

**Ministry of Defence
Defence Procurement Agency, ADRP2
Abbey Wood
Bristol
BS34 8JH**

OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

Aircraft Material Specification

CELLULOSE FINISHING SCHEME (Ester lubricant resistant)

NOTE 1. This specification is one of a series issued by the Ministry of Aviation, either to meet a limited requirement not covered by any existing British Standard or to serve as a basis for inspection of materials, the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for Standardisation.

NOTE 2. Specification DEF-1053, Standard Methods of Testing Paint, Varnish, Lacquer and related Products is published for the Ministry of Defence by H.M.S.O. and is on sale to the public.

1. Description

(a) The finishing scheme shall consist of:

(i) a primer - which shall be suitable for direct application to metal and which shall be one or other of the following types:

a pigmented synthetic resin vehicle (p.s.r.)
 an etching primer conforming to the requirements described additionally in Clause 1 (d), (h) and (i) below.

(ii) a filler - (where required) which shall be a pigmented nitrocellulose or synthetic resin vehicle suitable for application over the primer.

(iii) a sealer - (where required) which shall be a pigmented nitrocellulose and synthetic (or natural) resin vehicle suitable for application both over the primer alone and over the primer and filler.

(iv) a finish - which shall be a glossy pigmented nitrocellulose and synthetic resin vehicle suitable for application both over the primer alone or over the primer plus the filler, or over the primer plus the filler plus the sealer.

(v) two polishes - one which shall be an abrasive cutting compound and the other a liquid polish, both free from wax, and suitable for use in the operation denoted at (b) below.

The type of primer to be supplied shall be stated on the contract.

(b) The finish shall be capable of being polished to give a highly glossy surface without detriment to the life of the scheme or the protection it affords to the metal. The manufacturer shall agree with the Director of Chemical Inspection an inspection schedule for the control of the quality of the polishes described at (a) (v) above.

(c) The plasticiser shall be an approved plasticiser, and the remaining ingredients shall comply with the requirements of relevant B.S. or D.T.D. Specifications where available.

(d) The materials shall be suitable for application to metal in the following order to give when dry, the weight additions indicated, with or without flattening of the filler;

<i>Primer</i>	...	...	...	etching, not less than 0.4 oz nor more than 0.6 oz per sq yd. p.s.r. not less than 1.0 oz nor more than 1.25 oz per sq yd.
<i>Filler</i>	...	...	...	nitrocellulose, not less than 1.5 oz nor more than 2.0 oz per sq yd. synthetic, not less than 1.75 oz nor more than 2.25 oz per sq yd.
<i>Sealer</i>	...	...	...	not less than 1.0 oz nor more than 1.5 oz per sq yd.
<i>Finish</i> (one or two coats)				not less than 1.0 oz nor more than 1.5 oz per sq yd.

(e) The materials other than the etching primer shall be suitable for use by spraying when diluted with approximately 10 per cent of the appropriate thinners of the p.s.r. primer and between 15 and 20 per cent of the appropriate thinners for the filler, the sealer and the finish. Where the p.s.r. primer is required for use by dipping *and/or stoving this shall be specified on the contract.*

(f) When supplied for use in the Royal Air Force or the Royal Naval Air Service.

Thinners for the etching primer, the nitrocellulose filler, the sealer and the finish shall comply with the requirements of Specification DEF-1216, Thinners for Paint, Cellulose Nitrate, and Dopes.

Thinners for the p.s.r. primer and the synthetic filler shall comply with the requirements of specification D.T.D. 840.

(g) The nitrocellulose finish shall be capable of being sprayed (when thinned as above) without showing signs of blushing or other defect.

(i) under normal atmospheric conditions and

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

(h) When an etching primer is called for in the contract it shall comply with the following requirements in addition to the requirements stated above:

- (i) the etching primer shall consist of a pigmented Base and an Accelerator. These, when mixed together in equal parts by volume, 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 to Specification DEF-1216 or other approved cellulose thinners shall be used:
- (ii) the mixtures prepared as above shall remain suitable for use for not less than the following periods of time after mixing:
 - 8 hours at a temperature of 18°C (65°F) to 21°C (70°F).
 - 4 hours at a temperature of 32°C (90°F) to 35°C (95°F).
- (iii) test panels shall be prepared by the method described in Appendix I.
- (i) When supplied for use in the Royal Air Force or the Fleet Air Arm, etching primer shall comply with the requirements of Specification DEF-1408.

