BRITISH STANDARD AEROSPACE SERIES

BS 2X 26:2001
Superseding
BS X 26:1966

Doping and finishing schemes for fabric covered aircraft

ICS: 49.040

Committees responsible for this British Standard

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British Coatings Federation Ltd.
Ministry of Defence
Oil & Colour Chemists' Association
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Foreword

This British Standard is one of a series for paints and varnishes for aerospace purposes. It specifies the requirements for painting and doping schemes for aerospace purposes. It is a revision of BS X 26:1966 which is superseded and withdrawn. During its preparation the layout has been aligned with other BS X series standards and references have been revised.

It has been assumed in the drafting of this specification that the execution of its provisions is entrusted to appropriately qualified and experienced people.

The Quality Assurance Authority and Approving Authority referred to in this Specification are as stated in the contract or order, or the accredited representative of the authority stated, as instructed by the purchaser.

WARNING. This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the designer, producer, supplier or user from statutory obligations relating to health and safety at any stage of manufacture or use.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

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1 Scope

This British Standard specifies the requirements for doping schemes of low, medium and high tautness, together with matt and glossy finishes, for aerospace purposes.

These schemes provide methods of producing and maintaining on aircraft fabrics taut, water-proof and air-proof surfaces and also provides methods of protecting the fabrics from the deteriorative effects of light, weather and normal service conditions.

Annex F gives details of requirements for type approval.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 318 C, *Specification for colours for identification, coding and special purposes.*

BS 2015, *Glossary of paint and related terms.*

BS 3900, *Methods of test for paints.*

BS 3900: Group A, *Tests on liquid paints (excluding chemical tests).*

BS 3900-A1, *Sampling.*

BS 3900-A2, *Examination and preparation of samples for testing.*

BS 3900: Group B, *Test involving chemical examination of liquid paints and dried paint films.*

BS 3900-B18, *Determination of non-volatile matter of paints, varnishes and binders for paints and varnishes.*

BS 3900: Group D, *Optical tests on paint films.*

BS 3900-D1, *Visual comparison of the colour of paints.*

BS 3900-D5, *Measurement of the specular gloss of non-metallic paint films at 20°, 60° and 85°.*

BS 3900: Group F, *Durability tests on paint films.*

BS 3900-F6, *Notes for guidance on the conduct of natural weathering test.*

BS 9F 1, *Specification for 140g/m² linen (flax) fabric and serrated edge strip for aerospace purposes.*

BS L 163, *Specification for sheet and strip of aluminium coated aluminium-copper-magnesium-silicon-manganese alloy (solution treated, cold-worked for flattening and aged at room temperature).*

BS EN 23270, *Specification for temperatures and humidities for conditioning and testing paints, varnishes and their raw materials.*

BS EN ISO 1514, *Paints and varnishes. Standard panels for testing.*

BS EN ISO 1519, *Paints and varnishes. Bend test (cylindrical mandrel).*

ASTM D 3960, *Standard practice for determining volatile organic compound (VOC) content of paints and related coatings.*

Def. Stan 80-38[1)], *Thinners for paint epoxy two pack, cellulose nitrate paints, dopes, and lacquers.*

Def. Stan. 80-180[1)], *Cellulose nitrate for lacquers (Propan-2-ol damped).*

3 Definitions

For the purposes of this British Standard the definitions given in BS 2015 apply.

[1)] Obtainable from: Ministry of Defence, Directorate of Standardization, Kentigern House, 65 Brown Street, Glasgow G2 8EX.

4 Materials

4.1 Description

The complete scheme shall be of low, medium or high tautness with a matt or glossy finish, as specified. It shall consist of the dopes and finishes specified in Table 1, applied in the order listed and to the weight additions specified.

4.2 Composition of the dope and finish schemes

The materials shall be formulated on cellulose nitrate in accordance with Defence Standard 80-180, and the remaining ingredients shall conform to the requirements of relevant British Standards or Ministry of Defence, Defence Standards, where available.

5 Performance

5.1 General

5.1.1 The test panels shall be prepared and coated as in accordance with Annex A.

5.1.2 All tests shall be carried out in conformance with the temperature and relative humidity specified in BS EN 23270 unless otherwise specified in this standard.

5.2 Tests on dopes and finishes

When tested in accordance with Table 2 or Table 3, the coating shall conform to the requirements specified therein.

6 Inspection

Before despatch a representative sample of each batch of the material, shall be taken in accordance with BS 3900-A1. When tested by the manufacturer in accordance with tests 1, 6 and 8 of Table 2 for dopes, and tests 1, 6, 8 and 9 of Table 3 for non-tautening finishes the batch of material shall conform to the requirements in the appropriate table.

