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(Superseding Ministry of Aviation Specification D.T.D. 772A)

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BRITISH STANDARD SPECIFICATION FOR HIGH GLOSS FINISHING SCHEME FOR AERONAUTICAL PURPOSES

FOREWORD

This British Standard, one of a series for painting and doping schemes suitable for aeronautical purposes, supersedes Ministry of Aviation Specification D.T.D. 772A. During the transfer the filler coat has been changed from an optional to a mandatory requirement and provision is now made for the scheme to be identified by a code reference.

The values of metric equivalents for the dry weights given in Table 1 and Appendix B3 are of the same order of accuracy as the values in British units to which they correspond. Elsewhere in this standard, the metric equivalents that have been given are approximate only and the values in British units, or only in metric units, are to be regarded as the standard; more accurate conversions should be based on the data in B.S.350, 'Conversion factors and tables'.

This standard makes reference to the following specifications:

British Standards:

British Standard X:27	Cellulose finishing scheme for aeronautical purposes.
British Standard X:28	Matt synthetic finishing scheme for aeronautical purposes.
B.S.381C	Colours for specific purposes.
B.S.580	Trichloroethylene.
B.S.805	Toluenes.
B.S.872	Abrasive papers and cloths (technical products).
B.S.1449	Steel plate, sheet and strip.
B.S.1470	Wrought aluminium and aluminium alloys for general engineering purposes. Sheet and strip.
B.S.3900	Method of test for paints:
	Part A3. Preparation of panels prior to painting.
	Part D1. Colour comparison.
	Part E1. Bend test.
	Part E2. Scratch resistance test.
	Part G1. Resistance to organic liquids.
	Part G2. Resistance to aqueous liquids.

Ministry of Aviation Specification:

D.T.D. 827. Glossy synthetic pigmented enamel and primers.

Defence Specifications:

DEF.1216. Thinners for cellulose nitrate paints and dopes.
DEF.1408. Paint, pretreatment primer (etching primer).
DEF.1432. Cellulose nitrate for lacquers.

NOTE: The latest editions of these specifications should be used.

Price 5/- net.

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SPECIFICATION

SCOPE

1. This British Standard specifies the requirements for a high gloss finishing scheme suitable for application to metallic materials used for aeronautical purposes.

DESCRIPTION

2. The scheme shall consist of the materials listed in Table 1, which shall be suitable for application to metal in the order stated to give, when dry, the weight additions indicated, with or without flattening of the filler and/or polishing of the finish.

TABLE 1

Material	Dry weight	
	oz/sq yd	g/m ²
a. Primer:		
(i) Pigmented synthetic resin (p.s.r.) primer	1.1 ± 0.2	37.0 ± 7.0
OR		
(ii) Etching (wash) primer	0.4 ± 0.1	13.5 ± 3.5
b. Filler:		
(i) Pigmented cellulose nitrate	1.75 ± 0.25	59.5 ± 8.5
OR		
(ii) Synthetic resin vehicle	2.0 ± 0.25	68.0 ± 8.5
c. Finish	1.25 ± 0.25	42.5 ± 8.5

MATERIALS AND PROCESSES

3. a. Primer.*

- (i) The type of primer required shall be specified in the contract or order.
- (ii) The primer shall be suitable for direct application to metal, pre-treated where appropriate.
- (iii) The p.s.r. primer shall be suitable for use by spraying when diluted with approximately 10 per cent of thinners. Where this primer is required for use by dipping and/or stoving this shall be specified in the contract or order.
- (iv) The etching primer shall consist of a pigmented base and an accelerator. These, when mixed together in a simple proportion by volume as stated in the manufacturer's instructions, shall produce a material suitable for spray application. Where thinners are required, the amount to be added to the mixture of base and accelerator

shall not exceed 10 per cent by volume and only thinners as in *e* (ii) below or other approved cellulose thinners shall be used.

The mixture shall remain usable for up to 8 hours at a temperature of 18–21°C (65–70°F), or 4 hours at a temperature of 32–35°C (90–95°F), after which time it shall be discarded.

When supplied for British Service use, the etching primer shall comply with Defence Specification DEF-1408.

b. Filler.

- (i) The type of filler required shall be specified in the contract or order.
- (ii) The filler shall be suitable for application over the primer and shall be suitable for use by spraying when diluted with approximately 30 per cent of thinners.

c. Finish.

