Textiles– Polyester Textured Yarn Specification (HS Code: 5402.33)

**Draft Copy**

**Foreword**

Textured yarn is a generic term for filament(s) that have been given notably greater apparent volume or bulk than conventional yarns of similar filament count or which have been made more extensible by filament distortion through physical, chemical or heat treatment or a combination of these. Texturing introduces permanent distortions, crimps, loops, coils, or crinkles without destroying the essential continuity of the filaments. This improves the texture of the yarns. Texturing gives yarns a soft and woolly feel and increases the warmth and comfort of fabrics. The loops and crimps entrap a multitude of small pockets of air. The filaments prevent air movement and hold the fabric together.

The prime purpose of texturing filament yarns is to create bulky structure which is desirable for the following reasons:

- The voids in the structure cause the materials to have good insulation properties.
- The voids in the structure change the density of the material which makes it to have light weight with good covering properties.
- The disorganized surface of the yarn gives dispersed light reflection which in turn gives a desirable mat appearance.
- The sponge like structure feels softer than the lean twisted flat yarn. The crimp filament structure gives lower effective modulus of elasticity to the structure as compared to a flat yarn.

Polyester Textured Yarn (PTY) is a fully drawn, fully oriented polyester mono or multifilament yarn with soft crimp, high bulk and texture with cotton feel and very high durability and retention properties. This is manufactured by texturizing partially oriented yarn (POY) using high speed texturizing machines. Polyester Textured Filament Yarn (PTY) can be draw textured or air textured yarn. Polyester Draw Textured Yarn (DTY) is a continuous filament yarn textured by heat setting in a twisted condition to
give greater bulk, higher stretch and more pleasing aesthetics. One Heater DTY is normally woolly & more stretchable as compared to DTY with two Heaters. Draw Textured Yarn (DTY) is obtained when Polyester POY is simultaneously twisted and drawn. Yarns produced by the air-jet texturizing are called Air Textured Yarns (ATY). Air-jet texturizing process is a purely mechanical method that uses a cold air-stream to produce bulked yarns of low extensibility. ATY is very bulky with permanent crimps and loops.

1. SCOPE

This draft Indian Standard specifies requirements for all types of polyester textured yarns (PTY) for various end usages.

2. REFERENCES

The Indian standards given in Appendix contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

3. TERMINOLOGY

For the purpose of this standard, the following terminology shall apply:

3.1. Breaking Force: The maximum force applied to a test specimen carried to rupture during a tensile test.

3.2. Breaking Strength: The average of the results of breaking force measurements.

3.3. Breaking Tenacity: The breaking force divided by the linear density of the unstrained material.

3.4. Conventional Allowance: The conventional allowance is an agreed percentage to be added to the oven-dry mass of the material for the calculation of commercial mass and certain other properties. This allowance is normally fixed for each fibre type and includes the moisture regain which approximately corresponds with equilibrium.
under the standard atmosphere and for some fibres, an allowance for substances removable during normal processing, e.g. the finish normally applied to impart the required properties to the textile material (see Mass).

3.5. Crimp: The waviness of a fibre, yarn or tow. (Note – This characteristic may be expressed numerically by the combination of the crimp frequency either with the crimp contraction or in the case of textured yarns with the crimp elongation.)

3.6. Crimp Contraction (Percentage Crimp): The contraction of a crimped fibre or a textured yarn owing to the development of crimp, expressed as a percentage of its straightened length.

3.7. Crimp Elongation: The lengthening of a crimped fibre or of a textured yarn after development of crimp when it is straightened under specified tension expressed as a percentage of its initial length.

3.8. Crimp Frequency: The number of crimps per unit of length of filament yarn, staple fibre or tow. (Note – Different methods are in common use for expressing crimp frequency, based on half or whole waves and on straightened or un-straightened length. These bases must therefore be specified in any quantification.)

3.9. Crimp, Latent: Crimp that can be developed by a thermal treatment (hot temperature, hot air) or by mechanical treatment such as tensioning and subsequent relaxation.

3.10. Crimp Liveliness: The tendency for a textured yarn to develop its crimp immediately after the reduction of an applied tension.

3.11. Crimp Stability: The ratio of the crimp of a fibre or textured yarn after a specified treatment to the crimp prior to treatment, expressed as a percentage. (Note – The method for determination of crimp and the treatment must be reported.)

