



TIBCHEMICALS

Application instructions **PROTEGOL® Coatings**

Processing by 2K Airless hot spray equipment, air assisted cartridge device or manually

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1. Scope

The present application specification is valid for the surface preparation of steel to be coated, for the coating application itself and for the coating quality control.

It is valid for any 2K airless hot spray system, 2K pneumatic application device and 2K manual application of TIB Chemicals' PROTEGOL® Coatings.

2. Surface preparation

2.1. Surface Requirements

General minimum requirements to the steel surface to be coated:

- Steel surface must be dry, clean and free from dust and all components acting as release agents, e.g. oil, grease, old paint.
- Constructional shaping of steel and iron to conform to DIN EN 14879, part 1.
- Steel surface must fulfill the requirements for near-white blast cleaning acc. to EN ISO 8501-1 Sa 2 ½ (Nace 2 / SSPC SP-10). To obtain the necessary conditions, suitable surface preparation methods, such as grit blasting, must be employed.
- Allowed relative humidity max. 80 %.
- Substrate temperature min. 3 °C above the dew point of the ambient air in order to avoid condensation.
- Coating to be applied immediately after blasting.
- In case of divergent climatic conditions, obtain advice from TIB Chemicals AG.

2.2. Roughness of the steel surface and its inspection

The surface roughness for thick film coatings has to be R_z 50 to 100 μm (acc. to DIN EN 10290, 6.1.2), whereas thin film coatings like PROTEGOL® EP Flowcoat require only R_z 25 to 40 μm . Client or project specific requirements have to be considered separately together with TIB Chemicals AG.

For bare steel application, the abrasive blast medium shall be selected based on cleanliness, hardness and the ability to produce an angular anchor pattern profile between 50 and 100 μm . The surface roughness shall be taken with suitable instruments, e.g. contact stylus instruments, Press-O-Film replica tape.

The blasting media must be sharp-edged, e.g. steel grit, Asilikos. Do not use reprocessed blasting media! Cleaned surface shall be air blasted to remove dust and debris, and coated prior to formation of rust bloom. Requirements must be fulfilled at the beginning of each coating job, otherwise proceed to re-blasting. We suggest to again examining any work piece left uncoated for more than 8 hours in order to be able to identify and subsequently remove any flash rust or other bonds.

2.3. Surface preparation of pre-treated and factory-coated surfaces

Factory-coated or galvanized surface must be prepared according to DIN EN ISO 12944-4. Galvanized surface must be swept acc. to DIN EN ISO 12944-4. Factory coatings such as 3LPE can be prepared chemically, by flaming or mechanic roughening to achieve best adhesion. In case of doubt, contact the coating manufacturer.

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3. Requirements for processing equipment

3.1. Requirements for 2K airless hot spray unit

PROTEGOL® Coatings can be applied with any machine complying with the following parameters.

Processing	2K airless hot spray unit
Output	Max. 10 l/min
Pressure ratio	Approx. 66 : 1
Hose diameter*	3/8"
Nozzle size	0.021"-0.026"
Spray pressure	140-260 bar

* Divergent diameters for component A and B acc. to mixing ratio, if necessary.

The gravimetric/volumetric mixing ratio (e.g. A:B - A:B = 80:20 or 4:1) given in our technical data sheets must be ensured.

Fixed mixing ratio dosage systems must have a dosage accuracy of $\pm 5\%$ total tolerance. For dosage accuracy control, we recommend measuring the system's gravimetric mixing ratio and an automatic pressure control as well as the usage of a suitable volumetric flow control unit. Depending on the size of the dosage pumps, the dosage accuracy should be checked every 50 to 200 ml. Using dosage systems with variable mixing ratio, the suitability needs to be checked previously with TIB Chemicals AG.

After adjusting the specified mixing ratio, we recommend checking it by determining the nitrogen content of the cured coating samples through an analysis in our laboratory.

Each spray unit must be equipped with a continuous-flow heater for component A and tentatively B, which should be situated between the transfer pump and the dosage unit. We recommend additional drum heaters such as heating belts or plates in order to facilitate constant process temperatures. Do not use open water bath! For specific applications, additional equipment may be necessary. The diffusion stability of the employed parts need to be checked. We recommend an air dehumidification silica gel filter to ventilate component B (isocyanate).

