

DRAFT TANZANIA STANDARD

**Textiles – Woven, knitted fabrics and garments – Determination of
dimensional change – Machine method**



TANZANIA BUREAU OF STANDARDS

0 FOREWORD

0.1 This Draft Tanzania Standard describes a method to be followed for determination of dimensional change (shrinkage or stretch) of woven, knitted fabrics and garments due to laundering.

Dimensional change in textiles may be attributed to many causes. Some of the principle causes are moisture absorption, stress in fibres and yarns during manufacture, chemical and physical changes brought about by subsequent chemical or physical treatments either as part of the manufacturing process involving the textile or during its subsequent use. These changes may cause felting, re-orientation of molecular structures or relaxation of the latent forces inherent in the fibres.

0.2 In preparation of this Draft Tanzania Standard, assistance was derived from the following:

- a) ISO 675: 2014 – *Textiles – Woven fabrics – Determination of dimensional change on commercial laundering near boiling point.*
- b) ISO 3759: 2011 – *Textiles – Preparation, marking and measuring of fabric specimens and garments in tests for determination of dimensional change.*

0.3 In reporting the results of a test made in accordance with this Draft Tanzania Standard, if the final value observed or calculated, is to be rounded off, it shall be done in accordance with TZS 4: 2009 (See Clause 2)

1. Scope

This Draft Tanzania Standard describes a method for determining the dimensional change of woven, knitted fabrics and garments made from natural and man – made fibres. It also specifies methods for the preparation, marking and measuring of fabric specimens and garments for use in tests for determining dimensional change.

2. Normative references

For the purpose of this Draft Tanzania Standard, the following reference shall apply:

- a) TZS 534: Textiles – Standard atmospheres for conditioning and testing
- b) TZS 44: Textiles-Woven or knitted fabrics-Determination of length and width

3. Principal

The specimens are selected so as to be as representative of the sample. Pairs of reference points are marked on the fabric specimen or garment, and the distance between the two marks of each pair of reference marks is measured before and after specified treatments.

4. Apparatus

4.1 Ruler or flexible steel ruler or glass-fibre tape, marked in millimetres and longer than the greatest dimension being measured.

4.2 Suitable equipment for marking precise reference points, such as:

4.2.1 Indelible ink, for use, if necessary, with a template with a measuring grid;

4.2.2 Fine threads, of colour contrasting with the fabric sewn into the fabric.

4.2.3 Heated wire, with which small holes may be made (for thermoplastic fabrics only)

4.2.4 Staples – with measurements made from the point of entry of the staple into the cloth. Indicate on the cloth which end of the staple is used for measurement.

4.3 smooth flat surface, large enough to lay out complete articles.

4.4 Means of producing the required standard atmosphere, for conditioning and testing textiles as specified in TZS 534

5. Procedure for fabric specimens

5.1 Selection and number

For fabric piece goods, select specimen's representative of the sample. Take sufficient specimens to cover the width of the fabric but do not cut the specimens from within 1m (preferably not within 3m) of either end of the roll or piece of good neither within 75mm of either selvedge. Specimen should be taken from areas with different lengthwise and width wise yarns. Identify the length of the specimens before cutting them out of the sample.

Circular knitted fabrics produced on a body – width shall be used in their tubular form. Circular knit, seamless, or knit – to – wear fabric should be tested as a garment.

Tubular knitted samples should be slit and handled in the flat condition in a single layer.

5.2 Dimensions

Cut specimens, each measuring not less than 500mm x 500mm, with edge parallel to the length and width of the fabric. In the case of fabrics less than 650 mm in width, full width specimens may be used and measurements made by agreement between the interested parties.

NOTE- If there a possibility of the fabric unraveling during the test procedure over lock the edges of the specimen with dimensionally stable thread. Specimens treated in this way shall be cut slightly larger than the specified dimensions. Specimens of weft knitted fabrics shall be double – thickness and the edges shall be overstitched loosey using dimensionally stable thread.

