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Jawaharlal Nehru
“Step Out From the Old to the New”

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Satyanarayan Gangaram Pitroda
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Bhartrhari—Niti Satakam
“Knowledge is such a treasure which cannot be stolen”
Indian Standard

TEXTILES — MERCERIZED COTTON FABRICS FOR COVERING AIRCRAFTS AND GLIDERS — SPECIFICATION

( Third Revision )
AMENDMENT NO. 1 NOVEMBER 2000
TO
IS 514: 1992 TEXTILES — MERCERIZED COTTON
FABRICS FOR COVERING AIRCRAFTS AND
GLIDERS — SPECIFICATION
(Third Revision)

(Page 2, Table 1, col 9, Heading) — Substitute the following for the
existing:

'B Breaking Load
on 5cm x 20 cm
Strips,
Min'

(TX 13)
FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by Textile Materials for Aerospace Purposes Sectional Committee had been approved by the Textile Division Council.

The second revision of this standard was published in the year 1978, and has now been revised on the basis of experience gained during its use. The following are the main changes carried out:

a) Nominal widths specified have been modified on the basis of present requirements.

b) Requirement of maximum permissible percentage of total of sizing, finishing and other nonfibrous materials has been included.

c) Reference has been made to IS 11662 : 1986 for the purpose of carrying out rot-proofness.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 "Rules for rounding off numerical values (revised)". The number of significant place retained in the rounded off value should be the same as that of the specified value in this standard.
Indian Standard

TEXTILES — MERCERIZED COTTON FABRICS FOR COVERING AIRCRAFTS AND GLIDERS — SPECIFICATION
( Third Revision )

1 SCOPE

1.1 This standard prescribes the requirements of four grades of mercerized cotton fabrics for covering aircraft and glider surfaces such as wings, fuselage, ailerons, elevators and other airfoil surfaces:

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>199 : 1989</td>
<td>Textiles — Estimation of moisture, total size or finish, ash, and fatty matter in grey and finished cotton textile materials (third revision)</td>
</tr>
<tr>
<td>1390 : 1983</td>
<td>Methods for determination of pH value of aqueous extracts of textile materials (first revision)</td>
</tr>
<tr>
<td>1954 : 1990</td>
<td>Method for determination of length and width of fabrics (second revision)</td>
</tr>
<tr>
<td>1963 : 1981</td>
<td>Methods for determination of threads per unit length in woven fabrics (second revision)</td>
</tr>
<tr>
<td>1964 : 1970</td>
<td>Methods for determination of weight per square metre and weight per linear metre of fabrics (first revision)</td>
</tr>
<tr>
<td>1969 : 1985</td>
<td>Methods for determination of breaking load and elongation of woven textile fabrics (second revision)</td>
</tr>
<tr>
<td>3919 : 1966</td>
<td>Methods of sampling of cotton fabrics for determination of physical characteristics</td>
</tr>
<tr>
<td>5463 : 1969</td>
<td>Methods of sampling of cotton fabrics for chemical characteristics</td>
</tr>
<tr>
<td>6359 : 1971</td>
<td>Method of conditioning of textiles</td>
</tr>
<tr>
<td>11662 : 1986</td>
<td>Preservative treatments of textiles</td>
</tr>
</tbody>
</table>

3 MANUFACTURE

3.1 Yarn
The cotton yarn used shall be combed, evenly spun and preferably mercerized, and it shall be free from leaf particles, neps, snarls, slubs, etc.

3.2 Fabric
The fabric shall be woven in plain weave with firm and regular selvages. It shall be calendar-ed and mercerized (if yarn used is not mercerized). The calendering shall be sufficient to lay any nap present to provide smooth and even surface. Nap, if present, shall be removed by singeing.

3.2.1 The fabric shall be rot-proofed or finished for doping as required by the buyer.

3.3 Rot-Proofing
The fabric shall be rendered rot-proofed by treating with pentachlorophenyl laurate (PCPL), (normal process) in accordance with IS 11662: 1986.

