

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

## **OBSOLESCENCE NOTICE**

All DTD specifications were declared obsolescent from 1<sup>st</sup> 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.

**Aerospace Material Specification**  
**EXTERIOR AND INTERIOR FINISHING SCHEMES - MATT AND GLOSSY -**  
**SOLAR HEAT REFLECTING**  
**(Cold curing polyurethane type)**

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*NOTES. (1) This specification is one of a series issued by the Procurement Executive, Ministry of Defence either to meet a limited requirement not covered by any existing British Standard or to serve as a basis for inspection of material, the properties and uses of which are not sufficiently developed to warrant submission to the British Standard Institution for standardisation*

*(2) Requirements contained herein are absolute and are not subject to corrections for tolerance of test methods. If multiple determinations are made by the Inspecting Laboratory, average results will be used except for those test methods where repeatability data is given. In those cases the average value derived from the individual results that agree within the repeatability limits for the test method may be used if the Quality Assurance Authority permits.*

*(3) The Quality Assurance Authority responsible for the type approval of materials to this specification is shown in Clause 15 on page 5. After type approval has been granted to a material, the Quality Assurance Authority responsible for any subsequent quality assurance (routine inspection) of supplies will be named in the tender or contract for the material.*

*(4) The related documents and test methods to be used are the latest published editions of those given in this specification.*

*(5) Further details concerning the test apparatus specified in this specification can be obtained from the Director of Quality Assurance (Materials), EI35/17 Royal Arsenal East, Woolwich, London, SE18 6TD.*

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## **1. Scope and intended application**

This specification covers the requirements for a durable exterior finishing scheme designed to provide maximum reflectance of solar radiation compatible with a visual colour match for a limited range of colours. It has high resistance to chemical attack and is capable of easy decontamination. It is intended for use over a suitably pre-treated surface.

## **2. Description**

- (a) The schemes shall be similar to DTD 5580 Scheme II with added requirements for infra red reflectances.
- (b) The finishing scheme shall consist of the following combination of materials:  
primer and filler and finish.
- (c) The materials shall consist of:
  - (i) A *primer* - which shall be suitable for direct application to suitably pretreated metal, and which shall be a two component chromate pigmented cold-curing epoxide resin vehicle conforming to the requirements described additionally in Clauses 2(g) (i) and 2(g) (ii) below.
  - (ii) A *white filler* - which shall be suitable for application over the primer and which shall be a two component pigmented cold-curing epoxide resin vehicle conforming to the requirements described additionally in Clauses 2(g) (i) and 2(g) (ii) below.
  - (iii) A *finish* - which shall be suitable for application over the primer overcoated with the filler. The finish shall be of a two component pigmented cold-curing polyurethane resin vehicle conforming to the requirements described additionally in Clause 2(g) (iii) below. The finish shall be matt or glossy as required by the terms of the contract or order.

- (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:

Primer .....	$30 \pm 5 \text{ g/m}^2$
Filler .....	$70 \pm 8 \text{ g/m}^2$
Finish .....	$40 \pm 8 \text{ g/m}^2$

The filler and finish weight addition may be obtained in one or two coats.

- (e) When mixed for use the primer and finish shall be suitable for use by rolling or spraying when diluted, if necessary, with the appropriate thinners in the proportions stipulated by the manufacturer. The filler will normally be applied by spraying unless otherwise stipulated by the terms of the contract or order.
- (f) When supplied for Service use the primer and filler shall be compatible with thinners to specification DEF-1216 and the finish with DTD 5590 for rolling and DTD 5591 for spraying.
- (g) (i) The cold-curing epoxide primer and filler shall each consist of an epoxide resin vehicle and curing agent, either or both appropriately pigmented. The resin vehicle and the curing agent shall be suitable for use when mixed together in the declared proportions which shall be in a simple ratio by volume. The manufacturer shall state which curing agent shall be used for each material and the mixing proportions for each material. The mixing instructions shall be marked clearly on the containers.
- (ii) When supplied for Service use the primer shall also conform to DTD 5567 and the filler to DTD 5555.
- (iii) The cold-curing polyurethane finish shall consist essentially of a polyester vehicle and an isocyanate curing agent, either or both appropriately pigmented. The resin vehicle and the curing agent shall be suitable for use when mixed together in the ratio of 2 : 1 by volume. The mixing instructions shall be marked clearly on the containers.
- (iv) The mixtures prepared above shall not settle unduly and shall remain suitable for use for not less than the following periods of time after mixing:  
 8 hours at a temperature of  $20 \pm 2^\circ\text{C}$   
 4 hours at a temperature of  $33 \pm 2^\circ\text{C}$
- (v) The primer, filler and finish will not cure satisfactorily at low temperatures or in conditions of high humidity. If type approval is required for conditions other than those laid down in DEF STAN 03-7 then evidence of satisfactory performance shall be supplied.
- (vi) When ordered for use in the Services the materials and their curing agents in the correct amounts for mixing shall be supplied in multiple packs.

