

**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.

Aerospace Material Specification
CORROSION PREVENTIVE OIL: Hydraulic system
NATO Code Number: C-635
Joint Service Designation: PX-26

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 Standards 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 5 on page 2. 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 edition of those given in this specification.

(5) Further details concerning the test apparatus specified in this specification can be obtained from the Chemist in Charge, Materials Quality Assurance Directorate, Procurement Executive, Ministry of Defence, Harefield House, Harefield, Oxbridge, Middlesex, UB9 6BB.

(6) Material to the cleanliness standard given in this specification may only be available in specified small containers. If the standard of cleanliness is not required, then Item 3 of Table 2 should be deleted by contract action.

(7) Points of difference from DTD 5540A are indicated by asterisks.

1 Scope

This specification covers one grade of material intended for the preservation of hydraulic equipment in storage and for use in the rig testing of hydraulic components.

2 Related documents

Reference is made in this specification to:

Institute of Petroleum, 'IP Standards for Petroleum and its Products'.

*ASTM Standards, Parts 23, 24 and 25, 'Petroleum Products and Lubricants'.

DEF - 2000, 'Standard Methods for Testing Petroleum Oils and Lubricants (POL) and Allied Products'.

*BS 805, 'Toluenes'.

*BS 872, 'Abrasive papers and cloths'.

BS 903, Part A16, 'Methods of testing vulcanized rubber - Determination of swelling in liquids'.

*BS 1449, 'Steel plate, sheet and strip'.

TS 338, 'Standard "L" rubber sheet material'.

3 Composition

The material shall consist of refined petroleum oil containing approved additives to ensure compliance with the requirements for viscosity, resistance to oxidation, corrosion prevention and anti-wear properties of the finished product.

4 Constituents

- (a) The petroleum base oil stock, which shall not contain a pour point depressant additive, shall comply with the requirements of Table 1.

- (b) The viscosity index improver additive in the material shall not exceed twenty per cent by weight of active ingredient.
- (c) The quantity of oxidation inhibitors in the material shall not exceed two per cent by weight.
- (d) The anti-wear agent shall be triaryl phosphate. The quantity in the material shall be 0.5 ± 0.1 per cent by weight. It shall be of the "non-toxic" type and of acceptable quality when biologically tested to the satisfaction of the Quality Assurance Authority. The grade, specification and supplier of the triaryl phosphate shall be approved by the Quality Assurance Authority.
- (e) A corrosion inhibitor shall be added in sufficient quantity for the finished material to meet the requirements of this specification.
- (f) An oil soluble red dye shall be added in sufficient quantity for the finished material to comply with the colour requirements given in Item 2 of Table 2.

5 Type approval

- (a) Before material is accepted as complying with the requirements of this specification, the manufacturer shall obtain type approval. Applications for type approval, together with evidence that the base oil complies with all the requirements of Table 1 and the finished material with the requirements of Table 2, except Item No 3, shall be submitted to the Quality Assurance Authority - The Director of Materials Quality Assurance/G1, Headquarters Building, Royal Arsenal East, Woolwich, London SE18 6TD. Full details of formulation shall also be submitted, in confidence, and shall include the manufacturer, brand name, chemical name (where applicable), source, percentage, and function of each ingredient.
- (b) When applying for approval, the manufacturer shall forward to the Quality Assurance Authority a one litre sample of the base oil taken from one batch and a twenty litre sample of the finished material taken from one batch. These samples need not meet the cleanliness standard given in Item 3 of Table 2.
- (c) The material shall also pass such functional tests as are deemed necessary by the Quality Assurance Authority.
- (d) Failure to show compatibility with other materials approved to this specification shall be sufficient cause for rejection.
- (e) After formal approval has been given, no change in formulation will be permitted unless approval of the change has been obtained from the Quality Assurance Authority.

6 Quality assurance

- (a) A representative sample of each batch of base oil shall be tested for compliance with all the requirements of Table 1.
- *(b) A representative sample of each batch of finished material shall be tested for compliance with Items 1-8 inclusive, 10-14 inclusive, 16, 17, 19 and 20 of Table 2.
- *(c) The Director of Materials Quality Assurance may require the manufacturer to test to Items 9, 15, 18, and 21 of Table 2 at any time.
- (d) The manufacturer shall state on each test certificate that the material is identical in formulation and method of manufacture with the material which has been previously type approved in accordance with Clause 5.

