

EXPLANATION TO PRODUCT DATA SHEETS

GENERAL

Product datasheets (PDS) are used to introduce a product's purpose and properties. They contain a product description, properties and application information.

This information sheet explains how to use and interpret the information in a PDS. Additional information may be available in working procedures/application guidelines.

The following sections are generally found in PPG Protective and Marine Coatings' PDS.

Characteristics, Properties and Appearance

- Description
- Principal characteristics
- Color and gloss level
- Basic data

Application, Drying and Curing

- Recommended substrate conditions and temperatures System
- Specification
- Instruction for use
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CHARACTERISTICS, PROPERTIES AND APPEARANCE

Description

The generic categorization of the product is described using such items as the number of components and the generic (chemical) binder category of the product. The description may or may not include the product's key purpose as well. Some chemical description may be industry accepted sub-category descriptions, which can refer to purpose more than composition.

Principal Characteristics

This chapter of the PDS describes the designed purpose of the product and some of its key performance properties and a general indication of the exposure conditions that the product is designed to withstand. The general statements on immersion and exposure are for when using the product in a coating system that may include multiple layers and products. Specific conditions such as maximum temperatures, pressures, cargo or media composition, etc., should be confirmed with PPG.

Certification mentioned here should be checked for relevant regional applicability and expiration. Some product or system certification/approvals are linked to specific production locations. Certain certifications restrict film thickness to a tighter range than a PDS may allow and should be followed to conform to the relevant standards.

Further details on the composition may be mentioned in this part of the PDS; for example, meeting certain criteria such as a percentage of zinc in the product and whether this complies with a standard.

Gloss

Specular gloss is the ability of a (coated) surface to reflect light in a mirror-like manner. Gloss values are determined in Gloss Units (GU) on a gloss gauge at a 60° angle according to ISO 2813 (= ASTM D-523) and can be grouped in five ranges, compared with a standard sheet of black polished glass.

The expressions used in the PDS are:

| | |
|-------------|----------|
| Matt/Flat: | < 20 GU |
| Low Sheen: | 20-40 GU |
| Semi-gloss: | 40-70 GU |
| Gloss: | 70-85 GU |
| High-gloss: | > 85 GU |

Final gloss level can vary between colors of the same product and may be influenced by amongst others: substrate (type or previous coats), application method and thinner used, as well as application and curing conditions. Weathering (chalking, especially of epoxy coatings) and wear and tear (abrasion) reduce the gloss level in service in varying amounts depending on the product and (binder) technology used.

Color

The different shades available for a product are listed. Although the availability of a range of different colors may be mentioned, this does not mean these are available or stocked in all parts of the world. For certain product types, due to their function, such as primers, linings and antifouling, the given color is an indication and not linked to a specific standard color. They are not tinted; hence, visible deviations may be found between batches and products. Color matches for epoxy products are approximate. Appearance of different products in the same shade may be visibly different.

Adverse climate conditions during application and curing have an influence on the appearance and color. Some product types, such as epoxy coatings, discolor in service especially when exposed to UV radiation. Chemicals and/or high temperatures can have a similar effect. Color matching, especially to aged materials, can be an issue in such cases.

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For low film thickness topcoats, the color appearance may depend on the shade of the underlying coating. When contrasting undercoats are selected, bright shaded topcoats may deviate. Please contact your local PPG representative for more details.

Micaceous Iron Oxide and/or Aluminum-containing Paints

Micaceous iron oxide and/or aluminum-containing paints show a different appearance and color impression depending on thickness and application method. A touch-up by brush or roller is likely to be visible on a sprayed area. These products are not tinted to match a standard; colors mentioned in the PDS should be seen as an indication.

Basic Data

Number of Components

The minimum number of separately packed materials that are required to be mixed before application and are part of the product properties represented in the PDS. For two-component products, these materials may be called base and hardener, resin and cure, base and catalyst or binder and paste depending on their specific chemistry. Some products may have zinc or glass flake powders as a third component.

