



**Ministry of Defence  
Defence Standard 68-10**

**Issue 5 Publication Date 25 April 2003**

**Corrosion Preventive: Water Displacing  
NATO Code: C-634  
Joint Service Designation: PX-24**



**AMENDMENT RECORD**

<b>Amd No</b>	<b>Date</b>	<b>Text Affected</b>	<b>Signature and Date</b>

**REVISION NOTE**

This Standard has been revised to amend the test requirements, remove the Qualification Approval and Quality Assurance clauses and introduce the Product Conformity Certification clause.

**HISTORICAL RECORD**

**This standard supersedes the following:**

- Def Stan 68-10 Issue 1 dated February 1970
- Def Stan 68-10 Issue 2 dated September 1973
- Def Stan 68-10 Issue 3 dated April 1989
- Def Stan 68-10 Issue 4 dated June 1995

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**PREFACE**

**Standards for Defence**

**Corrosion Preventive: Water Displacing**

**NATO Code: C-634**

**Joint Service Designation: PX-24**

- a.** This standard provides requirements for one grade of corrosion preventive, water displacing.
- b.** The Technical Authority for this Defence Standard is the Aviation Fuels Technical Manager (AFTM), Defence Fuels Group (DFG), West Moors, Wimborne, Dorset, BH21 6QS.
- c.** This standard has been produced for of the Standards Advisory Group (SAG), by the Aviation, Propulsion Fuels and Lubricants Advisory Group (APFLAG), on behalf of the Defence Fuels and Lubricants Committee (DF&LC).
- d.** This standard has been agreed by the authorities concerned with its use and is intended to be used whenever relevant in all future designs, contracts, orders etc. and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, the UK Defence Standardization (DStan) shall be informed so that a remedy may be sought.
- e.** Any enquiries regarding this standard in relation to an invitation to tender or a contract in which it is incorporated are to be addressed to the responsible technical or supervising authority named in the invitation to tender or contract.
- f.** Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.
- g.** This standard has been devised solely for the use of the Ministry of Defence (MOD) and its contractors in the execution of contracts for the MOD. To the extent permitted by law, the MOD hereby excludes all liability whatsoever and howsoever arising (including, but without limitation, liability resulting from negligence) for any loss or damage however caused when the standard is used for any other purpose.

**TEXT****Standards for Defence****Corrosion Preventive: Water Displacing****NATO Code: C-634****Joint Service Designation: PX-24****SECTION 1 GENERAL REQUIREMENTS****1 SCOPE**

This standard specifies requirements for one grade of corrosion preventive, water displacing, for the preservation and corrosion inhibition of certain gas turbine engines and metal surfaces in use or short-term storage. When applied by pressure circulation, brushing, spraying, or dipping, it displaces any water present and forms a transparent protective film after evaporation of carrier solvent. It may be used on low voltage electrical equipment (up to 440 volts) and as a rust penetrating fluid. It may also be used in conjunction with supplementary barrier materials. Water separates from the used fluid on standing, allowing the fluid to be re-used. Removal may be effected by flushing, brushing, spraying or wiping with suitable hydrocarbon solvents e.g. white spirit or kerosene.

NOTE: This product must NOT be used as an insulating material.

**2 WARNING**

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at Work, without exemption. All Defence Standards either directly or indirectly invoke the use of processes and procedures that could be injurious to health if adequate precautions are not taken. Defence Standards or their use in no way absolves users from complying with statutory and legal requirements relating to Health and Safety at Work.

**3 RELATED DOCUMENTS**

**3.1** The publications referred to in the text of this Standard are listed at **Annex D**. Publications are grouped and listed in alphanumeric order.

**3.2** Reference in this Standard to any related document means in any invitation to tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated.

## **SECTION 1 GENERAL REQUIREMENTS**

**3.3** In consideration of **3.2** above, users shall be fully aware of the issue and amendment status of all related documents, particularly when forming part of an invitation to tender or contract. Responsibility for the correct application of standards rests with users.

**3.4** DStan can advise regarding where related documents are obtained from. Requests for such information can be made to the DStan Helpdesk. How to contact the Helpdesk is shown on the outside rear cover of this Defence Standard.

## **4 MATERIALS**

**4.1** The corrosion preventive, water displacing, shall consist of a homogeneous blend of film-forming petroleum materials, corrosion inhibitors, and other additives as necessary, in a hydrocarbon solvent of aromatics content less than 1 % m/m, to meet the requirements of **Table 1**. Chlorinated solvents are not permitted.