We advise to agree with TIB Chemicals on technical details before purchasing or employing a new machine.

3.2. Requirements for manual application and cartridges

Standard brushes, rollers or spatulas can be used, as long as they are clean, dry and free from release agent. For multiple use, immediately clean with solvent and fully dry before the next operation.

When mixing of the two components, use a clean vessel for repotting. Tools used for mixing must not pollute the coating, wooden slats or similar are unsuitable.

Dischargers for cartridges must be checked and approved by the cartridge manufacturer. We suggest purchasing them together with the coating product. Separate instructions have to be considered.

3.3. Operational test at application startup

- Follow the machine manufacturer's instructions
- Check all fittings for leaks
- Examine sealings of transfer and dosage pump
- Check and, when indicated, clean filters
- Pressure-test the transfer and dosage pumps
- Control temperature setting of the flow heaters

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- Inspect oil level in piston cups (refill with special oil)

3.4. Tasks for extended standstill of the hot spray airless system

After prolonged shutdown or long-term storage, check the components for sedimentation.

Standstill period of less than 7 days:

- Let the system run in circulation twice per week and at least 10 minutes.

Standstill period of more than 7 days:

- Clean filters of component A and B.
- Move dosage pumps in lower position and fill special oil into the piston cups.
- Remove transfer pump from component B barrel
- Immerse supply pump of component B into container with cleansing agent PROTEGOL® 77-02. Circulate PROTEGOL® 77-02 thus pushing component B out of the system until PROTEGOL® 77-02 drains off.
- Fill oil cups with special oil.
- Clean pump tube and move dosage pump in lower position.
- Re commissioning takes place in reverse order.

4. Coating material

4.1. Handling of coating materials

The instructions given in the technical data sheet as well as in the safety data sheet, section "Storage and Handling", apply. Observe the shelf life of the products.

Observe and follow the instructions of the safety data sheets. They must be made available to government agencies, doctors, waste management companies and similar authorities.

Also see chapter 5.1 for safe handling of coating materials.

4.2. Storage

PROTEGOL® Coatings can be stored in a cool (0 to 30 °C) and dry place, approx. 24 months in tightly closed original packs unless specified further. Component A has to be stirred thoroughly prior to material withdrawal. Stored below 0 °C, component B of polyurethane coatings in general may partly crystallize. In this case, warm to approx. 25 °C in an oven or oil bath in order to solve the crystals. Do not use water bath, as component B is sensitive to moisture! Component B with any crystals must not be used, since these cause blockage of the spraying equipment and interfere with the curing process.

4.3. Production Quality Control

Every production batch is tested and documented by TIB Chemicals AG. All test methods, equipment, nominal values and tolerances are specified and documented. A storage sample of each batch is kept. Our test reports do not relieve the processor from the obligation to test the goods to assure they comply with individual requirements.

5. Coating procedure

5.1. Work safety, environmental and fire protection

Indications in our Safety Data Sheets (SDS) must be noticed and observed. They must, in case, be requested from TIB Chemicals AG.

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The respective rules of industrial safety and country-specific regulations apply. Accident prevention regulations must be observed.

Handling coating materials, the following security-relevant prescriptions and technical information must be considered and notified to the staff:

- Safety data sheet (SDS) of the coating material
- All regulations about safety on workplace
- Indications on packaging labels, e.g. hazard notes and security advice (H+P Statements)
- All prevention, safety regulations and information about dangerous substances that may apply for the application of PROTEGOL® coatings, i.e. operating polyurethane or epoxide resin and hardener
- Special work instructions e.g. for handling material filled in cartridges
- Any applying local rules, regulations and specifications
- In case of doubt, the highest level of working safety applies.

5.1.1. *First aid measures*

Instructions for first aid measures are given in the safety data sheet (SDS) of the coating material at section 4: First aid measures

- General information:
 - Symptoms of poisoning can also only occur after several hours, therefore, a medical observation of min. 48 hours after the accident has to be insured
- Information about emergency aid or special treatment:
 - inhaling combustion products, symptoms may occur delayed
 - medical observation of minimum 48 hours

5.2. *Disposal and environmental measures*

Remains of material and impure packaging must be disposed in accordance with local governmental instructions and if necessary special treatment must be conducted. Prevent material from getting into the sewage system, waters or soil.

