



<u>Topic</u>	<u>Page</u>
Introduction	2
General Requirements	2
Health and Safety	2
Steelwork Preparation	4
Abrasive Blast Cleaning	4
Stripe Coating	5
Concrete	6
Application	6
Overcoating	7
Inspection	7
Laminate System	8
Dura-Plate UHS primer	9

The information in this guideline is not intended to be exhaustive; any person using the product for any purpose other than that specifically recommended in this guideline without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at their own risk. All advice given or statements made about the product (whether in this guideline or otherwise) is correct to the best of our knowledge but we have no control over the quality or the condition of the substrate or the many factors affecting the use and application of the product. THEREFORE, UNLESS WE SPECIFICALLY AGREE IN WRITING TO DO SO, WE DO NOT ACCEPT ANY LIABILITY AT ALL FOR THE PERFORMANCE OF THE PRODUCT OR FOR (SUBJECT TO THE MAXIMUM EXTENT PERMITTED BY LAW) ANY LOSS OR DAMAGE ARISING OUT OF THE USE OF THE PRODUCT. WE HEREBY DISCLAIM ANY WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. All products supplied and technical advice given are subject to our Conditions of Sale. You should request a copy of this document and review it carefully. The information contained in this guideline is liable to modification from time to time in the light of experience and our policy of continuous development. It is the user's responsibility to check with their local Sherwin-Williams representative that this guideline is current prior to using the product.



INTRODUCTION

This application guideline offers product details and recommended practices for the application of Dura-Plate UHS in the protection of internal tanks and vessels.

The procedures contained in this document have been compiled to provide guidance on achieving both the mandatory standards for surface preparation and for lining application. Any proposed deviations from these recommendations should be discussed and agreed with Sherwin-Williams before the project is commenced. The responsibility for achieving the standards detailed in this document to carry out installation in accordance with good lining practice rests with the contracting company carrying out the work. Under no circumstances does the responsibility become the burden of Sherwin-Williams or any associate company thereof, whether that company or associate is represented on site or not.

GENERAL REQUIREMENTS

This application guide must be read in-conjunction with the relevant specification, technical data sheet (TDS) and safety data sheet (SDS).

Contractors selected by the client for the application should be made familiar with the procedures required and be able to demonstrate competence to the client's satisfaction.

HEALTH AND SAFETY

Although Dura-Plate UHS is ultra high solids care must be taken as the paint droplets produced during spray operations can form explosive mixtures with air and additionally may contain materials which may necessitate personal protection against potential health hazards. A summary of the main precautions to be taken includes:

- Attention to the dangers of explosion or fire
- Provision of adequate ventilation (see Section f)
- Ensure that tanks and surrounding areas are flame and spark free
- Provide painters or operatives with the correct respiratory protection
- Ensure correct protective clothing is worn to avoid skin contact
- The safety advice provided is applicable to the surface preparation, application of the lining and inspection. It is not intended to be comprehensive and is a guide based on accumulated knowledge of the hazards involved, the proposed use of safety equipment and evolved safety procedures
- Full details of the Health and Safety requirements for this material are given in the Dura-Plate UHS Health and Safety Datasheets

General Site Requirements

Prior to any work being carried out there are a number of conditions which must be met.

a) Cleanliness

Any contaminants which may come in contact with the steel (even before surface preparation commences) can compromise performance of the coating system, and as such all effort must be made to keep the working area clean. Cleanliness must be maintained throughout all stages of the application.

b) Weather Shelters

Weather shelters should be made available to cover application equipment during mixing and application of material.

c) Power Source

Generator and sufficient fuel for entire contract to power all the equipment required for the application, i.e. compressors, lighting etc.



d) Paint Storage Facility

Dura-Plate UHS should be stored ideally between 10°C (50°F) and 25°C (77°F) and facilities should be made available to store the materials in the correct temperature range prior to mixing and application.

e) Dehumidification

Surfaces to be lined must have a temperature at least 3°C (37°F) above the dew point, immediately following blasting and priming, and during lining application, and must also remain in this condition during curing of the lining. To achieve this requirement heating/dehumidification may be necessary.

