

Guidance Document

G0230 Good Practice Guide for the Application of Surface Coatings to Premises

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1 Purpose

- 1.1 The purpose of this Guidance / Good Practice Guide is to provide guidance for specifiers and applicators of all surface treatments, both decorative and protective, for application to new work and for the maintenance of existing coated surfaces in order to introduce best practices and for the promotion of the highest achievable quality in application. It outlines surface preparation, coating application and paint stripping techniques that are suitable for use in the premises of London Underground.
- 1.2 This Guidance supports the delivery of project or maintenance works on assets required to comply with LU Cat 1 standard 1-135 Premises - Finishes.
- 1.3 This Guidance supersedes LU cat 2 standard M3002-A2 which is withdrawn.

2 Scope

This Good Practice Guide applies to all surface treatments carried out within London Underground premises and on London Underground infrastructure. It does not apply to powder coated materials which have been applied using electrostatic techniques within external factory premises.

Paints and surface coatings are required for a wide variety of metallic, masonry and wood substrates within the built environment to provide decoration and protection. Topics covered include 'Site Preparation', 'Surface Preparation Techniques', 'Methods of Paint Application', 'Paint Quality Control and Assurance', 'Painting in Below Ground Locations', 'Assessment of Paint' and 'Paint Stripping Methods'.

Contractors are responsible for the preparation of surfaces and for the application of surface coatings according to best practice, using manufacturer's product data sheets and this document for guidance and direction. Contractors should only be employed if they have proven competency in the application techniques that are required for quality workmanship.

Surface coatings to bridges and structures are not covered by this guidance and should comply with G-058 Civil Engineering - Technical Advice Notes.

3 Guidance

3.1 Introduction

Surface preparation on site can vary considerably, from addressing soundly adherent existing paintwork to corroded areas covered in laminar rust. Blast cleaning is the most effective method of removing corrosion products, but it is not always possible or practical, for operational, environmental or economic reasons, to use this method under site conditions.

Six commonly used techniques for surface preparation prior to the application of a protective treatment are discussed below:

- a) dry abrasive blast-cleaning
- b) wet abrasive blast-cleaning
- c) low pressure water cleaning
- d) high and ultra-high pressure water cleaning
- e) power-tool cleaning
- f) hand-tool cleaning.

Any site surface preparation process should pay due regard to health, safety and environmental requirements. For example, when using blast-cleaning it may be

necessary to encapsulate totally the work area such that spent abrasive, dust and debris are contained. All spent abrasive and dust should be recovered, bagged and removed from site for appropriate disposal.

3.2 Methods of Surface Preparation

3.2.1 Dry Abrasive Blast-cleaning

For dry abrasive blast-cleaning, abrasive particles are projected by an air stream at high velocity against the substrate to be cleaned. The process can produce large amounts of airborne dust depending upon the blast-cleaning abrasive and the nature of the substrate.

Blast-cleaning abrasives comprise solid materials in the form of grit or shot. To maximise the subsequent bond between the primer and the substrate, grit particles which are predominantly angular with sharp edges are preferred. Shot particles are predominantly round, and the surface produced is smoother than that produced using grit.

Abrasives should comply with the requirements of ISO 11126:1997 and the air supply should be free from oil and water contamination so that the substrate being blast-cleaned is not contaminated. The standard of surface cleanliness is defined in accordance with ISO 8501-1: 2007 and the surface profile is as specified and described in ISO 8503: 1995: Parts 2 and 3.

In order to minimise airborne dust, a vacuum recovery version of the process is available but this may be a relatively slow process and ineffective at corners and angles.

Dry abrasive blast-cleaning is suitable for both new and maintenance work. Preparation of steel substrates by this method should be in accordance with ISO 8504-2: 2001.

3.2.2 Wet Abrasive Blast-cleaning

Wet abrasive blast cleaning is the same basic process as dry abrasive blast cleaning but it involves the injection of water into the abrasive stream in order to reduce the levels of airborne dust. The operator controls both air pressure and the relative proportions of abrasive and water. This technique is normally used for maintenance work. The standard of surface cleanliness is defined in accordance with ISO 8501-1:2001 and the surface profile is as specified and described in ISO 8503: 1995: Parts 2 and 3.

In comparison with dry abrasive blast cleaning, wet abrasive blast cleaning has an advantage in removing soluble salts but it also has the following disadvantages:

- a) the technique may be slower
- b) the resultant debris may be difficult to remove from site due to its water content
- c) the process will cause flash rusting and gingering of treated steel surfaces.

3.2.3 Low Pressure Water Cleaning

Low to medium pressure water cleaning, usually in the range of 70-170 bar is used for removing dust, dirt and debris from sound existing protective coatings, but is ineffective for the removal of paint, mill scale or rust.