4 REQUIREMENT

4.1 The fabric shall conform to the requirements specified in Tables 1 and 2.

4.2 Dimensions
Unless otherwise specified, the length and width of the fabric shall be as given in Table 1.

4.3 If required by the buyer, the fabric, after dope finish shall withstand the tests and corresponding requirements given in Annex A.

4.4 Sealed Sample
If in order to determine characteristics such as appearance, smoothness and other requirements not covered under this standard, a sample has been agreed and sealed, the supply shall also conform to the sealed sample in such respects.

4.4.1 The custody of sealed sample shall be a matter of prior agreement between the buyer and the seller.

5 INSPECTION

5.1 The cloth shall be inspected by the method given in Annex B. The permissible number of
**Table 1 Physical Requirements of Aircraft Fabrics**

( *Clauses 4.1 and 4.2*)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Length</th>
<th>Width</th>
<th>Nominal Count of Yarn*</th>
<th>Ends/ dm</th>
<th>Picks/ dm</th>
<th>Mass, Max</th>
<th>Breaking Load on 50 x 20 cm Strips, Min</th>
<th>Suitable for Aircraft Surface with Wind Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Warp (tex (cotton count))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Weft (tex (cotton count))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>mm</td>
<td>900 ± 12</td>
<td>or</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td>1</td>
<td>1100 ± 15</td>
<td>or</td>
<td>10 tex x 2</td>
<td>(60 s/2)</td>
<td>10 tex x 2</td>
<td>330</td>
<td>330</td>
<td>140</td>
</tr>
<tr>
<td>2 50 m unless specified</td>
<td>1500 ± 25</td>
<td>or</td>
<td>10 tex x 2</td>
<td>(60 s/2)</td>
<td>10 tex x 2</td>
<td>330</td>
<td>330</td>
<td>140</td>
</tr>
<tr>
<td>3 specified in the contract or order</td>
<td>10 tex (60 s) 8.5 tex (70 s)</td>
<td>390</td>
<td>390</td>
<td>100</td>
<td>440</td>
<td>Up to 382</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10 tex (60 s) 9 tex (65 s)</td>
<td>380</td>
<td>380</td>
<td>85</td>
<td>295</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Tolerance**

- + 20
- - 10
- - 10
- -
- -

**Methods of Test**

- IS 1954 : 1969
- IS 1963 : 1969
- IS 1964 : 1970
- IS 1969 : 1985

*For guidance only.

Defects shall be 1 major and 3 minor per 20 metres of continuous fabric length.

**NOTE** — When calculating from the observed number of defects in a roll of fabric, the number of defects per 20 m shall be rounded off to the nearest whole number.

### 6 PACKING

**6.1** The fabric shall be packed in roll form in such a manner so as to prevent permanent distortion and damage from exposure to moisture, weathering, etc, during transportation and storage; or according to requirements of the buyer.

### 7 MARKING

**7.1** Each package of fabric shall be marked with the following informations:

- a) Name of the fabric and grade,
- b) Length (m), width (mm),
- c) Indication of the source of manufacturer, and
- d) Lot number and date of manufacture.

**7.1.1** The fabric may also be marked with the Standard Mark.

### 8 SAMPLING

**8.1** Unless otherwise agreed, the procedure for sampling for testing physical and chemical characteristics shall be as given in IS 3919 : 1966 and IS 5463 : 1969 respectively.

### ANNEX A

( *Clause 4.3*)

**DOPING SPECIFICATIONS AND TESTS**

**A-1 TEST FRAME**

**A-1.1** The test frame should be strong rectangular wooden frame reinforced with metal to prevent warping. It shall measure 25 x 25 cm internally and have 2 holes, 5 cm in diameter, bored through one of the sides. A piece of 13 mm thick 5-ply plywood with a central hole 25 mm in diameter, shall be screwed to one face (see Fig. 1). The frame shall be covered on the plywood face with linen fabric under a tension of approximately 360 g/cm width in the warp direction and 180 g/cm width in the weft direction.
A-2 CONDITIONING

Condition the test specimens for the stipulated time, in the standard atmosphere (65 ± 2 percent relative humidity and temperature of 27 ± 2°C).