- (i) The finish shall be a glossy pigmented cellulose nitrate and synthetic resin vehicle suitable for application over the primer alone or over the primer plus the filler and shall be suitable for use by spraying when diluted with approximately 30 per cent of thinners.
- (ii) It shall be capable of being polished to give a highly glossy surface without detriment to the life of the scheme or to the protection it affords to the metal.

d. Polishing.

- (i) This shall normally be a two-stage process—an abrasive cutting compound followed by a fine finishing compound. Both compounds shall be free from wax and suitable for use in the operation referred to in *c* (ii) above.
- (ii) An inspection schedule for the control of the quality of the polishes shall be agreed between the manufacturer and the Inspecting Authority.

e. Thinners. When supplied for British Service use, the thinners for the materials shall comply with the following specifications:

- (i) p.s.r. primer: Ministry of Aviation Specification D.T.D. 840.
- (ii) etching primer: Defence Specification DEF-1216.
- (iii) cellulose nitrate filler: Defence Specification DEF-1216.
- (iv) synthetic filler: Ministry of Aviation Specification D.T.D. 840.
- (v) finish: Defence Specification DEF-1216.

INGREDIENTS

4. **a.** The cellulose nitrate used shall be to Defence Specification DEF-1432 and the remaining ingredients shall comply with the requirements of relevant B.S., DEF or D.T.D. specifications where available.

b. Solvents, such as chlorinated compounds, or other substances which may cause injury or discomfort to operators, during or after application, shall not be used.

* In the U.K., the primers supplied to this specification shall be suitable for use with the finishes supplied by the same manufacturer to British Standards X.27 and X.28 and Ministry of Aviation Specification D.T.D. 827.

COLOUR AND FINISH

5. *a.* The colour required shall be specified in the contract or order.

b. The colour of the primer shall be different from that of the filler or the finish, and the filler shall be a different shade from the finish.

c. The dry film, resulting from the application of one priming coat, one filler coat and one or two finishing coats (unpolished) to a clean smooth metal panel, to the limits of weight given in Table 1, shall match the appropriate standard colour in B.S. 381C, using the method described in B.S. 3900, Part D1, and the standard for finish*.

FREEDOM FROM FILM DEFECTS

6. *a.* The cellulose nitrate filler and the finish shall be capable of being sprayed (when thinned as in Clause 3*b* and *c* above) without showing signs of blushing or other defect:

(i) under normal atmospheric conditions

and (ii) under adverse conditions of high temperature and high humidity, when diluted with thinners to Defence Specification DEF-1216.

b. When tested as described in Appendix B, the cellulose nitrate filler and the finish shall be free from blushing.

RATE OF DRYING

7. *a. Primer.* When tested as described in Appendix C, the priming coat shall become sufficiently dry, for the application of the filler and there shall be no blistering, wrinkling or lifting of the primer on overcoating with the filler or the finish.

When a stoving primer is required, the time and temperature shall be as specified by the manufacturer, except that the temperature shall not exceed 125°C (257°F) and the stoving time shall be not longer than 1 hour per coat.

b. Filler.

(i) When tested as described in Appendix C, the filler coat shall become dry in not more than 4 hours and no cracking, bubbling or other defects shall occur.

(ii) When tested as described in Appendix D, the filler coat shall be capable of being rubbed smooth without clogging the paper.

c. Finish. When tested as described in Appendix C, the finishing coat shall become dry in not more than 2 hours and no wrinkling, bubbling or other defects shall occur.

TOUGHNESS, HARDNESS AND ADHESION

8. *a. Bend test.* When tested as described in Appendix E, a film of the scheme shall withstand being bent double at 0°C (32°F) round a mandrel of $\frac{5}{16}$ in (8.0 mm) diameter without becoming detached or damaged.

* Details of the standard for finish are obtainable from the Director of Chemical Inspection, Ministry of Defence (Army Department), Building E.135/17, Royal Arsenal, Woolwich, London, S.E.18.

b. Scratch test. The resistance to scratching of a film of the scheme shall be such that, when tested as described in Appendix E, the metal shall not be visible and the scratch shall be free from jagged edges of overall width greater than 1 mm.

RESISTANCE TO SYNTHETIC SEA-WATER

9. The resistance to synthetic sea-water of a film of the scheme shall be such that, when tested as described in Appendix F, there shall be no flaking, change of colour or blistering and no corrosion shall occur.

RESISTANCE TO ORGANIC SOLVENTS

10. The resistance to organic solvents of a film of the scheme shall be such that, when tested as described in Appendix G, there shall be no permanent change in the original condition or appearance of the film and it shall not become detached or damaged.