The mix ratio of the components is prescribed in the "Application, Drying and Curing" chapter.

Mass Density

The weight per volume unit of the wet paint material (mixed in case of multiple component materials) without adding application thinner. Besides small differences between batches, this may vary between shades and should be seen as an indication. Shade specific information can be found in the relevant safety datasheet (may be described as relative density) and can be used to calculate the mixed density for multi component products.

$$MD_{Set} = \frac{(Mix_A \times MD_A) + (Mix_B \times MD_B)}{100}$$

EXAMPLE:

Two component epoxy product with volume mix ratio 75:25 (3:1)

| | | | |
|--------------|-------------------------------------|-----|--------------------------|
| MD_{Set} = | Mass Density Set= to be calculated | Mix | |
| Mix_A = | Ratio A (Base) component | | = 75% v/v |
| MD_A = | Mass Density A (Base) component | | = 1.55 g/cm ³ |
| Mix_B = | Ratio B (Hardener) component | | = 25% v/v |
| MD_B = | Mass Density B (Hardener) component | | = 0.95 g/cm ³ |

$$MD_{Set} = \frac{(75 \times 1.55) + (25 \times 0.95)}{100} = 1.40 \text{ g/cm}^3$$

Volume Solids

The volume solids figure is the practical value (percentage) of the dry material that remains after the coating has dried (evaporation of solvents and/or water) and is part of the calculation of the theoretical spreading rate. The volume solids figure is given as a range as it varies depending on shade and whether the material is tinted at a point of sale.

Volatile Organic Compounds (VOC)

Volatile organic compounds are reported as a gram per liter (g/l) value in the PDS. Unless noted differently, the value is based on a calculation of the composition of the coating (mixed components for multi-component products) and does not include any thinner added for application except GB test (China standard) method.

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VOC have been linked to indoor and outdoor air quality issues. VOC coming from coating products are mainly made up of solvents/thinners that evaporate out of the coating during the drying process. Environmental legislation aimed at reducing emissions of VOC are in place in many geographic areas. In some regions, limits may vary depending on the purpose or application of the product. Rules may regulate the amount of VOC allowed in paint or the “exhaust” quantities of paint shops. The definition of “volatile” varies around the world and sometimes local/regional VOC regulations can be stricter than national ones.

Additional data in line with local regulations such as EPA 24 (USA), Solvent Emission Directive (SED, Europe), and for China GB 38469-2019 and GB 30981-2020 may be included in the PDS as well. The user should ensure that the product they intend to apply meets local regulations for their specific application. Depending on regulation, it may be required to include any possible thinner being added.

Recommended Dry Film Thickness (DFT)

The dry film thickness (range) per coat in a coating system indicated in PPG documentation. The DFT indicated for a product is for specific exposure conditions or application and based on airless spray application.

Theoretical Spreading Rate

A function of a paint material’s volume solids and applied film thickness. The calculation does not take into consideration loss factor. The theoretical spreading rate for a given dry film thickness can be calculated using:

$$\text{m}^2/\text{l} = \frac{\% \text{ volume solids} \times 10}{\text{dry film thickness (in } \mu\text{m)}}$$

$$\text{ft.}^2/\text{US gallon} = \frac{\% \text{ volume solids} \times 16.04}{\text{dry film thickness (in mils)}}$$

Dry-To-Touch, Overcoating Interval, Full Cure After

Definitions can be found in the “Application, Drying and Curing” chapter below.

Shelf Life

The period from the date of manufacture during which the paint can be transported and stored in undamaged and unopened packing without any influence on the application or performance of the paint. Unless mentioned differently, the shelf life is given for storage temperatures between 5-35°C.

After exceeding this period, the paint is subject to re-inspection after which PPG may extend the shelf life. Waterborne products must be protected from freezing at all times during storage and/or transport.

Notes to Additional Data

Refer to tables further on in the PDS: drying/curing and overcoating; pot life at different temperatures.