TABLE 1-BASE OIL

Test	Limits	Test Method
Flash point, °C min	81	ASTM D93/IP34
Pour point, °C max	-60	ASTM D97/IP15
Total acid number max	0.1	ASTM D974/IP139

TABLE 2-FINISHED MATERIAL

Item No	Test	Limits	Test Method
1	Appearance	Clear, homogeneous and free from visible impurities	Visual examination
2	Colour, Lovibond Red, units min max	20 40	IP17 Method A 1 inch cell
*3	Solid particle contamination: Number of particles per 100 ml in size range, μm > 5-15 max > 15-25 max > 25-50 max > 50-100 max > 100 max	10,000 400 150 20 5	Appendix I
	NOTE. This requirement applies to material in filled and sealed containers. If the particle count is above the specification limit on any individual sample, two further samples from the same container shall be examined. The arithmetic average of the two closer particle counts shall be considered the particle count for the sample. All test results shall be reported.		
4	Viscosity, cSt, at: 37.78°C min -40°C max -54°C max	14.0 800 3,500	ASTM D445/IP71
5	Flash point, °C min	81	ASTM D93/IP34
6	Pour point, °C max	-60	ASTM D97/IP15
7	Total acid number max	0.2	ASTM D974/IP139
8	Strong base number max	0.2	ASTM D974/IP139
*9	Corrosiveness and oxidation stability: (a) Corrosiveness Weight change of test piece, mg/100 sqmm Steel max Aluminium alloy max Magnesium alloy max Cadmium plated steel max Copper max Appearance of test pieces (b) Oxidation stability. Change in viscosity at 37.78°C from original % max Increase in total acid number from original max Appearance of material	± 0.2 ± 0.2 ± 0.2 ± 0.2 ± 0.6 No pitting, etching or visible corrosion of any of the test pieces. Slight discoloration of the cadmium will be permitted. Copper corrosion not greater than classification No 3. $+ 20$ $- 5$ 0.2 No visible separation of insoluble matter. No gumming.	DEF-2000 Method No 29 Test temperature, $121^\circ \pm 1^\circ\text{C}$ Test period, 168 hours ASTM D974/IP139
*10	Copper corrosion: Classification max	No 3	ASTM D130/IP154 Test temperature, $100^\circ \pm 1^\circ\text{C}$ Test period, 72 hours
11	Corrosion prevention - steel: Appearance of test piece	Not more than 3 dots of rust, no one of which is larger than 1 mm diameter, on any panel.	Appendix II

PART 2-FINISHED MATERIAL-continued

Item No.	Test	Limits		Test Method
12	Corrosion prevention - steel/brass: Appearance of steel disc	No corrosion, pitting or other attack on the test area of at least two of three discs. One disc may show not more than 3 spots.		DEF-2000 Method No 31
*13	Corrosion prevention - static water-drop	No rusting on any test plate		Appendix III
14	Low temperature stability: Appearance of material	No gelation, crystallisation or separation of solid or liquid phases. Presence of dense cloud which does not settle shall not be cause for rejection.		DEF-2000 Method No 7 Test temperature, minus 54°C Test period, 72 hours
*15	Shear stability: Decrease in viscosity at 37.78°C from original, %	Not more than 2.0 per cent greater than the percent decrease in viscosity of reference fluid.		Appendix IV
*16	Extreme pressure properties: Mean wear scar diameter, mm max	1.0		IP239 but with ball pot heated to 75° ± 1°C Load 40 kg Running period 60 mins
*17	Rubber swell: Volume change, % min max	19.0 28.0		Appendix V
*18	Evaporation loss, % wt max	70		ASTM D972 Test temperature, 99° ± 1°C
*19	Foaming characteristics: Sequence I Sequence II Sequence III max max max	Foam volume at end of 5 minute blowing period	Foam volume at end of 10 minute settling period	ASTM D892/IP146
		100 100 100	nil nil nil	
20	Phosphorus content, % wt min max	0.035 0.050		IP149
*21	Storage stability: Appearance of material Test of material	Clear, transparent, no gelation, precipitation or separation of solid or liquid phases. Shall comply with requirements of Items 7 to 14 inclusive of Table 2.		Appendix VI

APPENDIX I**Method for the determination of solid particle contamination**

The solid particle contamination shall be determined by the use of a suitable HiAc automatic counter. The test procedure shall be as given in the operating instructions for the instrument.

NOTE: Alternative methods may be used if agreed by the Quality Assurance Authority but the above method is mandatory for referee purposes.

APPENDIX II**Method for the determination of corrosion prevention-steel**

Method ASTM D1748 shall be used, subject to the following modifications:

(a) Materials

- (i) Steel panels to BS S511 shall be used in lieu of those specified.
- (ii) 60/80 Petroleum spirit (IP Grade) shall be used for degreasing the panels in lieu of naphtha.

(b) Test procedure

- (i) Five panels prepared in accordance with ASTM D1748 using the aluminium oxide abrasive cloth polishing procedure, shall be tested.
- (ii) The test period shall be 100 hours.