### 3. Freedom from objectionable ingredients

Only low toxicity materials shall be used and satisfactory evidence of this shall be supplied to the Approving Authority.

### 4. Rate of drying

- (a) *Air drying*
- (i) *Primer* - The priming coat shall be capable of being overcoated in not more than 4 hours when applied as described in Appendix II(a).
- (ii) *Filler* - The filler coat shall be capable of being overcoated in not more than 4 hours when applied as described in Appendix II(b).
- There shall be no visible defects or lifting of the filler on overcoating with the finish as described in Appendix II(b). The filler shall be capable of being rubbed smooth without clogging the paper when tested by the method described in Appendix III.
- (iii) *Finish* - The finishing coat shall become "hard dry" in not more than 6 hours when applied by the method described in Appendix II(c) and tested as described in Appendix II(d). No visible defects shall occur.

### 5. Colour and Finish

- (a) The colour of the primer, filler and finish shall where possible be significantly different one from the other. The colour of the filler shall be white.
- (b) When applied to a hard aluminium panel, the dry film resulting from the application of one priming coat, a flatted filler coat and one or two finishing coats conforming to the limits of weight specified in Clause 2(d), shall match the standard in respect of colour and degree of gloss.
- (c) Details of the standard of colour and finish are obtainable from the Director of Quality Assurance (Materials), E1 35/17 Royal Arsenal East, Woolwich, London SE18 6TD.

## 6. Toughness, hardness and adhesion

**TABLE I**  
**Test conditions and requirements**

Test	Test method	Material	Requirement	Notes
(a) <i>Bend</i>	Panels shall be prepared and dried as in Appendix I  Testing shall be in accordance with BS 3900 Part E1 using the Type 1 apparatus	Soft aluminium	19.0 mm 0°C	The paint film shall not become detached or damaged
(b) <i>Dry scratch</i>	Panels shall be prepared and dried as in Appendix I  Testing shall be in accordance with BS 3900 Part E2	Hard aluminium	1500g at room temperature	Any scratch produced shall not penetrate the top coat
(c) <i>Wet scratch</i>	Appendix IV followed by BS 3900 Part E2	Hard aluminium	1500g at room temperature	Any scratch produced shall not penetrate the top coat

## 7. Protection against artificial sea water

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

## 8. Resistance to synthetic lubricating oils

The resistance to cold, hot and hot pyrolysed synthetic lubricating oils of films of the material consisting of primer, filler and finish shall be such that when tested by the method described in Appendix VI(a), (b) and (c) the films shall not become detached and shall show only negligible discolouration and the scratch, when specified, shall not penetrate the finishing coat.

## 9. Resistance to hydraulic fluids

### (a) *Mineral base to DTD 585*

The resistance to cold and hot DTD 585 hydraulic fluid of films of the material consisting of primer, filler and finish shall be such that when tested by the method described in Appendix VII(a) and (b) the film shall show no signs of blistering or lifting, and the scratch shall not penetrate the finishing coat.