RESISTANCE TO NATURAL WEATHERING
(TYPE TEST)

11. The resistance to natural weathering of a film of the scheme shall be such that, when tested as described in Appendix H:

a. There shall be no cracking, chipping, flaking or blistering of the film.

b. Retention of colour and gloss shall be to the satisfaction of the Inspecting Authority. (Slight chalking shall be disregarded.)

c. Neither the filler coat nor the priming coat shall be visible and the metal shall be free from corrosion. (Corrosion within $\frac{1}{4}$ in (6.4 mm) of the edge of the test piece may be ignored.)

KEEPING QUALITIES

12. The keeping qualities shall be such that the materials, when stored in their original sealed containers, shall retain the properties detailed in this specification for not less than 12 months in temperate climates or 6 months in tropical climates after the date of despatch.

APPROVAL

13. *a.* Before any material is accepted as complying with the requirements of this specification, the manufacturer shall submit an application for approval† accompanied by:

(i) Evidence that the materials comply with all the requirements other than that for keeping qualities (Clause 12).

(ii) Wet samples, including thinners, of all materials for which approval is sought.

(iii) Declaration of composition including percentage and nature of all ingredients, together with specification references where applicable.

† In the U.K., such approval will be known as 'Type approval' and the Approving and Inspecting Authority will be the Director of Chemical Inspection, Ministry of Defence (Army Department), Building E.135/17, Royal Arsenal, Woolwich, London, S.E.18.

- (iv) Two 9 in × 6 in (23 cm × 15 cm) sprayed panels, prepared and backed in accordance with Appendix H, in respect of each finishing colour for which approval is sought, and marked on the reverse with the description and film weight of each applied coat.
- (v) Two 6 in × 4 in (15 cm × 10 cm) panels, prepared in accordance with Appendix C, and stepped to show each coat, in respect of each finishing colour for which approval is sought, for reference purposes.

b. Provisional approval may be granted on the basis of short term tests before natural weathering tests can be completed. Such provisional approval shall be issued only in special circumstances and after consideration of evidence supplied by the applicant of durability of materials of the same or similar formulation, definition of the type of medium and the names of the manufacturers of any proprietary resins used, in addition to the details supplied in *a* above.

c. Approval shall be obtained in respect of each component and each finishing colour.

d. After provisional or formal approval has been given, no change in the formulation shall be permitted unless approval of the change has been sought and given.

ROUTINE INSPECTION

14. *a.* A representative sample of each batch of each of the components of the scheme shall be tested by the Inspecting Authority* and proved to comply with all requirements other than those for resistance to natural weathering (Clause 11) and for keeping qualities (Clause 12).

b. The manufacturer may be required, by the Inspecting Authority, to test to the requirements of Clause 11 at any time.

IDENTIFICATION

15. *a. Design purposes.* The scheme shall be identified for design purposes by the number of this British Standard, together with a reference to the type of primer, the type of filler and the colour of the finish.

For example, a scheme with p.s.r. primer, synthetic filler and a sky finish shall be identified as 'B.S. X.29/p.s.r./synthetic filler/sky'.

b. Ordering purposes. Each component shall be identified for ordering purposes by the number of this British Standard and the full description as given in Table 1, together with the colour of the finish required.

APPENDIX A

GENERAL TEST CONDITIONS

A1. Preparation of test pieces

a. Tests on p.s.r. primer. Prepare the panels by the appropriate method described in B.S. 3900, Part A3, as follows:

* In the case of those manufacturers in the U.K. who are Ministry of Aviation or Ministry of Defence (Army Department) 'Inspection Approved' firms, the tests may be carried out by the firms' chief inspectors.

(i) Aluminium panels: as for acid chromate pickled aluminium panels.

(ii) Steel panels: as for burnished steel panels.

b. Tests on etching primer. Clean the panel with either trichloroethylene to B.S. 580, Type 2 (vapour or liquid) or pure toluene to B.S. 805 used at room temperature. Do not otherwise pretreat the panel before the application of the etching primer.

A2. Coating and drying

a. Unless otherwise specified, apply the appropriate coat by spraying, to give, when dry, the film weight specified in Table 1, and then allow the panel to dry, for the specified time, at a temperature of 18–21°C (65–70°F).

b. When testing an etching primer, control the humidity at 60 to 70 per cent during the drying period.

c. When testing a stoving primer, stove for the time and at the temperature specified by the manufacturer (see Clause 7a).

APPENDIX B

METHOD FOR THE DETERMINATION OF FREEDOM FROM BLUSHING

B1. Test piece. Smooth (i.e. unabraded), hard aluminium panel to B.S. 1470, Grade S1C-H, 0.028 (0.7 mm) thick (22 SWG), prepared in accordance with Appendix A1.