7 Marking

7.1 Each container shall be legibly and durably marked with at least the following:

a) Description of material, relevant designation quoted in Table 1 and a reference to the colour and type of the finish required;

b) number of this British Standard, i.e. BS 2X 26[2)];

c) manufacturer’s name and recognized trade mark;

d) batch number;

e) mixing and thinning instructions;

f) date of manufacture.

7.2 Each component shall be identified for ordering purposes by the number of this British Standard and the full description as specified in Column 1 of Table 1, together with, in the case of dopes, the relevant designation quoted in Table 1 or, in the case of finishes, the colour and gloss required.

[2)] Marking BS 2X 26 : 2001 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is solely the claimant's responsibility. Such a declaration is not to be confused with third party certification of conformity.

Table 1 — General properties

Designation:	No. 751		No. 752		No. 753	
Tautness:	**Low**		**Medium**		**High**	
Description of components	**Dry weight** g/m²	**Normal number of coats**	**Dry weight** g/m²	**Normal number of coats**	**Dry weight** g/m²	**Normal number of coats**
For all finishes other than aluminium						
Red oxide tautening dope	—	—	68.0 ± 13.5	3	25.5 ± 5.0	1
Transparent tautening dope	68.0 ± 13.5	3 or 4	—	—	161.0 ± 32.0	6 or 7
Aluminium non-tautening finish	34.0 ± 7.0	2	—	—	—	—
Aluminium tautening dope	—	—	34.0 ± 7.0.	2	34.0 ± 7.0	2
Pigmented non-tautening[a]	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2
Transparent non-tautening finish[b]	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2
For an aluminium finish						
Red oxide tautening dope	—	—	102.0 ± 20.5	4	25.5 ± 5.0	1
Transparent tautening dope	68.0 ± 13.5	3 or 4	—	—	195.0 ± 39.0	8
Aluminium non-tautening finish	34.0 ± 7.0	2	34.0 ± 7.0	2	34.0 ± 7.0	2
Transparent non-tautening finish[b]	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2	34.0 ± 7.0	1 or 2

[a] For colour and finish matching purposes only, a weight addition of not more than 68 g/m² will be permitted for yellow, white and sky finishes.
[b] Only where a glossy finish is required.

Table 2 — Tests on tautening dopes

	Test	Test panel, preparation and paint system	Conditions	Test method	Requirement	
1	Condition	—	Component in the original or laboratory container	BS 3900-A2	The material shall be free from extraneous matter and shall show no objectionable separation, settling or other defect	
2	VOC	—	When prepared for use	ASTM D3960	≤ reference value[a]	
3	Shelf life	—	After 12 months at (0 to 30) °C. Component in the original container	Table 2 tests 1, 4, 7, and 10	Shall meet the requirements specified	
			After 6 months in a tropical climate as defined in BS 3900-F6			
4	Non-volatile matter	—	Component in the original or laboratory container	BS 3900-B18	Transparent tautening dope	> 9.5 % mass
					Red oxide tautening dope	> 10.0 % mass
					Aluminium tautening dope	> 12.0 % mass
5	Aluminium content	—	Component in the original or laboratory container	e.g. centrifuging or filtration	Aluminium tautening dope	> 2.5 % mass
6	Dry red oxide (Fe_2O_3) pigment content	—	Component in the original or laboratory container	e.g. centrifuging or filtration	Red oxide tautening dope	approximately 0.5 % mass
7	Application	**A.1.2** **A.2.1.2** and **A.2.1.4**	Single coat. Film allowed to dry under a) conditions specified in BS EN 23270 b) (30 ± 2) °C and > 80 % RH, with thinners to Def. Stan. 80-38 used. c) Annex E.	Visual examination, normal corrected vision	The film shall be smooth and continuous and free from blushing or other defects.	