### (b) *Phosphate ester to DTD 900/4881*

The resistance to cold and hot hydraulic fluid (phosphate ester based to AFS 295) of films of the material consisting of primer, filler and finish shall be such that when tested by the method described in Appendix VII(c) and (d) the film shall show no signs of blistering or lifting, and the scratch shall not penetrate the finishing coat.

### (c) *Castor oil/glycol ether based fluids*

The resistance to cold castor oil/glycol ether based hydraulic fluids of films of the material consisting of primer, filler and finish, shall be such that when tested by the method described in Appendix VII(e) the film shall show no signs of blistering or lifting, and the scratch shall not penetrate the finishing coat.

## 10. Resistance to methylated spirit to DEF 57

The resistance to methylated spirit of films of the material consisting of primer, filler and finish shall be such that when tested as described in Appendix VIII the film shall retain its original appearance and shall not become detached or damaged.

## 11. Fastness to light (type test)

The fastness to light of a film of the material consisting of primer, filler and finish shall be such that when tested by the method described in BS 3900 Part F5 paragraph 3.1.1 for 6 weeks there shall be negligible change in colour between the exposed and the unexposed portions of the paint film.

### 12. 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 checking, cracking, chipping, flaking or blistering. Retention of colour and finish shall be to the satisfaction of the Director of Materials Quality Assurance. Slight chalking and slight loss of gloss shall be disregarded. Neither the filler coat nor the primer coat shall be visible, and the metal shall be free from corrosion.

### 13. Infra red reflectance

The infra red reflectance of a film of the material consisting of primer and filler or primer, filler and finish of an appropriate colour prepared and tested as described in Appendix X shall be in accordance with the following table:

**TABLE II**  
**Infra Red Reflectance**

SHR Scheme			Minimum* % Reflectance at Specific Wavelengths						Reading on RRE IR Reflectance Meter - %  (10)
Colour (1)	Visually Similar to (2)	Finish (3)	700 nm (4)	800 nm (5)	900 nm (6)	1000 nm (7)	1400 nm (8)	2000 nm (9)	
Filler		Matt	80	80	80	80	70	55	80
White		Gloss or Matt	85	85	85	85	75	50	85
Light Stone	BS381C No 361	Gloss	60	85	85	85	75	50	80
		Matt	60	80	80	80	70	50	75
Light Grey	CDL Ref No 37 - 29 - 30	Gloss	40	75	75	75	70	50	75
Dark Sea Grey	BS381C No 638	Matt	20	50	75	75	70	50	70
Golden Yellow	BS381C No 356	Gloss	75	80	80	80	70	50	80
		Matt	70	70	70	70	65	50	70
Canary Yellow	BS381C No 309	Gloss	60	75	80	80	70	50	75
		Matt							†
Arctic Blue	BS381C No 112	Gloss	20	60	75	75	70	50	70
Dark Earth	BS381C No 450	Gloss	40	75	75	75	70	45	75
		Matt	40	65	65	65	60	45	70
Deep Bronze Green	BS381C No 224	Gloss	15 (max)	65	70	70	65	50	70
		Matt	15 (max)	60	70	70	65	45	65
Dark Green	BS381C No 641	Gloss	20 (max)	65	75	75	70	50	70
		Matt	20 (max)	65	70	70	65	45	65
Olive Drab	BS381C No 298	Matt	15 (max)	60	70	70	65	45	65
Black		Matt	25 (max)	65	65	65	60	45	65

\* Except where shown otherwise

† To be issued later

#### 14. 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 described in this specification for not less than 12 months in either tropical or temperate climates after the date of despatch.

#### 15. Type approval

Before any particular manufacturer's material is accepted as complying with the requirements of this specification, the manufacturer shall obtain type approval. Applications for type approval shall be submitted to the Director of Quality Assurance (Materials), E135/17 Royal Arsenal East, Woolwich, London, SE18 6TD accompanied by:

- (i) Evidence that the materials comply with Clauses 1 to 14 inclusive of this specification;
- (ii) Wet samples including thinners of all materials for which approval is sought together with details of their formulation, ie percentage of pigment, medium volatile, nature of medium, pigments and extenders and the specification references, where applicable, of the ingredients; and the relative density of each material submitted;
- (iii) One sprayed panel prepared in accordance with Appendix IX in respect of each finishing colour and scheme for which approval is sought, and marked on the reverse with the description and film weight of each applied coat.