HEALTH AND SAFETY

Safety Data Sheet (SDS)

The health and safety related information in the PDS and in this information sheet should be read in conjunction with the latest Safety Datasheet (SDS) for the components of the product(s). As regulations vary in different regions, the information in the SDS for the same article may vary.

Ventilation

Adequate ventilation during application and curing of the coating is not only required for health and safety reasons but also to ensure the optimal performance of the coating.

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Stagnant air/high vapor concentrations in confined spaces must be avoided. Forced ventilation will help to avoid high vapor concentrations and possible solvent entrapment in the coating, which may affect the coating performance and produce a temporary plasticizing effect. Ventilation with cold, humid air in the drying stage should be avoided. High humidity and condensation on the coating surface in this stage can affect curing and cause surface defects.

Also avoid ventilation with heated air during the wet film forming stage as this approach may cause skinning and increased solvent entrapment.

APPLICATION, DRYING AND CURING

Substrate Conditions and Temperatures

In order to achieve optimal application results, the technical requirements as stated in the relevant PDS should be followed. It is recommended that during the application and initial curing, the substrate temperature does not exceed 40°C, unless otherwise stated in the relevant PDS.

However, maintaining the required conditions in practice might prove difficult and the substrate temperature may occasionally exceed the recommended limits. In such cases, special care must be taken to ensure proper substrate wetting and film formation, avoid excessive overspray, dry spray, sagging and other application-related coating defects. Precautions such as additional thinning of the coating, providing suitable sun/heat protection and/or forced ventilation might be adequate. Maintaining the recommended conditions will facilitate optimal application results.

For further details regarding substrate treatment refer to:

- Information Sheet 1490 – Cleaning of Steel and Removal of Rust

Recommended Thinners

Any PPG product must only be thinned using the recommended PPG thinners. The use of alternative thinners, particularly those containing alcohols, can severely inhibit the curing mechanism of certain coating types and will influence the performance.

Follow the recommended thinner volume in the PDS as deviations may affect product properties. A test application is advisable before adding thinner; application conditions and batch-to-batch variances may affect the optimal thinner volume.

Thinners should not be used to extend the workable pot life as this may affect the performance of the applied coating.

Depending on local regulations, use of thinners may need to be taken into consideration when calculating the volatile organic compound content of the applied materials.

Dry Film Thickness (DFT)/Wet Film Thickness (WFT)

The dry film thickness can be calculated from the applied wet film thickness:

$$\text{DFT} = \frac{\text{WFT} \times \% \text{ volume solids}}{100}$$

$$\text{WFT} = \frac{\text{DFT} \times 100}{\% \text{ volume solids}}$$

Wet film thickness measurements using a WFT gauge or WFT comb should be taken directly after application as evaporation of solvents affects the results. These readings should be seen as an indication as the steps between the possible readings on the gauge can be significant compared to the applied thickness.



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Minimum DFT for Application

The minimum DFT of a paint system (also a one-coat system) should follow the 90/10 rule (e.g., 90% of the recommended DFT is acceptable for up to 10% of the readings only), whilst for individual coats the minimum DFT should not be lower than 80% of the recommended DFT and must form a closed film.

Maximum DFT for Application – General

Application of paint at thicknesses in excess of the DFT recommended in the PDS may result in performance problems. Such problems may, for instance, include solvent retention and a reduction in cohesive strength in association with certain types of topcoat.

In a coating system, the DFT of a primer is of the utmost importance. In general, PPG would restrict the DFT of any primer to 1.5 times that specified in the PDS.

For a coating system, including the individual coats (except the primer), the maximum DFT is 2 times the recommended DFT, whereas for the critical areas of a painted structure, 10% of the readings can be between 2 and 2.2 times the recommended DFT. Critical areas are, e.g., weld seams, edges, bolts, corners, nuts and areas of difficult access.

For coating specifications requiring coating thicknesses that exceed the recommended DFTs as mentioned in the PDS and other product documentation, the maximum DFT allowed should be established per project prior to start-up.