Table 2 — Tests on tautening dopes *(concluded)*

<table>
<tr><th colspan="2">Test</th><th>Test panel, preparation and paint system</th><th>Conditions</th><th>Test method</th><th>Requirement</th></tr>
<tr><td>8</td><td>Colour</td><td>A.1.1, A.2.1.2</td><td>24 hours after application under diffuse daylight</td><td>BS 3900-D1</td><td>Shall match the colour of the appropriate standard in BS 381C, as specified by the purchaser.</td></tr>
<tr><td>9</td><td>Gloss</td><td>A.1.1, A.2.1.2</td><td>24 hours after application using a 60° glossmeter</td><td>BS 3900-D5</td><td>Matt finish
< 5.0 units.</td></tr>
<tr><td>10</td><td>Tautness</td><td>A.1.1, A.2.1.3</td><td>Not ≤ 2 hours after application</td><td>Annex B</td><td>The ratio of tautness to the weight of dope shall be within the limits given below:
<table>
<tr><th>Scheme</th><th colspan="2">Ratio</th></tr>
<tr><th></th><th>Min.</th><th>Max.</th></tr>
<tr><td>No. 751</td><td>1.0</td><td>1.4</td></tr>
<tr><td>No. 752</td><td>1.4</td><td>1.8</td></tr>
<tr><td>No. 753</td><td>1.4</td><td>1.8</td></tr>
</table></td></tr>
<tr><td>11</td><td>Resistance to high temperatures</td><td>A.1.1, A.2.1.2</td><td>After application, allow to dry to constant tautness with both surfaces of fabric freely exposed to the air</td><td>Annex C</td><td>No sign of cracking</td></tr>
<tr><td>12</td><td>Resistance to natural weathering</td><td>A.1.1 without the plywood, A.2.1.2, A.2.3</td><td>24 hours after application of the final coat</td><td>Annex D</td><td>No cracking, chipping, flaking or blistering of the film, nor shall there be more than a slight change in colour and in the case of glossy finish, slight loss of gloss. Slight chalking shall be disregarded. The underlying coats shall not be visible through the final coat and the tautness shall not be materially impaired. The tensile strength shall be not less than the tensile strength of the undoped fabric.</td></tr>
<tr><td colspan="6">[a] The reference value is that which is established during type approval unless otherwise agreed between manufacturer and purchaser.</td></tr>
</table>

Table 3 — Tests on non-tautening finishes

	Test	Test panel, preparation and paint system	Conditions	Test method	Requirement	
1	Condition	—	Component in the original or laboratory container	BS 3900-A2	The material shall be free from extraneous matter and shall show no objectionable separation, settling or other defect	
2	VOC	—	When prepared for use	ASTM D3960	≤ reference value[a]	
3	Shelf life	—	After 12 months at (0 to 30) °C. Component in the original container	Table 3 tests 1, 4, 6 and 9	Shall meet the requirements specified	
			After 6 months in a tropical climate as defined in BS 3900-F6			
4	Non-volatile matter	—	Component in the original or laboratory container	BS 3900-B18	Aluminium non-tautening	> 15.5 % mass
					Transparent non-tautening	> 16.0 % mass
5	Aluminium content	—	Component in the original or laboratory container	e.g. centrifuging or filtration	Aluminium non-tautening finish	> 2.5 % mass
6	Application	**A.1.1**, **A.2.2.2**	Single coat. Film allowed to dry under: a) conditions specified in BS EN 23270. b) (30 ± 2) °C and > 80 % RH, with thinners to Def. Stan. 80-38 used. c) Annex E	Visual examination, normal corrected vision	The film shall be smooth and continuous and free from blushing, wrinkling, bubbling or other defects.	
7	Colour	**A.1.2**, **A.2.2.2**	24 hours after application, under diffuse daylight	BS 3900-D1	The colour shall match the appropriate standard in BS 381C, as specified by the purchaser.	
8	Gloss	**A.1.2**, **A.2.2.2**	24 hours after application using 60° glossmeter	BS 3900-D5	Matt finish ≤ 5.0 units.	
9	Tautness retention on application of non-tautening finishes	**A.1.1**, **A.2.2.3**	24 hours after application	Annex B	The non-tautening finish shall not reduce the tautness of the system by more than 20 % compared with tautness values determined before application.	

Table 3 — Tests on non-tautening finishes *(concluded)*

	Test	Test panel, preparation and paint system	Conditions	Test method	Requirement
10	Resistance to high temperatures	**A.1.1**, **A.2.2.3**	After application, allow to dry to constant tautness with both surfaces of fabric freely exposed to the air.	Annex C	No sign of cracking
11	Resistance to natural weathering	**A.1.1** without plywood, **A.2.2.3**, **A.2.3**	24 hours after application of the final coat	Annex D	No cracking, chipping, flaking or blistering of the film, nor shall there be more than a slight change in colour and in the case of glossy finish, slight loss of gloss. Slight chalking shall be disregarded. The underlying coats shall not be visible through the final coat and the tautness shall not be materially impaired. The tensile strength shall be not less than the tensile strength of the undoped fabric

[a] The reference value is that which is established during type approval unless otherwise agreed between manufacturer and purchaser.