The Director of Quality Assurance (Materials) may at his discretion grant a provisional type approval on the basis of short term tests before natural weathering 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 shall 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.

#### 16. Routine inspection

A representative sample of each batch of each of the components of the scheme primer, filler and finish, shall be tested by the manufacturer and proved to comply with Clauses 1 to 10 inclusive scheme and 13 before release is authorised. At the discretion of the Quality Assurance Officer the immersion time required by Clauses 8, 9(a) and 9(b), may be reduced from 6 weeks to 7 days and the scratch test loads increased to 1,700 grammes. The drying time of the finish may be assessed over primer and filler which has been allowed to dry for 18 hours instead of 4 hours as required by Appendix II(c). The reflectance may be measured using an RRE Reflectance Meter calibrated against the standards supplied by RRE and the percentage reflectance shall not be less than that shown in Table II, Column 10. The Director of Materials Quality Assurance may require the manufacturer to test to Clauses 11 and 12 at any time.

#### 17. Preparation for delivery

- (a) Delivery of material supplies under this specification shall be in multiple packs containing base and activator in the appropriate ratio.
- (b) In addition to bearing the markings called for by statutory requirements, the packages constituting a consignment shall be clearly and durably marked with the designation of the paint as shown by the title of this specification, a distinctive lot or batch number, the date of despatch, the contractor's initials or recognised trade make and such markings as may be prescribed in the terms of the contract or required by the provisions of DEF-1234A.
- (c) The following warning notices shall also be marked on drums as appropriate:
  - (i) "Use with Curing Agent . . . . . and Thinner . . . . ."
  - (ii) "This material shall be mixed in . . . . . parts by volume with Curing Agent . . . . . prior to use", the ratio as appropriate being stated.
  - (iii) In addition to the above, each container of pigmented component and curing agent shall have marked on the bottom outside the surface:
    - (a) Manufacturer's proprietary reference number or description.
    - (b) Batch number.

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Approved for issue,

N. J. WADSWORTH,

Director of Research/Materials 2.

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## APPENDIX I

### Method for preparation and painting of aluminium panels

The panels, which shall be hard or soft as required shall comply with the specification and gauge described in the appropriate Appendix and shall be acid chromate pickled, as described in Part A3 of BS 3900. In all cases drying shall be carried out at a temperature of  $20 \pm 2^\circ\text{C}$  and a relative humidity of 60 - 70 per cent. All film weights shall be as specified in Clause 2.

One coat of primer shall be applied by spraying. After 4 hours drying a coat of filler shall be applied by spraying and allowed to dry for 18 hours. The finishing coat shall then be applied by spraying and allowed to dry for 7 days unless otherwise specified.

## APPENDIX II

### Method for the determination of rate of drying

In all cases drying shall be carried out at a temperature of  $20 \pm 2^\circ\text{C}$  and a relative humidity of 60 - 70 per cent. All film weights shall be as specified in Clause 2(d).

(a) *Primer*

One coat of the primer shall be applied by spray to a hard aluminium panel prepared as described in Appendix I. After 4 hours drying the filler shall then be applied by spray and allowed to dry for 16 hours. The panel shall then be visually examined.

(b) *Filler*

Prepare the panel as described in (a), but after the filler has dried for 4 hours apply one coat of finish. Allow to dry overnight. The panel shall then be examined visually.

(c) *Finish*

Over filler - prepare the panel as in (b) above. After the finish has been allowed to dry for 6 hours it shall then be tested as described at (d) below.

(d) *Test for dryness*

The panel shall be placed on one pan of a pair of scales. After balancing the scales, a weight of 2000g 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 on the film shall be capable of being wiped away with dry cotton wool without damaging the film, or shall disappear on standing for one minute

## APPENDIX III

### Method for the determination of rubbing properties of the filler

A panel of hard aluminium 15 cm x 23 cm prepared as in Appendix I shall be coated with primer and filler as described in Appendix II(a) and allowed to dry for 16 hours.