As a guide, relative humidity levels of 40-60% give optimum installation conditions, although some lining applications may be carried out between 25% and 80% relative humidity. The requirement for dehumidification is dependent on prevailing environmental conditions and the actual lining being applied. Consult Sherwin-Williams product datasheets for recommendations.

When dehumidification is being used, provision must be made for continuous 24 hour operation to maintain the environment at the required levels throughout the contract.

f) Ventilation

During the blast cleaning operation, ventilation is necessary to allow adequate visibility for safe working. Flexible ventilation trunking should be used to allow extraction of the dust immediately adjacent to where blasting is being carried out.

Ventilation should be maintained during lining application and while solvent is released during drying of the lining. The air movement should be sufficient to prevent the vapour concentration exceeding 10% of the Lower Explosion Limit (LEL).

Product Material Safety Datasheets (MSDS) should be referred to for details of Required Air Quantity (RAQ) to ventilate to 10% of LEL. These figures can be found in the MSDS.

In order to calculate the RAQ to ventilate to 10% of LEL for 1 litre of mixed paint (RAQ_M) the following method is used:

X = Mix ratio base : Curing agent by volume (e.g. if the mix ratio is 49:1 by volume, the X will be 49).

B = RAQ to ventilate to 10% LEL for base component (m³/litre).

C = RAQ to ventilate to 10% LEL for curing agent component (m³/litre).

$$RAQ_M \text{ (m}^3\text{/litre)} = \left(\frac{X}{X+1} \times B \right) + \left(\frac{1}{X+1} \times C \right)$$

Ventilation rate require depends on the application rate of the paint in litres/hour.

If Y = number of litres of mixed paint applied per hour:

$$\text{Ventilation Rate (m}^3\text{/hour)} = RAQ_M \times Y$$

Note: Thinning of Dura-Plate UHS is not permitted.

g) Heating

Dura-Plate UHS must only be installed when steel temperatures are above the minimum temperature indicated on the Dura-Plate UHS product datasheets. If heating is necessary to satisfy the lining specification, it should be by means of a heat exchange system incorporated into the dehumidified air supply, i.e. air admitted to the tank should not pass directly through a combustion chamber. Provision should be made for 24 hour surveillance of heating equipment.

h) Lighting

Lighting during blasting and lining installation must be intrinsically safe and provide suitable illumination for all work. Ideally, lighting should be by powerful spotlights with background lighting on at all times in the interest of safety. Powerful, hand-held spotlights should be provided for inspection work.



STEELWORK PREPARATION

To provide a surface which will ensure optimum performance, preparation is required to remove surfaces which have a sharp edge. These include, but are not limited to, plate edges, weld spatter, plate laminations, weld undercuts, or gas cut surfaces. Preparation grades of welds, cut edges and surface imperfections are described in ISO 8501-3. Preparation to P3 grade of this standard will provide surfaces which will ensure optimum paint performance.

USE OF STRIKER PLATES

Prior to the application of the Dura-Plate UHS system, it is recommended that precoated striker plates are installed under any tank equipment that could cause mechanical damage to the lining system, namely column roof supports, floating roof legs, roof drainage systems or internal pipework.

- Installation of these striker plates should be done before the general surface preparation to minimise the contamination from the roof during the jacking operation to install the plates.
- Striker plates are to be made from appropriate gauge plate and be of sufficient size as to fit existing plates. If striker plates do not exist, the plates shall be of sufficient size to extend approximately 15cm (6 inches) in all directions from the roof support base.
- The new plates shall be blasted on both sides to Sa2½ ISO 8501-1:1988 or SSPC SP10. The top surface of the plate should be coated with the full Dura-Plate UHS system as originally specified.