3.12. Cross Section: The shape of a fibre when viewed perpendicular to its axis. (Note – The shape of man-made fibres can be influenced by the spinning process and subsequent processing and treatments, such as texturizing.)

3.13. Edge Crimped Yarn: A textured filament yarn obtained by drawing heated filament yarn over an edge of small radius of curvature.
3.14. **Elasticity**: That property of a material by virtue of which it tends to recover its original size and shape immediately after removal of a deforming force.

3.15. **Elongation**: The ratio of the extension of a test specimen to its initial length, expressed as a percentage.
   - B. Elongation at Rupture: The elongation of a test specimen corresponding to rupture.
   - C. Elongation at Specified Force: The elongation of a test specimen produced by a specified force.

3.16. **False Twist Stretch Yarn**: A false twist yarn which has a high crimp elongation or high crimp contraction.

3.17. **False Twist Yarn**: A torsion textured yarn obtained by a continuous process applying high twist, heat setting and untwisting.

3.18. **Filament yarn**: A yarn composed of one or more continuous filaments assembled with or without twist. (Note - Filament yarns can have the morphologies like: flat, interlaced, twisted, twistless, textured or combinations of these.)

3.19. **Finish**: A chemical composition applied to yarns in order to facilitate processing.

3.20. **Flat Yarn**: Man-made continuous filaments that have not been twisted or textured.

3.21. **Industrial Filament Yarn**: Yarn intended for use in products other than non-protective clothing, household, furnishing and floor coverings selected principally but not exclusively for their performance and properties as opposed to their aesthetic or decorative characteristics.

3.22. **Intermingled Yarn**: A continuous filament yarn in which the constituent filaments are entangled by passing a turbulent air stream through the yarn to produce knots. These knots are not actually the knots tied when two threads are broken but they are the tangle knots created by heating pressure.

3.23. **Partially Oriented Yarn (POY)**: A synthetic polymer in continuous filament form that already has a substantial degree of molecular
orientation but which requires further orientation. This may be done by drawing during a subsequent process such as texturing.

3.24. **Polyester Textured Filament Yarn (PTY):** A filament yarn characterised by actual or latent filament crimps, twists, interlaces, coils or loops, or other fine distortions along the length of the filament with or without twist liveliness, by which it has, or can develop by after-treatment, bulk and/or stretch properties.

A. **Air Textured Yarn:** Textured filament yarn obtained by overfeeding filament yarn into a turbulent stream of air.

B. **Draw Textured Yarn (DTY):** Textured filament yarn obtained by heat setting in a twisted condition to give greater bulk, higher stretch and more pleasing aesthetics. (Notes: 1. One Heater DTY is normally woolly & more stretchable as compared to DTY with two Heaters. 2. Draw Textured Yarn (DTY) is obtained when Polyester POY is simultaneously twisted and drawn

3.25. **Shrinkage:** The decrease in length of a test specimen caused by a specified treatment, expressed as a percentage of the length of the untreated test specimen. The lengths are measured before and during or after treatment under specified tensions.

a) **Boiling Water Shrinkage:** The decrease in length of a test specimen caused by a treatment in boiling water for specified time, expressed as a percentage of the length of the untreated test specimen. The lengths are measured before and after treatment under a specified pretension.

b) **Hot Water Shrinkage:** The decrease in length of a test specimen caused by a treatment in hot water under specified conditions of temperature and time, expressed as a percentage of the length of the untreated test specimen. The lengths are measured before and after treatment under a specified pretension. The water temperature to be applied is specified between buyer and seller.

c) **Hot Air Shrinkage, After Treatment:** The decrease in length of a test specimen caused by a treatment in hot air under specified conditions of temperature and time, expressed as a percentage of the length of the untreated test specimen. The lengths are measured before and after treatment under a specified pretension.
d) **Hot air shrinkage, During Treatment:** The decrease in length of a test specimen caused by a treatment in hot air under specified temperature and time, expressed as a percentage of the length of the untreated test specimen. The lengths are measured before (under a specified pretension) and during treatment (under a specified measuring tension).

3.26. **Stuffer Box Crimped Yarn:** Textured filament yarn obtained by overfeeding yam and compressing it into a chamber, which may be heated.

3.27. **Tenacity:** Force divided by linear density.

3.28. **Tenacity at Break:** See Breaking Tenacity.

3.29. **Tare:** The sum of the masses of all the pallets, wrappers and containers, tie bands, and if appropriate the entire yam supports such as bobbins, tubes, relating to a consignment or its part.

