience. After one laundering resilience increased 24 percent, but after three launderings showed a 47 percent increase. After six launderings the fabric had recovered to 65 percent of its original resilience. In either cleaning method there was appreciable terminal loss in resilience.

The wool and dacron when compared with the original fabric showed decreased resilience at each cleaning interval in both cleaning procedures. It was 44 and 38 percent less resilient after the six dry cleanings and launderings. The loss in compressional resilience was greatest in the first three dry cleanings with slight change in the remaining three. Greatest decrease in resilience occurred in the last three launderings.

There was significant increase in resilience in the rayon and orlon fabric in the first dry cleaning and laundering. There was an increase of 57 percent following the first dry cleaning as compared to 82 percent after the first laundering. However, at the second testing interval of dry cleaning resilience change was negligible. After the final dry cleaning this fabric was only 1 percent less resilient and 2 percent more resilient after the final laundering. The behavior of this fabric was definitely inconsistent.

The rayon and dacron blend showed variation in decreased compressional resilience at each cleaning interval except after the final laundering where it showed a slight increase. The changes in compressional resilience were erratic at the various intervals in both dry cleaning and laundering. The greatest loss in resilience occurred in the first cleaning procedure. After six dry cleanings this fabric was 42 percent less resilient as compared to a slightly improved resilience after comparable launderings.

Drapability

Neither cleaning method had much effect on the draping qualities of any of the four fabrics.

Kaswell states that the range of values for good drapability lies somewhere between 40 and 60 percent (26). Since all of these fabrics were within this range, they may be classified as satisfactory in drapability.

The drapability value of the wool and orlon showed an equivalent increase after one dry cleaning and one laundering. It remained unchanged during the subsequent launderings, but after the third dry cleaning its drapability was comparable to that of the original fabric. During the last three dry cleanings it decreased slightly in drapability.

After the terminal dry cleaning and laundering the wool and dacron had decreased similarly in drapability. After the first cleaning procedure in both cleaning methods there was a slight increase, but after three dry cleanings its drapability value had dropped to that of the original fabric. The laundered fabric showed slightly less drapability. After the terminal dry cleaning this fabric was still slightly lower in drapability than originally. Terminally the laundered fabric lost slightly more in drapability than the dry cleaned.

The rayon and orlon blend was slightly more drapable after laundering but some improvement in drapability was noted in both cleaning methods. After six dry cleanings the drapability had increased by 4 percent, and by 6 percent after a corresponding number of launderings.

Table XXV

DRAPABILITY OF DRY CLEANED AND LAUNDERED FABRICS[1]

Fabric Number	Fabric Composition	Original	After 6 Dry Cleanings	Percent Change	After 6 Launderings	Percent Change
I	W-O	52.4	53.0	+.01	48.0	- .09
II	W-D	54.4	57.0	+.05	57.0	+ .05
III	R-O	62.4	62.4	-.10	57.5	- .08
IV	R-D	56.0	56.0	0	53.5	- .04

[1]The square root of warp times filling, each of which is the average of 3 determinations

The greatest change in drapability for the rayon and dacron was noted after the first dry cleaning and laundering. The dry cleaned fabric increased 8 percent and the laundered fabric increased 7 percent. After three dry cleanings and launderings the fabric had a drapability value of 55 and 53 percent respectively. After the terminal dry cleaning the rayon and dacron had returned to its original drapability value while the laundered fabric was slightly better.

Coefficient of friction

There was no significant change in the coefficient of friction values of any of these four fabrics for any of the eight different fabrics against which they were tested.

Colorfastness to crocking

Each of the four fabrics were classified as 4 in colorfastness to crocking after dry cleaning and laundering.

The only change that occurred was in the wet determination of the rayon and orlon. It had been classified as class 3 originally, but after cleaning had ceased to show any discoloration of the white cloth, so was reclassified as 4. All other fabrics retained their class 4 ratings throughout both cleaning processes.

COMPARISON OF FABRICS IN DRY CLEANING AND LAUNDERING

Dimensional change

There was no significant dimensional change in any of the fabrics during either method of cleaning. The rayon and orlon was the only fabric that showed any increase. This occurred after laundering but was negligible. The wool and dacron fillingwise showed no change at all in either cleaning procedure. The rayon and dacron showed no change warpwise during laundering procedures, and less than 0.2 of one percent in dry cleaning, indicating that the addition of dacron improves the dimensional stability of these blends.

Weight per square yard

There were negligible changes in weight for any of the fabrics during either cleaning process. Of the four fabrics the two containing dacron showed the least change. After the terminal dry cleaning and laundering all of the fabrics, except the wool and orlon showed a slight decrease in weight; ranging from .09 pounds to .29 pounds per square yard. The wool and orlon increased 2 percent in six dry cleanings and 6 percent in six launderings. All gains or losses fell within a 6 percent change.

Dry cleaning affected the wool and dacron more than laundering, while laundering affected the rayon and orlon more than dry cleaning. The two cleaning methods had about the same effect on the rayon and dacron. The rayon and orlon lost 2 percent in weight in six dry cleanings and 6 percent in six launderings. Obviously, the blending of orlon and dacron with wool and rayon improves performance in cleaning.

Thickness

In general, there was increase in thickness in each of the fabrics as a result of consecutive launderings and dry cleanings, except in laundered rayon and orlon. The two fabrics containing wool showed 8 to 10 percent increase in thickness in dry cleaning, and 12 to 13 percent after six launderings. The two fabrics containing rayon increased approximately one-half as much in dry cleaning as the wool blends and significantly less in laundering. The increase in thickness of the fabrics containing wool was approximately 5 percent greater after the terminal laundering than after the terminal dry cleaning.

The rayon and dacron showed approximately the same increase in thickness terminally in both methods of cleaning, while the rayon and orlon showed a 5.5 percent increase in thickness after six dry cleanings and a 2.4 percent decrease in thickness after comparable launderings. Laundering is apparently the preferred cleaning procedure for rayon and orlon and dry cleaning for the other three fabrics.

Yarn count

The increase in yarn count of the four fabrics was negligible either warpwise or fillingwise and parallels the insignificant dimensional change which characterizes all of the fabrics in this study.

Elongation

In general, the percent change in warp elongation in the wool and orlon was similar after either laundering or dry cleaning. In the rayon and orlon fabric there was slightly greater increase for the dry cleaned fabric than the laundered.

The laundered wool and dacron increased more in warp elongation than the dry cleaned specimen. In both warp and filling there was increase in elongation in the laundered specimen with similar loss in elongation for the dry cleaned specimen.

Elongation change, in general, was greater in the dry cleaned than the laundered rayon and dacron. This was not true for the rayon and orlon.

In most cases wet determinations for either the laundered or dry cleaned fabrics showed greater change in elongation from their control than dry determinations of those same fabrics. However, the differences in wet and dry determinations are so inconsistent that it is difficult to make comparisons for the two methods of cleaning.

Tensile strength

The dry cleaned wool and orlon increased in strength both warpwise and fillingwise. The laundered specimen decreased in strength in the dry determinations, but increased in strength in wet determinations.

The dry cleaned wool and dacron ranked lowest in strength retention in either cleaning method. This fabric not only decreased more in strength in successive dry cleanings than launderings, but showed greater loss of strength than any of the other fabrics after either dry cleaning or laundering. The wool and orlon held up better than wool and dacron in dry cleaning. The wool and dacron similarly retained more of its original strength in laundering.

The strength changes in the fabrics containing rayon were more erratic than those containing wool. There was relatively little loss in strength in rayon and orlon after either method of cleaning. The warp showed practically no change at all in dry cleaning or laundering, but the filling showed 5 percent in dry cleaning and 2 percent increase in laundering. An average warpwise decrease in strength of 3 percent in dry cleaning and 5 percent increase in laundering was noted in the rayon and dacron fabric, while fillingwise the loss in strength was 6 percent in dry cleaning and practically none in laundering.

During the laundering procedures the wool and orlon showed a 3 percent loss in dry warp and 7 percent in dry filling. The wool and dacron showed lower losses after laundering than after dry cleaning. While wool and orlon held up better under dry cleaning procedures, the wool and dacron retained more strength when laundered.