Over-application and its consequences for final DFT is a complex subject and is dependent on the generic type of system, recommended DFT and number of coats, as well as the intended exposure. Stacking of overlaps during application of subsequent coats should be minimized. Please refer to your local PPG representative if you should have any questions on this important issue.

The lifetime of any protective coating system is also determined by the dry film thickness applied to critical areas. The DFT of all of these critical areas should be closely monitored and controlled by the application of stripe coats with the same material as the consecutive coat of the system (or as recommended otherwise by PPG). Please note that if a solvent-based coating has been applied over the specified DFT then the minimum overcoating time must be increased to ensure that sufficient time is given for solvent evaporation. Care must also be taken to avoid overapplication on critical areas during the progress of the job. Over application does not lead to enhanced performance lifetime of the coating system.

Maximum DFT for Application – Linings

For linings for severe exposure conditions, reinforced, solvent-free systems or Corrosion Under Insulation (CUI) systems, the DFT of the primer and the subsequent coatings can be more critical. DFT limitations are detailed in the respective PDS and system sheets.

Practical Spreading Rate

The practical spreading rate depends on a number of factors: surface condition and profile (often considered separately as the dead-volume), application method, normal-, high build- or solvent-free paint, skill of labor and weather conditions.

It is often estimated at about 70 % of the theoretical spreading rate but under many conditions this is still far too high.

The complexity of a structure to be coated, and open framing for instance, can make it harder to deposit a controlled thickness on the substrate only. Even using a small nozzle angle the amount of overspray will be significant. Substrates like wood and concrete present other variable factors, especially in the preparation, the filling of pores, etc.



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An estimation of the volume of paint required for a paint job can be calculated by dividing the area to be coated by the practical spreading rate and including the estimated losses. The following formulas can be used for metric (liters, μm, m²) or imperial units (gallons, mils, ft²):

$$Q_{\text{metric}} \text{ (liters)} = \frac{10 \times A \times \text{DFT}}{\text{VS} \times (100-W)} \qquad Q_{\text{imperial}} \text{ (gallons)} = \frac{A \times \text{DFT}}{0.1604 \times \text{VS} \times (100-W)}$$

Example

| | | | |
|-------|----------------------------------|-------------------------|--------------------------|
| | | <u>Metric</u> | <u>Imperial</u> |
| Q = | paint quantity in | Liters to be calculated | Gallons to be calculated |
| A = | area in m ² | 1,000 m ² | 10,000 ft ² |
| DFT = | dry film thickness | 100 μm | 4 mils |
| VS = | % volume solids (see data sheet) | 80 | 80 |
| W = | % estimated losses | 40 | 40 |

$$Q_{\text{metric}} = \frac{10 \times 1,000 \times 100}{80 \times (100-40)} \approx 208 \text{ liters} \qquad Q_{\text{imperial}} = \frac{10,000 \times 4}{0.1604 \times \text{VS} \times (100-W)} \approx 52 \text{ gallons}$$

Nozzle Orifice and Spray Angle

In the PDS, the recommended orifice is stated in mm and/or thousands of an inch.

The size of the opening determines how many liters per minute can be atomized through the spray tip. Too small an opening may result in poor spray pattern and blocked nozzles. Too large an opening may result in spatter and poor atomization.

Depending on application conditions, such as temperature, amount of thinner added, etc., other nozzle sizes can give satisfactory application of the product as well.

The choice of the spray angle depends on the practical situation. Smaller (sharper) angles can facilitate a reduction in loss factor and overspray on small items but create multiple overlaps and risk of localized over application.

Nozzle pressure

A pressure (range) is indicated on the PDS that should allow for an even and stable spray fan. This should be used to find the suitable pressure for given site conditions and specific spray equipment used. Lower pressure within the workable range observed will generally be preferable, as this will create less dry spray and a more controlled application.

Mixing Ratio

Multiple component products are generally supplied in pre-measured sets of a specific volume or weight. To prevent the risk of off-ratio material being applied, full sets should preferably be prepared. Pigmented components should be homogenized before mixing the set.