B2. Test conditions

- a.* Relative humidity: 65–70 per cent
b. Temperature: 18–21°C (65–70°F)
c. Air speed: approximately 3 ft (1 m) per second.

B3. Test procedure

a. Store samples of the filler and finish, the brushes to be used during the test and the aluminium panel, previously coated with the primer and allowed to dry for the following times in accordance with Appendix A2, under the test conditions for not less than 2 hours:

etching primer	1 hour
p.s.r. primer	4 hours
stoving primer	1 hour after completion of stoving.

b. Apply, by brush, to the primer on the aluminium panel, one full coat of the material to be tested to give, when dry, a weight addition of 0.7–1.0 oz/yd² (24.0–34.0 g/m²), allow to dry under the test conditions and then examine visually.

APPENDIX C

METHOD FOR THE DETERMINATION OF RATE OF DRYING

C1. Test pieces. Smooth (i.e. unabraded), hard aluminium panels to B.S. 1470, Grade S1C-H, 0.028 in (0.7 mm) thick (22 SWG), prepared in accordance with Appendix A1.

C2. Test procedure

a. Primer

(i) Apply one coat of primer, allow to dry for the following times, apply one coat of filler over the primer and allow to dry overnight, all in accordance with Appendix A2:

etching primer 1 hour
 p.s.r. primer 4 hours
 stoving primer 1 hour after completion of stoving.

(ii) Examine the panel visually.

b. Filler. Apply one coat of primer, allow to dry as in *a* (i) above, apply one coat of filler over the primer, allow to dry for 4 hours, all in accordance with Appendix A2, then test immediately as in *d* below.

c. Finish. Apply one coat of primer, allow to dry as in *a* (i) above, apply one coat of filler over the primer, allow to dry overnight, apply one coat of finish over the filler and allow to dry for 2 hours, all in accordance with Appendix A2. Then test immediately as in *d* below.

d. Test for dryness. Place the test piece in one pan of a pair of scales. After balancing the scales, place a weight of 5 lb (2.3 kg) in the other pan and balance the scale again for 20 seconds by pressing the thumb on the film. No sign of tackiness to the thumb shall be apparent and any impression produced shall be capable of being wiped away with dry cotton wool without damaging the film or shall disappear on standing for one minute.

APPENDIX D

METHOD FOR THE DETERMINATION OF RUBBING PROPERTIES OF THE FILLER

D1. Test piece. Smooth (i.e. unabraded), hard aluminium panel to B.S. 1470, S1C-H, 0.028 in (0.7 mm) thick (22 SWG), not less than 1 sq ft (0.1 m²) in area, prepared in accordance with Appendix A1.

D2. Test procedure

a. Apply one coat of primer, allow to dry for the following times, apply one coat of filler over the primer and allow to dry for 4 hours, all in accordance with Appendix A2:

etching primer 1 hour
 p.s.r. primer 4 hours
 stoving primer 1 hour after completion of stoving.

b. Rub the test piece with silicon carbide paper Grade A320, to B.S. 872, wet with water.

APPENDIX E

METHOD FOR THE DETERMINATION OF TOUGHNESS, HARDNESS AND ADHESION

E1. Coating and drying of test piece. Coat and dry the test piece, in accordance with Appendix A2, as follows:

a Apply one coat of primer and allow to dry for the following times:

etching primer 1 hour
 p.s.r. primer 4 hours
 stoving primer 1 hour after completion of stoving

b. Apply one coat of filler over the primer and allow to dry overnight.

c. Apply one coat of finish over the filler and allow to dry for 24 hours.

E2. Bend test. Using a soft aluminium panel to B.S. 1470, Grade S1C-0, 0.0124 in (0.3 mm) thick (30 SWG), prepared in accordance with Appendix A1 and coated in accordance with Paragraph E1 above, carry out the bend test at 0°C (32°F) round a mandrel of 5/16 in (8.0 mm) diameter, as described in B.S. 3900, Part E1, using a Type 1 apparatus.

E3. Scratch test. Using a hard aluminium panel to B.S. 1470, Grade S1C-H, 0.028 in (0.7 mm) thick (22 SWG), prepared in accordance with Appendix A1 and coated in accordance with Paragraph E1 above, carry out the scratch test under a load of 1500 grammes, as described in B.S. 3900, Part E2.