5.3 Conditioning

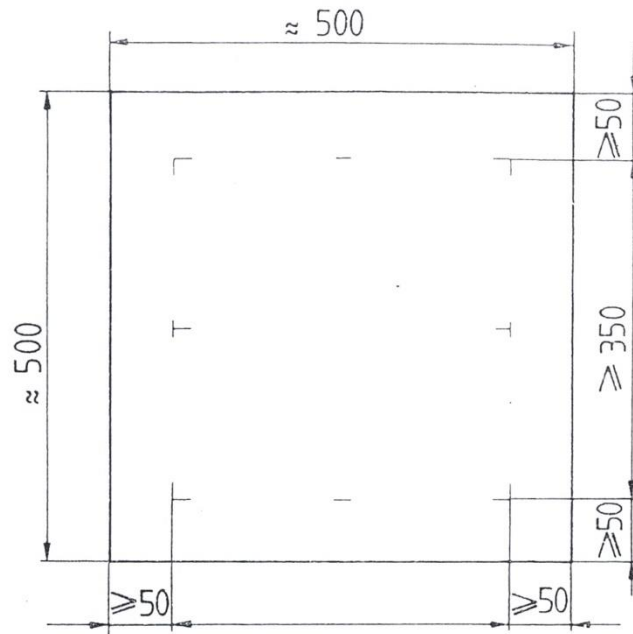
Expose the specimen to the pre – conditioning atmosphere specified in clause 4.4 until it is brought to approximately constant mass.

NOTE: A constant mass is considered to be achieved when measurements made at intervals of 1h do not show a change in mass greater than 0.25%

Expose the specimen to one of the standard atmosphere for testing textiles, as specified in clause 4.4 until it reaches equilibrium.

5.4 Marking

Place the specimen on the measuring table and make not fewer than three pairs of marks on it in both the length and width directions using a suitable means (see 4.2). The distance between the two marks in each pair shall be not less than 350 mm and no mark shall be less than 50 mm from the edges of the specimen. The pair of marks shall be displaced from each other in such a manner as to yield a representative measure of the whole specimen (see Figure 1). Dimensions given are minimal, expressed in millimetres.



Marking of specimen for fabric with 650 mm or greater

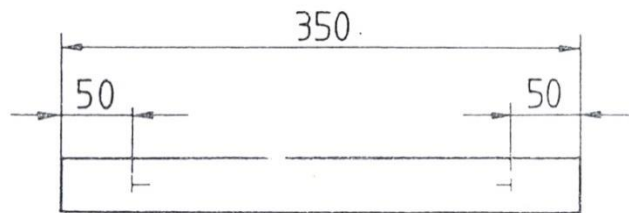


Figure 1 – Marking of fabric specimens

5.5 Method of measuring before treatment

Conduct all measurements in the standard atmosphere specified in 5.3, proceeding as follows for the measurement of each specimen. Lay the specimen flat on the measuring table and remove wrinkles gently by hand without stretching the specimen. Lower the measuring rule vertically on to the specimen to ensure that it is flat. Measure the distance, to the nearest 1 mm, between the two marks of each pair of reference marks.

5.6 Method of measurement after treatment

Proceed as indicated in 5.3, 5.4 and 5.5.

6. Garments

6.1 General

The measurements listed are comprehensive. Not all may be necessary as their selection will depend on the type and style of the garment. In all cases the exact sites measured when testing garments shall be specified in the test report.

Unless otherwise arranged by agreement, make measurements as specified in the relevant clause. If for example it is required to relate changes in dimensions to change in the marked size of garments, it may be necessary to make more measurements than those specified in this Draft Tanzania Standard. Such additional measurements would be made by agreements, at the specified parts of the garment which customarily denote the size of the garment. Examples of this application are:

- a) The sizing of shirts by the collar size. i.e. the length between the outer edge of the buttonhole and the center of the button.
- b) The sizing of brassieres by the circumference of the body at the level of the diaphragm plus various tolerances dependent on cup size, which are of the order of 125 mm.

Any modification of this type shall be noted when reporting the results.

When it is required to determine the dimensional change of the cloth of a garment as distinct from the dimensional change at seams and hems which may change more or less than the cloth, additional measurements shall be taken in the direction of the warp (wales) and of weft (courses) between marks located as far as is practicable from seams and hems (see figure 2)