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

## APPENDIX IV

### Method for the determination of toughness, hardness and adhesion after water immersion (Wet scratch test)

A 13 cm x 5 cm panel of hard aluminium shall be prepared and painted as described in Appendix I.

*Wet scratch test* - The test described in BS 3900, Part E2 shall be carried out after immersion of the panel for 24 hours in distilled water at  $20 \pm 2^\circ\text{C}$ . Surplus water shall be removed rapidly from the surface of the panel by shaking and by means of clean, dry filter paper and the wet scratch test performed  $25 \pm 5$  seconds after removal from the water using a weight of 1,500 grammes.

## APPENDIX V

**Method for the determination of protection  
against artificial sea water**

(a) A 15 cm x 10 cm burnished steel panel prepared as described in BS 3900, Part A3 shall be painted as described in Appendix I.

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 ¼ 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 panels shall be partially immersed in the testing solution at a temperature of  $20 \pm 2^\circ\text{C}$  continuously for 7 days, immediately after which time the panel shall be examined visually. A strip of paint film shall be removed from the face of the panel by a suitable paint remover so that a representative section of the panel is exposed, and the metal shall be examined for signs of corrosion.

The composition of the testing solution shall be that given in BS 3900, Part F4, Clause 6.1.

## APPENDIX VI

**Method for the determination of resistance to synthetic oils**

(a) *Cold oil* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:

1. *Test piece*. Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470, Grade S1C-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
2. *Test solution* Lubricating oil, aircraft turbine engine - synthetic type to specification D Eng RD 2487 (RDE 0/463).
3. *Test procedure*.
  - (i) A cut shall 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.
  - (ii) Completely immerse the test piece in the test solution continuously for 6 weeks at a temperature of  $20 \pm 2^\circ\text{C}$ .
  - (iii) Remove the test piece from the test solution and wipe clean with a soft rag dipped in a mixture of:
    - 75 parts** by volume of 2.2.4 trimethylpentane IP reference fuel quality; and
    - 25 parts** by volume pure toluene to BS 805.
  - (iv) Carry out the scratch test as described in BS 3900, Part E2, under a load of 1,500 grammes immediately the solvent has evaporated. The scratch shall be made parallel to and approximately 1 cm from the cut described above.

(b) *Hot oil* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:

1. *Test piece*. Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade S1C-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
2. *Test solution* Lubricating oil, aircraft turbine engine - synthetic type to specification D Eng RD 2487 (RDE 0/463).
3. *Test procedure*
  - (i) A cut shall 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.
  - (ii) Completely immerse the test piece in the test solution continuously for 16 hours at a temperature of  $70 \pm 2^\circ\text{C}$ .
  - (iii) Remove the test piece from the test solution and wipe clean with a soft rag dipped in a mixture of:
    - 75 parts** by volume of 2.2.4 trimethylpentane IP reference fuel quality; and
    - 25 parts** by volume pure toluene to BS 805.
  - (iv) Carry out the scratch test as described in BS 3900, Part E2, under a load of 1,500 grammes immediately the solvent has evaporated. The scratch shall be made parallel to and approximately 1 cm from the cut described above.

- (c) *Hot pyrolised oil* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:
1. *Test piece.* Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade SIC-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
  2. *Test solution.* The pyrolised ester lubricant shall be prepared by heating lubricating oil, aircraft turbine engine - synthetic type to specification D Eng RD 2487 (RDE 0/463) 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 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.
  3. *Test procedure*
    - (i) Uniformly spread half the area of the panel with  $0.10 \pm 0.02$  g of the test solution which shall then be placed horizontally on the shelf of an oven maintained at  $70 \pm 2^\circ\text{C}$  for a total of 6 weeks. The pyrolised ester lubricant shall be wiped off and renewed daily on 5 consecutive days every week for the complete test period.
    - (ii) The panel shall then be wiped clean with a soft rag dipped in a mixture of:
      - 75 parts** by volume 2.2.4 trimethylpentane IP reference fuel quality; and
      - 25 parts** by volume pure toluene to BS 805,
 and examined visually for softening, blistering, discolouration or loss of adhesion.