APPENDIX III***Method for the determination of corrosion prevention-static water-drop****1 Apparatus**

- a* Beakers, 100 ml squat form, of heat resisting glass.
- b* Cover glasses, to fit the beakers.
- c* Syringe, hypodermic, with a No 24 stainless steel needle and capable of delivering 0.2 ± 0.02 ml of water.
- d* Oven, air circulating, capable of being maintained at $60 \pm 1^\circ\text{C}$.
- e* Tweezers.
- f* Test plates, of cold rolled steel, to BS 1449 Part 1 Grade CR3/FF as shown in Figure 1. Prior to forming, the plates shall be cleaned in accordance with DEF-2000 Method No 25.
- g* Tongs.

2 Materials

- a* Cleaning solution, glass, a saturated solution of sodium or potassium dichromate in concentrated sulphuric acid. Detergent cleaning solutions may be used in lieu but for referee purposes, the standard cleaning solution must be used.
- b* Aluminium oxide abrasive cloth, 240 grit, to BS 872.
- c* Cotton wool, surgical.
- d* Filter paper.
- e* Toluene to BS 805/3.
- f* Petroleum spirit - 100/120°C, IP Specification.

3 Procedure

- a* Soak three of the beakers and cover glasses in the cleaning solution overnight, wash them with tap water, rinse with distilled water and dry at 105°C .

- b* In each of the beakers place 20 ml of the oil to be tested.
- c* Prepare three test plates as follows:
- WARNING:** Procedures involving the use of toluene and petroleum spirit shall be carried out in a fume chamber and away from sources of ignition.
- (1) Hold each test plate with the filter paper and abrade the dimpled side with a new piece of the abrasive cloth.
 - (2) Swab each plate with the toluene, using clean cotton wool held in clean tweezers and rinse in toluene.
 - (3) Using the tongs immerse each plate in fresh boiling toluene for three or four minutes.
 - (4) Using the tongs, immerse each plate in fresh boiling petroleum spirit for approximately one minute.
- d* Using the tongs, remove the plates from the petroleum spirit, and as soon as they are dry immerse one plate, dimple side up, in each of the beakers of test oil. Cover the beakers and place them in the test oven at $60^{\circ} \pm 1^{\circ}\text{C}$ for one hour.
- e* Remove the beakers from the oven and into the dimple of each plate, place 0.2 ml of distilled water, using the hypodermic syringe.
- NOTE:* It is important that during this operation, the needle of the syringe does not touch the surface of the plate.
- f* Replace the covers on the beakers and store them in the oven at $60 \pm 1^{\circ}\text{C}$.
- g* Inspect the plates at 24 hour intervals for evidence of rust under or around the water droplet. If the water droplet shrinks appreciably, add more distilled water to restore it to its original size.
- h* After 168 hours remove the plates from the test oil, wash them with the petroleum spirit and examine.
- NOTE:* Some additives cause staining of the plate under these test conditions and careful examination may be needed to distinguish between this and rusting.

4 Reporting

- a* Report the appearance of the three test plates and comment upon the presence of rusting as follows:
- (1) If all three plates are free from rusting, report the test as satisfactory.
 - (2) If the three plates are not similar, repeat the test using three new test plates.
 - (3) If all three test plates show rusting, report the test as fail.
- b* If rusting has occurred before completion of the test, report the time at which it was observed.

APPENDIX IV

*Method for the determination of shear stability

Method ASTM D2603 shall be used, subject to the following modifications:

(a) **Materials**

The reference fluid shall be DTD 585B Shear Stability Reference Fluid.

NOTE: Samples of DTD 585B Shear Stability Reference Fluid may be obtained, upon payment, from A/O Stores, Materials Quality Assurance Directorate, Headquarters Building, Royal Arsenal East, Woolwich, London SE18 6TD.

(b) **Test procedure**

- (i) The volume of test sample shall be 30 ml.
- (ii) The period of test shall be 30 minutes.
- (iii) The test temperature shall be $38^{\circ} \pm 1^{\circ}\text{C}$.
- (iv) The power setting shall be regulated so that the viscosity decrease of the DTD 585B Shear Stability Reference Fluid at 37.78°C is 15 ± 1 per cent.
- (v) The viscosity of the reference fluid before and after test and of the material after test shall be determined by Method ASTM D445/IP71.

APPENDIX V**Method for the determination of rubber swell**

Method A of BS 903 Part A16 shall be used, subject to the following modifications:

(a) Materials

The test rubber shall be Standard L rubber to Specification TS338.

NOTE: Samples of Standard L rubber may be obtained, upon payment, from A/O Stores, Materials Quality Assurance Directorate, Headquarters Building, Royal Arsenal East, Woolwich, London SE18 6TD.

Supplies of the standard rubber shall be stored flat and protected from light by wrapping in their original packaging materials. Moist conditions must be avoided and the storage temperature shall be below 25°C. The storage place must not contain any electrical equipment capable of generating ozone because this is particularly deleterious.