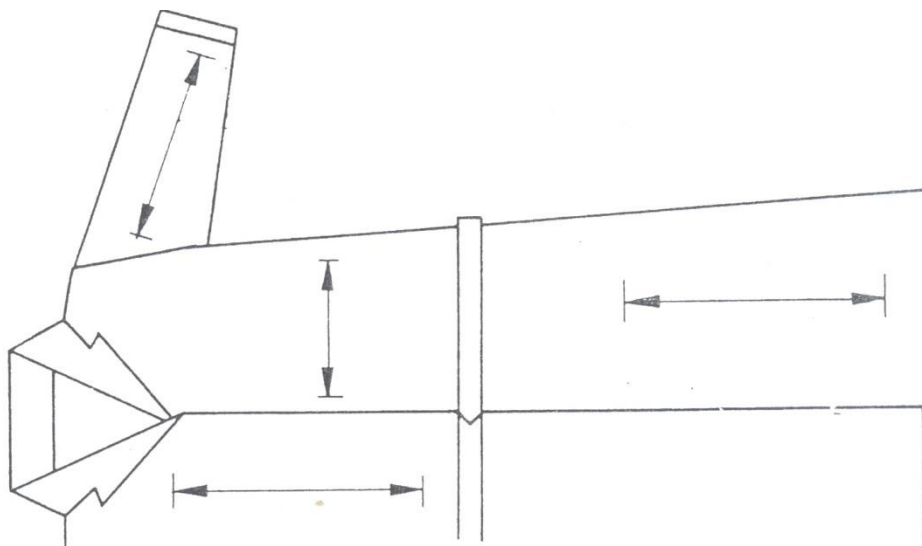


Figure 2 – Marking of garment when measuring dimensional change of the cloth

6.2 Instructions relating to all garments

6.2.1 Make length and width measurements between specific points, preferably at the seams between points where seams meet. The positions on the garment at which the measurements are to be made shall be marked by one of the methods described in 4.2. If the garment design is complicated it may be helpful to provide a diagram showing the measuring points.

6.2.2 Where lining are of a fabric different from the outer fabric, measure these in the appropriate positions described in 6.3 (i.e. treat the lining separately)

6.2.3 Pre – condition the garment in the atmosphere specified in clause 4.4 until it is brought to approximately constant mass.

6.2.4 Expose the garment to one of the standard atmosphere for testing textiles specified in 4.4 until a constant mass is achieved by hanging it on an appropriate hanger. If the garment would not normally be hung, lay each test specimen separately.

6.2.5 Place the garment on a smooth flat surface or on the workroom stand for measuring (see 4.4)

6.2.6 Measure the distance between the two marks for each pair of marked positions without stretching or tensioning the garment in any way, using the flexible steel ruler or glass fiber tape (4.2) and measuring to an accuracy of at least 5mm, and where practicable, to an accuracy of 1mm.

6.2.7 Measure the width or circumference with the garment closed and ensure that the buttons of the buttoned garments are fully home in the buttonholes.

6.2.8 Measure elasticated garments or portions of garments in the relaxed state.

Measure corresponding measurement on both halves of the garment, e.g. both sleeves.

6.3 Specific positions at which measurements should be made.

The following measuring positions are recommended but not all positions are necessarily relevant to all garments of particular type. Corresponding measurements shall be made on both halves of the garment under examination, for example both sleeves.

6.3.1 Jacket – like garments (including dresses, coats, pullovers, pyjamas, shirts, vests)

The measuring positions are the following:

6.3.1.1 Length of neck – band for garments where the collar is intended to be closed;

NOTE A suitable former can be used to fit the neck/band

6.3.1.2 Vertical length from the lowest point of armhole to bottom hem of garment.

6.3.1.3 Vertical length of front from junction of shoulder seam and neck seam to bottom hem of garment.

6.3.1.4 Vertical length of center back from neck immediately below the collar or ribbing to bottom hem of garment.

6.3.1.5 Length of underarm (seam (s)) from armhole to bottom of sleeves.

There may be two such seams if the sleeve is made from upper and lower sleeve section: both shall be measured.

6.3.1.6 Length of shoulder seam from sleeve seam to neck.

6.3.1.7 Where applicable, the garment shall be folded as shown in figure 3 with the wildest part of the bust section along the fold. Measure along the fold between side seams, or between sleeve seams, or between panels, depending on the construction of the garment.

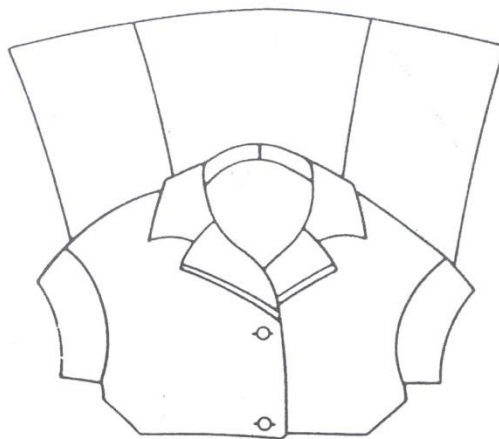


Figure 3 – Method of folding garment

6.3.1.8 Width across back between sleeve seams measured at a distance halfway between center – back neck and lowest point of armhole, or width of yoke from sleeve seam to sleeve seam.