Dry determinations for rayon and dacron showed increase in strength after six launderings and loss in strength in wet determinations. The dry cleaned rayon and dacron showed greater loss in wet determinations. As far as retention of strength is concerned dry cleaning procedures are better for the two orlon blends, while laundering appears to be better for the two dacron blends.

Tensile strength after abrasion

A comparison of the dry strength loss in the original fabrics after warpwise abrasion showed the wool and orlon lost 57 percent of its strength. Next in order of strength loss was the wool and dacron followed by the rayon and orlon with the least loss in strength shown in the rayon and dacron fabric. After dry cleaning, the wool and orlon showed 53 percent loss in strength warpwise, wool and dacron 57 percent, rayon and orlon 36 percent, and rayon and dacron 41 percent. After laundering the warpwise loss in strength was: wool and orlon 71 percent, wool and dacron 65 percent, rayon and orlon 42 percent, and rayon and dacron 57 percent.

Except in the case of wool and dacron the dry cleaned specimens of the fabrics showed lesser loss in strength when abraded than the laundered fabrics. The laundered wool and orlon fabric lost 18 percent more strength in dry warp determinations than the dry cleaned, while the laundered wool and dacron lost only 5 percent more strength than when dry cleaned. The laundered rayon and orlon lost 6 percent more strength than dry cleaned and the rayon and dacron lost 15 percent more when laundered than when dry cleaned.

The wool and dacron and the rayon and orlon did not show as great differences in loss of strength between laundering and dry cleaning as the wool and orlon and rayon and dacron.

The dry filling determinations of the laundered wool and orlon after abrasion lost twice as much strength as the dry cleaned specimens. The wool and dacron lost almost twice as much as the rayon and dacron. Differences between the dry cleaned and laundered specimens of the rayon and orlon fabric was less significantly different than in the other three fabrics. In other words laundering procedures resulted in greater strength loss in all of the fabrics than in dry cleaning.

The rayon and orlon had the highest loss in strength both warpwise and fillingwise in either method of cleaning. The disproportionally high warp strength compared to its filling strength in the rayon and orlon probably accounts for the high losses fillingwise after abrasion. This fabric both initially and after either cleaning method, did not hold up well under abrasion. However, it is unfair to compare this fabric with the others on the basis of fiber only. Inasmuch as its weave structure and yarn count was different from the others that accounts for some of the difference in its loss of strength after abrasion.

<u>Elongation after abrasion</u>

Loss in warp elongation of the control fabrics was, in order of extent of loss: the wool and orlon, the wool and dacron, the rayon and orlon, and the rayon and dacron. After six dry cleanings these fabrics showed comparable increase in elongation. When abrasion was in the direction of the filling, elongation was appreciably lower for the control fabric of wool and orlon and wool and dacron fabrics, but greater for both control fabrics and rayon. After six dry cleanings elongation decrease was less than in the new fabric. After comparable launderings elongation was 12 percent greater in the rayon and orlon blend than when dry cleaned. This was not true of the other three fabrics.

After six dry cleanings the two woolen blends showed similar decrease in elongation. After a comparable number of launderings the wool and orlon showed much greater loss in elongation than the wool and dacron. The decrease in elongation of the dry cleaned rayon and orlon blend was greater than the rayon and dacron, but the laundered rayon and orlon also showed greater loss than rayon and dacron after laundering.

Warpwise, the wool and orlon showed the greatest loss in elongation after either cleaning treatment, while the rayon and orlon showed the least change. Fillingwise, the greatest change in elongation by either method of cleaning was noted in the rayon and orlon, with the rayon and dacron showing second greatest change.

<u>Wrinkle recovery</u>

There was significant improvement in wrinkle recovery both warpwise and fillingwise in each of the four fabrics after dry cleaning, and even greater recovery after laundering. The two fabrics containing wool showed lesser change in recovery from wrinkling than the rayon blends. The wool and dacron showed loss in wrinkle recovery in the direction of the warp after the first two cleanings, but after the third cleaning showed slight improvement over its original recovery. In each of the fabrics there was greater wrinkle recovery after laundering than after dry cleaning, indicating that more of the wrinkle resistant finish was removed in the dry cleaning process than in laundering.

Wool and orlon had three to four times as much increase in wrinkle recovery after dry cleaning and laundering as the wool and dacron. Warpwise, the rayon and dacron showed a 5 percent greater increase after dry cleaning than the rayon and orlon, while the rayon and dacron had a 7 percent greater increase after laundering. Fillingwise, it was reversed with rayon and dacron having a 2 percent greater increase than the rayon and orlon after dry cleaning, and a 4 percent greater increase after laundering. However, for the two fabrics containing orlon and the rayon and dacron, the wrinkle recovery values increased after either method of cleaning and did not show a great deal of variation. The wool and dacron was the most erratic of the group and showed significantly less increase in wrinkle recovery than any of the other fabrics, but its original recovery was approximately 10 degrees higher than the other fabric.

<u>Compressibility</u>

The two fabrics containing dacron had greater compressibility increases after each dry cleaning and laundering than the fabrics containing orlon. The wool and dacron showed the greatest amount change in compressibility after dry cleaning and the wool and orlon showed the least. Rayon and dacron showed the second greatest change, and rayon and orlon the third.

After laundering the two fabrics containing dacron, which had the lowest compressibility originally, showed greatest increase in compressibility. The two orlon blends, which had the greatest compressibility originally, showed the least increase after cleaning. Changes in compressibility was due to the effect of the cleaning procedure on the finish of the fabric rather than differences in fiber properties.

<u>Compressional resilience</u>

The blends containing dacron showed greater decreases in compressional resilience at most testing intervals than the other fabrics. The orlon fabric blends showed greater increase in resilience than the other. The wool and dacron, which had the best resilience originally, showed greater resilience decrease in dry cleaning and in laundering than any of the other fabrics. The rayon and dacron, which ranked second in compressional resilience originally, likewise showed a marked decrease in resilience after dry cleaning. In the first and second laundering there was a decrease in resilience but by the sixth laundering its resilience was approximately the same as originally. The wool and orlon, which was third in original resilience, lost appreciable resilience in dry cleaning but in laundering showed a similar increase in resilience. The rayon and orlon, being the least resilient originally showed 57 percent and 82 percent increases respectively in resilience after one dry cleaning and one laundering. However, following the terminal dry cleaning and laundering the rayon and orlon showed negligible changes from the original.

The significant losses noted in dry cleaning may, unquestionably, be attributed to the fact that these fabrics were commercially steam pressed. This heavy pressure made them appreciably less resilient than the laundered fabrics which were pressed with an ordinary steam iron and less pressure.

<u>Drapability</u>

Originally, the rayon and orlon was less drapable than the other fabrics, but it showed more change in this characteristic during the series of dry cleanings and launderings than the other fabrics. The wool and dacron showed similar change in both cleaning procedures. The wool and orlon and the rayon and dacron showed increase in drapability after laundering as well as after dry cleaning. However, during the last five cleanings these two fabrics tended to return to approximately their original drapability values.

<u>Coefficient of friction</u>

The changes noted in the coefficient of friction values of these four fabrics, when tested against eight different fabrics, were negligible after either dry cleaning or laundering.

<u>Colorfastness to crocking</u>

Colorfastness to crocking for each of the four fabric blends was acceptable. However, the rayon and orlon showed slight discoloration of the white cloth when wet.

DISCUSSION OF JACKET RATINGS AND EVALUATIONS

To compare the performance of the different fabrics in respect to different construction procedures and the general appearance of the jackets before and after six dry cleanings and launderings, a panel of four professionally trained women were asked to compare and rate the jackets on appearance as well as specific construction features.

One of the judges was a college instructor in clothing, one an extension clothing specialist, and the other two were graduate students in Textiles and Clothing.

