Intumescent Coating Systems Dulux Protective Coatings

Dulux FIRETEX® Solvent Based Intumescent Application Guide

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The purpose of this manual is to ensure correct application of Dulux FIRETEX® FX2000 series Solvent Based Intumescents.

For the safe handling and use of Dulux FIRETEX® products reference must also be made to the current Technical and Safety Data Sheets.

Dulux FIRETEX® FX2000 products are fully tested and certified and this information is available to design architects and engineers on request.

The information contained in this application manual is based upon independent test data, comprehensive research and field experience, and is considered to be accurate at the time of publication. However, the contents will be subject to revision from time to time due to our policy of continuously improving our products, processes and service.

Only the electronic copy of this manual is a 'controlled document' and all paper versions are 'uncontrolled'. Thus, the user is advised to ensure they have the latest issue of the manual by contacting Dulux Protective Coatings.

1.0 Introduction

Dulux FIRETEX® FX2000 series products are single pack solvent based intumescent coatings designed to provide up to 120 minutes fire protection to structural steelwork.

1.1 What are Dulux FIRETEX® Solvent Based Intumescents and where are they used?

Dulux FIRETEX® Solvent Based FX2000 intumescent coatings are used to enhance the fire resistance of structural steel members by providing a layer of insulation, which is formed as a result of a chemical reaction initiated by fire. This insulation reduces the rate of heat transfer and extends the time period for which the structural member can resist the weakening effects of the heat.

Dulux FIRETEX® FX2000 intumescent coatings have been designed for cellulosic fire resistance periods up to 120 minutes. They have been tested and certified in accordance with a range of national and international fire testing standards. Please consult the relevant product data sheet or Dulux Protective Coatings for details of certifications.

The aim of this manual is to provide relevant technical information to the applicator of Dulux FIRETEX® FX2000 series coatings, helping to ensure that the completed project is fit for purpose.

It is the responsibility of the applicator to ensure that all coatings, within the solvent based intumescent series, are applied in accordance with the stated guidelines in this procedure. Since product failure could threaten life in an emergency fire situation, applicators must not deviate from these guidelines without written prior agreement from Dulux Protective Coatings.

1.2 Product quality assurance

All raw materials are subjected to ISO 9001:2015 registered quality testing systems before being released for manufacture. Representative batches of Dulux FIRETEX® FX2000 are routinely selected from production and subjected to fire testing.

1.3 Technical support

Our specialist teams co-ordinate the front line technical and sales focus for the Dulux FIRETEX® FX2000 series. To support our customers in the field, we have experienced Technical Service teams working in conjunction with a dedicated product estimators.

2.0 Surface Preparation & Priming

2.1 Surface preparation

All surfaces to be protected by Dulux FIRETEX® FX2000 intumescent coatings must be correctly prepared and primed. Surface preparation and painting should be carried out in line with 'best industry practice' as indicated in many publications by institutions such as NACE, SSPC, AMPP, ICORR, ISO, ASTM, AS, etc. The standards of surface preparation contained herein are to be considered minimum requirements. Where other client company specifications or product technical data sheets demand a higher level of preparation, the higher level should be adopted. In all cases the applicator should obtain and refer to the current Dulux FIRETEX® FX2000 product technical data sheets.

2.2 Surface defect repair

All steel surface defects, including weld splatter, cracks, surface laminations, and deep pitting, are likely to be detrimental to Dulux FIRETEX® FX2000 intumescent coatings and must be removed prior to abrasive blast cleaning. All fins, burrs, and sharp edges shall be removed by grinding to a minimum radius of 2mm (0.08"). The integrity of welds must be inspected, as these are often a location where corrosion forms. Undercut welds, blow holes, discontinuous seams, and other defects should be rectified. Uneven welds should be ground smooth to ensure proper adhesion of the system. It is not necessary to grind weld seams flush.

2.3 Abrasive blast cleaning

All steel surfaces must be clean, dry and free from all surface contamination, refer to AS 1627.1-2003 (similar to SSPC-SP1), prior to abrasive blast cleaning as per AS1627.1-2003 to a minimum standard of ISO 8501-1:2007 Sa 2½, similar to (NACE No.2/SSPC-SP10). Abrasive blast profile should generally be in the range of 50–75 microns (2 to 3 mils). When blasting has been completed, all dust and arisings must be removed from the cleaned surface by use of a vacuum cleaner, dry oil free compressed air or brush.

2.4 Priming

Primers must be approved and been satisfactorily tested and qualified for use under Dulux FIRETEX® FX2000 coatings.