**4.2** The fluid shall be undyed and suitable for use on electrical equipment (up to 440 volts).

## **5 PRODUCT CONFORMITY CERTIFICATION (PCC)**

**5.1** Product Conformity Certification (PCC) procedure applies to product supplied for MoD use against this Standard.

**5.2** Before any product can be considered as complying with this Standard, the manufacturer must demonstrate to the Technical Authority that the product meets all the requirements of this Standard. At this time, a declaration in confidence of the formulation, including identification and source of all components, is required.

**5.3** The Technical Authority will then assign a unique identification reference to this product, which becomes a Technically Acceptable Product. The Technical Authority will maintain a list of Technically Acceptable Products in a Technically Acceptable Products List (TAPL). Only those products that are listed on the TAPL may be stated as complying with the requirements of this specification.

**5.4** Once accepted as a Technically Acceptable Product, no change in formulation of the product so referenced shall be made without prior notification to the Technical Authority. The supplier shall also certify that the reformulated product continues to meet the requirements of this Standard and provide evidence to that effect.

**5.4.1** Once such certification and evidence has been received, the reformulated product will be assigned a new discrete identification number and will be added to the TAPL.

**5.5** When supplying product to the Ministry of Defence, the supplier shall certify that the product delivered fully complies with the requirements of this Standard.

## SECTION 1 GENERAL REQUIREMENTS

**5.6** Testing of the finished product shall be in accordance with **Table 1**. The Technical Authority reserves the right to require additional evidence that the product or components are compliant at any stage of the manufacturing process.

**5.7** If any sample taken from the consignment were found not to comply with the requirements of this standard, the whole consignment may be rejected.

## 6 KEEPING QUALITIES

The product, when suitably stored in its original sealed containers, shall retain the properties described in this Standard for a period, from the date of filling, of not less than 12 months in temperate climates and not less than 6 months in tropical climates.

## 7 CONTAINERS AND MARKING OF CONTAINERS

**7.1** The product shall be supplied in sound, clean and dry containers, suitable for the product and in accordance with the requirements of the contract or order.

**7.2** Coatings and paint finishes shall comply with the requirements of the contract or order. Markings shall be in accordance with the requirements of Def Stan 05-52 (Part 1). The product identification shall be specified in the contract or order.

**7.3** It shall be the responsibility of the contractor to comply with any legal requirements for the marking of containers.

**SECTION 2 MATERIAL REQUIREMENTS**

**8 TESTING**

**8.1** Test results for the product shall not exceed the maximum nor be less than the minimum values set out in **Table 1**.

**8.2** Methods quoted in the table are referee methods and shall be used in cases of dispute. Alternative, technically equivalent standard methods may be used by agreement of the Technical Authority.

**8.3** The IP 367 procedure, which covers the use of precision data, shall be used for the interpretation of test results.

<b>Table 1 – Test Requirements</b>				
<b>Test</b>	<b>Property</b>	<b>Units</b>	<b>Limits</b>	<b>Method</b>
1	Appearance		Homogeneous, clear, free from visible impurities	Visual examination
2	Odour		Free from objectionable odour	Olfactory examination
3	Flash Point	°C	Min 61	IP 34
4	Water Content	% m/m	Max 0.1	IP 438
5	Film-forming Properties:			Def Stan 05-50: Part 23 (Annex A)
5.1	Appearance After 10 Minutes		Pass	
5.2	Appearance and Removability After 72 hours		Pass	
5.3	Salt Spray Resistance; Condition of Steel After 30 Hours		Pass	
6	Water Displacement and Protection Against Corrosion		At least two of the three panels shall show no evidence of rusting, pitting, etching or staining	Annex A
7	Freedom From Corrosive Effects		No evidence of pitting, etching or staining	Def Stan 05-50: Part 23 (Annex F)
8	Demulsification Properties: Sample Layer Separation	ml	Min 60	Annex B

(Concluded on page 7)

## SECTION 2 MATERIAL REQUIREMENTS

<b>Table 1 – Concluded</b>				
<b>Test</b>	<b>Property</b>	<b>Units</b>	<b>Limits</b>	<b>Method</b>
9	Effect on Non-metallic Materials:			Def Stan 05-50:
9.1	Acrylonitrile-butadiene Rubber (SRE-NBR/L) (NOTE); Volume Change	%	2 to 25	Part 64 (168 hours at 50°C)
9.2	Polymethacrylate		No crazing or surface defects	Part 23 (Annex N)
10	Lacquer-forming Tendency:			Annex C
10.1	At 150 °C and Resistance to Removal;			Procedure A
10.1.1	Lacquer Formed	mg	Max 10	
10.1.2	Lacquer Remaining	mg	Max 2	
10.2	At 250 °C	mg	Max 15	Procedure B
NOTE: The test rubber shall be to BS ISO 13226.				