The jackets were modeled by the writer so that their overall appearance might be more easily compared. The judges were then asked to examine the jackets more closely and to rate them in specific construction details. In order to keep the judging as objective as possible, the criteria for evaluating specific construction features were listed. The judges were requested to score each point by the following rating scale:

Points	
5	... excellent
4	... above average
3	... average
2	... below standard
1	... very poor, not acceptable

The instruction sheet for the judges and the sheets listing the criteria for evaluation of the jackets is in the appendix (see page 112). In Charts VII through XII are the averages of the four ratings for each of the points for appearance and construction details respectively.

As the averages show, the wool and dacron fabric was consistently rated higher than the other three with a total score of 198. However, the wool and dacron did not always rank highest on every point. Wool and orlon ranked second with a score of 187 followed by rayon and orlon with 158 points, and the rayon and dacron as the least desirable of the four fabrics.

In overall appearance jacket IB of wool and dacron received the highest rating, and the wool and orlon jacket was rated second highest. The rayon and orlon jacket ranked third while the rayon and dacron jacket was rated as lowest (see table XXVI, page 90). This indicated that the wool and dacron blend was regarded as the most attractive fabric.

In comparing the appearance of the collar, lapels, shoulder area, and bust area, the wool and orlon was slightly better in appearance than the wool and dacron, although the wool and dacron received the highest ratings on specific construction procedures relative to these areas. The wool and orlon had better drapability and responded better to pressing. The wool and orlon fabric was softer than the wool and dacron, and could be moulded better by shrinking out excess fullness. The wool and dacron was stiffer and firmer and more difficult to press. However, the wool and orlon did not retain its pressed appearance as long as the wool and dacron. Likewise, the rayon and orlon did not retain its shape as well as the rayon and dacron. This indicates that the blending of orlon with wool or rayon gives loft and softness to the fabric. Dacron tends to increase crispness and stiffness in the fabric. However, other variables such as yarn and fabric geometry, or finish can affect stiffness to such an extent that they may alter a fabric's characteristic fiber properties.

In the appearance of the sleeves the wool and dacron again received the highest ranking. There was practically no difference in the rating of the two fabrics containing orlon. The rayon and dacron was rated as poorest in appearance of the four fabrics. The two dacron blends were more difficult to mould and shape at the shoulder cap than orlon blends. Jackets IB of wool and dacron and IIIA of rayon and orlon had smoother and better fitting waistlines than the jackets of the other two fabrics.

The wool and dacron gave a smoother, flatter edge at the front opening and the lower edge of the jackets than the other three fabrics. This was probably due to the firmness of this fabric and its finish. The upper edge of the hemline was more visible from the right side in the two fabrics containing dacron than either of the orlon blends. However, this was primarily due to the frosty-like appearance of the orlon blends which obscured the stitches.

The pockets in the wool and dacron jackets were smoother and more attractive than those in the other jackets. However, there was little difference between the two fabrics containing wool. Seams were less conspicuous in the fabrics containing orlon than those containing dacron, and this again was partially due to the color as well as texture. Although the bound seam ranked high, the pinked and edge stitched seams were rated as the most suitable for the jackets.

Table XXVI

COMPOSITE JACKET EVALUATION
(Total Average*)

		IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Wool	IIIB Rayon-Dacron
Original	1	195	204	167	155
	2	189	202	159	145
	3	184	200	159	138
	4	181	185	147	137
	Total	749	791	632	575
	Av.	187	198	158	144
After Dry Cleaning	1	192	199	158	169
	2	191	199	157	168
	3	180	195	157	146
	4	166	186	125	137
	Total	729	779	597	620
	Av.	182	195	149	155
After Laundering	1	188	201	162	167
	2	179	198	150	166
	3	165	187	149	157
	4	157	173	131	153
	Total	689	759	592	643
	Av.	172	190	148	161

*Composite averages of four ratings

JACKET PERFORMANCE IN DRY CLEANING AND LAUNDERING

After the initial rating of the jackets, two jackets were subjected to six dry cleanings and two to six launderings. The dry cleaning was done by a commercial dry cleaning establishment, where the jackets constituted part of a regular cleaning load. A petroleum base cleaning fluid was used. The jackets were pressed on a commercial steam presser.

The laundering was done in an automatic tumbler-type washer, with neutral soap flakes being added. After completion of the laundry cycle, the jackets were removed and rolled in towels. They were pressed with an ordinary steam iron while still damp.

After completion of the six cleaning treatments, the jackets were again examined by the panel of judges and reevaluated. Any changes in appearance that had occurred during the series of cleanings were indicated in their rating.

The data in table XXVI indicated the composite rating averages for each of the jackets as lower than their respective original ratings after either cleaning procedure, except the two made of the rayon and dacron blend. The dry cleaned jacket of rayon and dacron was rated 11 points higher than its original rating. The laundered jacket was rated 17 points higher.

In general, the appearance of each of the jackets was rated lower after laundering than after dry cleaning, indicating that the panel judged dry cleaning as the better cleaning method to be used.

Although the appearance of the jackets was slightly affected by both cleaning treatments, the two made of the blends containing wool were given a higher rating than the arbitrary average of 156 points. The jackets made of the rayon and dacron blend rated above the average after six launderings, but dropped one point below the average after the six dry cleanings. The jackets of rayon and orlon rated below average after both cleaning methods (see table XXVI, page 90).

The loss of some of the finish during cleaning decreased the crispness and firmness of the fabrics and caused the pockets of the two jackets containing rayon to sag, as there were no reinforcements in the welts. Loss of finish increased the drapability of the fabrics, so the excess fullness at the sleeve caps was not as apparent after cleaning.

Press marks were more noticeable after cleaning and the hymo reinforcement across the shoulders was apparent from the right side. The rayon and orlon fabric stretched slightly during both cleaning processes so the hemline was less smooth. A slight amount of shrinkage was noted in the other fabrics. Frayage of the seams was more evident after laundering than after dry cleaning.

Generally speaking, the jackets held up well during both cleaning treatments, but especially well in laundering, which was due to the orlon and dacron content in these fabrics.

<u>Pleat retention</u>

The pieces which had been pleated by a commercial pleating establishment, were subjected to the same dry cleaning and laundering procedures as the jackets, but were not pressed after any of the six dry cleanings or launderings.

Examination of these pieces after the first, third, and sixth dry cleaning and corresponding laundering showed that the wool and dacron retained the pleats better than the other fabrics.

The wool and orlon ranked second, the rayon and dacron ranked third, and the rayon and orlon as fourth. Since these pleats were not heat-set, both cleaning procedures tended to remove the sharpness of the pleat. In order to be acceptable in appearance all of the fabrics would require pressing or re-pleating after every cleaning.

CONCLUSIONS

Based on evaluation of the laboratory test data, and subjective analysis and evaluation of the four jackets in this study, the following conclusions were drawn:

1. Both the laboratory test data and subjective analysis of the jackets showed the wool and dacron fabric to be the most satisfactory of the four fabrics in appearance and performance.
2. Orlon in blends with wool or rayon increases the fabric's bulking qualities and performs more similarly to all wool fabric than dacron.
3. The dacron blends resisted wrinkling more effectively and recovered from wrinkling more satisfactorily than the blends containing orlon.
4. The small differences between wet and dry tensile strength in all of the fabrics showed that the addition of orlon and dacron not only greatly improved wet strength, but stabilized the fabrics to the extent of negligible dimensional change in dry cleaning and laundering.
5. Dacron increased abrasion resistance and crease retention of the blends more than orlon.
6. Wool was significantly less resistant to abrasion than rayon when blended with orlon or dacron.

7. Both orlon and dacron greatly improved wrinkle recovery in blends with wool and rayon, as each of the four fabrics in this study ranked above the commercially acceptable standard for recovery.
8. Blends containing rayon showed better initial drapability than the wool blends, therefore showing that rayon improves drapability when added to blends in sufficient amounts.
9. Analysis of the performance test data revealed that dacron is more adversely affected by dry cleaning than laundering, and that orlon is more adversely affected by laundering than dry cleaning. Therefore, laundering is recommended as the better cleaning method for dacron blends, and dry cleaning as more suitable for blends containing orlon.
10. Each of the fabrics in this study were satisfactory in colorfastness to light, laundering, crocking, and perspiration.
11. The differences in the percentage amount of orlon and dacron in the blends in this study accounts for some of the variation in test data and expected performance.
12. The findings of this study are in accord with other research studies, in respect to the contributions claimed for the various fibers when combined with each other. Dacron's significant contributions to a blend are increased tensile strength, resistance to abrasion,

resistance to and recovery from wrinkling and retention of shape. The contribution of orlon is improved drapability, handle, wool-like appearance, and similarity in performance. Rayon's contributions to blends are improved drapability, and increased liveliness. Wool's contribution is greater resilience, improved wrinkle recovery, and ease in handling during garment construction.