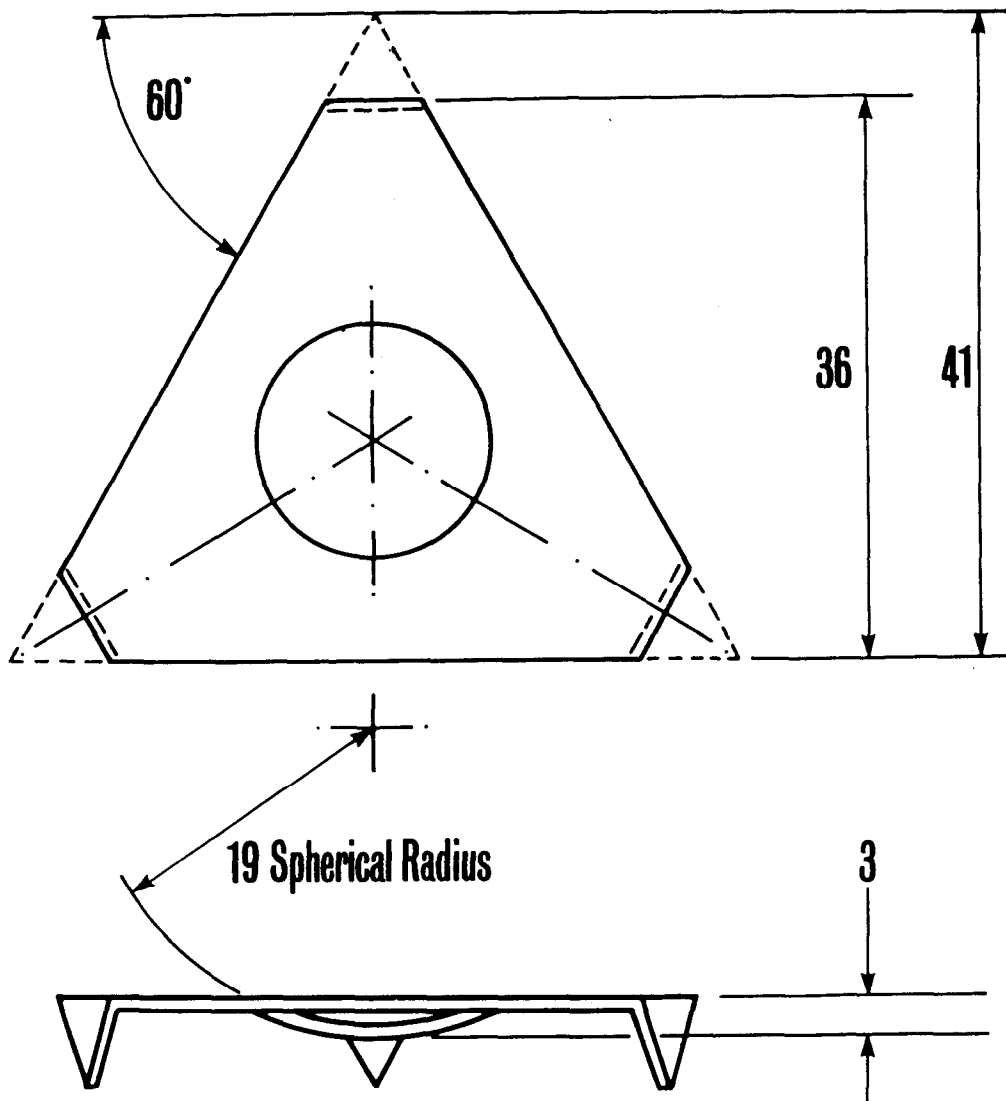
Subject to satisfactory storage conditions as described above, the standard rubber can be used for a period not exceeding five years from the date of cure marked upon the supply.

(b) Test procedure

- (i) The test temperature shall be 70°C ± 1°C.
- (ii) The test period shall be 168 hours.

APPENDIX VI**Method for the determination of storage stability**

- (i) 1000 ml of the material shall be stored in the dark in a glass-stoppered bottle for 6 months at 25 ± 5°C.
- (ii) The material shall then be visually examined for clarity, transparency and evidence of gelling, precipitation or separation of solid or liquid phases.
- *(iii) The stored material shall be tested to the requirements of Items 7 to 14 inclusive of Table 2.



Dimensions in millimetres

Material BS1449 Part1 Grade CR3/FF 1.2mm thick

Figure 1 Test Plate

CORROSION PREVENTION - STATIC WATER DROP

Approved for issue,

N. L. PARR

Director of Research/Materials

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Printed in England by Hobbs the Printers Ltd., Southampton, SO9 2UZ
and published by Her Majesty's Stationery Office

28p Net

(322) Dd290624 K11 4/76

ISBN 0 11 771628 6