## APPENDIX VII

### Method for the determination of resistance to hydraulic fluids

- (a) *Cold DTD 585* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:
1. *Test piece.* Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade SIC-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
  2. *Test solution.* Mineral based hydraulic oil to DTD 585.
  3. *Test procedure*
    - (i) A cut shall 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.
    - (ii) Completely immerse the test piece in the test solution continuously for 6 weeks at a temperature of  $20 \pm 2^\circ\text{C}$ .
    - (iii) Remove the test piece from the test solution and wipe clean with a soft rag dipped in a mixture of:
      - 75 parts** by volume 2.2.4 trimethylpentane IP reference fuel quality; and
      - 25 parts** by volume pure toluene to BS 805.
    - (iv) Carry out the scratch test as described in BS 3900, Part E2, under a load of 1,500 grammes immediately the solvent has evaporated. The scratch shall be made parallel to and approximately 1 cm from the cut described above.
- (b) *Hot DTD 585* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:
1. *Test piece.* Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade SIC-H, 0.027 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
  2. *Test solution* Mineral based hydraulic oil to DTD 585.
  3. *Test procedure*
    - (i) A cut shall 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.
    - (ii) Completely immerse the test piece in the test solution continuously for 6 weeks at a temperature of  $70 \pm 2^\circ\text{C}$ .
    - (iii) Remove the test piece from the test solution and wipe clean with a soft rag dipped in a mixture of:
      - 75 parts** by volume 2.2.4 trimethylpentane IP reference fuel quality; and
      - 25 parts** by volume pure toluene to BS 805.

- (iv) Carry out the scratch test as described in BS 3900, Part E, under a load of 1,500 grammes immediately the solvent has evaporated. The scratch shall be made parallel to and approximately 1 cm from the cut described above.
- (c) *Cold phosphate ester based hydraulic oil to DTD900/4881* - As described in Appendix VII(a) (i) but using phosphate ester hydraulic oil to DTD900/4881
- (d) *Hot phosphate ester based hydraulic oil to DTD900/4881* - Carry out the test described in BS 3900, Part G1 subject to the following special conditions:
1. *Test piece.* Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade SIC-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
  2. *Test solution.* Phosphate ester based hydraulic oil to DTD900/4881.
  3. *Test procedure*
    - (i) A cut shall 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.
    - (ii) Uniformly spread half the area of the panel with  $0.02 \pm 0.01$  g of the test solution using a small camel hair brush. The panel shall then be placed horizontally on the shelf of an oven maintained at  $70 \pm 2^\circ\text{C}$  for 6 weeks. The film of phosphate ester hydraulic oil to DTD900/4881 shall be renewed daily on 5 consecutive days every week for the complete test period. Before renewing the oil the previous day's residue shall be wiped off using fresh phosphate hydraulic oil to DTD900/4881 and the surface wiped clean of any residue.
    - (iii) The panel shall then be wiped clean with a soft rag dipped in a mixture of:
      - 75 parts** by volume 2.2.4 trimethylpentane IP reference fuel quality; and
      - 25 parts** by volume pure toluene to BS 805.
    - (iv) After cooling to room temperature carry out the scratch test as described in BS 3900, Part E2, under a load of 1,500 grammes immediately the solvent has evaporated. The scratch shall be made parallel to and approximately 1 cm from the cut described above.
- (e) *Castor oil/glycol ether based hydraulic oil* - Carry out the test as described in BS 3900, Part G1, subject to the following special conditions:
1. *Test piece.* Smooth (ie unabraded) size 13 cm x 5 cm hard aluminium panel to BS 1470 Grade SIC-H, 0.028 inch (0.7 mm) thick (22 swg) prepared, coated and dried in accordance with Appendix I.
  2. *Test solution.* 1 part by volume castor oil to DTD 71B, 4 parts by volume ethylene glycol monoethyl ether to BS 2713.
  3. *Test procedure*
    - (i) A cut shall 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.
    - (ii) Completely immerse the test piece in the test solution continuously for one hour at  $20 \pm 2^\circ\text{C}$ .
    - (iii) Remove the test piece from the test solution and wipe clean with a soft rag dipped in ethylene glycol monoethyl ether. Allow to stand for 2 hours.
    - (iv) Carry out the scratch test as described in BS 3900, Part E2, under a load of 1,500 grammes. The scratch shall be made parallel to and approximately 1 cm from the cut described above.