SUMMARY

The purpose of this study was to evaluate and compare specifications and initial performance characteristics of four fabric blends--wool blended with orlon and dacron and rayon blended with orlon and dacron--with performance after dry cleaning and laundering. A second purpose was evaluation and comparison of the appearance of garments made from these fabrics and problems encountered in their construction.

Two identical sets of jackets were constructed, one-half of each jacket being a different fabric. One set of jackets was subjected to six dry cleanings and a duplicate set was given six launderings. Subjective analysis of change in appearance as a result of dry cleaning and laundering was made following each cleaning procedure and the results compared.

Initial specifications and performance characteristics of each fabric were determined through laboratory analysis. Performance characteristics were also made following the first, third, and sixth dry cleaning and laundering for determination of change resulting from either cleaning method. All laboratory tests were done in accordance with A.S.T.M. methods and instruments of test under standard conditions for testing.

Analysis of test data showed slight differences in fabric weight primarily due to the application of different amounts of finish. Finish also accounted for some of the differences in compressional resilience and compressibility. The differences in thickness between the four fabrics was negligible. Little change in thickness was noted in either cleaning procedure.

All fabrics contained yarns of rather high twist. Yarns of similar twist were used in the warp and filling in these fabrics.

The dimensional change in laundering or dry cleaning was negligible in any of the four fabrics and significantly indicates the stabilizing effect of orlon and dacron when blended with rayon or wool.

None of the fabrics showed significant change in tensile strength after either cleaning treatment. Elongation changes were erratic. The high breaking strength of the dacron blends is evidence of improvement in strength effected by the addition of dacron. The slight differences between wet and dry tensile strengths in the two orlon blends indicated the stabilizing effect of the orlon and improved wet strength. The dacron content in the rayon-dacron blend did not improve the wet strength of the rayon as much as the orlon improved the wet strength of the rayon in the orlon-rayon blend.

The dacron blends were significantly more resistant to abrasion than the two fabrics containing orlon. The two wool blends were less resistant to abrasion than the two rayon blends.

The initial wrinkle recovery values of each of the fabrics in this study were above the commercially acceptable standard and in most cases showed improvement after six dry cleanings and launderings.

Compressibility was higher in the two fabrics containing orlon then those containing dacron. Compressibility increased as a result of both cleaning procedures.

All of the fabrics showed erratic changes in compressional resilience after cleaning. The dacron blends showed greater loss in resilience than the orlon blends after either method of cleaning, but both dacron blends were superior in initial resilience and recovery from wrinkling.

The initial drapability of the wool blends was better than for the fabrics containing rayon. There was improvement in the drapability of each of the fabrics in the first two or three cleaning treatments, but terminally they approximated their initial drapability values.

The coefficient of friction of each of the fabrics was similar and showed negligible effect from cleaning.

All the fabrics exhibited good colorfastness qualities. The dacron blends showed significantly poorer colorfastness to light. The wool and orlon showed slight discoloration to wet crocking. Each fabric showed excellent colorfastness to laundering and perspiration.

In the evaluation of the appearance and construction techniques of the jackets by the panel of judges the wool and dacron was ranked as best; the wool and orlon as second best; the rayon and dacron as third; and the rayon and orlon as the least acceptable of the fabrics and jackets before and after cleaning.

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Chart I. DIMENSIONAL CHANGE IN INCHES *

Fabric	Direction of Test	Orig.	Dry Cleaned 1 D. Cl.	Chg.	Per-cent Chg.	3 D. Cl.	Chg.	Per-cent Chg.	6 D. Cl.
I									
Wool-	Warp	12	11.9	-.1	-.008	11.9	-.1	-.008	11.8
Orlon	Filling	12	11.9	-.1	-.008	11.9	-.1	-.008	11.9
II									
Wool-	Warp	12	11.9	-.1	-.008	11.9	-.1	-.008	11.8
Dacron	Filling	12	11.9	-.1	-.008	12.0	0	0	12.0
III									
Rayon-	Warp	12	11.9	-.1	-.008	11.9	-.1	-.008	11.9
Orlon	Filling	12	11.9	-.1	-.008	12.0	0	0	11.8
IV									
Rayon-	Warp	12	11.9	-.1	-.008	11.9	-.1	-.008	11.9
Dacron	Filling	12	11.9	-.1	-.008	11.9	-.1	-.008	11.8

Chart II. WRINKLE RECOVERY IN DEGREES **

I									
Wool-	Warp	136	152	+16	+11.8	156	+20	+14.7	150
Orlon	Filling	142	146	+ 4	+ 2.8	145	+ 3	+ 2.1	159
II									
Wool-	Warp	153	145	- 8	- 5.2	150	- 3	- 2.0	159
Dacron	Filling	155	149	- 6	- 3.9	149	- 6	- 3.9	160
III									
Rayon-	Warp	127	143	+16	+12.6	135	+ 8	+ 6.3	145
Orlon	Filling	136	161	+25	+18.4	139	+ 3	+ 6.2	150
IV									
Rayon-	Warp	132	137	+ 5	+3.8	142	+10	+7.6	158
Dacron	Filling	133	136	+ 3	+2.6	139	+ 6	+5.2	149

* Average of 3 determinations

**Average of 5 determinations

		Laundered								
Chg.	Per-cent Chg.	Laund.	Chg.	Per-cent Chg.	Laund.	Chg.	Per-cent Chg.	Laund.	Chg.	Per-cent Chg.
-.2	-.017	11.8	-.2	-.017	11.6	-.4	-.033	11.8	-.2	-.017
-.1	-.008	11.9	-.1	-.008	11.9	-.1	-.008	11.8	-.2	-.017
-.2	-.017	11.9	-.1	-.008	11.9	-.1	-.008	11.9	-.1	-.008
0	0	12.0	0	0	12.0	0	0	12.0	0	0
-.1	-.008	12.0	0	0	12.0	0	0	12.1	.1	-.008
-.2	-.017	11.9	-.1	-.008	12.0	0	0	12.2	.2	-.017
-.1	-.008	12.0	0	0	12.0	0	0	12.0	0	0
-.2	-.017	11.9	-.1	-.008	11.9	-.1	-.008	11.9	-.1	-.008
+14	+10.3	151	+15	+11.0	151	+15	+11.0	161	+25	+18.4
+17	+12.0	143	+ 1	+ .7	145	+ 3	+ 2.1	159	+17	+12.0
+ 6	+3.9	154	+ 1	+ .7	159	+ 6	+3.9	161	+ 8	+ 5.2
+ 5	+3.2	149	- 6	- 3.9	154	- 1	- .6	161	+ 6	+ 3.9
+18	+14.2	145	+18	+14.2	138	+11	+11.0	156	+29	+22.8
+14	+10.3	157	+21	+15.5	137	+ 1	+ .7	143	+ 7	+ 5.2
+26	+19.7	147	+15	+11.4	139	+ 7	+ 5.3	153	+21	+15.9
+16	+12.0	141	+ 8	+ 6.0	137	+ 4	+ 3.0	166	+27	+20.3

CHART III. COMPRESSIBILITY*

Fabric Number	Fabric Composition	Orig.	Dry Cleaned 1 D. Cl.	Chg.	Per-cent Chg.	3 D. Cl.	Chg.	Per-cent Chg.	6 D. Cl.
I	W-O	.080	.084	+.004	+ 5.0	.092	+.012	+ 1.5	.092
II	W-D	.057	.084	+.027	+47.4	.085	+.028	+49.1	.095
III	R-O	.099	.113	-.014	+14.2	.112	+.013	+13.1	.114
IV	R-D	.069	.094	+.025	+36.2	.088	+.019	+28.0	.096