The completed plate is ready for installation to the tank bottom.

- Raise the support column to allow installation of pre-coated striker plate. When the support column has been raised, apply a coat of Dura-Plate UHS to the bottom side of the pre-coated plate and to the prepared area underneath the support on the tank floor. Centre the plate under the support column and lower the jack. Remove excess Dura-Plate UHS.

ABRASIVE BLAST CLEANING

General

- The standard of blast cleaning for tank linings is higher than that required for coatings subject to atmospheric service. The two common standards specified are to ISO 8501-1:2007 and SSPC-SP – Surface Preparation Standards and Specifications
- Dura-Plate UHS should be applied over steel prepared to a minimum Sa2½ (ISO8501-1:2007) or SSPC-SP10, with a sharp angular profile of 50-100µm (2-4 mils) in depth
- If advice on any other standard of surface preparation is required, please consult Sherwin-Williams
- It may be necessary to fresh water wash areas after abrasive blasting, followed by a re-blast, to reduce levels of soluble corrosion products. If rapid re-oxidation is occurring, this treatment should be carried out
- The maximum allowable residual salt (Chlorides) contamination immediately prior to the application of the first coat is 5 micrograms per square centimeter (mg/M²) as measured with a Bresle Patch (ISO 8502-6), Chlor*Test CSN Salts test kit or approved equivalent field test method. The testing for Chlorides will be performed on all tanks that have history of storing crude oil or salt water as well as new tanks. Tanks with extensive coating failure will also be tested. A minimum four (4) test will be performed on each tank



Compressed Air

- Air used for blasting must be clean, oil free and dry. The pressure should be at least 7kg per cm² (100lbs per inch²) at the nozzle

Abrasive

- Abrasive used for blasting should be dry and free from dirt, oil, grease or contamination and have content of water soluble matter not exceeding 0.05%
- The abrasive must be capable of producing the standard of cleanliness and surface profile specified
- For tank lining a sharp angular profile is required, consult individual product datasheets for minimum required profile. This can be achieved by hard angular abrasive of particle size 1.0-1.5mm (0.04-0.06 inches) using an efficient blast cleaning technique. Procedures to be adopted by the contractor for blast cleaning should be agreed with Sherwin-Williams
- Iron or steel abrasives are not recommended for in-situ open blasting. This is to prevent corrosion occurring at sites where spent abrasive is deposited and not fully removed

Cleaning

- Before initial blast inspection, the bulk of the spent abrasive should be removed. Any substandard areas should be identified and repaired. All marking paint, chalk etc. must be removed after rectification
- Following inspection of the blast profile and standard, remaining traces of abrasive and dust should be removed from all areas. Industrial vacuum cleaners fitted with brushes should be used – sweeping alone is not acceptable. Blowing down with compressed air is not recommended due to the potential of contamination
- Cleaning should be carried out on any area on which debris or dust can collect, to avoid contaminating surfaces to be coated including, scaffolding, underside of lowered floating roofs, support columns etc.
- The steelwork for lining application should be re-checked after the final cleaning process is finished

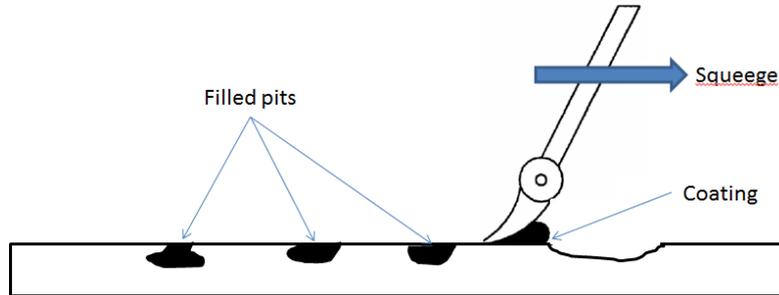
STRIPE COATING

Stripe coating is an essential part of good working practice, and as such should form part of any lining specification. The number and sequence of stripe coats are highlighted in the recommended technical specification.