2.5 Coating over of approved primers with Dulux FIRETEX® FX2000 series

Before application of Dulux FIRETEX® FX2000 coatings, ensure the primer to be coated is dry and free from all visible traces of rust, breakdown, surface contaminants, especially grease and soluble salts.

Areas of break down or damage on the primer should be prepared to the specified standard (e.g. AS 1627.1-2003, ISO 8501-1:2007, Sa 2½, SSPC SP11 Power Tool Cleaning, Level 1 for small areas) prior to patch repairing and subsequent application of specified Dulux FIRETEX® FX2000 product.

Ensure that the over coating time/temperature intervals are in line with the primer manufacturer's data sheet and the Dulux FIRETEX® FX2000 series primer approval.

Contact Dulux Protective Coatings for a list of approved primers.

2.6 Primer queries

If there are doubts about the suitability for overcoating of the primed substrate e.g. unknown primer, excessive primer dry film thickness, contamination, it is essential to contact Dulux Protective Coatings prior to application of Dulux FIRETEX® products. Such situations should be treated on a case-by-case basis.

3.0 Product Storage and Handling

Consult relevant Material Safety Data Sheet for information on safe storage, handling and application of Dulux FIRETEX® FX2000 products. It is important that the most current and up to date Material Safety Data Sheet for the product being used is referred to ensure that the latest storage and handling guidance is observed.

For operator safety it is essential that all recommended PPE as detailed in the relevant Dulux FIRETEX® FX2000 series Material Safety Data Sheet is worn/used.

3.1 Storage

- Keep away from sources of ignition, heat, sparks or open flame. No smoking.
- Containers which are open should be properly re-sealed and kept upright to prevent spillage.

4.0 Application

Dulux FIRETEX® FX2000 intumescent series technical product data sheets also contain essential information regarding application parameters and must be read in conjunction with this manual. A copy of the relevant data sheets can be obtained from Dulux Protective Coatings.

4.1 Recommended equipment

As a minimum, a 45:1 ratio airless spray pump (or equivalent) is required. It is also possible to use electric or petrol-powered airless spray pumps. Check with Dulux Protective Coatings Technical Services to see if the proposed pump will adequately apply the material.

Use 3/8" (9.53mm) fluid lines and short ¼"(6.35mm) whip end, and spray gun such as a Graco® XTR 7. Maximum fluid line should not exceed 30 metres.

Remove all filters in the pump and spray gun prior to beginning the application.

FIRETEX® FX2000 series material typically requires a nozzle/tip Size of 21–27' thou (0.53–0.58mm), >30° is recommended, but application conditions may require use of alternative tips.

Operating pressure range of 3,000–2,500 psi is suggested, but in all instances the pressure should be set to the minimum value to allow satisfactory atomisation of the Dulux FIRETEX® FX2000 series material.

4.2 Brush application

The products are suitable for brush application, but due to the nature of the products a ribbed appearance may result and as such are generally not recommended for large areas. Application of more than one coat may be necessary to give equivalent dry film thickness of a single spray applied coat.

4.3 Mixing instructions

As Dulux FIRETEX® FX2000 products are thixotropic in nature and develop 'false body' post manufacture and filling, it is recommended to power mix the materials in the pail to ensure that the product flows into the wet end of the spray pump. By doing so, steady flow and reduction in cavitation is improved. It is recommended that the material is stirred using a handheld air powered mixer, typically for a duration of one to two minutes.

4.4 Application conditions

Good ventilation conditions are essential. Do not apply at temperatures below 5°C. Do not apply at relative humidity above 85% or when the surface is less than 3°C above the dewpoint.

The application of Dulux FIRETEX® FX2000 at elevated material and surface temperatures may reduce the sag resistance of the product. It is the responsibility of the applicator to determine what thickness of product can successfully be applied at the prevailing ambient conditions.

Dulux FIRETEX® FX2000 products must be protected from moisture during the drying period. Moisture ingress prior to drying may affect the integrity and fire protection properties of the coatings.

4.5 Overcoating

No more than two coats by airless spray should be applied within any 24-hour period.

If the maximum recommended thickness per coat is exceeded or high film thicknesses are overcoated prematurely, cracking and/or blistering may occur. This is even more important when high film thicknesses/loadings are involved.

Product data sheets will state minimum periods before an intumescent film can be overcoated, however these are guide figures and the experience of the applicator and inspector will also play a key role in deciding when the coating is dry enough to recoat. There will still be a percentage of solvent still retained in the film when it is overcoated.