CHART IV. COMPRESSIONAL RESILIENCE IN PERCENT*

I	W-O	26.6	28.0	+ 1.4	+ 5.3	17.6	- 9.0	-33.8	19.3
II	W-D	38.3	27.0	-11.3	-28.8	19.6	-18.7	-47.6	21.0
III	R-O	22.3	35.0	+12.7	+57.0	24.6	+2.3	+ 1.0	19.6
IV	R-D	31.3	14.7	-16.6	-53.0	24.6	-6.7	-21.4	18.0

* Average of 9 determinations

		Laundered								
Chg.	Per-cent Chg.	1 Laund.	Chg.	Per-cent Chg.	3 Laund.	Chg.	Per-cent Chg.	6 Laund.	Chg.	Per-cent Chg.
-.012	+ 1.5	.092	+.012	+ 1.5	.083	+.003	+ 2.8	.080	0	0
-.038	+66.7	.097	+.040	-70.2	.089	-.032	-56.2	.097	-.040	-70.2
+.015	+15.1	.103	+.004	- 4.0	.092	-.007	- 7.1	.114	-.015	-15.2
+.027	+39.1	.080	+.011	-15.9	.078	-.011	-15.9	.084	-.015	-21.8
- 7.3	27.4	33.0	+ 6.4	+24.0	39.0	+12.4	+46.6	20.0	- 6.6	+24.8
-17.3	-44.1	26.6	-11.7	-29.8	30.3	- 8.0	-20.4	23.6	-14.7	-37.5
- 2.7	- 1.2	40.6	+18.3	+82.0	28.6	+ 6.3	+ 2.8	27.3	+ 5.0	+ 2.2
-13.3	-42.4	18.0	-13.3	-42.4	26.0	- 5.3	-16.9	31.6	+ 0.3	+ 1.0

Chart V

DRAPABILITY IN INCHES[1]

	I Wool-Orlon		II Wool-Dacron		III Rayon-Orlon		IV Rayon-Dacron	
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling
Original	56	49	58	51	72	54	56	56
$\sqrt{W x F}$ (2)	52.4		54.4		62.4		56.0	
After 1 Dry Clean.	52	44	54	51	56	49	50	46
$\sqrt{W x F}$ (2)	47.8		52.4		52.3		48.0	
After 3 Dry Clean.	55	49	55	53	64	44	55	51
$\sqrt{W x F}$ (2)	52.0		54.0		53.1		53.1	
After 6 Dry Clean.	54	52	59	55	63	50	59	53
$\sqrt{W x F}$ (2)	53.0		57.0		56.1		56.0	
After 1 Launder.	52	44	53	51	66	54	52	47
$\sqrt{W x F}$ (2)	48.7		53.0		59.4		49.4	
After 3 Launder.	49	47	58	54	63	54	55	56
$\sqrt{W x F}$ (2)	48.0		56.0		56.0		55.0	
After 6 Launder.	49	46	57	58	65	51	55	52
$\sqrt{W x F}$ (2)	48.0		57.5		57.5		53.5	

[1]Average of 3 determinations
[2]The square root of warp times filling

Chart VI

COEFFICIENT OF FRICTION *

	Nylon Knit	Rayon Knit	Rayon Satin	Rayon Crepe	Cotton	Orlon	Dacron	Nylon Plain Weave
ORIGINAL:								
I-Wool & orlon								
Warp	56	47	28	47	66	31	37	32
Filling	58	59	50	41	61	35	42	39
II-Wool & dacron								
Warp	58	43	23	48	69	32	36	45
Filling	62	65	57	43	65	41	41	40
III-Rayon—orlon								
Warp	57	45	30	49	66	39	42	48
Filling	57	53	47	42	61	41	42	41
IV-Rayon—dacron								
Warp	53	45	27	47	66	35	40	45
Filling	62	61	59	45	60	43	46	41
AFTER 6 DRY CLEANINGS:								
I-Wool & orlon								
Warp	58	45	23	45	61	31	34	32
Filling	56	57	44	40	56	34	39	30
II-Wool & dacron								
Warp	64	45	25	42	65	31	34	32
Filling	64	66	52	43	64	39	43	40
III-Rayon & orlon								
Warp	59	44	27	44	64	34	36	41
Filling	48	58	48	42	63	40	42	39
IV-Rayon & dacron								
Warp	60	46	25	47	67	34	38	43
Filling	66	65	56	45	61	40	45	40

Chart VI (continued)

	Nylon Knit	Rayon Knit	Rayon Satin	Rayon Crepe	Cotton	Orlon	Dacron	Nylon Plain Weave
AFTER 6 LAUNDERINGS:								
I-Wool & orlon								
Warp	63	47	24	47	67	33	38	43
Filling	63	59	45	41	61	38	41	37
II-Wool & dacron								
Warp	61	46	23	51	70	34	38	39
Filling	69	71	57	46	69	42	44	42
III-Rayon-orlon								
Warp	53	41	26	40	63	34	36	40
Filling	58	58	48	43	66	42	43	40
IV-Rayon-dacron								
Warp	60	44	25	50	69	36	39	44
Filling	65	67	55	45	65	43	46	42

*Average of 3 determinations

EVALUATION SHEET FOR JACKETS

You are requested to judge four jackets. The same construction procedures were used on each. The pressing techniques were the same except when fiber content indicated a different procedure. Jackets I and II are made of the same two fabrics, jackets III and IV are likewise made of the same two materials. A and B indicate the right and left side of the garment. The fabric used in A is unlike that used in B. The following chart summarizes the information on fabric name and fiber content for each garment.

Jacket I-A:	Lorette, 55% Orlon and 45% Wool
Jacket I-B:	Tropical, 55% Dacron and 45% Wool
Jacket II-A:	Lorette, 55% Orlon and 45% Wool
Jacket II-B:	Tropical, 55% Dacron and 45% Wool
Jacket III-A:	Chattertwist, Orlon and Rayon
Jacket III-B:	Suiting, Dacron and Rayon
Jacket IV-A:	Chattertwist, Orlon and Rayon
Jacket IV-B:	Suiting, Dacron and Rayon

Jackets I and III are to be dry cleaned 6 times and jackets II and IV are to be laundered 6 times. Comparisons after the terminal laundering and dry cleaning will be made.

In order to give you an opportunity to evaluate the jackets for general or overall appearance and for fit they will be modeled. Later a more critical examination of the jackets for scoring specified construction techniques will be asked of you. Sheets with suggested criteria for evaluation and scoring will be provided.

Please use the following rating scale for each half-jacket. The five point scale is defined as follows:

5 pts. - excellent quality

4 pts. - above average quality

3 pts. - average quality

2 pts. - below standard quality

1 pt. - very poor quality, not acceptable

Please choose and circle your score for each half-jacket from the points listed after each item on the evaluation sheet. Criteria for scoring has been arbitrarily set up, but space is provided on the score sheet for any additional comments which you may wish to make in respect to general appearance or specific parts of the garments.