ANNEX A

**METHOD FOR THE DETERMINATION OF WATER DISPLACING PROPERTIES  
AND PROTECTION AGAINST CORROSION**

**A.1 Scope**

This method describes a procedure for determining the ability of the test fluid to displace salt water and protect mild steel against subsequent corrosion.

**A.2 Outline of Method**

A prepared steel panel is immersed in salt water solution. The panel is withdrawn and allowed to drain momentarily before immersion in the sample. The coated panel is then exposed to high humidity for a specified duration, and then visually examined for evidence of corrosion.

**A.3 Apparatus**

**A.3.1** Humidity cabinet, operated at a relative humidity of 85 % to 92 % at  $(23 \pm 2)$  °C. Suitable is a closed glass vessel of approximately 5 litres capacity and of such dimensions that the test panels can be suspended freely over a 30 mm depth of saturated sodium carbonate solution.

**A.3.2** Double-ended glass hooks.

**A.4 Materials**

**A.4.1** Mild steel panel as specified in Def Stan 05-50: Part 25, of dimensions 75 mm x 38 mm, with a 5 mm diameter hole, the centre of which shall be on the longitudinal centre line and approximately 5 mm from one end.

**A.4.2** Sodium chloride, laboratory reagent grade: 3 % m/v aqueous solution.

**A.4.3** Humidity control solution (if required): a saturated aqueous solution of sodium carbonate decahydrate, laboratory grade, with excess salt present, which should break the surface of the solution.

**A.4.4** Petroleum spirit, 60/80: laboratory reagent grade.

**A.4.5** Cotton cambric.

**A.5 Procedure**

**A.5.1** Prepare three of the steel panels as specified in Def Stan 05-50: Part 25.

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**A.5.2** Suspend a panel from a glass hook and completely immerse it in the sodium chloride solution for  $(30 \pm 2)$  seconds. Withdraw the panel and allow to drain vertically for  $(10 \pm 1)$  seconds then completely immerse it in the sample, avoiding any lateral movement, for 2 minutes  $\pm 5$  seconds at  $(23 \pm 2)$  °C.

**A.5.3** Withdraw the panel and allow to drain vertically for 1 hour at  $(23 \pm 2)$  °C, in a draught-free atmosphere, free from contact with other objects.

**A.5.4** Suspend the panel in the humidity cabinet (or vessel) for 72 hours.

**A.5.5** Repeat the process from **A.5.2** to **A.5.4** with the other two panels.

**A.5.6** At the end of the test period, remove the panels and wipe them with the cotton cambric soaked with the petroleum spirit in order to remove the test sample and allow to air dry.

**A.5.7** Visually examine the panels for rusting, pitting, etching or staining.

## **A.6 Reporting**

Report the condition of the panels.

## **A.7 Precision**

Not applicable.

ANNEX B

METHOD FOR THE DETERMINATION OF DEMULSIFICATION PROPERTIES

**B.1 Scope**

This method describes a procedure for the determination of the readiness of the product to separate from water.

**B.2 Outline of Method**

The sample is emulsified with sodium chloride solution, and after standing the volume of separated sample is recorded.

**B.3 Apparatus**

**B.3.1** Glass cylinder, graduated, 100 ml, with stopper, to BS 604.

**B.3.2** Stopwatch.

**B.4 Materials**

**B.4.1** Sodium chloride, laboratory reagent grade, 3 % m/v aqueous solution.

**B.4.2** Distilled water to BS EN ISO 3696.

**B.4.3** Acetone, laboratory reagent grade.

**B.4.4** General purpose detergent solution.

**B.5 Procedure**

**B.5.1** Thoroughly soak the graduated cylinder in warm detergent solution and leave overnight. Wash the cylinder thoroughly with tap water, followed by distilled water. Finally rinse with acetone and allow to air dry.

**B.5.2** Pour  $(25 \pm 1)$  ml of the sodium chloride solution, followed by  $(75 \pm 1)$  ml of the sample, into the graduated cylinder.

**B.5.3** Stopper the cylinder and shake through an arc of approximately 450 mm, 120 times per minute, for 2 minutes.

**B.5.4** Allow the cylinder to stand undisturbed at  $(23 \pm 2)$  °C for  $(60 \pm 1)$  minutes, then record the volume of separated sample to the nearest ml.

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**B.6 Reporting**

Report the volume of separated sample to the nearest ml.