4.6 External exposure

FIRETEX® FX1000/2000 coatings are capable of withstanding external exposure without topcoat for up to 6 months providing:

The product is allowed to dry for at least 24 hours at 15°C in dry conditions with good air movement and ventilation. These conditions are based on a total dry film thickness of up to 800 microns DFT. The drying time required will be increased if the film thickness is greater than 800 microns DFT.

The substrate temperature is at least 3°C above the dew point at the time of application and during the drying period.

The specific use, or storage does not lead to ponding or running water due to rainfall, condensation or other site/transportation/storage circumstances.

4.7 Spray techniques

- Keep overlap areas down to a minimum.
- Do not trigger the gun, a uniform and continuous film is required.
- Try to ensure the gun is aimed directly at steel to avoid dusty finish – even more important when ambient temperatures are raised.
- Ensure good air movement and proper ventilation are present.
- Typical application thickness per coat by airless spray for Dulux FIRETEX® FX2000 are;
  - 1400 microns dry film thickness DFT
  - 1860 microns wet film thickness WFT
- The maximum average applied DFT must not exceed the maximum tested DFT. If this occurs, then it will be necessary to abrade or remove to reduce the thickness. Refer to the applicable product data sheet for specific maximum dry film thickness.
- Dry spray is usually not detrimental to the performance of the fire protection. Dry spray is usually an aesthetic issue only. However, over coating dry spray can lead to inter-coat adhesion issues and as such it is required to be removed prior to applying another layer of coating over it.

- In-Shop activities;
  - Plan the paint shop to have a good lay-out area (trestles/bogies).
  - Have planned procedures in application and handling of completed painted sections to reduce damage.

4.8 Recommended topcoat/sealer coats

In all instances where a topcoat is to be applied this must be an approved product for use with Dulux FIRETEX® FX2000 series, specified DFT's should be followed, this includes **any** subsequent re-decoration of fire protected steelwork.

Contact Dulux Protective Coatings for a list of approved topcoats.

Almost invariably, there will still be a small percentage of solvent still retained in the film when it is overcoated. The retained solvent will be added to the solvent from the applied topcoat and can 'strike back' into the underlying coating layer(s).

The release of solvent will decrease at an exponential rate as the solvent has to diffuse from deeper within the coating layers and theoretically it could take several months (or longer) to reach a true equilibrium.

Under normal exposure conditions, the gradual release of retained solvent will proceed without any noticeable effect; however under certain extreme (in particular very warm weather) exposure conditions, there may be a situation where the release of retained solvent vapour from the intumescent layers exceeds the rate at which the sealer coat will allow the solvent vapour to diffuse out, which may result in the formation of blisters underneath the sealer. This phenomenon is rare; however, it could be influenced by the following factors:

- Thickness of the applied Dulux FIRETEX® FX2000 coating and sealer coat layers. (High Loadings of Dulux FIRETEX® FX2000 contain more solvent to be released, and thicker sealer layers will be less permeable to solvent release).
- Exposure to strong solar heat – Sections exposed to direct sunlight will get hot quickly. (This may be exacerbated if the steel is behind glass, leading to a greenhouse effect).
- Colour of the sealer coat (Darker colours have greater solar absorption and will heat up to a greater extent)
- Section factor of the steel (Thinner steel will have less heat sink than thicker sections, and thus heat up more rapidly).
- Chemistry of the sealer coat (Single pack acrylics are more permeable to solvent release than two pack PU's).

Any such blistering will not have an adverse effect on the fire protection integrity of the system, however it will be necessary to repair any blistered areas in order to maintain the integrity of the sealer coat in the given exposure environment, and to meet the aesthetic decorative requirements of the client. Dulux Protective Coatings will provide remedial specifications in any such instances.

The factors listed above should be given due consideration in order to reduce the possibility of this solvent retention and blistering taking place under extreme exposure conditions.

5.0 QC Inspection

As with any painting project, good inspection and record keeping is essential. Dulux Protective Coatings recommend that as a minimum the following records be kept by the applicator regarding the application of Dulux FIRETEX® FX2000 series:

- At least two times per day, more frequently if the environmental conditions are changing:
  - Air temperature
  - Substrate temperature
  - Relative humidity
  - Dew point
- Product batch numbers

Further records should also be kept in order to provide traceability of the material usage:

- Areas coated
- Primer condition and thickness
- Operator/sprayer
- Any cleaning or preparation work prior to painting
- Localised conditions/issues (e.g. leaking water, adjacent operations)

6.0 Handling of Coated Steelwork

Due to the application, loading, transportation and erection of fire protected steelwork, some form of damage to the sections is inevitable in the form of contact point marks, handling or erection damage. Some of this can be mitigated by the careful placement of 'chop blocks', using nylon lifting straps or lifting eyes, and careful handling of steelwork during transport and erection. Other factors that will affect this are the film thickness applied, the number of coats applied and the length of time that the coating is allowed to dry prior to handling.