6.3.1.9 Width or circumference of garment at not more than three places at stated distances from the center back neck.

6.3.1.10 Width or circumference of sleeve from junction of side and sleeve seams at right angles to sleeve length

6.3.1.11 Width from front sleeve seam junction with the body to the back sleeve seam junction with the body, as shown in figure 4

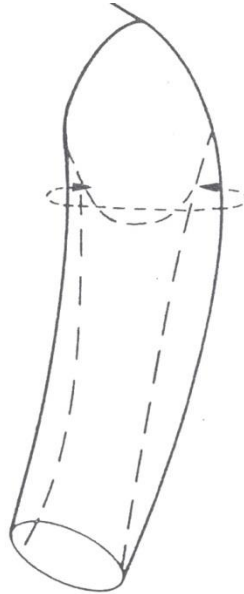


Figure. 4 – Measurement described in 6.3.2.11

6.3.1.12 Width or circumference of sleeve halfway between lowest point of armhole and bottom sleeve

6.3.1.13 Width or circumference at cuff or bottom of sleeve.

6.3.2 *Trousers like garments* (for example, briefs, pants, swim trunks)

The measuring positions are the following:

6.3.2.1 Length from top to junction or leg seams at front excluding the waistband

6.3.2.2 Length from top to junction of leg seams at back. If seams are curved, measure rounds the curves. If there is more than one seam, measure all seams.

6.3.2.3 Inside leg from crotch to bottom of leg

If leg length is short, measure from the bottom of one leg to the bottom of the other leg via the crotch.

6.3.2.4 Width at, or circumference of, waist

6.3.2.5 Maximum width or circumference between top and crotch

6.3.2.6 Width or circumference of bottom or leg

6.3.2.7 Width or circumference of leg halfway between crotch and bottom (omit if leg length is short)

6.3.2.8 Width or circumference of top of leg

6.3.3 *Boiler suits (jump suits), coveralls, bib and – brace overalls, combinations and one piece swim suits.*

These can be accommodated by combining the categories jacket – like garments (6.3.1) and trousers (6.3.2) but where applicable replacing 6.3.1.3 with the following:

By length from center – front neck to crotch seam or end or opening:

And 6.3.1.4 with the following:

By length from center - back neck to crotch seams

6.3.4 Girdles

The measuring positions are the following:

6.3.4.1 Length at a minimum of three places.

6.3.4.2 Width or circumference at top.

6.3.4.3 Width or circumference at bottom

6.3.4.4 Width or circumference halfway down garment

6.3.5 Pantie – girdle categories

These can be accommodated by combining the categories trousers (6.3.2) and girdles (6.3.4)

6.3.6 Brassieres

These include the appropriate portions of foundation garments, dresses, nightgowns, vests or slips, swim suits, with or without padded or pre – shaped bra sections.

If adjustable shoulder straps are fitted, preferably adjust the sliders to give the longest possible strap or mark the position of the sliders.

The measuring positions are the following:

6.3.6.1 Circumference of bottom of bra or bra section

6.3.6.2 Total length of top edge of bra or bra section

It may necessary to include the strap length in this measurement for certain types of garment.

Examples of types which require measurement round the top to include the strap length on the slide nearer the neck occur when the straps are:

6.3.6.1 Not adjustable, but incorporate elastic sections as shown in figures 5 and 6.

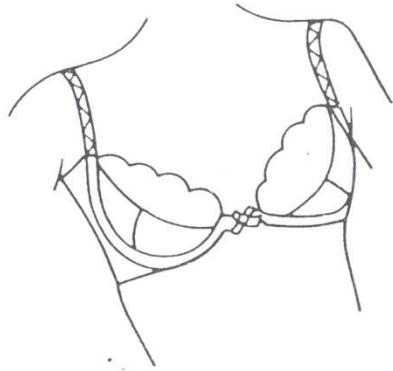


Figure 5 – Example of bra in which strap is not adjustable



Figure 6 – Example of bra in which strap is not adjustable

6.3.6.2 Adjustable but made from a continuous piece of fabric which may or may not be shown as shown in figure 7



Figure 7 – A bra in which strap is adjustable but made from a continuous piece of fabric

With garments of these types of construction, the circumference of the armhole, including the strap length on the side nearer the arm, should also be measured.

