D.T.D.939

Ministry of Defence
Defence Procurement Agency, ADRP2
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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.

MINISTRY OF TECHNOLOGY

D.T.D. 939

March, 1966

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Process Specification

SILVER PLATING OF HEAT-RESISTING THREADED PARTS FOR ANTI-SEIZURE PURPOSES

Reference is made in this specification to:

B.S. 558 — Nickel Anodes and Nickel Salts for Electroplating.

D.T.D. 901 — Cleaning and Preparation of Metal Surfaces.

DEF-2331 — Temporary Protective PX-1.

SECTION I

Scope and general requirements

1. Scope and application

1.1 This specification covers the requirements for the silver plating of:

(i) threaded parts made from austenitic or ferritic/martensitic corrosion-resisting steels of minimum specified tensile strength not exceeding 90 tonf/in^2 (142 kgf/mm^2)

(ii) threaded parts made from heat-resisting nickel-base alloys, and

(iii) wire thread inserts made from heat-resisting nickel-base alloys,

for the purpose of preventing seizure after use at elevated temperatures.

1.2 The plating is not applied as a protection against corrosion.

1.3 Processing may if desired be carried out to a Works Process Specification accepted by the Inspecting Authority as meeting the minimum requirements of this specification.

2. General requirements

2.1 Unless otherwise stated herein, all parts shall be treated in accordance with the requirements of D.T.D. 901.

2.2 Any treatment required under Clause 5 or 12 shall be stated on the drawing or order.

2.3 Mercury or mercury compounds shall not be present in any of the materials used.

SECTION II

Silver plating

3. Condition of parts

3.1 Steel parts shall normally be submitted to the plater in a scale-free condition. This condition shall be achieved by machining all over or by descaling in accordance with D.T.D. 901 before final machining.

3.2 A heat treatment oxide film is normally present on nickel-base parts when submitted to the plater (see Clause 7).

4. Degreasing

4.1 All parts shall be degreased in an organic solvent. Vapour degreasing is preferred.

5. Stress relieving

5.1 After degreasing, parts made from steel of minimum specified tensile strength of 65-90 tonf /in^2 (103-142 kgf/mm^2) (or of equivalent surface hardness, i.e., 300-430 HV or 295-405 HB) and those parts of lower tensile strength which have been subjected to heavy grinding, machining or cold-working operations without subsequent heat-treatment, shall be stress-relieved by heating at 190°-230°C for not less than one hour.

6. Removal of oxide from nickel-base parts

6.1 The parts shall be abrasive blasted so as to ensure complete removal of the oxide film with a minimum removal of metal. Alternatively, the parts shall be pickled in accordance with D.T.D. 901.

7. Cleaning

7.1 All parts shall be given an alkaline or other cleaning treatment in accordance with the requirements of D.T.D. 901.

7.2 A cathodic/anodic alkaline cleaning treatment suitable for parts made from steel of minimum specified tensile strength not exceeding 65 tonf /in^2 (103 kgf/mm^2 and for nickel-base parts is given in Appendix I.

8. Etching

8.1 All parts shall be etched in ferric chloride solution as described in Appendix II or by any other method which is acceptable to the Inspecting Authority.

9. Nickel striking

9.1 All parts shall be given a nickel strike by the appropriate methods described in Appendix III or by any other method which is acceptable to the Inspecting Authority. Care should be taken to avoid contamination of the strike solution with copper.

10. Silver striking

10.1 All parts shall be given a silver strike coating. Typical conditions of striking are given in Appendix IV.

10.2 On removal from the silver strike, the solution should be allowed to drain or should be rapidly rinsed from the parts which should then be transferred without delay to the silver plating solution (Clause 11).

11. Silver plating

11.1 Unless otherwise specified by the drawing or order, all parts shall be plated with a minimum average thickness of 0.0002 inch (5 microns) silver. Typical conditions of plating are given in Appendix V.

11.2 After washing, drying of the plated parts should be facilitated by immersing the parts in clean boiling water or by means of hot air.

12. Removal of embrittlement

12.1 Parts made of steel of minimum specified tensile strength of 65-90 tonf /in^2 (103-142 kgf/mm^2) (or of equivalent hardness) shall be heated at 190°-230°C for not less than 4 hours as soon as is practicable but within 16 hours of plating.

13. Inspection

13.1 *Visual.* All parts shall be visually inspected to ensure that the silver deposit is continuous on threaded and other significant areas and free from "burns", blisters, flaking, cracking or other defects.

13.2 *Gauging.* One per cent of each barrel load and 10 per cent of each vat load (minimum of two parts) shall be gauged to ensure that the plated threads comply with the appropriate screw thread specification.