2. Freedom from objectionable ingredients

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

3. Freedom from blushing

The finish shall be free from blushing when tested by the method described in Appendix II.

4. Rate of drying

(a) Primer - The priming coat shall become sufficiently dry at room temperature for the application of the filler or the finish in not more than the following times.

etching primer	...	...	...	1 hour
p.s.r. primer	...	...	...	4 hours

There shall be no blistering, wrinkling or lifting of the primer on overcoating with the filler, the sealer or the finish when tested by the method described in Appendix III (a).

When a stoving primer is required, the stoving temperature and the time shall be as specified by the manufacturer.

(b) Filler. - The filler coat shall become "hard dry" in not more than four hours when tested by the method described in Appendix III (b) and (e) and no cracking, bubbling or other defects shall occur. It shall be capable of being rubbed smooth without clogging the paper when tested by the method described in Appendix IV.

(c) Sealer. - The sealing coat shall become "hard dry" in not more than two hours when tested by the method described in Appendix III (c) (i) (ii) and (e). There shall be no wrinkling, bubbling or other defects.

(d) Finish. - The finishing coat shall become "hard dry" in not more than two hours when tested by the method described in Appendix III (d) (i) (ii) (iii) and (e) and no wrinkling, bubbling or other defects shall occur.

5. Colour and finish

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

(b) The dry film resulting from the application of one priming coat, one flatted filler coat and one or two finishing coats to a clean smooth metal panel and conforming to the limits of weight specified in Clause 1 (a) shall match the standard in colour and finish. The finish shall be glossy. Black, white and grey-green colours shall be additionally available in matt finish and the contract shall state which finish is required.

(c) Details of the standards of colour and finish are obtainable from the Director of Chemical Inspection (C.36), Royal Arsenal, Woolwich, London, SE.18

6. Toughness, hardness and adhesion

(a) Bend test. - A film of the materials consisting of primer, filler and finish, prepared and tested as described in Appendix V (a), shall withstand being bent double at 0°C, round a mandrel $\frac{3}{8}$ inch in diameter without becoming detached or damaged.

(b) Scratch test. - The resistance to scratching under a load of 1,000 grammes of a film of the material consisting of primer, filler and finish, prepared and tested as described in Appendix V (c), shall be such that any scratch produced shall not penetrate the top coat. The scratch shall also be free from jagged edges of width greater than 1 mm.

(c) Wet scratch test. - The resistance to scratching under a load of 600 grammes of a film of the material consisting of primer, filler and finish, prepared and tested as described in Appendix V (c), shall be such that any scratch produced shall not penetrate the top coat. The scratch shall also be free from jagged edges of width greater than 1 mm.

7. Protection against sea water

The protection against sea water of a film of the material consisting of primer, filler and finish prepared and tested as described in Appendix VI, shall be such that no flaking, change of colour, blistering or corrosion shall occur.

8. Resistance to synthetic lubricating oils

The resistance to cold and hot (pyrolysed) synthetic lubricating oils of films of the material consisting of primer, filler, sealer and finish shall be such that when tested by the methods described in Appendix VII (a) and (b) the films shall not become detached or damaged and any scratch produced shall not penetrate the top coat.

9. Resistance to organic solvents and hot kerosine

The resistance to organic solvents and hot kerosine of films of the material consisting of primer, filler and finish shall be such that when tested by the methods described in Appendix VIII (a) and (b) the film shall regain its original appearance and shall not become detached or damaged.

10. Resistance to natural weathering (type test)

The resistance to natural weathering of a film of the material consisting of primer, filler and finish, prepared and tested as described in Appendix IX, shall be such that, after exposure for two years, the film shall not show signs of cracking, chipping, flaking or blistering. Retention of colour and finish shall be to the satisfaction of the Director of Chemical Inspection. Slight chalking shall be disregarded. Neither the filler coat nor the primer coat shall be visible, and the metal shall be free from corrosion.

11. Keeping qualities

The keeping qualities of the materials shall be such that when stored in their original sealed containers, the materials shall retain the properties detailed above for not less than the following periods after date of delivery:

- (a) Twelve months in temperate climates.
- (b) Six months in tropical climates.