6.3.6.3 Length at centre back

6.3.6.4 Length at centre front

6.3.6.5 Depth at armhole seam or at seams adjacent to the armhole

6.3.6.6 Distance between the tops of cups while the garment lies on the table.

This is suitable for padded or pre – shaped types

6.3.6.7 Length of each cup seam

6.3.6.8 Length round curve of cup when folded garment is flat on table

This is suitable for garments without padding or pre – shaped sections.

6.3.6.9 Length of shoulder straps

6.3.7 Skirts

The measuring positions are the following:

6.3.7.1 Length from waist to bottom hem, excluding waistband if one is present, taken at seams and midway between seams.

6.3.7.2 Width at, or circumference of, waistband

6.3.7.3 Width or circumference at not less than three places stated distances from top edge or from bottom edge of waistband if present.

For flared and bias – cut skirts (see figure 8) four additional measurements are required preferable on each panel.

6.3.7.4 As 6.3.7.1

6.3.7.5 As 6.3.7.1, marked length parallel to the warp direction

6.3.7.6 Ad 6.3.7.1, marked length parallel to the weft direction.

6.3.7.7 As 6.3.7.1, marked length at 45° to the warp direction (mandatory measurements)

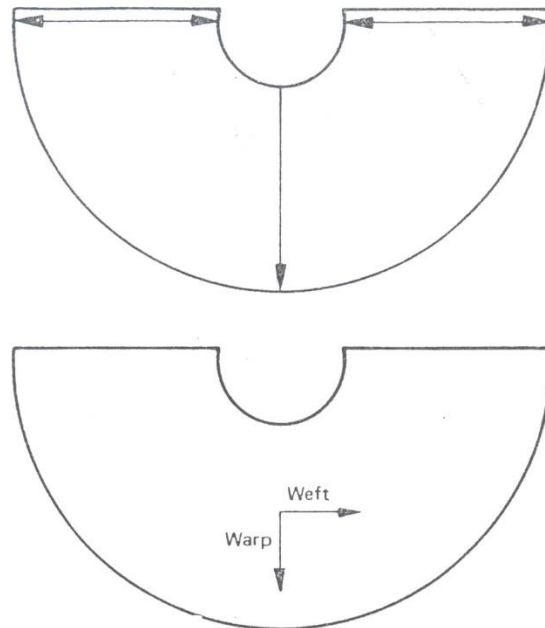


Figure 8 – Flared and bias – cut skirts

6.3.8 Hosiery (socks, stockings)

The measurement of hosiery and especially of tights is difficult and the procedure should be agreed between the interested parties

It is suggested that for socks and stocking the following measurements should be made as indicated in figure 9

6.3.8.1 Length leg from top to heel

6.3.8.2 Length of foot from heel to toe

6.3.8.3 Width of leg midway between top and heel

6.3.8.4 Width of foot midway between heel and toe

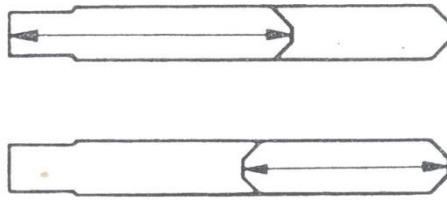


Figure 9- Measurement of socks

6.3.9 Hats and caps

The measuring positions are the following

6.3.9.1 Length of band

6.3.9.2 Length of seams

6.3.9.3 Width of band

6.3.9.4 Overall diameter (inside dimensions)

6.3.10 gloves

6.3.10.1 Overall length

6.3.10.2 Length of thumb seam(s)

6.3.10.3 Width across wrist at hem

It may be found helpful to use a template

6.4 Treatment of specimens

Subject the garment to the required test method, and repeat the procedure described in 6.2.3 to 6.2.8 making the same series of measurements as conducted under 6.3

6.5 Procedure for flat made – up textiles articles

Follow the procedure described in 6.1, 6.2, using the following measuring positions:

- a) Overall length;
- b) Overall width;

NOTE

1. Heavy drapes can stretch during hanging and shrink during washing. Methods for assessing dimensional change do not, in general, include dimensional changes occurring under tension.
2. Additional measurements might be necessary for particular articles, e.g. fitted sheets.