- Stripe coats are applied to areas where it is difficult to get the required coverage, including but not limited to:
 - Plate edges
 - Welds
 - Pipes
 - Ladders
 - Difficult access areas
- Stripe coats are normally applied to a specified film thickness range via a combination of narrow angle airless spray and brush methods. Overcoating intervals for the stripe coats should be strictly adhered to as per the individual product datasheet.

PIT FILLING

Areas showing deep pitting should either be filled with Dura-Plate UHS primer which is designed as a low viscosity Product to penetrate and fill pits. As an alternative the pits can be filled by spraying material over the pitted area and then ensuring penetration by use of a squeegee. The filled pits may be overcoated “wet on wet” with Dura-Plate UHS although allowing a minimum of 15 minutes is recommended, to allow the material to flow into the pits, before overcoating.



CONCRETE

New concrete shall be properly cured prior to the application of Dura-Plate UHS. Any laitance and efflorescence shall be removed. Moisture content of the concrete must also be measured to ensure that it is less than 7% prior to coating application. The presence of contaminants such as oil, grease and release agents in concrete may cause loss of coating adhesion. Surface preparation of concrete should be done in accordance to SSPC-SP13/NACE 6. All chemical contamination must be removed prior to the application of Sherwin Williams Lining systems. Contamination includes florescence, laitance, oils, chemicals, acids, salts, alkalis, curing compounds, form release agents, and microorganisms.

All existing coatings and sealers must be removed to insure proper bond between the concrete substrate and lining. A qualified civil engineer must be consulted to ensure the concrete structure is fit for application of the lining system. The concrete substrate should have a vapour barrier on the soil side to prevent hydrostatic forces. Consult a qualified civil engineer to determine if these forces are present. If so, it is recommended a test patch be applied to test the bond strength and evaluated over a reasonable period of time.

A good blast profile is required to ensure the adhesion of the lining system. Depending on condition of the concrete, a combination of chemical cleaning and/or abrasive blasting or scabbling may be required. Previously applied coating will require abrasive blasting for removal. Dry blasting is recommended. Blasting will remove loose and powdery concrete and surface laitance. The resulting surface must be hard, with surface voids open and with a profile that is satisfactory for coating adhesion. The blast nozzle must be kept at a distance that will provide good results without gouging the concrete. The resulting surface should be at least as rough as 50-100 grit sandpaper or refer to ICRI profile standards. All dust and debris must be removed after abrasive blasting. Dry, oil-free air must be used for the blasting operation. Use ASTM Method D4285 for determination of oil and water in compressed air sources.

An appropriate primer is required to effectively seal the concrete substrate. Consult Sherwin Williams for specific advice on primer choice.

When working outside or in direct sunlight, concrete 'gassing' or 'breathing' can occur, when the surface temperature rises due to exposure to sunlight or increasing ambient temperatures. This can cause bubbles or holes in the applied lining. If this problem occurs, it is necessary to shade the surface from the sun and/or apply the material in the evening or at night, so that initial cure can take place in cooler temperatures, without air escaping from the concrete.

APPLICATION INSTRUCTIONS

Airless Spray

Dura-Plate UHS is suitable for application through normal airless spray equipment. Available air pressure and capacity of spray equipment should be at least 5.0kg cm⁻² and 7.0m³ per minute (70 p.s.i. and 250 c.f.m.). Airless spray equipment should be in good working order. Pumps with ratios of ranging from a minimum 63:1 up to 74:1 have been used with successful results. Output pressures and tip sizes as stipulated on the product datasheets should be used. Where possible Teflon seals should be fitted to the airless spray unit.



It is recommended that 10mm (3/8") nylon lined fluid hose is used for pumping this material to maintain sufficient volume of product and gun pressure. A short whip end of 6mm diameter (1/4") (maximum 1m length) may be added to the paint line and a suitable swivel connected to the line and paint gun to ensure ease of application. Clean-up solvent is No.13.