12. Type approval

Before any particular manufacturer's material is accepted as complying with the requirements of this specification the manufacturer must obtain approval. Applications for type approval shall be submitted to the Director of Chemical Inspection (C.36), Royal Arsenal, Woolwich, London S.E.18 accompanied by:

- (i) evidence that the materials comply with Clauses 1 to 10 inclusive of this specification;
- (ii) wet samples including thinners of all materials for which approval is sought together with details of their formulation, i.e., percentage of pigment, medium, volatile and nature of medium, pigments and extenders and the specification references, where applicable, of the ingredients;
- (iii) two sprayed panels prepared in accordance with Appendix IX 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.

The Director of Chemical Inspection (C.36) may at his discretion grant a provisional type approval on the basis of short term tests before natural ageing tests can be completed. Provisional approvals will 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 details supplied under (i), (ii) and (iii) above.

Type approval must be obtained in respect of each component and each finishing colour. After provisional or formal approval has been given, no change in the formulation will be permitted unless approval of the change has been sought and given.

13. Routine inspection

A representative sample of each batch of each of the components of this scheme (i.e. primer, filler and finish) shall be tested by the manufacturer and proved to comply with Clauses 1 to 9 inclusive before release is authorised.

The Director of Chemical Inspection may require the manufacturer to test to Clause 10 at any time.

APPENDIX I

Method for the preparation of panels for tests on etching primers

The panels used in the tests on etching primers shall be of unused metal complying with the appropriate specification and gauge, as required by the following Appendices, cleaned with either

- (a) trichlorethylene to B.S. 580 Type II (vapour or liquid)
- or
- (b) pure toluene to B.S. 805 used at room temperature.

APPENDIX II

Method for the determination of freedom from blushing

The atmospheric conditions throughout the test shall be:

Relative humidity	...	...	...	...	65-70 per cent
Temperature	...	...	...	...	18°C (65°F)-21°C (70°F).
Air speed	...	...	...	...	3 ft per second.

Samples of the finish, the brushes to be used during the test and aluminium panels previously coated with the primer and allowed to dry as specified in Clause 4 shall be stored under the above test conditions. After a period of not less than two hours one full coat of the material to be tested shall be applied by brush to the primer on the aluminium panels, allowed to dry under the conditions given above and then examined visually.

APPENDIX III

Method for the determination of rate of drying

(a) *Primer.* - One coat of the primer shall be applied by spray (or by dipping if a dipping primer is being tested) to a chromate dipped hard aluminium panel as described in Method No. 2, para. 5 (a) (i) and (b) (ii) of specification DEF-1053, to give a film weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for the time specified in Clause 4 (a), i.e., - etching primer 1 hour, p.s.r. primer - 4 hours.

When testing the etching primer the humidity shall be controlled at 65 to 70 per cent R. H. during this period.

When testing stoving primers the panels shall be stoved at a temperature and for a time to be specified by the manufacturer.

One coat of filler shall then be sprayed over the primer to give a film weight as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for 16 hours. The panel shall then be visually examined.

The test shall be repeated using one coat of finish instead of one coat of filler.

(b) *Filler.* - One coat of the primer shall be applied to a clean smooth metal panel as described at (a) above.

One filler coat shall then be sprayed over the primer to give a film weight when dry as specified in Clause 1(d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for four hours.

The filler coat shall then be tested as described at (e) below.

(c) *Sealer*

(i) *Over filler.* - One coat of the primer shall be applied to a clean smooth metal panel as described at (a) above.

One filler coat shall then be sprayed over the primer to give a film weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for 16 hours.

The sealer coat shall then be sprayed over the filler to give a weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for two hours.

The sealer shall then be tested as described at (e) below.

(ii) *Over primer.* - One coat of the primer shall be applied to a smooth clean metal panel, as described at (a) above. The panel shall be allowed to dry for 16 hours.

The sealer coat shall then be sprayed over the primer to give a weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for two hours.

The finish shall then be tested as described at (e) below.

(d) *Finish*

(i) *Over sealer.* - A clean smooth metal panel shall be prepared and coated with the primer, the filler and the sealer as described at (c) (i) above.

Two hours after the application of the sealer, the finish coat shall be applied to give a weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for two hours.

The finish shall then be tested as described at (e) below.

(ii) *Over filler.* - A clean smooth metal panel shall be prepared and coated with the primer and the filler as described at (b) above.

Sixteen hours after the application of the filler, the finish coat shall be applied to give a weight when dry as specified in Clause, 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for two hours.

The finish shall then be tested as described at (e) below.