3.30. **Tenacity at Specified Elongation:** The tenacity associated with a specified elongation on the tenacity-elongation curve.

3.31. **Tensile Stress:** The force per unit cross-sectional area of the unstrained specimen.

3.32. **Torsion Textured Yarn:** A textured filament yarn obtained by heat setting of a twisted filament yarn and subsequently untwisting it (see False Twist Yarn)
4. REQUIREMENTS OF PTY

4.1. The PTY shall meet the constructional and performance requirements specified in Table-4.1 in addition to those specified in clauses 4.2 to 4.4, Table-4.2.

Table- 4.1: Constructional and Performance Requirements of PTY

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Method of Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mean Linear Density in Denier (Tex)</td>
<td>As Declared ± 2%</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>No. of Filaments in case of multifilament yarns</td>
<td>As Declared ± 2 Filaments</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Elongation at Break %</td>
<td>14-32</td>
<td>8</td>
</tr>
<tr>
<td>3.</td>
<td>Tenacity, (gpd)</td>
<td>3 - 5</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Finish Oil Pick-Up %</td>
<td>1 - 5</td>
<td>15</td>
</tr>
<tr>
<td>5.</td>
<td>Boiling Water Shrinkage %</td>
<td>≤ 4.5</td>
<td>10</td>
</tr>
<tr>
<td>6.</td>
<td>Hot Air Shrinkage % at 180°C for 30 min</td>
<td>≤ 7</td>
<td>10</td>
</tr>
<tr>
<td>7.</td>
<td>Moisture Content %</td>
<td>≤ 1</td>
<td>17</td>
</tr>
<tr>
<td>8.</td>
<td>Bulk Ratio</td>
<td>≥ 1.5</td>
<td>7</td>
</tr>
<tr>
<td>9.</td>
<td>Crimp Contraction %</td>
<td>≤ 40</td>
<td>8</td>
</tr>
<tr>
<td>10.</td>
<td>Stretch Potential %</td>
<td>≤ 45</td>
<td>11</td>
</tr>
<tr>
<td>11.</td>
<td>Recovery Potential %</td>
<td>≥ 10</td>
<td>20</td>
</tr>
</tbody>
</table>

4.2. Freedom from Yarn Defects - The yarn shall be free from the following major defects:

4.2.1. Dirt/Grease – No soiling or grease spots shall be allowed. It is acceptable if the spots can be cleaned off. Air strip yarn to remove dirt on the outside surface,. For dirt on the ends, clean with sprayer. If dirt does not come off, reject to off grade.

4.2.2. Wound in Waste - None allowed. Strip to correct or reject to rewind.
4.2.3. **Damaged/bumped** – None allowed. Strip to correct or reject to rewind.

4.2.4. **Finish oil Contamination** – Dry or regular oil yarn shall not be contaminated with Finish Oil when viewed under a packing table UV light, unless very slight (not immediately visible). Strip to clean if possible. Otherwise reject to off-grade.

4.2.5. **Broken Filaments** – The number of broken filaments shall not be more than 8 per end for standard package and not more than 10 per end for large package. The number of broken filaments depends upon the Denier per filament (DPF)

4.2.6. **Fluorescent Oil** - If applicable, the package shall have even coverage under UV light.

4.2.7. **Crossed Ends** - Nose end crosses can be allowed, unless they appear matted or too numerous to count. Up to 25 mm crosses on the tail end are allowed or crosses < 6 mm from the tube shall be allowed.

4.2.8. **Slubs/Loops/Kinks** - None shall be allowed.

4.2.9. **Proper Wind** - No patterns or bands, no high or falling off edges and no excessive hard/soft packages shall be allowed.

4.2.10. **Tube Defects** - No crushed, nicked, or cut tubes, especially on the nose end shall be allowed.

4.2.11. **Ridges/Grooves** – No ridges or grooves > 3mm high or deep shall be allowed.

4.2.12. **Texture** – Yarn should bulk up when stretched several times and relaxed. No end should lack any bulk (raw end). 4 ply through 6 ply may have slight lean ends (end lacks full bulk), otherwise lean ends shall not be allowed. The tail shall also be checked.

4.2.13. **Air Tacks** (Entanglement) – The minimum number of tacks per dm though dependent upon the type of yarn, shall be 4 for regular air and low air shall have some evidence of air tacks.