7.0 Repairs

The repair procedure must be carried out as soon as possible to prevent further damage and moisture ingress.

7.1 Repair methods

All surfaces to be coated shall be prepared in accordance with the guidance given in the product's data sheet or application manual.

Where the damage has exposed the substrate, the affected area should be prepared in accordance with the guidance given in the surface preparation clause of this manual.

The topcoat shall be removed in areas where new Dulux FIRETEX® FX2000 will be applied over the existing (intact) coating system.

Damaged Dulux FIRETEX® FX2000 shall be removed until a firm edge is achieved. Where the existing coatings will be over coated as part of the repair, these should be abraded to ensure good adhesion of the subsequent coats.

Where Dulux FIRETEX® FX2000 series is to be used, follow the application and usage information provided in the product data sheet and this application manual. Care shall be taken to ensure that the area of repair satisfies the specified DFT for the structural member under repair.

If specified, topcoat can then be applied to the finished Intumescent repair.

ATTENTION: Where there is damage to the coating greater than 25mm in size, it is essential repairs are carried out to ensure coating integrity, durability and fire performance.

8.0 Quality of Finish

NBS Definitions for Intumescent Finish

440 Basic Finish

Definition: Reasonably smooth and even. Orange peel, other texture, minor runs and similar minor defects are acceptable.

450 Normal Decorative Finish

Definition: Good standard of cosmetic finish generally, when viewed from a distance of 5m or more. Minor orange peel or other texture is acceptable.

460 High Decorative Finish

Definition: High standard of evenness, smoothness and gloss when viewed from a minimum distance of 2m.

Definitions as set out in SCI P160 (Blue Book)

R470 The quality of finish falls under the following categories

(i) Basic Finish:

The coating system achieves the required fire performance and corrosion protection performance but is not required to achieve any requirements for standard of finish.

(ii) Decorative Finish:

In addition to the requirements for (i) above, a good standard of cosmetic finish is generally required, when viewed from a distance of 5m. Minor orange peel or other texture resulting from application or localised repair is acceptable.

(iii) Bespoke Finish:

In addition to the requirements for (i) above, the coating finish is required to have a standard of evenness, smoothness and gloss agreed between the Specifier and Contractor.

When agreeing a bespoke standard of finish, the Specifier and Contractor should take account of the effects of steel size, section shape, design complexity and the required period of fire resistance.

The Contractor shall provide for a Basic finish unless otherwise noted in the Contract.

9.0 Dry Film Thickness Measurement Procedures Guidance Notes

9.1 Calibration:

In accordance with ISO 2808:2001 or SSPC PA-2, calibration of the DFT gauge should be carried out following the manufacturer's instructions using a smooth plate (similar in composition to the substrate being measured) at least 1.2mm thick. The calibration should be checked using shims of known thickness above and below the expected DFT.

ISO 2808:2001 refers to a figure of 25µm as a correction factor for blast profile. It is intended to use this correction factor for measurements of all coating thicknesses above 50µm nominal. When using SSPC PA-2, refer to Appendix 8 on guidance to adjust for surface profile.

Calibration checks should be performed prior to carrying out measurements, in the environment in which the measurements are to be taken. During a series of measurements, the calibration should be rechecked on a regular basis.

9.2 Measurement procedure:

Tests shall be carried out in accordance with the following:

(i) I Sections, Tee Sections and Channels

Webs: Two readings per metre length on each face of the web.

Flanges: Two readings per metre length on the outer face of each flange. One reading per metre length on the inner faces of each flange.

(ii) Square and Rectangular Hollow Sections and Angles Two readings per metre length on each face.

(iii) Circular Hollow Sections.

Eight readings per metre length evenly spread around the section.

(iv) Where members are less than 2m in length, three sets of reading shall be taken, one near to each end and one at the centre of the member. Each set shall comprise the number of readings on each face given by (i), (ii), or (iii) above, as appropriate.

(v) For flat plates take 5 readings per metre square.

If defects are identified a more detailed survey may be appropriate.