NOTE — Guidance on conditioning is available in IS 6359 : 1971.

A-3 RESISTANCE TO HIGH TEMPERATURE

A-3.1 The number of test specimens shall be one for each tautening dope included in the doping scheme in addition to the one for complete doping scheme.

A-3.2 Procedure

Apply tautening dope uniformly on each of the test specimens held on individual test frames (see B-1.1) to impart the coating mass of 120 ± 15 g/m² when measured after drying to constant tautening with both the fabric surfaces freely exposed to air.

A-3.2.1 Apply the complete doping scheme (see Table 3) to the test specimen meant for it.

A-3.2.2 Cut a strip 15 × 2.5 cm Min in the warp direction from each of the doped test specimens and heat it for 4 days (96 hours, Min) at a temperature of 95°C Min, cool to room temperature and bend it along weft around a mandrel moving the strip through minimum of 15 cm over it during bending operation. The diameter of the mandrel shall be 3.2 mm in the case of black finish and 1.6 mm in other cases.

A-3.3 There shall be no sign of cracking of the dope film(s).

Table 3 Doping Specifications

( Clause A-3.2.1 )

<table>
<thead>
<tr>
<th>Description of Components</th>
<th>Low (1)</th>
<th>Medium (2)</th>
<th>High (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>g/m²</td>
<td>Normal number of coats</td>
<td>g/m²</td>
<td>Normal number of coats</td>
</tr>
<tr>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
</tbody>
</table>

For all finishes other than aluminium

Red oxide tautening dope 68·0 ± 13·5 3 or 4 34·0 ± 7·0 2 34·0 ± 7·0 1 or 2

Aluminium non-tautening finish 34·0 ± 7·0 2 34·0 ± 7·0 2 34·0 ± 7·0 1 or 2

Aluminium tautening dope

Pigmented non-tautening finish (Note 1)

Transparent non-tautening finish (Note 2)

For an aluminium finish

Red oxide tautening dope

Transparent tautening dope 68·0 ± 13·5 3 or 4 34·0 ± 7·0 2 34·0 ± 7·0 1 or 2

Aluminium non-tautening finish

Aluminium tautening dope

Pigmented non-tautening finish (Note 1)

Transparent non-tautening finish (Note 2)

Notes

1. For colour and finish matching purposes only, a mass addition of not more than 68 g/m² shall be permitted for yellow, white and sky blue finishes.

2. Only when a glossy finish is required.
A-4 RESISTANCE TO NATURAL WEATHERING

A-4.1 There shall be only one specimen for this test, protected at the back of the frame with a covering of waterproof material.

A-4.2 Procedure

A-4.2.1 Freely expose the frame to maximum sunlight in the open for 6 months including at least 2 months from the period of May to August.

A-4.2.2 During exposure period, examine the frame at least once a day for adhesion of dope, cracks, etc, and its behaviour in dry and wet weather. Also examine tautness once a week.

A-4.2.3 After exposure for 6 months, cut from the fabric in the warp direction, 6 test specimen 2.5 cm wide and sufficient long to allow 20 cm between the jaws of a suitable tensile testing machine, condition them for 24 hours in standard atmosphere and then determine the tensile strength. Also determine, by the same method and under the same atmospheric conditions, the tensile strength of a piece of untreated fabric cut from the same length of fabric which was held on frame.

A-4.3 There shall be no cracking, clipping, flaking or blistering of the film, slight chalking be disregarded. The change in colour shall not be too apparent and the underlying coats shall not be visible through final finishing colour. The breaking strength and tautness shall not be impaired.

A-5 TAUTNESS PROPERTIES

A-5.1 The number of test specimens shall be one each for the tautening dopes included in the doping scheme.

A-5.2 Procedure

A-5.2.1 Apply each tautening dope uniformly to the individual test specimen held on the frame to impart it a coating mass of 120 ± 15 g/m² measured after drying to constant tautness, both the surfaces of the fabric freely exposed to air.