Dura-Plate UHS should be applied in accordance with technical datasheets.

Dura-Plate UHS is used as part of a specialised coating system and as such special attention should be taken to the application of the materials.

Heated plural Component

There are numerous configurations for a plural system dependent upon coating type, temperature, hose length, type of pump, etc. Below please find general recommendations. Please consult your plural pump supplier for specific requirements.

Sherwin-Williams suggests the lowest temperature and pressure that will result in optimal flow and leveling. Suggested pressure for application is 3200-3600 psi. The maximum material temperature within the system is 49°C (120 F). The maximum material temperature at the gun is 35°C (95°F) to 41°C (105°F). Use a 3/8" ID hose (10' whip with a 1/4" ID is acceptable). Clean-up solvent is No.13.

Plural component equipment is an excellent means to apply coatings with a short pot life. However, care must be taken to ensure that the coating is applied at the proper ratio. Regularly scheduled ratio checks of the plural pump are recommended. Ideally, the ratio will be verified every time the pump is used. Check with the plural pump supplier for ratio check instructions. Off-ratio coatings will likely require complete removal as they will not cure or perform as expected. **Every caution** should be taken to prevent application of off-ratio coatings as this may lead to catastrophic failure of the coating system. Table below lists typical defects when a coating is applied off-ratio.

Catalyst-rich and base-deficient	Catalyst-deficient and base-rich
Color and gloss variations	Color and gloss variations
Poor adhesion*	Soft coating
Brittleness and cracking*	Poor drying and curing characteristics
Poor chemical resistance*	All physical properties will be poor

**These defects may not be immediately obvious. Deficiencies will become apparent after coating has been in service.*

Dura-Plate UHS should be applied in accordance with technical datasheets.

Dura-Plate UHS is used as part of a specialised coating system and as such special attention should be taken to the application of the materials.

Mixing Procedure Dura-Plate UHS

Thoroughly mix contents of each component thoroughly using low speed power agitation until homogenous. Make certain no pigment remains on the bottom or the sides of the can. Due to aeration in the base that occurs during manufacture, fill level may appear greater than 14 litres. Do not adjust prior to mixing. Combine base with hardener components. Thoroughly agitate the mixture with low speed power agitation. To ensure that no unmixed material remains on the sides or bottom of the cans after mixing, visually observe the container by pouring the material into a separate container. Always mix full pack size, units must not be split for part mixing.



Spray Procedure

Prime the pump, before application of the paint, by flushing thoroughly with S-W Cleanser No.13 (minimum 2 litres depending on set up). Begin pumping the mixed material and discard the first litre before commencing spray. Once spraying is underway regular flushing (once every 2-3 hours) is recommended using S-W Cleanser No.13 to prevent build-up of curing material.

Cleaning Procedure

Thoroughly flush the airless spray unit with S-W Cleanser No.13. It is recommended that this is circulated through the equipment for ~15 minutes to ensure all material is removed.

OVERCOATING

Overcoating of the Dura-Plate UHS can take place as soon as the material has reached its hard dry time according to the Technical data Sheet. Please refer to Technical datasheet for overcoating times at various temperatures. In warm climates or those with strong sunshine resulting in high steel temperatures the overcoating time will be dramatically reduced.

INSPECTION

On completion of installation, the final coating should be inspected using a suitable non-destructive magnetic gauge to verify the average total applied system thickness.

The coating system should be free of pinholes and other defects. A final inspection should be carried out using a high frequency spark type Holiday Detector. The instrument shall be set at 100 volts per 25µm (1 mil) thickness.

Alternatively when using an OAP fluorescent pigment system, use the Dura-plate UHS Primer, with a non-OAP containing Dura-Plate UHS topcoat colour. Guidance on techniques and required equipment to inspect a coating system incorporating Opti-Check OAP Technology can be found in SSPC-TU 11.