This technique is often used prior to dry abrasive blast-cleaning for maintenance work to remove soluble contaminants, which would otherwise be impacted into the surface.

3.2.4 High and Ultra-high Pressure Water Cleaning

High pressure water cleaning generally uses 65 litres of water/minute usually at a pressure in the range of 700-1000 bar. Cleaning is effected by directing a jet of water at the surface, and the process is slow due to the small nozzle size employed. The process is potentially hazardous due to the difficulty in handling the high reaction forces, and special safety precautions will need to be taken. The large volume of water employed is likely to present drainage problems in many situations. This method will reveal any surviving original profile under existing paintwork.

Ultra-high pressure water cleaning generally uses 15 litres of water/minute in the 2000-2500 bar range. The process is somewhat slow where a single nozzle is used, but multi-nozzle and rotating heads can improve the performance rate. The process is potentially hazardous and special safety precautions will need to be taken, but it has a relatively low reaction force with reduced amounts of water for disposal. Normally this technique is used for maintenance work although it does not produce a surface profile. However, any surviving original profile under existing paintwork will be revealed by this method.

3.2.5 Power-tool Cleaning

Power-tool cleaning involves the use of various types of equipment, used sequentially, to suit particular operations, and includes the use of powered hammers, chisels and needles of the percussion type, and grinders and wire brushes of the rotary type. The preparation of steel substrates using power-tool cleaning should be carried out in accordance with ISO 8504-3: 2001 to provide a standard of surface cleanliness as defined by the St grades in ISO 8501-1: 2007.

This method is normally used for maintenance work and is intended to remove heavy corrosion products and expose sound clean metal.

The main advantages are:

- a) it can be used where blast-cleaning cannot due to environmental considerations.
- b) it is more convenient for small areas.
- c) it can be carried out from ladders or scaffold towers.

The main disadvantages are:

- a) noise
- b) cleaning is not always fully effective
- c) it can be slow, expensive and labour intensive
- d) there is a heavy reliance on the skill of the operatives.

Powered chisels and needles can damage the surface of the substrate leaving snags and indentations. The surface can also become polished.

3.2.6 Hand-tool Cleaning

The preparation of steel substrates using hand-tools should be carried out in accordance with ISO 8504-3:2001 to provide a standard of surface cleanliness as defined by the St grades in ISO 8501-1:2007. This method of preparation can cause actual damage to surfaces, and should therefore only be used where no other method can be employed.

4 Substrate – Condition, Cleaning and Preparation

4.1 Introduction and Objective

The performance of any surface coating system, whether protective or decorative, is dependent largely upon the standard of surface preparation specified and achieved. Inadequate surface preparation will lead to premature failure. The aim should be to prepare the surface of the substrate so that the subsequent treatment protects and adheres strongly to it. This necessitates the complete removal of all surface contaminants.

Reference should also be made to National Building Specification (NBS) Section M60 Clauses 400-700 as applicable

4.2 Substrate types

4.2.1 Steel and Ferrous Metals

Prior to the application of a primer paint, all steelwork should be dry abrasive blast-cleaned to a minimum surface standard of Sa 2.5 as defined in ISO 8501: Part 1.

The surface profile to receive a protective treatment should have a mean peak to valley height (R_{tm}) of 75-100 micrometres.

Other forms of manual and powered cleaning, such as hammers, needle guns, chisels, wire brushes, scrapers etc. are inferior to blast-cleaning and should only be used when blast-cleaning is not practicable. In this case cleaning should be to surface standard St3 quality as defined in ISO 8501: Part 1.

The use of hand-tools should be confined to the cleaning of localised small areas of corrosion or superficial rusting, as the intended use is for the removal of loosely adherent rust and unsound protective treatment without damaging sound areas. All powdery layers of rust and loose protective treatment should be removed by light scraping or wire brushing in order to render the surface suitable for further application of protective treatment. The steel may be cleaned with hand held wire brushes, chipping hammers and hardened steel scrapers.

The cleaned surface should be tested for the presence of soluble salts in accordance with the various parts of ISO 8502. Soluble salt levels should be less than 4 µg/cm². If soluble salts are present then subsequent cleaning by water jetting or wet abrasive cleaning is necessary. In both cases a corrosion inhibitor compatible with the proposed coating system should be used to prevent flash rusting, or flash rust must be removed by lightly dry blasting.

All debris from blast-cleaning should be removed by brushing or vacuum cleaning prior to painting. The assessment of dust on steel surfaces should be in accordance with ISO 8502: Part 3: 1993. Primer, or metal application, should be applied within 4 hours of blast cleaning. If this time is exceeded or contamination of the surface occurs then further blast cleaning is necessary.