13.3 *Adhesion.* One per cent of each barrel load or vat load (minimum of two parts) shall be quenched in cold water from 190°-230°C. After quenching there shall be no evidence of blistering or detachment of the deposit. Alternatively, any other adhesion test acceptable to the Inspecting Authority may be used.

14. Replating of rejected parts

14.1 Rejected parts may be stripped and replated.

14.2 Stripping shall be done by the method given in Appendix VI or by any other method acceptable to the Inspecting Authority. It should be noted that ferritic steels may be attacked by application of the process described in Appendix VI.

15. Protection against corrosion

15.1 Immediately after inspection, all parts shall be dipped in Temporary Protective DEF-2331 and allowed to drain.

15.2 Parts which will not be inspected within 8 hours of plating shall be treated as in Clause 15.1 immediately after plating. Immediately before inspection, the protective shall be removed by washing in paraffin followed by vapour degreasing and the parts shall be allowed to cool.

APPENDIX I

Typical electrolytic alkaline cleaning treatment

Electrolyte —		
	Sodium hydroxide (NaOH)	80-100 g/l (12-16 oz/gal)
	Sodium cyanide (NaCN)	8-10 g/l (1.2-1.6 oz/gal)
	Water	remainder
Temperature		Room
Voltage		6-8
Treatment cycle	Cathodic for 20 sec Anodic for 10 sec	} repeated not less than 4 times.

APPENDIX II

Typical ferric chloride etching treatment

Solution —

Ferric chloride, anhydrous ($FeCl_3$)	150-200 g/l (24-32 oz/gal)
(or Ferric chloride ($FeC1_3.6H_2O$))	250-330 g/l (40-53 oz/gal)
Hydrochloric acid (*d* 1.16)	150-170 ml/l (24-27 fl oz/gal)
Water	remainder.

Temperature ..... Room
Time ..... 5 sec

APPENDIX III

Typical nickel strike treatments

A. For vat plating

Electrolyte—

Nickel chloride ($NiC1_2.6H_20$)	300-400 g/l (48-64 oz/gal)
Hydrochloric acid (*d* 1.16)	70-110 ml/l (1 1-17 fl oz/gal)
Water	remainder.

Anodes ..... Oval depolarised nickel anodes to B.S. 558 (without bags) should be used.
Temperature ..... Room
Current density ..... 30 amp/ft^2 (3.2 amp/dm^2) minimum
Time ..... 2 min approx.

B. For barrel plating

Electrolyte —

Nickel chloride ($NiC1_2.6H_2O$)	400-600 g/l (64-96 oz/gal)
Hydrochloric acid (*d* 1.16)	90-130 ml/l (14-21 fl oz/gal)
Water	remainder.

Anodes ..... Oval depolarised nickel anodes to B.S. 558 (without bags) should be used.
Temperature ..... Room
Voltage 6-8
Time ..... 4 min approx.

APPENDIX IV

Typical silver strike treatments

Electrolyte—

Silver cyanide (AgCN)	(3 g/l (0.5 oz/gal)
Potassium cyanide (KCN)	80 g/l (13 oz/gal)
(or Sodium cyanide (NaCN)	60 g/l (10 oz/gal))
Water	*remainder.

Anodes ..... Silver or steel
Temperature ..... Room
Current density for vat plating ..... 20-25 amp/ft^2 (2.2-2.7 amp/dm^2)
Voltage for barrel plating 6-8
Time ..... 30 sec approx. for vat plating
5 min approx. for barrel plating

APPENDIX V

Typical silver plating treatment

Electrolyte —

Silver cyanide (AgCN)	25 g/l (4 oz/gal)
Potassium cyanide (KCN)	38 g/l (6oz/gal)
Potassium carbonate (K_2CO_3)	g/l (4 oz/gal)
Water	remainder.

Anodes ..... Silver
Temperature ..... 20°-30°C
Current density ..... 5 amp/ft^2 (0.5 amp/dm^2)
Time ..... 15 min minimum

0.4 g/l of ammonium thiosulphate (dissolved in a small quantity of water) should be added to the new solution and further additions of 0.2g after every 125 amp hr. Alternatively, other suitable addition agents may be employed.

APPENDIX VI

Method of stripping silver deposits

The faulty parts should be degreased in an organic solvent and be allowed to cool. They should then be immersed at room temperature in an aqueous solution containing about 500 ml/l (80 fl oz/gal) of nitric acid (*d* 1.42) for sufficient time to dissolve the deposit. The parts should then be washed thoroughly in clean cold water and dried.

Approved for issue,

E. W. RUSSELL,

Director of Materials Research and Development.

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