4.2.14. **Twist** – For single ply yarns only, Z twist shall rotate clockwise when allowed to relax and S twist rotates counter-clockwise.

4.2.15. **Proper Ply** – Count the number of ends if the yarn is three ply or more. Air strip the yarn to correct if possible. Also check the tail.
4.2.16. **Latching** – Filaments or plies that separate when winding off package shall not be allowed.

4.2.17. **No Tail** – Only one tail package per layer shall be permitted. The minimum tail length shall be one wrap around the tube. If tail is too short, take a short length of yarn and tie it on to the tail. For parallel yarn smalls and no tails are allowed.

4.2.18. **Multiple Tails** – If there are multiple tails, then correct if possible or reject to rewind.

4.2.19. **Tube Clearance** – It shall be 9 mm, Min from yarn roll to tail end of tube and 25 mm Max (nominal should be 15 mm)

4.2.20. **Oversize or Small Package** – Check suspect packages with appropriate gauge, scale, diameter tape, or balance. Do not put excessive minimum size packages in one case.

4.3. **Intermingled Yarns**: Normally PTY shall be any of the following types and shall meet requirements of knots/metre as specified against each type when tested by the method prescribed in Annex E.

- Non-Intermingle (NIM) - 0 to 10;
- Soft Intermingle (SIM), Low Intermingle (LIM) and Intermingle (IM) - 40 to 50;
- High-Intermingle (HIM) - 100 – 120

**Note** – The number of knots/metre depends upon the denier, number of filaments and the intermingling jet orifice

4.4. **Lustre / Brightness**: PTY shall be classified as Full Dull, Semi Dull, Bright or Super Bright and shall meet the requirements specified in Table 4.2 when tested by the method prescribed in Annex-F.

**Table-4.2: Requirements of Brightness of PTY**

<table>
<thead>
<tr>
<th>Type of PTY</th>
<th>TiO₂ Content % Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Dull (FD)</td>
<td>1.50- 2.10</td>
</tr>
<tr>
<td>Semi Dull (SD)</td>
<td>0.20 – 0.30</td>
</tr>
<tr>
<td>SUPER BRIGHT (SUB), BRIGHT (B) or Trilobal Bright (TB)</td>
<td>0.05 – 0.10</td>
</tr>
</tbody>
</table>
5. SAMPLING AND CRITERIA FOR CONFORMITY

5.1. Lot: The number of cartons of PTY of the same type and designation delivered to a buyer against one dispatch note shall constitute a lot. The number of cartons of PTY to be selected at random from a lot shall be according to col 2 of Table 5.1. From each carton one cheese shall be selected at random to constitute the sample size. To ensure the randomness of selection, IS 4905 may be followed.

5.2. Number of Tests and Criteria for Conformity: The number of cheeses to be selected for manufacturing defects shall be in accordance with col 2 of Table-5.1. For linear density, number of filaments, elongation, tenacity, intermingling and commercial mass, the number of cheeses selected shall be in accordance with col 4 of Table-5.1. For all other properties, the number of cheeses selected shall be in accordance with col 5 of Table-5.1.

Table 5.1 Sample Size

<table>
<thead>
<tr>
<th>Lot Size, Number of cartons of PTY</th>
<th>Sample Size, Number of cartons</th>
<th>Permissible Number of Non-conforming cheeses</th>
<th>Sub-sample Size</th>
<th>Sub-sub-sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>51 – 150</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>151 – 300</td>
<td>13</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>301 – 500</td>
<td>20</td>
<td>1</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>501 – 1000</td>
<td>48</td>
<td>3</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>1001 and above</td>
<td>50</td>
<td>3</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

All the cheeses selected for requirements shall be tested for those requirements as specified in Table-4.1 & 4.2. All the selected cheeses from the lot shall be visually examined for yarn defects as specified in sub heading 4.2 & 4.3. A cheese shall be declared defective if it contains at least four yarn defects or it does not meet any of the requirements specified in this standard. The lot shall be declared conforming to the requirements of this standard if the total number of defective cheeses does not exceed the value given in col 3 of Table-5.1.
### Table - 5.2 Declaration of Result