A-5.2.2 Measure tautness by any approved method, however, in case of dispute the following reference method shall be used:

After conditioning the test specimen in the standard atmosphere for 2 hours, minimum, fit the frame with an air-tight back in a conditioned room. Connect it, through the holes at its side, to a suitable manometer and a water pump, adjusted to reduce the air pressure inside the frame by 5 cm H₂O, including a large air reservoir to smooth out variations in the pressure. Measure the resulting depression (d) at the centre of the circle of unsupported fabric, using any instrument accurate to read in 0.025 mm units and that does not impose a load exceeding 5 g on the area of unsupported fabric.

The tautness (T) in the doped fabric is given by the equation:

\[ T = \frac{2}{d} \text{ kgf/cm}^2 \]

where d is depression read in millimetres.

A-5.2.3 Determine the mass of added dope by the following method:

Cut minimum area of 250 cm² from the circle of unsupported doped fabric. Weigh it, remove the dope by suitable solvents and weigh it again. Record the difference in mass (A). Cut a piece of undoped fabric of the same area from the same length as was used to cover the test frame. Weigh it, apply the same solvent treatment as before under the same atmospheric conditions and weigh it again. Record the difference in mass (B); apply (B) as a correction to (A) and calculate the mass in g/m² of the dope.

A-5.3 The tautness acquired by the mercerized fabric shall be 0’002 to 0’003 kgf/cm² per g/m² of the dope in case of low doping and 0’003 to 0’004 kgf/cm² per g/m² of the dope for medium and high doping.

A-6 FREEDOM FROM FILM DEFECTS

A-6.1 Testing Atmosphere

The test shall be conducted at

a) Relative humidity of 65-70 percent,
b) Temperature of 25-29°C, and
c) Air speed of a 1 m/s.

A-6.2 Procedure

A-6.2.1 Condition the test frames, samples of the dopes and finishes to be tested, and the brushes to be used for application in the testing atmosphere in A-6.1 for 2 hours, Min.

A-6.2.2 Dope the fabric with the materials as follows:

a) Apply by brush application, one full coat of each tautening dope included in the doping scheme to an individual test piece.

b) When testing non-tautening finishes, apply one full coat of the finish, thinning wherever appropriate, to a test piece previously tautened with the doping scheme in accordance with Table 3.

A-6.2.3 Allow to dry under the test conditions and then examine visually.

A-6.3 The dopes shall be free from blushing, wrinkling, gubbling, etc.
A-7 KEEPING QUALITIES

A-7.1 The doped mercerized fabric stored in the original sealed condition shall retain its original properties for a minimum of 6 months in tropical climate and minimum of 12 months in temperate climate.

ANNEX B

(Clause 5.1)

INSPECTION AND TAGGING OF DEFECTS

B-1 INSPECTION

B-1.1 Each cut shall be inspected under transmitted light for defects by passing the fabric, metre by metre, over 'light rails' or an artificial light table.

B-2 CATEGORIES OF DEFECTS

B-2.1 Major Defects

The following shall constitute major defects:

a) Bad floats of more than one end or more than one picks,
b) Bad slubs (warp or weft),
c) Weft snarls,
d) Thin places (due to starting or stopping the loom or rip cuts),
e) Broken ends or picks,
f) Torn or wavy selvedges,
g) Holes,
h) Spots of oil, and
j) Such other defects as are obviously detrimental to strength, durability or use of the fabric.

NOTE — Such of the above defects as are obviously not detrimental to strength, durability or use of the fabric, shall be considered as minor defects.

B-2.2 Minor Defects

The following shall constitute as minor defects:

a) Neps,
b) Small slubs,
c) Small snarls,
d) Loose ends,
e) Single end cut, and
f) Such other defects as are obviously not detrimental to strength, durability or use of the fabric.

B-3 TAGGING

B-3.1 All major defects shall be tagged by sewing red thread in the selvedge opposite the defects.

B-3.2 All minor defects shall be tagged by sewing blue thread in the selvedge opposite the defects.

B-3.3 All tags shall be affixed only on one side of the roll.
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