CRITERIA FOR EVALUATING GENERAL APPEARANCE AND FIT

Original Dry Cleaned Laundered

Garment ______________

1. Overall appearance:	
general effectiveness	1 2 3 4 5
fit	1 2 3 4 5
Workmanship	1 2 3 4 5
2. Collar:	
is smooth	1 2 3 4 5
sets close to neck	1 2 3 4 5
covers neckline seam in back	1 2 3 4 5
3. Lapel:	
has smooth rolled appearance	1 2 3 4 5
breakline holds close to chest	1 2 3 4 5
4. Shoulders:	
smooth	1 2 3 4 5
well set to body	1 2 3 4 5
no wrinkles or excess fullness apparent	1 2 3 4 5
5. Bust area:	
smoothly molded	1 2 3 4 5
6. Waistline:	
smooth	1 2 3 4 5
well set to figure	1 2 3 4 5
7. Front opening:	
edges hang straight and smooth	1 2 3 4 5
no noticeable curling under or outward	1 2 3 4 5
8. Pockets:	
smooth	1 2 3 4 5
not bulky	1 2 3 4 5

9. Lower edge of jacket:

lies flat and smooth 1 2 3 4 5

upper edge of hem invisible 1 2 3 4 5

10. Sleeves:

hangs smoothly from armhole to wrist 1 2 3 4 5

no noticeable fullness of sleeve cap 1 2 3 4 5

lower edge smooth and firm 1 2 3 4 5

upper edge of hem invisible 1 2 3 4 5

11. Additional comments:

Scored by____________________

Date ________________________

CRITERIA FOR EVALUATING CONSTRUCTION

Original   Dry Cleaned   Laundered

Garment____________

1. Collar:
   - shaping 1 2 3 4 5
   - smoothness 1 2 3 4 5
   - inconspicuousness of seam 1 2 3 4 5
   - smoothness inside neckline when held in position as worn.......................... 1 2 3 4 5
2. Lapel:
   - smooth 1 2 3 4 5
   - thinness of edge 1 2 3 4 5
   - flatness of seam where collar and lapel join 1 2 3 4 5
3. Front edge;
   - straight and smooth 1 2 3 4 5
   - flatness and thinness of edge 1 2 3 4 5
   - seam inconspicuous 1 2 3 4 5
4. Buttonholes - General appearance of:
   - machine made 1 2 3 4 5
   - ordinary bound 1 2 3 4 5
   - corded 1 2 3 4 5
5. Pockets:
   - welt smooth and flat 1 2 3 4 5
   - pocket pouch flat, invisible from right side..... 1 2 3 4 5
6. Darts: flat and inconspicuous
   - front shoulder dart 1 2 3 4 5
   - back shoulder dart 1 2 3 4 5
   - underarm dart 1 2 3 4 5
   - waistline darts 1 2 3 4 5

7. Seams:

flat and inconspicuous 1 2 3 4 5

general seam finishes:

bound seam 1 2 3 4 5

pinked and edge stitched 1 2 3 4 5

pinked 1 2 3 4 5

8. Sleeve cap:

handling of fullness............................ 1 2 3 4 5

9. Lower edge of sleeve:

smooth 1 2 3 4 5

inconspicuousness of upper edge of hem 1 2 3 4 5

10. Hemline of jacket:

upper edge of hem invisible 1 2 3 4 5

smooth 1 2 3 4 5

11. Additional comments:

Scored by________________

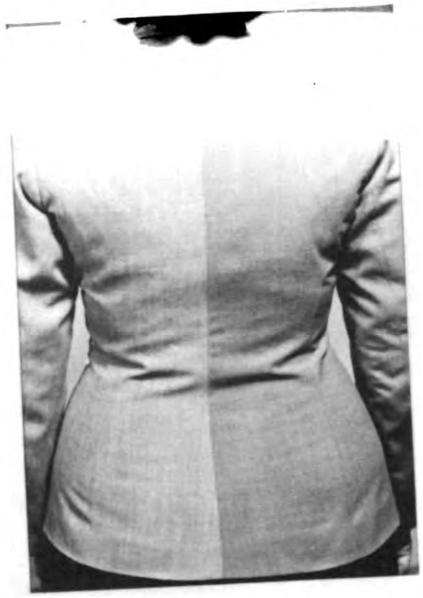
Date ____________________

Chart VII

JACKET RATING - APPEARANCE
ORIGINAL

	IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Orlon	IIIB Rayon-Dacron
1. Overall appearance:				
general effectiveness	3.5	4.0	3.0	2.8
fit	3.5	3.5	3.3	2.8
2. Collar:				
is smooth	4.5	4.0	2.8	2.8
sets close to neck.............	4.8	4.0	3.3	3.0
covers neckline seam...........	4.8	4.0	2.8	2.8
3. Lapel:				
smooth rolled appearance........	4.8	4.8	3.3	2.3
holds close to chest	4.8	4.8	3.3	2.8
4. Shoulders:				
smooth	4.0	4.0	3.0	3.3
well set to body	3.8	4.0	2.8	3.5
no wrinkles or excess fullness apparent...............	4.0	3.5	3.8	3.5
5. Bust area:				
smoothly molded	3.5	3.8	3.8	3.5
6. Waistline:				
smooth	3.5	3.8	3.8	2.8
well set to figure	3.0	3.8	3.8	3.0
7. Front opening:				
edges straight and smooth.......	3.5	4.0	3.8	2.8
no noticeable curling under or outward.................	3.5	4.0	3.8	2.8
8. Pockets:				
smooth	3.8	4.0	3.5	2.5
not bulky	4.0	4.3	3.3	3.0
9. Lower edge of jacket:				
lies flat and smooth	3.3	3.3	2.5	2.3
upper edge of hem invisible.....	3.5	3.3	2.5	2.0
10. Sleeves:				
hang smooth from armhole to wrist	2.5	4.8	3.0	2.5
no noticeable fullness of sleeve cap.................	3.5	2.8	3.3	2.3
lower edge smooth and firm.......	3.3	4.0	3.3	2.3
upper edge of hem invisible......	3.0	3.3	3.3	2.0

PLATE - I
JACKETS BEFORE DRY CLEANING AND LAUNDERING



FRONT VIEW CONTROL BACK VIEW

IA-LEFT SIDE WOOL-ORLON
IB-RIGHT SIDE WOOL-DACRON

FRONT VIEW CONTROL BACK VIEW

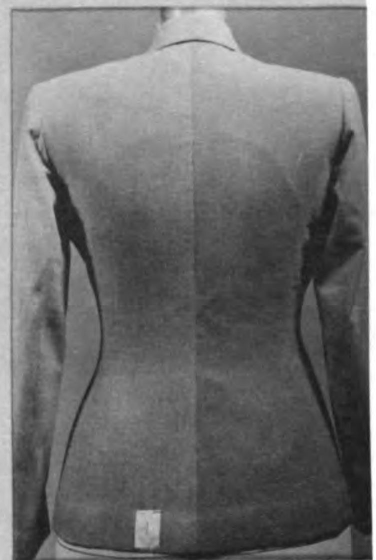
IIIA - RIGHT SIDE RAYON-ORLON
IIIB-LEFT SIDE RAYON-DACRON

Chart VIII

JACKET RATING - APPEARANCE
AFTER DRY CLEANING

	IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Orlon	IIIB Rayon-Dacron
1. Overall appearance:				
general effectiveness	3.5	4.0	3.8	3.8
fit	3.0	3.5	3.3	3.5
2. Collar:				
is smooth	3.5	4.0	2.3	3.0
sets close to neck	4.0	4.0	2.8	3.5
covers neckline seam	4.0	4.0	2.0	2.5
3. Lapel:				
smooth rolled appearance	3.8	4.0	2.0	3.0
holds close to chest	4.3	3.8	2.8	3.0
4. Shoulders:				
smooth	2.8	3.8	3.3	3.5
well set to body	2.8	3.5	3.3	3.3
no wrinkles or excess fullness apparent..............	2.8	2.8	3.5	3.0
5. Bust area:				
smoothly molded	3.5	3.5	3.5	3.3
6. Waistline:				
smooth	3.0	3.3	3.0	3.3
well set to body..............	3.0	3.5	3.3	3.3
7. Front opening:				
edges straight and smooth......	3.5	3.5	3.0	3.8
no noticeable curling under or outward..................	3.3	3.5	3.0	3.8
8. Pockets:				
smooth.........................	3.8	4.3	3.3	3.8
not bulky	4.0	4.3	3.3	4.0
9. Lower edge of jacket:				
lies flat and smooth	3.5	3.8	2.5	2.8
upper edge of hem invisible....	3.8	3.3	2.8	2.8
10. Sleeves:				
hang smooth from armhole to wrist	3.0	3.5	3.0	3.0
no noticeable fullness sleeve cap	3.3	2.8	3.8	3.5
lower edge smooth and firm	3.3	3.8	3.0	3.0
upper edge of hem invisible	3.0	3.5	3.0	2.5