7. Expressions of results

The changes in dimensions shall be recorded separately as percentages of the original values. The changes in the recorded measurements may be reported as well as, or instead of, the changes in dimensions. A plus sign (+) shall be used to indicate an extension, and a minus sign (-) to indicate shrinkage.

Calculate the percentage change in dimensions using the following formula:

$$\frac{x_t - x_0}{x_0} \times 100$$

Where

x_0 is the original dimension, in millimetres;

x_t is the dimension measured after treatment, in millimetres.

DETERMINATION OF DIMENSIONAL CHANGE ON COMMERCIAL LAUNDERING NEAR THE BOILING POINT

8. Principles

Washing of a specimen in a cylindrical reversing laundry machine under specified conditions. Extraction of excess water and pressing without preliminary drying. Measurement, before and after laundering of distances marked on the specimen in the warp and weft directions.

9. Reagents

9.1 Detergent soap

A stock solution may be prepared by dissolving 0.5 kg of soap in 4 litres of hot water. When cooled, this solution forms a thick homogenous jelly which may be used as required.

Soap meeting the following specification is satisfactory:

a) Moisture and volatile matter contents at 105 °C, max	10.0% (m/m)
b) Sum of free alkali, total matter insoluble in alcohol and sodium chloride contents max,	4.0% (m/m)
c) Free alkali content, calculated as NaOH, max,	0.2% (m/m)
d) Content of matter insoluble in water, max	1.0% (m/m)
e) Titre of the mixed fatty acids prepared from the soap, min	39 °C
f) Anhydrous soap content, mm	85%

9.2 Water

Soft water (not more than 50mg/kg hardness) shall be used. (See Annex A)

9.3 Anhydrous sodium carbonate

10. Apparatus

10.1 Wash wheel

A horizontal cylindrical machine with rotating cage and reversing mechanism shall be used. The cage should have a diameter between 40 and 60 cm and peripheral speed of 50 to 55 m/min. other diameters may be used as a temporary measure, provided that the rotational frequency is adjusted to give an equivalent peripheral speed.

For preference, three or four fins or liters about 8cm wide equally spaced around the interior of the cage and extending its full length, should be used. Either a single fin or two fins may be used, however, provided that equivalent results can be obtained.

The cage shall turn at such speed that the load is lifted by the fins and falls back into it. (A peripheral speed of 54m/min has been found satisfactory.) The cage shall make 5 to 10 revolutions before reversing its direction.

The machine shall be equipped with heating facilities, such as live steam, gas or electricity and with an outlet large enough to permit discharge of all water from the machine in less than 2 min

A thermometer in a suitable well, or equivalent equipment shall be provided to indicate the temperature of the water to within 1 °C during the washing and rinsing, and there shall be an outside water gauge to indicate the level of water in the wheel.

The mass of the load to be run in the machine shall be between 8 and 50kg of air – dry fabric per cubic metre of cage space, including the volume of the fins. The load shall be made up of test specimens and as much other similar fabrics as is required. The quantity of water used shall be sufficient to cover the load, the level being situated at a height from 1/7 to 1/3 of the inside diameter of the cage.

10.2 Extractor

A laundry type centrifugal extractor with perforated basket or equivalent apparatus shall be used and shall be capable of adjusting the moisture retention to a range between 50% and 100% (m/m) based on the air – dry of the fabric.

Any other apparatus that will give equivalent results without fabric distortion may be used, for example, a rubber roll wringer which could pass the specimen through the rolls along a diagonal line without altering its dimensions.

NOTE Heavier fabrics of tight construction require a high – moisture retention to ensure removal of wrinkles during pressing

10.3 Pressing equipment

A flat bed press capable of pressing a specimen 60cm x 60cm and of providing a minimum pressure of 3.0 KPa is required. The temperature of the press shall be 150 ± 15 °C

10.4 Marking equipment

The equipment specified in clause 4 is required.

11. Preparation of specimen

Take a specimen, preferably the full width of the cloth and at least 60 cm long. Each specimen shall be cut, not torn, from the material to be tested so that its sides are parallel to the warp and weft. Take three specimens from at least 1m away from the end of a roll and preferably 3m away from the end. Mark, condition and measure the specimens as specified in 5.2 to 5.6, but using at least 500 mm between adjacent marks in each direction.