**B.7 Precision**

Not applicable.

## ANNEX C

### METHOD FOR THE DETERMINATION OF LACQUER-FORMING TENDENCY AND RESISTANCE TO REMOVAL OF LACQUER

#### C.1 Scope

This method consists of two procedures. Procedure A describes the determination of lacquer forming tendency at 150 °C and the resistance to removal of the lacquer formed. Procedure B describes the lacquer-forming tendency at 250 °C.

#### C.2 Outline of Method

Weighed steel test panels are immersed in the sample, allowed to drain, then heated for a specified period and cooled. This is repeated a further nineteen times. The panels are then reweighed and the mass of lacquer determined.

Additionally for Procedure A, the lacquered panels are subjected to solvent washing and the mass of lacquer remaining determined.

#### C.3 PROCEDURE A

##### C.3.1 Apparatus and Materials

C.3.1.1 Steel panel as specified in Def Stan 05-50: Part 25, dimensions shown in **Figure C1**.

C.3.1.2 Double-ended glass hooks.

C.3.1.3 Oven, air circulating, capable of regaining the specified temperatures within 6 minutes of opening and closing the oven door.

C.3.1.4 Metal frame of low thermal capacity, from which to suspend the panels.

C.3.1.5 Beaker, tall form, 600 ml capacity, graduated.

C.3.1.6 Variable speed magnetic stirrer with stirrer bar.

C.3.1.7 Wash solvent solution of 75 % iso-octane (laboratory reagent grade) and 25 % toluene (laboratory reagent grade) by volume.

##### C.3.2 Procedure

C.3.2.1 Prepare two of the steel test panels as specified in Def Stan 05-50: Part 25.

C.3.2.2 Control the oven at  $(150 \pm 2)$  °C.

(Continued on page 13)

**C.3.2.3** Weigh each test panel to the nearest 0.1 mg (W1).

**C.3.2.4** Suspend one of the test panels on a glass hook and completely immerse it in the sample. Avoiding any lateral movement, carefully remove the panel in a period of five seconds at an even rate and suspend it from the metal frame. Repeat the procedure for the remaining test panel, and discard the sample.

**C.3.2.5** Suspend the panels from the frame and allow to drain in a draught-free atmosphere for one hour at  $(23 \pm 2)$  °C.

NOTE: Droplets formed by drainage at the lowest panel point shall not be removed.

**C.3.2.6** Place the frame in the oven for 1 hour, then remove and allow to cool to  $(23 \pm 2)$  °C.

**C.3.2.7** Repeat **C.3.2.4** to **C.3.2.6** inclusive 19 times to give a total of 20 cycles for each test panel. Reweigh each panel to the nearest 0.1 mg (W2).

**C.3.2.8** Place the beaker containing 500 ml of the solvent solution on the magnetic stirrer and insert the stirrer bar. Control the stirring rate so that the bottom of the vortex is level with the 200 ml graduation.

**C.3.2.9** Suspend a test panel centrally in the beaker and completely immerse it in the swirling solvent for 5 minutes  $\pm$  15 seconds at  $(23 \pm 2)$  °C. Remove the panel and allow to drain at  $(23 \pm 2)$  °C for a minimum of 15 minutes. Repeat this process for the other panel.

**C.3.2.10** Suspend the panels from the frame and place in the oven controlled at  $(70 \pm 2)$  °C for 30 minutes.

**C.3.2.11** Remove the frame from the oven, allow the panels to cool to  $(23 \pm 2)$  °C, and then reweigh them to the nearest 0.1 mg (W3).

### **C.3.3 Calculation**

**C.3.3.1** Calculate the mass of lacquer on each test panel (W2-W1), and the arithmetic mean for the two panels.

**C.3.3.2** Calculate the mass of lacquer remaining on each panel after the solvent wash (W3-W1), and the arithmetic mean for the two panels.

### **C.3.4 Reporting**

**C.3.4.1** Report the result of **C.3.3.1** to the nearest 0.1 mg as the Lacquer Formed at 150 °C.

**C.3.4.2** Report the result of **C.3.3.2** to the nearest 0.1 mg as the Lacquer Remaining.

(Continued on page 14)

### **C.3.5 Precision**

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### C.3.5.1 Repeatability

**C.3.5.1.1** Lacquer forming tendency: Duplicate results obtained by the same operator should not be considered suspect unless they differ by more than 3 mg.

**C.3.5.1.2** Lacquer remaining: Duplicate results obtained by the same operator should not be considered suspect unless they differ by more than 1 mg.

### C.3.5.2 Reproducibility

Under review.