## APPENDIX VIII

### Method for the determination of resistance to methylated spirit

A 13 cm x 5 cm panel of hard aluminium shall be prepared and painted as described in Appendix I.

The panel shall be placed with the long edge at an angle of  $45^\circ$  to the horizontal paint film uppermost under a burette attached to a constant head reservoir containing industrial methylated spirit 74 OP to specification DEF-57. The methylated spirit shall be allowed to drip from the burette from a height of 3 cm on to the paint film at the rate of about 1 drop every 2 seconds for a period of 30 minutes.

## APPENDIX IX

### Method for the determination of resistance to natural weathering

Panels of hard aluminium shall be painted as described in Appendix I. The filler coat shall be flatted. After the application of the finishing coat, the panel shall be allowed to dry at a temperature of  $20 \pm 2^\circ\text{C}$  and a relative humidity of 60-70 per cent for 7 days. The panel shall have an exposed area of at least  $225 \text{ cm}^2$  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.

The treated panel shall be exposed for two years in the open facing south at an angle of  $45^\circ$  to the horizontal. During the exposure, the panel shall be sprayed three times per working day at intervals of three to four hours with a solution of artificial sea water the composition of which is given in BS 3900, Part F4, Clause 6.1.

## APPENDIX X

### Methods for the determination of percentage reflectance value

#### Method No 1 (Type testing)

1. *Apparatus.* The apparatus shall be a spectrophotometer providing a continuous record of the reflectance of the test panel over the wavelength range 700 nm to 2000 nm, expressed as a percentage of the reflectance of a magnesium oxide standard at each wavelength.

The magnesium oxide standard shall consist of a layer at least 2 mm thickness of magnesium oxide freshly smoked onto a suitable surface.

A suitable spectrophotometer will be of the photoelectric type and the illuminating source shall be a tungsten filament lamp with a filament temperature of approximately  $2800^\circ\text{K}$ . Illumination of the test panel and reference standard shall be at an angle of  $5^\circ$  to the normal to the test surface. The reflectance unit shall incorporate an integrating sphere disposed to collect both the diffuse and specular components of the reflected energy. The collected energy shall be measured by means of a lead sulphide type of photoelectric cell.

*Note:* A Beckman DK2 continuous ratio recording spectrophotometer is a suitable instrument for providing the continuous reflectance record.

2. *Procedure.* Use the described spectrophotometer to obtain the percent reflectance over the range 700-2000 nm inclusive at each of four positions on the painted surface selected so that no two are less than 35 mm apart. Report the reflectance values at 700, 800, 900, 1000, 1400 and 2000 nm as the average of the four values obtained for each of those wavelengths.

#### Method No 2 (Batch testing)

1. *Apparatus* A suitable instrument is described in RRE Drawing No RR/D29482\*. Low and high reflectance standards complying with the RRE requirements RTS/15/033 may be obtained from RRE Malvern.

The instrument consists of two separate units, the probe and the meter unit. The probe contains the radiation source, the reflectance detector, the focussing system and an infra-red filter.

A beam of light from the radiation source is transmitted through a light guide in the probe and focussed on to the specimen. The reflected radiation is detected by a photo transistor and the responses are fed to the meter unit. The meter unit linearises the responses from the photo head to give a direct reading in percentage reflectance.

\* Electronic Designs Ltd, Prospect House, East Cowes, Isle of Wight manufacture a suitable instrument.

2. *Procedure.* Calibrate the unit in accordance with the manufacturers instructions using the low and high standard reflectance panels.

Place the probe in contact with the test specimen and report the meter reading as the average of four values obtained at four positions on the panel.

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