APPENDIX F

METHOD FOR THE DETERMINATION OF RESISTANCE TO SYNTHETIC SEA-WATER

F1. General. Carry out the test as described in B.S. 3900, Part G2, subject to the following special conditions.

F2. Preparation of test piece. When testing an etching primer, clean the test piece in accordance with Appendix A1b.

F3. Coating and drying of test piece. Coat and dry the test piece, in accordance with Appendix A2, as follows:

a. Apply one coat of primer and allow to dry for the following times:

etching primer 1 hour
 p.s.r. primer 4 hours
 stoving primer 1 hour after completion of stoving

b. Apply one coat of filler over the primer and allow to dry overnight.

c. Apply one coat of finish over the filler and allow to dry for 24 hours.

F4. Test procedure. Partially immerse the test piece continuously for 168 hours in the following solution:

Sodium chloride	NaCl	26.5 g
Magnesium chloride	Mg Cl ₂	2.4 g
Magnesium sulphate	Mg SO ₄	3.3 g
Calcium chloride	Ca Cl ₂	1.1 g
Potassium chloride	KCl	0.73 g
Sodium hydrogen carbonate	NaHCO ₃	0.20 g
Sodium bromide	Na Br	0.28 g
made up to 1000 ml with distilled water.		

NOTE. The above figures refer to the anhydrous salts. Due allowance should be made for hydrates.



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APPENDIX G

METHOD FOR THE DETERMINATION OF RESISTANCE TO ORGANIC SOLVENTS

G1. General. Carry out the test as described in B.S. 3900, Part G1, subject to the following special conditions.

G2. Test piece. Smooth (i.e. unabraded), soft aluminium panel to B.S. 1470, Grade S1C-0, 4 in x 2 in x 0.0124 in thick (30 SWG) (10 cm x 5 cm x 0.3 mm).

G3. Preparation of test piece. When testing an etching primer, clean the test piece in accordance with Appendix A1b.

G4. Coating and drying of test piece. Coat and dry the test piece, in accordance with Appendix A2, as follows:

- a. Apply one coat of primer and allow to dry for the following times: etching primer 1 hour, p.s.r. primer 4 hours, stoving primer 1 hour after completion of stoving. b. Apply one coat of filler over the primer and allow to dry overnight. c. Apply one coat of finish over the filler and allow to dry for 24 hours.

G5. Test procedure

- a. Immerse the test piece for 15 minutes in the following solution: 2, 2, 4-trimethylpentane I.P. reference fuel quality: 75 parts by volume, Pure toluene to B.S. 805: 25 parts by volume. b. Remove from the test solution, allow to dry for 30 minutes and examine for appearance and condition. c. Keep the test piece at room temperature for 24 hours and then carry out the bend test at room temperature round a mandrel of 1 in (25.4 mm) diameter, as described in B.S. 3900, Part E1, using a Type 1 apparatus.

APPENDIX H

METHOD FOR THE DETERMINATION OF RESISTANCE TO NATURAL WEATHERING

H1. Test pieces. Two smooth (i.e. unabraded), hard aluminium panels to B.S. 1470, Grade S1C-H, 0.028 in

(0.7 mm) thick (22 SWG), each having an exposed area of at least 35 in² (226 cm²), prepared in accordance with Appendix A1.

H2. Protection of back and edges. Protect the backs of the panels. Round the edges of the panels but do not protect them other than by application of the material under test.

H3. Test solution. As in Appendix F4.

H4. Coating and drying of test pieces. Coat and dry the test pieces, in accordance with Appendix A2, as follows:

- a. Apply one coat of primer and allow to dry for the following times: etching primer 1 hour, p.s.r. primer 4 hours, stoving primer 1 hour after completion of stoving. b. Apply one coat of filler over the primer and allow to dry overnight. c. Apply one coat of finish over the filler and allow to dry for 168 hours. d. Polish one of the panels with the materials described in Clause 3d.

H5. Test procedure

- a. Expose the test pieces for two years in the open, at an angle corresponding to maximum sunlight (in the U.K. facing South at an angle of 45°). During the exposure, spray the test pieces with the test solution three times daily, at intervals of three to four hours, on five days a week, ensuring that the test pieces are thoroughly wetted each time.

At intervals of three months, wash the polished panel with soap and water, rinse with clean water, dry and re-polish it.

- b. Examine visually, then strip half of each panel, using a suitable paint remover, and examine the underlying metal for signs of corrosion.

This British Standard, having been approved by the Aerospace Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council of the Institution on 21st November, 1966.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard: Committee reference ACE/44. Draft for comment D65/7445.