Repair of Coating System

Damages during application:

If sags or runs are observed caused by too high wet film thickness or the spray gun used too close to the surface, smoothen the wet film with a paint brush to repair small sags and runs. More extensive sags and runs must be removed using scrapers or rags depending on severity and accessibility.

Damages to the cured coating layers:

Prepare the area through sandpapering or grinding, followed by thorough removal of dust via cleaning/vacuuming. When the surface is clean and dry the coating may be over coated, ref. original specification. Always observe the maximum over coating intervals. If the maximum over coating interval is exceeded the surface should be carefully roughened in order to ensure good intercoat adhesion.

Damaged areas exposing bare steel:

Remove all corrosion products, loose paint, grease or other contaminants by spot abrasive blasting, mechanical grinding, water and/or thinner washing. Feather edges of surrounding intact coating.

Too thin areas:

Remove any contaminants and roughen surface and reapply as soon as possible after surface is cleaned to prevent contaminants on the surface. Overlapping zones to intact coating shall be masked off with a minimum 200 mm distance to the damage and should cover the surrounding area so that overspray to sound coating does not occur during repair application. Edges of intact coating around damage shall be feathered to ensure a smooth transition from the coating to the prepared steel. Consecutive layers of coating shall be feathered to expose each layer and new coating shall always overlap to an abraded existing layer.



Curing

In order for any lining to perform as expected, sufficient cure time must be allowed before placing into service. The length of time required is dependent on the coatings intended, in-service use, substrate temperature, and relative humidity. Consult Sherwin-Williams for details.

The recommended temperature and humidity as specified on individual product data and system sheets must be maintained over a 24 hour basis throughout the cure cycle. As a guideline, a minimum temperature of 10°C (50°F) should be maintained for a minimum of 7 days.

This value will change depending upon the material to be stored and Sherwin-Williams should be consulted.

Dura-Plate UHS Laminate System

All application of the chopped fibreglass reinforced epoxy coating system carried out using the equipment as recommended by Sherwin-Williams.

Spray apply Dura-Plate UHS incorporating chopped, continuous fibreglass roving at a level of 400-450g/m². Immediately after application the mat formed by spraying shall be thoroughly rolled to embed the fibreglass strands, eliminate air entrapment in the coating film, forming a compact uniform laminate. Spray applications should overlap 7.5cm (3") onto the coated surface of the pre-coated tank bottom column support plates and extend up a minimum 5cms of all appurtenances and to the required height on the lower shell course. Following each day's application or when the laminate is sufficiently hard, the surface should be visually inspected. Protruding fibreglass strands or other irregularities should be removed by abrading with either coarse abrasive paper or orbital sanders.

A typical specification is described below:

Optional blast primer (general non-pitted areas) - Macropoxy L574 Blast Primer @ 25 microns d.f.t.

Optional primer (pitted areas) - Dura-plate UHS Primer @ 100 microns d.f.t.

Full coat - Dura-plate UHS @ 900 microns d.f.t.
(incorporating chopped glass applied into the wet surface at 400 – 450g/m²)

Full coat - Dura-Plate UHS @ 300microns dft

Use of Dura-Plate UHS Primer

Repair of Pitted Tank Bottoms

Extensive, deep pitting:

Options:

Option 1Apply a full wet coat, by spray application, of Dura-Plate UHS Primer. Follow with rubber squeegee to work material into and fill the pitted areas. After recommended drying time, apply a full coat of Dura-Plate UHS at recommended film thickness.

Option 2Weld new steel plates, or use puddle welds, as required to repair pitted areas. Coat areas as recommended.



Shallow pitting, isolated areas:

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross-coat spray at a right angle. Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, over thinning, climatic conditions, and excessive film build. No reduction of material is recommended as this can affect film build, appearance, and adhesion.

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

Do not mix previously mixed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment and hose, flush equipment with cleanser No 13.