5.3. *Conducting coating activities*

It must be guaranteed that the staff is professionally instructed. Requirements of the machine manufacturer must be considered. Personal protective equipment (PPE) shall be available in adequate amount and must be used.

5.4. *Coating process*

Apply the coating according to the guidelines given below. Thinning of solvent-free thick-film coating systems is not intended and not necessary.

The coating thickness is specified in the technical data sheet. Indications in relevant norms or standards and project-related requirements must be considered. The applicator shall meter the coating thickness with an appropriate device and document the findings. The relative humidity must be under 80 %. Additional advice is necessary in case of deviation. The surface temperature must be at least 3°C above the dew point of the ambient air to avoid condensation on the substrate. For determination of the values, use contact thermometer, hygrometer and hygrometric curves or comparable accurate device.

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5.4.1. *Coating with 2K hot airless system*

When beginning the coating works, assure stable machine pressure and the absence of solvents in the system. It is therefore convenient to point the operating spray gun into a separate drum until the materials exits clean, steady and in an even spray fan. Prior to application, heat the material sufficiently by circulation.

Each layer can be over-coated without mechanical roughening within the specified time, see technical data sheet. However, the surface must be dry and free of oil, grease and dust. Having exceeded the maximum waiting period, the coating has to be sweep-blasted.

5.4.2. *Manual application*

PROTEGOL® products with the ending L or TD are destined for application by brush, roller or spatula. The specified coating thickness shall be applied within three or four operations to ensure a pore-free coating.

The two components are supplied in containers and according to their mixing ratio (exempt: deliveries in hobbocks and drums). Thoroughly mix them with a slow-running mechanical stirrer, e.g. drill fitted with a stirring paddle running at max. 400 rpm) or manually, after component B has been filled into the component A container.

Make sure to mix in any material adhering to the container walls. Afterwards, transfer the content to a larger, clean vessel. Strip any adhering remains from the mixing vessel with a spatula and add to the total quantity, stir again until the material has been mixed uniformly. It is essential that the whole quantity of both components be used to ensure the correct mixing ratio. Avoid stirring air to prevent formation of blisters in the coating.

Mixing has to be intense and occur within a short period, since the process of curing starts with first contact of the components. The mixture has to be totally uniform (homogeneous) to ensure steady curing of the coating. Using cartridge products, the homogeneous mixing occurs inside the static mixer.

Depending on its viscosity, mixed PROTEGOL® is applied by spatula, brush or roller.

5.4.3. *Coating with air assisted spray device*

Solvent-free 2K PROTEGOL® UR Coatings twin cartridges are pre-filled according to the respective mixing ratio and applied with a special pneumatic spray device for 2K cartridges.

Equipment preparation and work instructions:

- The cartridge should be tempered to 20 to 30 °C.
- Open the half-moon caps on top of the cartridges and connect the static mixer with the cartridge by screwing.
- Insert the 2K cartridge into the pneumatic spray device, properly adjusting the pushing disks of the spray device to the cartridges.
- Connect the spray orifice with the air supply.
- Connect the spray device with the compressor unit and adjust to spray pressure of approx. 2 to 3 bar.
- Activate the spray device and spray into a separate bin for the first 2 seconds to avoid mixing errors and air entrapment.
- Start to coat the prepared surface from a distance of approx. 50 cm

See separate application specification for further information and safety requirements.

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5.4.4. Application of PROTEGOL® PU Repair cartridges

PROTEGOL® PU Repair is a solvent-free polyurethane coating pre-filled in cartridges with 1 : 1 volumetric and gravimetric mixing ratio. This product is applied with a mechanic application device.

Equipment preparation and work instructions:

- Take off the cartridge spill protection and connect the static mixer to the cartridge by screwing.
- Insert the twin-cartridge into the manual application device.
- Activate the application device and fill the static mixer completely with coating. The first 1 cm of the material leaving the mixer orifice must not be used to avoid any mixing errors or air entrapment.
- Start to coat the prepared surface

See separate application specification for further information and safety requirements.