(iii) *Over primer.* - A clean smooth metal panel shall be prepared and coated with the primer as described at (a) above.

Sixteen hours after the application of the primer, the finish coat shall be applied to give a weight when dry as specified in Clause 1 (d) and shall be kept in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for two hours.

The finish shall then be tested as described at (e) below.

(e) *Test for dryness.* - The panel shall be placed on one pan of a pair of scales. After balancing the scales, a weight of 5 lb shall be placed in the other pan. The scales shall then be balanced 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 IV

Method for the determination of rubbing properties of the filler

A panel of smooth (i.e. unabraded) hard aluminium not less than 1 square foot in area, pretreated in accordance with Method No. 2, paragraph 5 (a) (i) and (b) (ii) of specification DEF-1053 shall be coated with primer and filler and allowed to dry for four hours as described in Appendix III (b).

The panel shall then be rubbed with silicon carbide paper Grade A320, B.S. 872, wet with water.

APPENDIX V

Method for the determination of toughness, hardness and adhesion

(a) *Bend test.*—Method No. 13, Issue No. 2 of specification DEF-1053 shall be used employing a mandrel of $\frac{3}{8}$ inch diameter. The test panel shall be coated with the materials as described in Appendix III (d) (ii) and after the application of the final coat shall be allowed to dry at a temperature of 18°C (65°F) to 21°C (70°F) in a horizontal position for 24 hours before testing. The test shall be made at 0°C.

(b) *Dry scratch test.*—Method No. 14 of specification DEF-1053 shall be used employing a panel of materials as described in Appendix III (d) (ii) and after the application of the final coat shall be allowed to dry at 18°C (65°F) to 21°C (70°F) in a horizontal position, for 24 hours before testing.

(c) *Wet scratch test.*—The test described at (6) above shall be repeated after immersion of the panel for 24 hours in distilled water at 18°C (65°F) to 21°C (70°F). Surplus water shall be removed rapidly from the surface of the panel by shaking or by means of clean, dry filter paper and the wet scratch test performed immediately using a weight of 600 grammes.

APPENDIX VI

Method for the determination of protection against sea water

(a) A burnished steel panel prepared by Method No. 2, paragraph 2 of Specification DEF-1053 shall be coated with the materials as specified in Appendix III (d) (ii). After the application of the finishing coat the panel shall be allowed to dry at a temperature of 18°C (65°F) to 21°C (70°F) in a horizontal position for 24 hours. The back of the panel shall be protected either with the materials under test or with any other protective which will not affect the testing solution. The edges shall be protected by dipping for $\frac{1}{4}$ inch in melted wax.

Alternatively two panels each painted on one side only may be placed back to back and sealed around the edges with wax.

(b) The test panels shall be partially immersed in the testing solution, the composition of which is given below, at ordinary temperatures, continuously for one week immediately after which time the panel shall be examined visually.

The composition of the testing solution shall be as described in Method No. 24 DEF-1053.

APPENDIX VII

Method for the determination of resistance to lubricating oils

(a) *Cold oil.*—A small panel of smooth (i.e. unabraded) hard aluminium, pretreated in accordance with method No. 2, para 5 (a) (i) and (b) (ii) of Specification DEF-1053 shall be coated with a film of primer plus filler plus sealer plus finish as described in Appendix III (d) (i). After the application of the last coat the panel shall be allowed to dry in a horizontal position at a temperature of 18°C (65°F) to 21°C (70°F) for 24 hours. A cut shall then be made through the film down to the metal, using a sharp knife or razor edge. The cut shall be made down the middle of the panel parallel to the long edge.

The panel shall then be immersed continuously for 1,000 hours in Lubricating Oil: Aircraft Turbine Engines—Synthetic Type to Specification D. Eng. R.D.2487 (R.D.E./O/463) at a temperature of 18°C (65°F) to 21°C (70°F). Oils other than RDE/O/463 must not be used for this test unless the agreement of the Director of Chemical Inspection (C36) has been obtained.

At the discretion of the inspecting officer the time of immersion may be reduced to 4 days for routine testing.

The panel shall then be removed from the oil and wiped with a soft rag dipped in a mixture of—

75 parts by volume ...	...	2.2.4 trimethyl pentane, I.P. reference fuel quality; and
25 parts by volume ...	...	pure toluene B.S. 805.