Annex A (normative)
Preparation of test panels

A.1 Preparation of substrates

A.1.1 *Test frame*

Where specified, a strong rectangular wooden frame shall be used reinforced with metal to prevent warping, measuring (250 × 250) mm internally, with two holes 4.8 mm in diameter bored through one of the sides, and having a piece of 12.7 mm 5-ply wood, with a central hole 250 mm in diameter, screwed to one face (see Figure F.1) and covered on the plywood face with linen fabric to BS 9F 1 under a tension of approximately 36 gf/mm width in the warp and 18 gf/mm in the weft.

A.1.2 Where specified use test panels made from unabraded aluminium sheet, measuring (150 × 50 × 0.8) mm conforming to BS L 163, which have been solvent degreased in accordance with BS EN ISO 1514.

A.2 Application

A.2.1 *Dopes*

A.2.1.1 The dopes shall be supplied ready for use by brushing and shall be applicable by spraying when diluted with approximately 10 % thinners to Def. Stan. 80-38.

A.2.1.2 Unless otherwise specified apply the dope by spraying it in accordance with Table 1, when thinned as specified in **A.2.1.1**.

A.2.1.3 Uniformly apply each tautening dope that is to be included in the scheme to an individual frame, to give an added film weight of (119 ± 17.0) g/m^2 this quantity being the added weight per square metre, after drying to constant tautness with both surfaces of the fabric freely exposed to the air.

A.2.1.4 Brush apply the dope in accordance with Table 1.

A.2.2 *Non-tautening finishes*

A.2.2.1 The non-tautening finishes shall be applicable by spraying when diluted with approximately 30% of thinners to Def. Stan. 80-38.

A.2.2.2 Unless otherwise specified apply the finish by spraying it in accordance with Table 1 when thinned as specified in **A.2.2.1**.

A.2.2.3 Unless otherwise specified, spray apply the non-tautening finish in the number of coats and to the film weights given in Table 1, over fabric already tautened by the use of tautening dopes, applied as specified in **A.2.1.2**.

A.2.3 Protect the back of the frame with water-proof material.

Annex B (normative)
Method for the determination of tautness properties

B.1 Measure the tautness by any approved method. In case of a dispute use the following method:

B.2 After conditioning, fit the frame, still in the conditioned atmosphere, with an airtight back and connect it through the holes in its side with a sensitive and accurate manometer and any device, such as a water pump, adjusted to reduce the air pressure inside the frame by an amount equivalent to 51 mm of water, including a large reservoir in the system to smooth out variations in the pressure. Measure the resulting depression (d mm) of the centre of the circle of unsupported fabric, using any instrument accurate to within 0.025 mm that does not impose a load exceeding 5 g on the area of unsupported fabric.

B.3 The tautness (T) in the doped fabric is given by the equation:

$$T = \frac{2}{d} kgf/cm$$

where d is in mm.

B.4 Determine the weight of the added dope by the following method:

Cut a minimum area (23 200 mm^2) from the circle of unsupported dope fabric, weigh it, remove the dope by solvents and weigh it again. Record the difference in weight (*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 weight (*B*). Apply (*B*) as a correction to (*A*) and calculate the weight in grams of dope per square metre of fabric.

Annex C (normative)
Method of test for resistance to high temperatures

Cut from each doped fabric, in the warp direction, a strip of size 25 mm by not less than 150 mm, heat it at a temperature of not less than 95 °C for 96 hours, cool to room temperature and bend it double along the weft threads round a cylindrical bend test mandrel conforming to BS EN ISO 1519, moving the strip through at least 130 mm of its length over the mandrel during the bending operation. Use a 3.0 mm diameter mandrel for black finishes and a 2.0 mm diameter mandrel for all other colours.

Annex D (normative)
Method of test for resistance to natural weathering

D.1 Expose the frame in the open at an angle corresponding to maximum sunlight in the UK, facing south at an angle of 45° (see BS 3900-F6) for a period of 6 months, which shall include at least 2 months from May to August inclusive.

D.2 During the exposure examine the frame at intervals for adhesion of the dope, cracks, etc., and note the general behaviour in wet and dry weather. Also make comparative tautness tests (Annex B) at intervals in both wet and dry weather.

D.3 After exposure for 6 months, cut from the fabric, in the warp direction, six specimens 25 mm wide and sufficiently long to allow 178 mm between the jaws of a testing machine, condition them (see **5.1.2**) for 18 hours and then determine the tensile strengths. 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 as was used to cover the frame.

Annex E (normative)
Method of test for freedom from film defects

E.1 Test conditions

Temperature (18 to 21) °C; Relative humidity: (65 to 70) %; Air speed of approximately 1m/sec.