PLATE - II
JACKETS AFTER
DRY CLEANING



FRONT VIEW BACK VIEW

I A - LEFT SIDE WOOL-ORLON
I B - RIGHT SIDE WOOL-DACRON

FRONT VIEW BACK VIEW

III A - RIGHT SIDE RAYON-ORLON
III B - LEFT SIDE RAYON-DACRON

Chart IX

JACKET RATINGS- APPEARANCE
AFTER LAUNDERING

	IIA Wool-Orlon	IIB Wool-Dacron	IVA Rayon-Orlon	IVB Rayon-Dacron
1. Overall appearance:				
general effectiveness	2.5	3.5	2.8	3.0
fit	2.8	3.0	3.0	3.3
2. Collar:				
is smooth	3.5	3.8	2.5	3.3
sets close to neck	3.5	4.0	3.3	3.3
covers neckline seam...........	4.0	4.0	2.8	3.0
3. Lapel:				
smooth rolled appearance	3.8	3.3	2.3	3.8
holds close to chest	3.8	3.8	2.5	3.5
4. Shoulders:				
smooth	3.0	3.3	3.3	2.8
wet set to body	3.0	3.8	3.8	3.0
no wrinkles or excess fullness apparent	2.8	3.3	3.5	2.8
5. Bust area:				
smoothly molded	3.0	3.5	3.3	2.8
6. Waistline:				
smooth	3.3	3.3	3.3	2.5
well set to body	3.0	2.8	3.3	2.8
7. Front opening:				
edges straight and smooth	3.0	3.5	3.0	3.5
no noticeable curling under or outward..................	2.8	3.5	2.8	3.5
8. Pockets:				
smooth	4.0	4.3	3.3	3.5
not bulky	3.8	4.3	2.8	3.8
9. Lower edge of jacket:				
lies flat and smooth	3.0	4.0	2.3	3.3
upper edge of hem invisible ...	3.0	4.3	2.8	2.8
10. Sleeves:				
hang smooth from armhole to wrist	3.5	4.0	3.3	3.5
no noticeable fullness of sleeve cap	2.5	3.0	3.8	3.5
lower edge smooth and firm	2.8	4.4	2.8	2.8
upper edge of hem invisible	3.5	3.8	3.0	2.8

PLATE- III
JACKETS AFTER
LAUNDERING

FRONT VIEW

BACK VIEW

II A - RIGHT SIDE WOOL-ORLON
II B - LEFT SIDE WOOL-DACRON

FRONT VIEW

BACK VIEW

IV A - LEFT SIDE RAYON-ORLON
IV B - RIGHT SIDE RAYON-DACRON

Chart X

JACKET RATINGS - CONSTRUCTION
ORIGINAL

	IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Orlon	IIIB Rayon-Dacron
1. Collar:				
shaping	3.3	3.8	2.5	2.5
smoothness of outer edge	4.3	4.0	2.8	2.5
inconspicuousness of seam	3.8	4.0	2.8	2.5
smoothness inside neckline when held in position	3.5	3.8	3.3	2.8
2. Lapel:				
smooth	4.3	4.8	3.3	2.5
thinness of edge	4.5	4.8	3.0	2.8
flatness of seam where collar and lapel join	4.0	4.5	2.8	2.8
3. Front edge:				
straight and smooth	3.5	4.0	2.8	2.8
flatness and thinness of edge	3.8	4.0	2.8	2.8
seam inconspicuous	4.0	3.8	3.3	2.5
4. Buttonholes:				
machine made	3.8	3.8	4.0	4.3
ordinary bound	3.0	3.3	3.0	3.3
corded	4.0	3.8	3.3	3.3
5. Pockets:				
welt smooth and flat	4.3	4.3	3.3	2.5
pocket pouch flat, invisible from right side	3.8	4.0	3.3	2.8
6. Darts: flat and inconspicuous				
front shoulder dart	3.8	4.0	3.0	2.8
back shoulder dart	3.5	3.8	3.0	2.8
underarm dart	3.8	4.0	3.0	3.0
waistline darts	3.8	4.0	3.5	3.0
7. Seams:				
flat and inconspicuous	4.3	3.5	3.5	3.0
general seam finishes:				
bound seam	3.8	4.5	3.8	3.8
pinked and edge stitched	4.0	4.5	3.5	4.0
pinked	3.5	3.8	3.0	3.8
8. Sleeve cap:				
handling of fullness	3.0	2.8	3.8	2.8
9. Lower edge of sleeve:				
smooth	3.0	3.3	3.0	2.5
inconspicuous of upper edge/hem	3.3	3.5	2.8	2.3
10. Hemline of jacket:				
upper edge of hem invisible	3.3	3.8	2.8	2.3
smooth	3.0	4.0	3.0	3.0

PLATE-IV

JACKET CONSTRUCTION BEFORE
DRY CLEANING AND LAUNDERING

LEFT SIDE-I A

CONTROL

RIGHT SIDE-I B

I A WOOL-ORLON
I B WOOL-DACRON

RIGHT SIDE III A

CONTROL

LEFT SIDE III B

III A RAYON-ORLON
III B RAYON-DACRON

Chart XI

JACKET RATINGS - CONSTRUCTION

AFTER DRY CLEANING

	IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Orlon	IIIB Rayon-Dacron
1. Collar:				
shaping	4.0	4.3	2.8	2.5
smoothness of outer edge	3.8	4.3	2.3	2.5
inconspicuousness of seam	4.0	4.3	2.3	3.0
smoothness inside neckline when held in position or worn	3.3	3.5	2.0	3.0
2. Lapel:				
smooth	4.0	4.3	2.0	2.5
thinness of edge	4.0	4.3	2.5	2.8
flatness of seam where collar and lapel join	3.5	3.8	2.3	2.3
3. Front edge:				
straight and smooth	4.0	4.0	2.8	2.8
flatness and thinness of edge	3.8	4.3	3.0	3.0
seam inconspicuous	4.5	4.0	3.3	3.0
4. Buttonholes:				
machine made	3.8	4.0	3.8	3.8
ordinary bound	3.3	3.5	3.3	2.5
corded	4.3	4.3	3.3	3.8
5. Pockets:				
welt smooth and flat	4.3	4.3	3.0	3.8
pocket pouch flat, invisible from right side	4.0	4.3	3.0	3.8
6. Darts: flat and inconspicuous				
front shoulder dart	4.0	4.0	3.0	3.8
back shoulder dart	3.5	4.0	3.0	3.0
underarm dart	3.8	3.8	3.0	3.0
waistline darts	3.8	3.8	3.0	3.0
7. Seams:				
flat and inconspicuous	4.0	4.0	3.3	3.0
general seam finishes:				
bound seam	4.5	4.5	3.8	3.5
pinked and edge stitched	3.3	4.3	3.0	2.8
pinked	2.8	4.0	2.8	3.0
8. Sleeve cap:				
handling of fullness	2.8	3.0	3.3	3.5
9. Lower edge of sleeve:				
smooth	3.0	3.8	3.0	2.5
inconspicuousness of upper edge of hem	3.5	3.8	2.5	2.5
10. Hemline of jacket:				
upper edge of hem invisible	3.8	3.8	2.5	2.5
smooth	3.8	3.8	2.8	2.5