Mixing Ratio – Twin Feed

The mix ratios in volume for twin-feed or plural spray applied products should be retrieved from the specific PDS. It is very important that the right ratios are maintained but deviations up to a maximum of 3% are acceptable unless otherwise stated on the specific PDS.

These products are generally supplied ready for use and diluting is not allowed.



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Induction Time

If mentioned in the PDS, the coating should be thoroughly mixed and left for the recommended period. This induction time, sometimes called sweat-in time or pre-curing of the product ensures that the coating will give the required performance and application properties. The requirement for, and duration of, an indication time may vary with the temperature.

Drying and curing

The drying and curing data in the PDS are based on consistent temperatures. Variations in temperature during this period will affect the practical curing rate. The PDS information regarding drying and curing times refers to the properties of a single coat of the product. It should be noted that drying and curing of a coating system comprising of multiple coats of products or combinations of products can be longer than those of the individual products in isolation. The Dry Film Thickness of products will also have an effect on the drying and curing properties.

Touch Dry

The touch-dry time corresponds with the tack-free time measured in accordance with ASTM D-1640. The touch-dry time will be influenced by DFT, ventilation conditions and substrate temperature.

Dry-to-Handle

The dry-to-handle time corresponds with the dry-through time measured in accordance with ASTM D-1640. The dry-to-handle time will be influenced by DFT, ventilation conditions and substrate temperature and should not be necessarily interpreted as ready for transportation due to the likelihood of excessive damage.

Full Cure

“Full cure” means that the properties of the product as described in the PDS are achieved (suitable for service). However, in case of dry bulk carriage, an extra curing time may be required before the coating has reached its full mechanical strength and is suitable for the carriage of hard, angular cargoes. Similarly, for chemical-resistant linings, additional curing requirements such as a post-cure or hot-cure may be mentioned for specific exposure scenarios. Please refer to the product’s chemical resistance list and relevant notes.

Overcoating Table

The data given in the product overcoating table is based on application of the DFT as mentioned in the table and under the application conditions as stated in terms of temperature and humidity and adequate ventilation.

The minimum over coating time of the product will be typically longer when the product is applied at higher DFT and / or within multi coat systems. Addition of Thinner to the coating product can also lead to longer minimum over coating times.

Contact your local PPG representative for specific details on overcoating times in circumstances deviating from those provided for.

Pot Life

This gives the time interval after mixing of the components of the coating during which the material can be applied, without change of application and performance properties of the coating. Adding additional thinner to extend the pot life is not advisable. For solvent-free and high-solid coatings, an exothermic reaction occurs, resulting in gelation shortly after reaching the end of the pot life. This makes it hard to control the pot life extension process. For solvent-containing coatings, an extra addition of thinner up to 5% is allowed. For solvent-free coatings, the addition of thinner is not permitted. It is important to clean equipment with the recommended cleaning solvent before the pot life has expired and/or directly after completion of the application.

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TOLERANCES AND DISCLAIMERS

Tolerances

Values given for specific gravity, theoretical spreading rate and solids content are averages from standard production batches; these values can vary slightly and also between colors of one product.

For ease of reference, figures are usually stated in metric units only, but imperial equivalents may be included.

All values are given for a temperature of 20°C (68°F) and relative humidity of 70%, unless stated otherwise.

WARRANTY

PPG warrants (i) its title to the product, (ii) that the quality of the product conforms to PPG's specifications for such product in effect at the time of manufacture and (iii) that the product shall be delivered free of the rightful claim of any third person for infringement of any U.S. patent covering the product. THESE ARE THE ONLY WARRANTIES THAT PPG MAKES AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, UNDER STATUTE OR ARISING OTHERWISE IN LAW, FROM A COURSE OF DEALING OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION, ANY OTHER WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE DISCLAIMED BY PPG. Any claim under this warranty must be made by Buyer to PPG in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life of the product, or one year from the date of the delivery of the product to the Buyer, whichever is earlier. Buyer's failure to notify PPG of such non-conformance as required herein shall bar Buyer from recovery under this warranty.

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