E.2 Store test frames, samples of the dopes and finishes to be tested and the brushes to be used for application under the above test conditions for not less than 2 hours. Then apply the coating as specified. Allow the coating to dry under the above test conditions and examine visually.

Annex F (normative)
Type approval

F.1 When the manufacturer is required to prove conformance to this British Standard, the following shall be provided:

a) test evidence that the material conforms to the requirements of this British Standard;

b) wet sample of the material;

c) declaration of composition including the percentage and nature of all ingredients;

d) reference values if required, e.g. VOC content.

F.2 After type approval has been granted, there shall be no change in the product formulation unless this is approved by the approving authority.

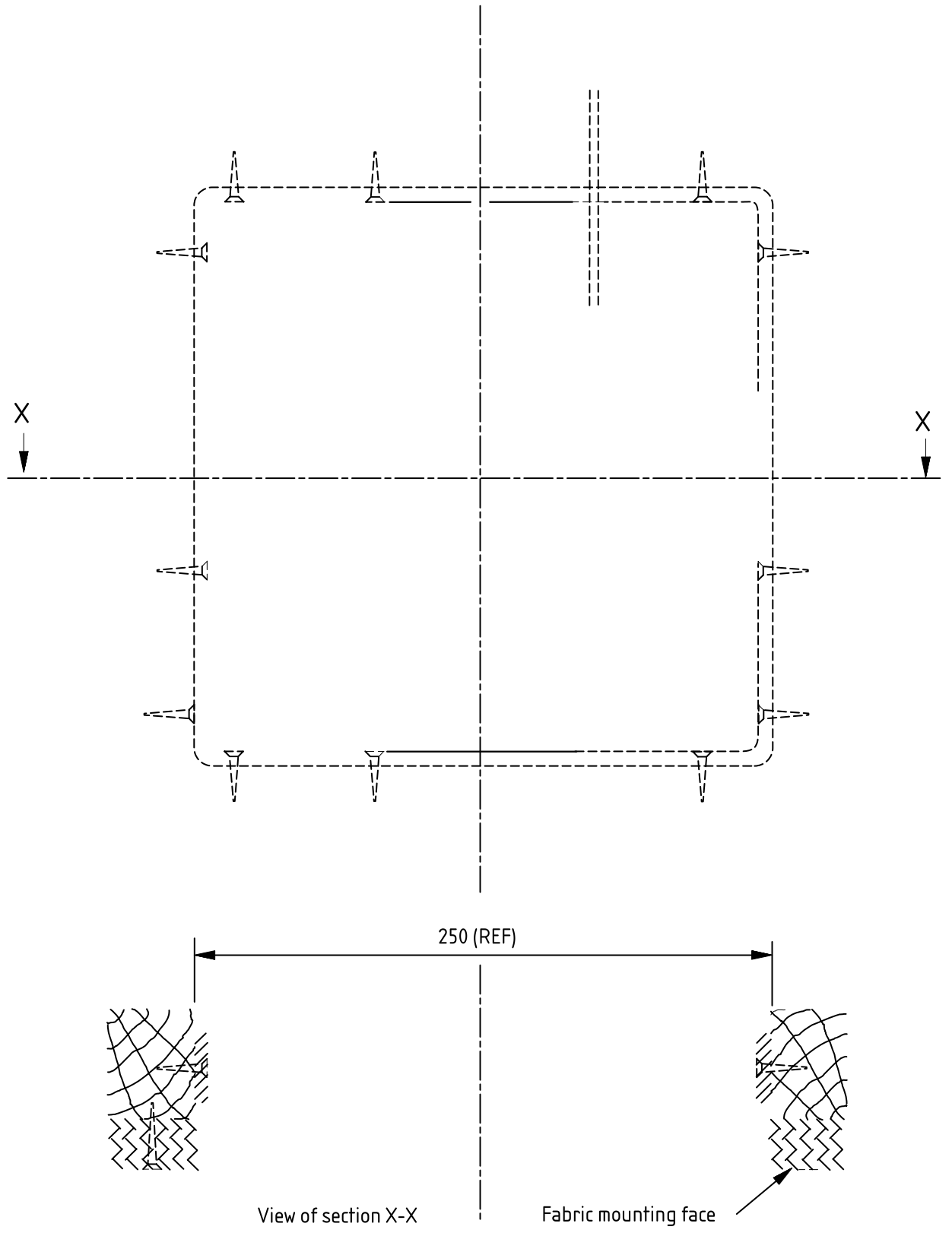

Figure F.1 — Test frame for doped fabric

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