12. Procedures

12.1 Washing and rinsing

12.1.1 Place the specimen or specimens individually in the machine with sufficient similar fabric to make up the proper dry load (see 10.1). Start the machine, noting the time, and allow the machine to run continuously for 60 min. During this time, carry out the following operations as indicated, each without delay

12.1.2 Run water (see 9.2) into the machine at a temperature such that the machine will heat the liquor to boiling point within 10 min maximum and fill to the proper level for washing (see 10.1) within 4 min.

12.1.3 Add approximately 2g per litre of anhydrous sodium carbonate (see 9.3). Raise the temperature rapidly to 95°C. Add sufficient soap (see 9.1) to give good running suds. If more than 5g per litre of soap is used, the amount and reasons for use shall be reported (see clause 14h). The temperature shall be maintained at not less than 80°C

12.1.4 When the machine has run for 40 min timed from the start of the test, drain off the soap solution quickly and fill the machine with water to the proper level for rinsing. Raise the temperature to 60 °C within 2 min

12.1.5 When the machine has run for 45 min from the start of the test, drain off water fill again and heat to 60°C as before.

12.1.6 At the end of 55 min from the start of the test, drain off the water quickly. Allow the machine to run without further additions to complete the full 60 min of operation. Stop the machine

12.2 Extraction

Remove the specimen from the machine. Extract the excess water (see 10.2)

12.3 Pressing

Press each specimen, using the press (see 10.3), taking care to ensure that it is smoothed without stretching, to remove wrinkles before pressing. Continue this operation until sufficient moisture has been extracted from the fabric to ensure conditioning from the dry side.

12.4 Evaluation

Allow the pressed specimen to cool, condition it in the standard atmosphere for testing chose from these specified in TZS 534 and repeat the producer specified in 5.4 to 5.6. Make all measurements to the nearest 1 mm

13. Calculations and expression of results

Calculate the average dimensional changes in the warp and weft directions separately. Express as percentage of the original value to the nearest 0, 1%, using a minus sign (-) to indicate shrinkage and a plus sign (+) to indicate stretch. Calculate the mean value and the range of the dimensional change for each set of replicates.

14. Test report

The test report shall include the following particulars:

- a) a reference to this Draft Tanzania Standard;
- b) the description, mark and size of the article tested,
- c) an adequate description of each measuring position;
- d) the dimensional change of each specimen, in the warp and weft directions, as a percentage of the original value;
- e) an adequate description of the treatment used values.
- f) the results, expressed in accordance with clause 10.

Note: The application of even moderate tension in commercial washing and pressing may be expected to cause considerable extension of the washed fabrics”

ANNEX A

HARDNESS OF WATER

Hardness refers to the presence of such soap – precipitating compounds as calcium, magnesium and iron salts in the water. It is expressed in various units, most of them based on equivalents of calcium carbonate. Definitions of some of the units used are given below, followed by a table showing the conversion factors for these units.

TABLE – Conversion factors for units water hardness

Name of unit	Definitions	symbol	Conversion factors						
			Ca ²⁺		CaO		CaCO ₃		
			mmol/l	meq/l	°d	Mg/kg ¹	°e	°a	°f
Millimole per litre	1 mmol of calcium (II) ions (Ca ²⁺) in 1 litre of water	mmol/l	1	2.000	5.600	100	7.020	5.8500	10.00
Milliequivalent per litre	20.04 mg of calcium (II) ions (Ca ²⁺) in 1 litre of water	meq/l	0.500	1	2.800	50	3.510	2.9250	5.00
German degree of hardness	10 mg of calcium oxide (CaO) in 1 litre of water	°d	0.178	0.357	1	17.8	1.250	1.0440	1.78
Milligram per kilogram	1mg of calcium carbonate (CaCO ₃) in 1 litre of water	Mg/kg ¹	0.010	0.020	0.056	1	0.070	0.0585	0.10
English degree of hardness	1 grain of calcium carbonate (CaCO ₃) in 1 gal (UK) of water	°e	0.142	0.285	0.793	14.3	1	0.8290	1.43
American degree of hardness	1 grain of calcium carbonate (CaCO ₃) in 1 gal (US) of water	°a	0.171	0.342	0.958	17.1	1.200	1	1.71
French degree of hardness	1 mol: (100g) of calcium carbonate (CaCO ₃) in 10m ³ of water	°f	0,001	0.200	0.56	10.0	0.702	0.5830	1

1) The unit “part per million” (ppm) is often used for mg/kg