## C.4 **PROCEDURE B**

### C.4.1 **Apparatus**

The apparatus shall be as specified in **C.3.1.1** to **C.3.1.4** inclusive.

### C.4.2 **Procedure**

The procedure shall be as specified in **C.3.2.1** to **C.3.2.7** inclusive, except that the temperature in **C.3.2.2** shall be  $(250 \pm 2)$  °C.

### C.4.3 **Calculation**

As in **C.3.3.1**.

### C.4.4 **Reporting**

Report the result of clause **C.4.3** to the nearest 0.1 mg as the lacquer formed at 250 °C.

### C.4.5 **Precision**

#### C.4.5.1 Repeatability

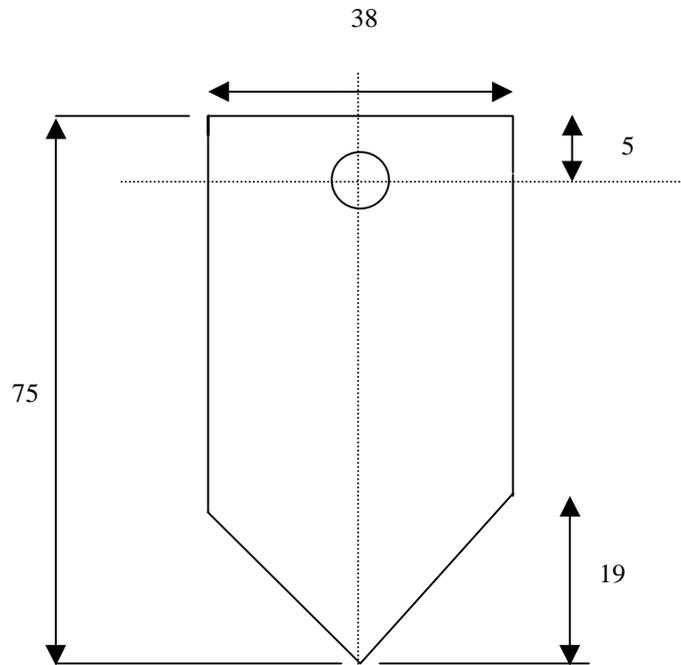
As in **C.3.5.1.1**.

#### C.4.5.2 Reproducibility

Under review.

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**Steel Test Panel:** Dimensions in millimetres – hole approx. 5 mm diameter.



**Fig C 1**

**ANNEX D**

**RELATED DOCUMENTS LIST**

<b>Designation</b>	<b>Title</b>
BS EN ISO 3696	Water for Analytical Use – Specifications and Test Methods
BS ISO 13226	Standard Rubber Elastomers (SRE's) for Characterising the Effect of Liquids on Vulcanised Rubbers
BS 604	Specification for Graduated Measuring Cylinders
IP 34	Determination of Flash Point – Pensky-Martens Closed Cup Method
IP 367	Determination and Application of Precision Data in Relation to Methods of Test
IP 438	Determination of Water – Coulometric Karl Fischer Titration Method
Def Stan 05-50: Part 23; Annex A	Methods for Testing Fuels, Lubricants and Associated Products: Methods of Test for Corrosion Preventatives; Film-forming Properties of Oil Film, Water-displacing Corrosion Preventives
Annex F Annex N	Freedom From Corrosive Effects on Metals and Metal Alloys. Assessment of the Effect of Corrosion Preventives on Polymethacrylate
Part 25 Part 64	Preparation of Steel Panels for Test Purposes Effect of Petroleum Products on Elastomers
Def Stan 05-52: Part 1	Markings for the Identification of Fuels, Lubricants and Associated Products: Containers Holding 216.5 Litres or Less

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The DStan file reference relating to work on this standard is D/DStan/80/81.

**Contract Requirements**

When Defence Standards are incorporated into contracts users are responsible for their correct application and for complying with contractual and statutory requirements. Compliance with a Defence Standard does not in itself confer immunity from legal obligations.

**Revision of Defence Standards**

Defence Standards are revised as necessary by up issue or amendment. It is important that users of Defence Standards should ascertain that they are in possession of the latest issue or amendment. Information on all Defence Standards is contained in Def Stan 00-00 Standards for Defence Part 3 , Index of Standards for Defence Procurement Section 4 'Index of Defence Standards and Defence Specifications' published annually and supplemented regularly by Standards in Defence News (SID News). Any person who, when making use of a Defence Standard encounters an inaccuracy or ambiguity is requested to notify the Directorate of Standardization (DStan) without delay in order that the matter may be investigated and appropriate action taken.