9.3 Paint film thickness acceptance criteria

Intumescent Coating Schemes

These criteria are based on the required thickness as stated in the paint specification, advised by the applicator or from Dulux Protective Coatings loading schedule:

(i) The average dry film thickness applied to each element shall be greater than or equal to the specified nominal value.

(ii) The average measured dry film thickness on any face of any member shall not be less than 80% of the specified nominal value.

(iii) Dry film thickness values less than 80% of the specified nominal value are acceptable, provided that such values are isolated.

Where any single thickness reading is found to be less than 80% of the specified nominal value, a further two, or where possible three, readings shall be taken within 150 to 300mm of the low reading. The initial reading may be considered isolated if all the additional readings are at least 80% of the specified nominal value. If one or more of the additional readings are less than 80% of the specified nominal value, further readings shall be made to determine the extent of the area of under thickness.

(iv) All dry film thicknesses shall be at least 50% of the nominal value.

When measuring Intumescent fire protected steelwork, the mean must not exceed the maximum fire tested thickness for that type and orientation/use of section.

Where possible the primer thickness should be determined prior to the application of the Intumescent coating. This mean value and the blast profile correction should then be subtracted from the primer and Intumescent thickness, measured before the application of any topcoat.

If it is not been possible to measure individual primer thickness and the combined primer and Intumescent thickness, thus determining the Intumescent thickness accurately, then the specified nominal thickness for primer and topcoat may be used and assumptions can be drawn from those thicknesses.

In either case the 50 and 80% values relate to the full primer (and topcoat) thickness plus 50 or 80% of the specified Intumescent thickness.

i.e. Specification:

Primer = 25µ, Intumescent = 1000µ, Topcoat = 50µ

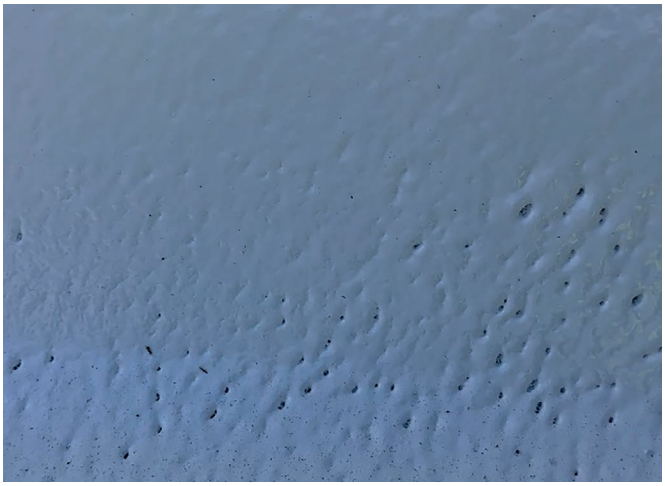
50% value = Blast Profile + Primer + 50% Intumescent + Topcoat
600µ = 25 + 25 + 500 + 50

80% value = Blast Profile + Primer + 80% Intumescent + Topcoat
900µ = 25 + 25 + 800 + 50

10. Additional Notes

10.1 Application defect photos:

Deteriorated primer surfaces that would require surface preparation prior to applying Dulux FIRETEX® products



Pin holing and non-closed out coating

Water damage examples during construction phases

Extreme water damage / absorption

Water damage from concrete slab interface

Water damager on external column without topcoat

Typical type site repair

Typical other trade damage

10.2 Thin film passive fire protection – solvent retention

Solvent based single pack thin film intumescent coatings dry purely by means of solvent evaporation from the applied film. There is no chemical curing mechanism involved in the drying process. The rate at which the film hardens will depend upon several factors which prevail during the drying process, including:

- Thickness of the applied film
- Temperature (air and substrate)
- Ventilation
- Relative humidity

Almost invariably, there will still be a small percentage of solvent still retained in the film when it is overcoated, and this will be added to as solvent from the applied topcoat strikes back into the underlying coating; however the physical drying will continue as the film is built up to completion, and even after the sealer coat is applied, and the coated steelwork is sent out for construction and commissioning.

Sealer coats, whilst resisting the ingress of water from external atmospheric exposure, will allow retained solvent to slowly escape from the dried film. The release of solvent will decrease at an exponential rate as the solvent has to diffuse from deeper within the coating layers and theoretically it could take several months (or longer) to reach a true equilibrium.

If there is a severe risk of any such situation, one possibility to consider would be the use of a multi-pack methacrylate PFP which chemically cures and does not contain any residual solvent in the cured film.

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