For long lasting corrosion protection of iron and steel metal coating with zinc or aluminium is recommended. Most of these processes would need to be performed off site by metal finishing companies, but metal spraying may be possible on some sites. Metal sprayed ferrous surfaces should be prepared and painted with systems suitable for the applied metal.

4.2.2 Non-ferrous Metals

Zinc coated steel (e.g. galvanised) and zinc should be degreased with a suitable, proprietary product, taking into account local conditions, e.g. surface or below ground, and then lightly abraded with an abrasive pad. Any 'white rust' should be removed with warm water. Adhesion promoting primers specially designed for application onto non-ferrous metals should be employed as recommended by the paint manufacturer. For surface preparation, reference should also be made to EN ISO 12944-4: 1998.

Aluminium should be similarly degreased and abraded. Likewise, copper should be degreased and abraded with fine grade abrasive paper.

4.2.3 Brick, Stone and Cement Based Surfaces

Exposed surfaces should be brushed down with a stiff, short-haired brush to remove all dirt, dust and other contamination. Areas of heavy contamination should be treated by washing, steam cleaning or by other suitable methods as directed by the DER.

Water blasting of brick, stone and similar materials should be carried out using suitable high-pressure water jetting equipment. The conditions of flow rate and water pressure need to vary considerably, depending on the type and condition of the substrate, and must be closely controlled to avoid significant erosion of the surface. Trial areas should be cleaned under controlled conditions, to the satisfaction of the DER, before commencing full-scale blast cleaning.

Any loose pointing should be removed to a minimum depth of 12 mm and made good with a suitable mortar e.g. 1 part of cement to 4 parts of sand by volume. Cracked or spalled areas of concrete or rendering in internal areas, at sight level, or in any external location should be cut out to a square edge (i.e. not feathered) and repaired using a suitable polymer-modified mortar. The repaired areas should be allowed to dry completely before coating with an approved alkali-resisting primer.

Bulky, powdery deposits of efflorescence should be removed by brushing followed by wiping with a damp cloth, which is frequently wrung out in clean water. The process should be repeated at 48 hour intervals until efflorescence has ceased. Any efflorescence must be removed by abrading prior to painting.

Laitance and all other loosely adherent material must be removed from cement-based surfaces prior to sealing or painting.

4.2.4 Plastered Surfaces

Cracks in plaster should be properly cut out with undercut edges, cleaned and made good with an approved hard plaster. Areas of loose or damaged plaster should be similarly cut out and made good. The repaired areas must be allowed to dry thoroughly before over-coating.

Brown stains derived from certain types of clinker block and brick sometimes appear in emulsion paints, having no appreciable surface deposits. If it is suspected that this type of staining is likely to occur, a thinly applied coat of alkali resisting primer will usually prevent staining.

Surfaces infected with mould should be treated with a suitable proprietary anti-fungal treatment used according to the manufacturer's instructions. Finally the surface should be rinsed with clean water and allowed to dry thoroughly before painting.

4.2.5 Building Boards

Wood based building boards should be cleaned and allowed to dry before painting. Moisture content should be below 12%, as for interior wood, before painting.

Plasterboard should be treated as for plaster, described above in Section 4.2.4.

Other inorganic building boards should be cleaned, dried and brushed to remove any loose material.

Thin cementitious building boards may require painting on both sides (back-painting) to reduce the probability that carbonation on one side only may warp or crack the sheets.

Efflorescence should be treated as described above in Section 4.2.3.

Mould should be treated as described above for plaster in Section 4.2.4.

4.2.6 Wood

Wood surfaces to be painted should be rubbed down with an appropriate grade of glass paper, wiped with white spirit, to remove all loose material, grease, etc, and dusted when dry.

In office areas or at sight level large knots should be cut out, plugged and the surface planned smooth prior to preparation for painting.

Other knots should be scraped clean of resin and painted with a sealer coat conforming to the requirements of BS 1336. The knotting should be evenly and thinly applied over and slightly beyond the area of each knot.

To reduce water absorption the end-grain of exterior wood should be sealed with extra coats of primer/sealer.

Clear (varnish) systems are not recommended for exterior wood work with significant exposure to direct sunlight.

Mould should be treated as described above for plaster in Section 5.5.

4.2.7 Existing Paint

If new paint is to be applied over an existing paint system, the previous coating system should be hard and firmly adherent and the surface should be brushed down to remove all loose dust, etc. The surface should then be rubbed with a suitable grade of abrasive paper to aid adhesion of the next paint layer. Finally, the surface should be washed with a mild neutral detergent solution and rinsed with clean water to remove all loose material together with any oil, grease, etc. All new paint must be compatible with the existing paint.

Where localised failure of the original coating system has occurred, the old paint should be scraped back to a firm edge and the edges feathered.

If paint stripping has taken place, then surfaces can be treated as for new work according to the substrate type.