

INTRODUCTION:

Installation of a lining system is the most effective method of protecting steel tanks and vessels from corrosion and preventing product contamination. There are three essential elements to a correct tank lining:-

- Selection of the appropriate lining system
- Suitable film thickness specification
- Correct installation

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 International Protective Coatings 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 International Protective Coatings or any associate company thereof, whether that company or associate is represented on site or not.

GENERAL REQUIREMENTS FOR TANK LINING:

- Tanks must be structurally sound. Tank lining is intended to mitigate corrosion, prevent product contamination and give assurance against leakage. No tank lining, including fibre glass systems, afford structural strength to the tank.
- Contractors selected by the client for tank lining application should be made familiar with the procedures required and be able to demonstrate competence to the client's satisfaction.

NEW CONSTRUCTION:

The preferred manufacturing procedure for new tanks is that internal surfaces should be coated with a preconstruction primer prior to fabrication. The primer should then be removed after erection and hydrostatic testing. Benefits of this procedure are:-

- Reduced potential for steel contamination from soluble salts either from corrosion or hydrostatic testing.
- Easier to achieve specified blast standard as recommended on individual product data sheets.

TANK CONDITION PRE-CONTRACT:

Before the start of treatment it is essential that internal tank surfaces are clean, dry and in a condition suitable for surface preparation and application of the lining system. The following minimum requirements apply:-

- Tanks must be structurally sound and gas free.
- All inlet pipes must be blanked off.
- Surfaces should be de-sludged and residues removed from the tank. Oil or grease must be removed from all surfaces to be lined.
- Heavy scale or other debris must be removed from all surfaces, including the roof. For heavily scaled or contaminated surfaces rough cleaning by sweep blasting may be required.
- Corroded steel that is heavily contaminated may require additional cleaning, e.g. steam cleaning or high pressure fresh water washing, before surface preparation starts.
- Any hot work or welding must be completed before surface preparation commences.

- Tanks are often subjected to hydrostatic testing and if this is carried out using salt or brackish water then this test must be followed by fresh water washing. In these conditions the maximum allowed total soluble salt contamination before application of Interline 399 is $5\mu\text{g cm}^{-2}$. When Interline 399 is used for storage of aqueous media (e.g. distilled water) then a lower salt contamination level of $2.5\mu\text{g cm}^{-2}$ is recommended to prevent premature failure due to osmotic blistering. International Protective Coatings recommends ISO 8502, Part 6, as a suitable test procedure.

HEALTH & SAFETY

Interline 399 contains flammable organic solvents which 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 H&S requirements for this material are given in the Interline 399 Health & Safety Data Sheets.

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 comments) can compromise the performance of a tank lining system, and as such all effort must be made to keep the working area clean. It is good working practice to establish a clean area around the entrance to the tank where clean footwear can be put on prior to entering the vessel. If clean footwear is not readily available then disposable overshoes can be worn for short periods. 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

Interline 399 should be stored ideally between 15°C (59°F) and 30°C (86°F) and facilities may be needed 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 (5°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 International Protective Coatings product data sheets 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 Data Sheets (MSDS) should be referred to for details of Required Air Quantity (RAQ) to ventilate to 10% of LEL. These figures can be found in Section 9 of 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 4:1 by volume, the X will be 4).

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).

T = RAQ to ventilate to 10% LEL for Thinners.

V = % by volume of Thinners added.

$$\text{RAQ}_M (\text{m}^3/\text{litre}) = \left(\frac{X}{X+1} \times B \right) + \left(\frac{1}{X+1} \times C \right) + \left(\frac{V+T}{100} \right)$$

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

If Y = Number of litres of mixed paint applied per hour

Ventilation Rate (m³/hour) = RAQ_M x Y

Values shown below can act as a guide to the ventilation requirements for the application of Interline 399. The figures are the absolute minimum number of air changes and the number (where applicable) is based on a typical application rate of 120 litres per hour. International Protective Coatings do however recommend a minimum of 2 air changes per hour to ensure good visibility and a safe working environment.

Diameter (m)	Tank Construction	Minimum Air Changes/Hour
30	Floating Roof (2m from Floor) ↓	3.61
50		1.30
100		0.33
20	Cone Roof (10m High) ↓	1.62
30		0.72
50		0.26

- For other tank sizes the RAQ calculation on previous page should be used.
- To minimise dry-spray formation caused by excessive air movement the ventilation level may be reduced during application – paint application rate should then be adjusted to ensure 10% of Lower Explosion Limit is maintained.

N.B. These recommendations are based on unthinned paint only. Ventilation should also be used during the curing period to maintain the correct climatic conditions for the coating. If in doubt consult International Protective Coatings.

- As with all processes, the ventilation equipment must be intrinsically safe during operation. Abrasive dust and solvent vapour should not be reintroduced to the tank. A positive pressure greater than normal atmospheric should be maintained inside the tank. Provision should be made for 24 hour surveillance of ventilation equipment.

g) Heating

Interline 399 must only be installed when steel temperatures are above the minimum temperature indicated on the Interline 399 product data sheets.