The panel shall be subjected to the scratch test described in Appendix V (b) using a weight of 1,000 grammes. The scratch shall be made parallel to and approximately $\frac{1}{2}$ inch from the cut described above.

(b) *Hot pyrolysed oil.*—A small panel (5 in x 2 in) of smooth (i.e. unabraded) hard aluminium to B.S. 1470 Grade, SIC-H, 22 S.W.G. shall be pretreated in accordance with Method No. 2, paragraph 5 (b) (ii) of Specification DEF-1053 and shall then be coated with a film of Primer plus Filler plus Finish as described in Appendix III (d) (i) and after application of the finishing coat shall be allowed to dry at a temperature of 18-21°C (65-70°F) in a horizontal position for 24 hours.

Half the area of the panel shall be uniformly spread with 0.1 ± 0.02 g of pyrolysed ester lubricant (prepared by method described below) and the treated panel shall be placed horizontally on the shelf of an oven maintained at $60 \pm 2^\circ\text{C}$ for 48 hours. After cooling to room temperature the panel shall be examined for softening, blistering or discolouration.

Pyrolysed ester lubricant shall be prepared by heating Lubricating Oil: Aircraft Turbine Engines Synthetic Type to Specification D.Eng.R.D. 2487 (RDE/O/463) in a standard distillation apparatus until approximately one-third of the lubricant has broken down and distilled over. The rate of heating shall be such that the thermometer at the top of the distillation column reaches 175°C at the end of the process, although the temperature of the lubricant itself may be approximately 500°C. The distillate and residue shall be allowed to cool to room temperature and then mixed together. Further details of this preparation may be obtained from the Director of Chemical Inspection (C.36). Royal Arsenal, Woolwich, London, S.E. 18.

APPENDIX VIII

Method for the determination of resistance to organic solvents and hot kerosine

(a) *Resistance to organic solvents.* - A small panel of smooth (i.e. unabraded) soft aluminium pretreated in accordance with Method No. 2, para. 5 (a) (ii) and (b) (ii) of Specification DEF-1053 shall be coated with a film of primer plus filler plus finish as described in Appendix III (d) (ii) and after the application of the finishing coat shall be allowed to dry at a temperature of 65°F to 70°F in a horizontal position for 24 hours.

The panel shall then be immersed for 2 hours at a temperature of 18°C (65°F) to 21°C (70°F) in a mixture of:

75 parts by volume 2.2.4 trimethyl pentane I.P. reference fuel quality
25 parts by volume pure toluene B.S. 805.

The panel shall be removed and allowed to dry for 1 hour.

It shall be examined for appearance and then bent double over a mandrel 1 inch in diameter. This bend test shall be made in the apparatus described in Method No. 13 of Specification DEF-1053 at a temperature of 18°C (65°F) to 21°C (70°F). The time of bending shall be not less than one second or more than 1½ seconds.

(b) *Resistance to hot kerosine.* - A small panel of smooth (i.e. unabraded) soft aluminium pretreated and prepared as specified in (a) above, shall be immersed in kerosine to Specification D.Eng.R.D. 2482 at 120°C for 2 hours. It shall then be removed from the kerosine and wiped with a soft rag.

APPENDIX IX

Method for the determination of resistance to natural weathering

A panel of smooth hard aluminium, cleaned in accordance with Method No. 2, para 5 (a) (i) and (b) (ii) of Specification DEF-1053 shall be coated with the primer, filler and finish as specified in Appendix III (d) (ii). The filler coat shall be flatted. After the application of the finishing coat, the panel shall be allowed to dry at a temperature of 18°C (65°F) to 21 °C (70°F) in a horizontal position for seven days. The panel shall have an exposed area of at least 35 sq in and the back of the panel shall be protected. The edges of the panel shall be rounded but not protected other than by application of the material under test.

Another panel shall be prepared as above and shall then be polished with the material described in Clause 1 (a) (v) and (b).

The treated panels shall be exposed for two years in the open facing south at an angle 45° to the horizontal. During the exposure, the panels shall be sprayed three times daily at intervals of three to four hours with a solution, the composition of which is described in Method No. 24, DEF-1053.

Corrosion within ¼ inch of the edges of the panels may be ignored in assessing the results of the tests.

The polished panel shall be washed with soap and water, rinsed with clean water, dried and repolished at intervals of three months.

Approved for issue,

E. W. RUSSELL,

Director of Materials Research and Development.

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