5.5. Repair works

Coating imperfections, detected after visual inspection or non-destructive testing, or caused by destructive testing, need to be repaired according to DIN EN 10289 / 10290, section 9. The material has to be selected according to size and form of the damaged area.

Preparation

- Thoroughly clean all coating imperfections, such as pores, pinholes, low thickness or air entrapments, and any overlapping coatings with a wire brush and free of any corrosion residue.
- In case of bare metal clean to Sa 2 ½ acc. to EN ISO 8501-1
- Chamfer and roughen at least 10 mm of the coating surrounding the imperfection by means of a grinding machine, emery paper or sweep blasting.
- Free of all dust, corrosion residue and loosely adhering coating.
- Coating works have to be executed according to the indications given before.

5.6. Waiting periods for over coating

When applying in several operations or for refinishing works, wait until the applied layer has reacted enough so that further application passes do not lead to running and sagging. This usually corresponds to a touch-dry slightly sticky surface. The maximum waiting time for recoating is three days at room temperature. The applied coating layer must be clean, dry and free of release agents. Sweep-blast the surface in case of extended waiting periods. When in doubt, a mechanic pretreatment is recommended to avoid later lamination.

5.7. Quality control

5.7.1. Quality control during coating works

Before and during coating works spray on a test foil. Remove the coating film and check the reacted coating concerning mixing errors, detectable through soft/sticky areas. Measure and record relative humidity, surface and air temperature, and dew point.

Measure and record the wet film thickness using a wet film thickness gauge. These metering points must immediately be over-coated or later repaired. Coated test plates must be produced and tested according to the relevant customer specification if requested.

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5.7.2. *Quality control of coated work pieces*

- Coating thickness: Record dry film thickness acc. to DIN EN 12944-6.
- Visual inspection: visually inspect the coating concerning coating defects/imperfections
- Holiday detection: High voltage test to detect freedom of pinholes. Test voltage 8 V/μm acc. to DIN EN 10290/ 10289; max. 20,000 V or acc. to customer specification.

5.7.3. *Waiting periods for standard examinations*

- Wet film thickness: Continuously during coating works
- Dry film thickness: After sufficient curing of the coating (usually 1 hour to 1 day); the testing instrument must no longer cause any marks
- Holiday detection: As soon as the coating material is tack-free (normally within 0,1 to 6 hours)
- Adhesion test (pull-off): 1 day, dollies can be glued to the coating when sufficiently cured, normally tack-free

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6. Flow diagram for coating works

<p>Raw material inspection and verification of environmental parameters</p>	<ul style="list-style-type: none"> • State of package/labeling, batch number, manufacturing date, inspection/quality certificate • Surface temp. $\geq 10\text{ }^{\circ}\text{C}$ and min. $3\text{ }^{\circ}\text{C}$ above the dew point, rel. humidity $< 80\%$ • Take appropriate protective measures if necessary
<p>Protective measures and rules of conduct, commissioning the coating equipment</p>	<ul style="list-style-type: none"> • Mount/test personal protective equipment for completeness and integrity • Commissioning acc. to manufacturer's instructions • Temper material to processing temperature
<p>Surface preparation and inspection</p>	<ul style="list-style-type: none"> • Surface near-white blast cleaning Sa 2 1/2, with suitable blasting media • Elimination of dust, blow-off with dry, oil-free compressed air • Roughness and visual examination of the surface, observation of max. time interval between blasting and coating
<p>Coating</p>	<ul style="list-style-type: none"> • Flush hoses and mixing block solvent-free (into empty containers) • Prepare spray test foil, perform work piece coating • Meter wet film thickness by wet film comb, re-pass if necessary, clean mixing sections of the spray equipment
<p>Testing of the applied anti-corrosion coating</p>	<ul style="list-style-type: none"> • Visual examination of the coating for imperfections • Meter dry film thickness • Conduct high voltage (holiday) test ($U = 8\text{ V}/\mu\text{m}$, max. 20 kV)
<p>Reworking of imperfections</p>	<ul style="list-style-type: none"> • Use suitable touch-up product • Prepare imperfect/touch-up areas • Test for surface cleanliness • Consider overcoating period
<p>Documentation</p>	<ul style="list-style-type: none"> • Complete coating records • Establish test samples

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