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characteristic</th>
<th>Observed</th>
<th>Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Value</td>
<td>CV %, Max</td>
</tr>
<tr>
<td>1.</td>
<td>Mean Linear Density in Denier (Tex)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>No. of Filaments in case of multifilament yarns</td>
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<td></td>
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<tr>
<td>3.</td>
<td>Elongation at Break %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Tenacity, (gpd)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Finish Oil Pick-Up %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Boiling Water Shrinkage %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Hot Air Shrinkage % at 180°C for 30 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Moisture Content, Percentage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Bulk Ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Crimp Contraction, Percentage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Stretch Potential, Percentage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recovery Potential, Percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Result:** The above yarn Qualifies / does not qualify as Polyester Textured Yarn
## APPENDIX

### LIST OF REFERRED INDIAN STANDARDS

<table>
<thead>
<tr>
<th>IS No</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>686:1985</td>
<td>Methods for determination of colour fastness of textile materials to daylight <em>(first revision)</em></td>
</tr>
<tr>
<td>766:1988</td>
<td>Method for determination of colour fastness of textile materials to rubbing <em>(first revision)</em></td>
</tr>
<tr>
<td>971:1983</td>
<td>Method for determination of colour fastness of textile materials to perspiration <em>(first revision)</em></td>
</tr>
<tr>
<td>2454:1985</td>
<td>Methods for determination of colour fastness of textile materials to artificial light (Xenon lamp) <em>(first revision)</em></td>
</tr>
<tr>
<td>3361:1979</td>
<td>Method for determination of colour fastness of textile materials to washing : Test 2 <em>(first revision)</em></td>
</tr>
<tr>
<td>3456:1966</td>
<td>Method for determination of water soluble matter of textile materials</td>
</tr>
<tr>
<td>4636:1988</td>
<td>Method for determination of colour fastness of textile materials to dry-heat treatments (excluding pressing) <em>(first revision)</em></td>
</tr>
<tr>
<td>4905:1968</td>
<td>Methods for random sampling</td>
</tr>
<tr>
<td>IS 7703(Part 1):1990</td>
<td>Methods of test for continuous filament polyester and polyamide flat yarn – Linear density <em>(first revision)</em> (Superseding IS 1226:1957)</td>
</tr>
<tr>
<td>IS 7703(Part 2):1990</td>
<td>Methods of test for continuous filament polyester and polyamide flat yarn – Tenacity and elongation at break <em>(first revision)</em> (Superseding IS 1228:1957)</td>
</tr>
<tr>
<td>IS 7703(Part 3):1991</td>
<td>Methods of test for man-made fibre continuous filament flat yarn – Commercial mass <em>(first revision)</em> (Superseding IS 1229:1957)</td>
</tr>
<tr>
<td>IS 7703(Part 5):1987</td>
<td>Methods of test for continuous filament polyester and polyamide flat yarn – Unevenness percentage</td>
</tr>
<tr>
<td>15570:2005</td>
<td>Textiles – Method of test - Detection of banned azo colourants in coloured textiles</td>
</tr>
<tr>
<td>IS 15651:2006</td>
<td>Textiles – Requirements for environmental labelling – Specification</td>
</tr>
</tbody>
</table>
ANNEX-A

METHOD FOR DETERMINATION OF OIL PICK UP

A-1 Principle
The specimen is extracted with petroleum ether or methanol in Soxhlet Apparatus and then distilled. The specimen is then dried and oil pick up is calculated from the mass of original specimen and the dried specimen.

A-2 Apparatus
- Precision Balance
- Stainless Steel Vessels
- Conical Flasks
- Bowls
- Forceps

A-3 Procedure
Take the hank (normally, prepared for denier check) of textured yarn for the analysis. Note down the actual weight of the sample. Take required amount of petroleum ether along with sample in the vessel / conical flask. Immerse the yarn sample in petroleum ether for extraction of oil for 15 minutes. After 15 minutes take out sample, squeeze it completely and then place the yarn in the tray kept in open air for 20 minutes. Then put the hanks in oven at temp 85° C. Take out the yarn from the oven after drying up to 15 minutes. Keep the yarns for cooling room temperature for 15 - 20 minutes. Weigh the yarn and note down the weight.

A-4 Calculations
Calculate the per cent oil pick up (OPU) by the following formula:

\[
OPU, \text{ per cent } = \frac{\text{Weight of Sample} - \text{Weight of the yarn after drying}}{\text{Sample weight}} \times 100.
\]
ANNEX-B
METHODS FOR DETERMINATION OF SHRINKAGE IN BOILING WATER

B-1 Apparatus
- Hot air oven
- Water bath
- Wrap reel

B-2 Principle
The specimens in the form of skeins are treated in a water bath at 95 ± 2 °C for 10 minutes, dried and conditioned in the standard atmosphere of 27 ± 2 °C temperature and 65± 2 per cent relative humidity for two hours.