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 lining 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.

INSTALLATION OF STRIKER PLATES

- Prior to the application of the Interline 399 system, it is recommended that pre-coated 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 pipe-work.
- Installation of these striker plates is 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 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. These plates shall be primed on both sides with the specified Interline primer masking off a 5cm (2 inches) area on all sides at the leading edge on top. The top surface of the plate should be coated with the full Interline 399 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 an even coat of an appropriate Interline caulk 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 caulk.

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 SSPC and ISO 8501-1:1988 and SSPC-SP – Surface Preparation Standards and Specifications.
- Interline 399 should be applied over steel prepared to a minimum Sa2½ (ISO 8501-1:1998) or SSPC-SP10, with a sharp angular profile of 50-75µm (2-3 mils) depth.
- In some areas of very aggressive service Sa3 (SSPC SP5) may be specified. Always consult the individual data sheets for minimum surface preparation standards.
- If advice on any other standard of surface preparation is required, please consult International Protective Coatings.
- 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.

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 data sheets for minimum required profile. This can be achieved by hard angular abrasive of particle size 1-1.5mm(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 International Protective Coatings.

- Iron or steel abrasives are not recommended for in-situ open blasting stainless steel. This is to prevent corrosion occurring at sites where spent abrasive is deposited and not fully removed.

Automatic Floor Blasting

- Automatic blasting using centrifugal wheel machines is recommended for floor blasting. The abrasive selected must be from blended shot and angular abrasive to achieve the specified profile and standard.

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 rechecked after the final cleaning process is finished.

HOLDING PRIMERS

- Linings should always be applied to blasted surfaces with a visual appearance in accordance with the specified standard.
- If practical, normally in small vessels only or in larger tanks where small areas will be blasted and then coated after a short period, the blast standard may be maintained by use of dehumidification only. If maintaining standard by this method the standard must meet the requirements stipulated in the individual product data sheets.
- Under practical conditions, a holding primer is often used to aid the blasting programme. Holding primers must be compatible with the lining system and applied at the specified film thickness to avoid introducing a weakness into the system.

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 detailed product specification sheets.
- 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 data sheet.

LINING APPLICATION

- All linings should be applied in accordance with the recommended specification and product data sheets.
- The majority of linings are applied by using airless spray. Brush or roller may be used for application of stripe coats or touch-up coats only.
- Available air pressure and capacity of spray equipment should be at least 5.0kg per cm² and 3.5m³ per minute (70 p.s.i. and 125 c.f.m.). International Protective Coatings request the use of the highest available ratio pump to ensure optimum delivery of product.
- Airless spray equipment should be in good working order. Output pressures and the correct tip sizes as stipulated on product data sheets should be used.

INSPECTION

The coating should be inspected using a suitable non-destructive magnetic gauge to verify the average total applied system thickness. The material should be free of pinholes and other defects.

The coating should be free of pinholes and other defects. A final inspection should be carried out with a low voltage detector using wet sponge method. The method of operation is to draw the moistened sponge over the surface. Where a defect has occurred a small current will flow and activate an audible alarm. Excessive wetting of the sponge should be avoided.

REPAIR PROCEDURE

The repair procedure recommended will depend upon the extent of damage involved but can be split into:-

- (i) Repairs of major areas
- (ii) Repairs of minor areas

• Major Repairs

A major repair should essentially be dealt with as if the project were beginning. The recommendations given earlier for steel preparation, coating application etc, MUST all be adhered to.

• Minor Repairs

Under this heading are repairs to areas damaged either at the initial coating stage or caused during service, i.e. tank cleaning equipment damages, spot corrosion etc. The principle requirements are:-

- The area to be repaired must be fresh water washed and dry.
- Remove any corrosion by means of either:-
 - vacuum blasting;
 - hand tools, i.e. disc sander and grinder.
- Abrade area immediately surrounding repair to provide key for subsequent paint application.
- Apply the paint system in accordance with International's recommendations. If small areas are involved and application is by brush, several coats may be required to achieve the correct dry film thickness.

CURING

In order for any lining system to perform as expected, sufficient cure time must be allowed before being placed into service. The recommended temperature and humidity as specified on individual product data sheets must be maintained over a 24 hour basis through the cure cycle. The length of time required is dependent on the coatings intended in-service use, substrate temperature and relative humidity. Consult International Protection Coatings for details.

Disclaimer

The information given in this sheet is not intended to be exhaustive and any person using the product for any purpose other than that specifically recommended in this sheet without first obtaining written confirmation from us as to the suitability of the product for the intended purpose does so at his own risk. Any warranty, if given, or specific Terms & Conditions of Sale are contained in International's Terms & Conditions of Sale, a copy of which can be obtained on request. Whilst we endeavor to ensure that all advice we give about the product (whether in this sheet or otherwise) is correct we have no control over either the quality or 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 whatsoever or howsoever arising for the performance of the product or for any loss or damage (other than death or personal injury resulting from our negligence) arising out of the use of the product. The information contained in this sheet is liable to modification from time to time in the light of experience and our policy of continuous product development.