PLATE - V
JACKET CONSTRUCTION AFTER
DRY CLEANING

LEFT SIDE IA

RIGHT SIDE IB

IA WOOL - ORLON
IB WOOL - DACRON

RIGHT SIDE IIIA

LEFT SIDE IIIB

IIIA RAYON - ORLON
IIIB RAYON - DACRON

Chart XII

JACKET RATINGS - CONSTRUCTION
AFTER LAUNDERING

	IA Wool-Orlon	IB Wool-Dacron	IIIA Rayon-Orlon	IIIB Rayon-Dacron
1. Collar:				
shaping	3.5	4.0	2.0	2.8
smoothness of outer edge	3.5	4.0	2.5	3.0
inconspicuousness of seam	3.5	4.3	3.0	3.0
smoothness inside neckline when held in position as worn	3.3	3.5	2.3	2.8
2. Lapel:				
smooth	4.0	3.8	2.8	2.8
thinness of edge	4.3	3.8	2.8	2.8
flatness of seam where collar and lapel join	3.8	4.3	2.0	3.0
3. Front edge:				
straight and smooth	3.8	4.0	3.0	3.0
flatness and thinness of edge .	4.3	4.5	2.8	3.5
seam inconspicuous	3.8	4.0	3.3	3.5
4. Buttonholes:				
machine made	4.3	4.0	3.8	3.8
ordinary bound	3.0	3.5	2.5	3.0
corded	3.8	4.3	3.0	3.5
5. Pockets:				
welt smooth and flat	3.8	4.5	2.8	3.8
pocket pouch flat, invisible from right side	3.8	4.5	3.3	4.0
6. Darts: flat and inconspicuous				
front shoulder dart	3.5	4.0	3.0	2.8
back shoulder dart	3.0	4.3	3.0	2.8
underarm dart	3.0	4.4	3.3	3.0
7. Seams:				
flat and inconspicuous	3.5	3.8	3.8	3.3
general seam finishes:				
bound seam	4.0	4.3	3.5	4.0
pinked and edge stitched	3.0	3.0	2.5	3.3
pinked	2.3	2.3	2.0	2.8
8. Sleeve cap:				
handling of fullness	3.5	3.3	3.5	3.8
9. Lower edge of sleeve:				
smooth	3.5	3.8	2.8	3.3
inconspicuousness of upper edge of hem	3.5	3.8	3.0	2.8
10. Hemline of jacket:				
upper edge of hem invisible ...	3.8	4.4	2.5	2.8
smooth	3.0	3.5	2.0	3.0

PLATE- VI

JACKET CONSTRUCTION AFTER LAUNDERING

RIGHT SIDE II A

LEFT SIDE II B

II A - WOOL-ORLON
II B - WOOL-DACRON

LEFT SIDE IV A

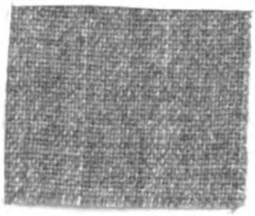
RIGHT SIDE IV B

IV A RAYON-ORLON
IV B RAYON-DACRON

PLATE VII

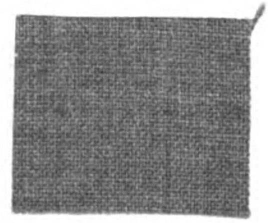
I Wool & Orlon

Original



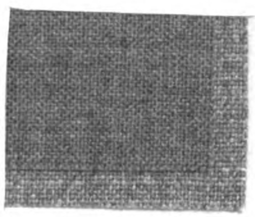
II Wool & Dacron

Original



After Dry Cleanings

After Launderings



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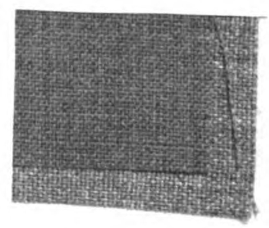

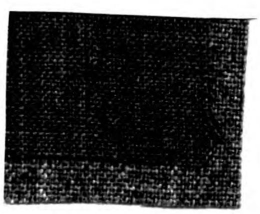

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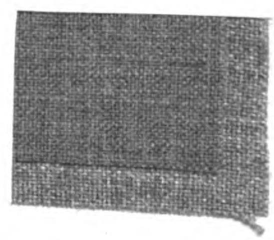
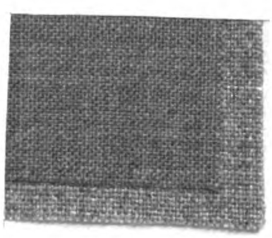


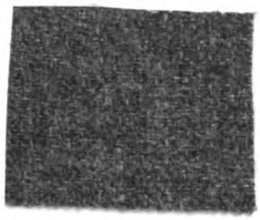


6

PLATE VIII

III Rayon & Orlon

Original



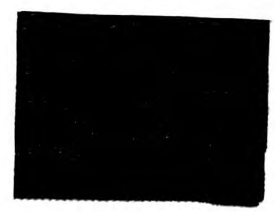
IV Rayon & Dacron

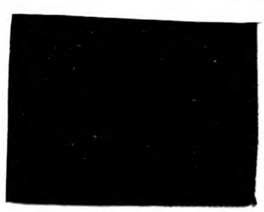
Original

After Dry Cleanings

After Launderings

1





3

6

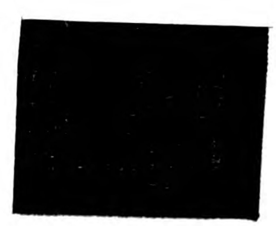
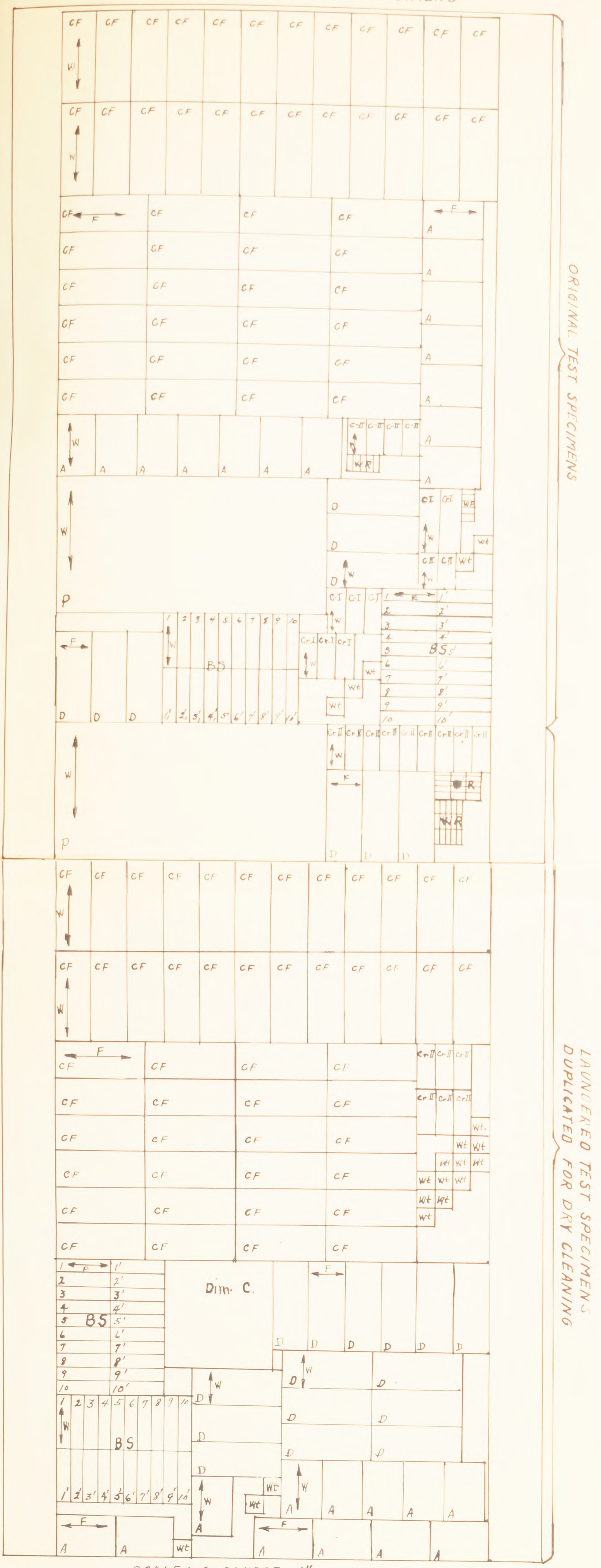


PLATE IX

CUTTING CHART FOR TEST SPECIMENS



SCALE: 1 SQUARE = 1"

W = WARP
F = FILLING
CF = COEFFICIENT OF FRICTION
A = ABRASION
C-II = COLORFASTNESS TO LAUNDERING
WR = WRINKLE RECOVERY
D = DRAPABILITY
C-I = COLORFASTNESS TO LIGHT
C III = COLORFASTNESS TO PERSPIRATION
Wt = WEIGHT
P = PLEATS
Dim C. = DIMENSIONAL CHANGE
BS = BREAKING STRENGTH