B-3 Procedure
Wind sufficient lengths of yarn (say about 10 turns of 1m each) on a wrap reel at a tension of 1cN/Tex) 0.2 g/denier. Prepare hanks for measuring residual yarn shrinkage. Measure the original length of the skeins Lo in mm at a tension of 500 g.

Place the hanks in a boiling water bath at 95 ± 2 °C for 10 minutes, then dry in a free state. Condition the hanks for 120 minutes in the standard atmosphere of 27 ± 2 °C and 65 ± 2% RH after drying.

Measure the final skeins length Lf in mm under the same tension (500 g) and calculate the yarn shrinkage, percent as follows:

Yarn shrinkage, % = [(L₀ – Lf) / (L₀)] × 100
ANNEX-C

METHODS FOR DETERMINATION OF MOISTURE CONTENT, BULK RATIO, CRIMP CONTRACTION, STRETCH AND RECOVERY POTENTIAL

C-1 Apparatus
- Draw-texturing machine
- Instron/Statimat tensile tester
- Wrap reel
- Microscope
- Digital balance
- Hot box oven
- Meter rule

C-2 Conditioning of Samples
The samples shall be allowed to condition at temperature of 27 ± 2°C and a relative humidity of 65 ± 2% before carrying out the tests. All tests shall also be performed under standard conditions (see IS 6359).

C-3 Moisture Content Determination
Weigh the yarn skein before the test (W1) and dry in the oven at a temperature of 107±2°C. After thirty minutes weigh the sample and record its mass. Subsequently carry out the weighing every twenty minutes until a constant mass (W2) is obtained. Calculate the moisture content using the relations:
\[ W = W_1 - W_2 \]  
Moisture Content, M, Percent \[ = \frac{100 \times W}{W_2 - W} \]

C-4 Determination of Bulk Ratio
Wind yarns of equal length using the wrap reel at the same tension and weigh them. The ratio of the weight of original yarn (W1) to that of textured yarn (W2) indicates the bulk ratio i.e.
Bulk Ratio (B) \[ = \frac{W_1}{W_2} \]

C-5 Determination of Crimp Contraction, Stretch and Recovery Potentials:
A length of yarn 40cm long was withdrawn from the package and loaded with 6g at a point about 30cm from one end. It was then cut free
from the package at a point between the package and the weight, but close to the latter. From the weighted end, 20cm length of yarn (L1) was measured.

The length (L1) was then contracted or shrunk by immersing completely for 5 min in a cylinder of water at boil. The contracted yarn was removed and the length (L2) taken immediately. After measuring it was loaded at the lower end with a 15 g weight and allowed to stretch. The fully extended length (L3) was determined and the stretch load was removed. After 5 min the final or recovered length (L4) was measured. The crimp contraction (CC), percentage, stretch potential (SP) percentage and recovery potential (RP) percentage were calculated using the following equations:

\[
\text{CC} \% = \frac{(L1 - L2) \times 100}{L1}
\]

\[
\text{SP} \% = \frac{(L3 - L2) \times 100}{L3}
\]

\[
\text{RP} \% = \frac{(L3 - L4) \times 100}{L4}
\]
ANNEX-D

METHODS FOR DETERMINATION OF NUMBER OF FILAMENTS

D-1 Apparatus

- Microscope
- Microscopic Slides
- Glycerol / Water
- Cutter & Measuring Scale

D-2 Principle

The specimens in the form of filament yarn are cuttings from different places so as to cover the entire surface in each direction/different cones. Mount those specimens on the microscopic slides using glycerol / Water.

D-3 Procedure

- Take 5 specimens of yarn cuttings from separated different places so as to cover the entire surface in each direction/different cones.
- Mount the specimens on the microscopic slides using glycerol and tease the strands so as to achieve maximum separation of all individual filaments.
- Mount the slides on the microscope.
- Count the individual no of filaments visually.
- Note down the no of filaments on the work sheet.
- Repeat the same process for all the specimens.
- Then report the No of filaments average of five readings as the direction wise incase of fabric.

ANNEX-E

METHOD FOR DETERMINATION OF INTERMINGLING

(To be extracted from BISFA standard)

ANNEX-F

METHOD FOR DETERMINATION OF TiO2 PERCENTAGE

(To be extracted from relevant ASTM / BIS standard)