EXPLANATION TO PRODUCT DATA SHEETS 1411

an eight page issue

July 2007
revision of November 2006

GENERAL

For ease of reference figures are usually stated in one unit only. Equivalents are given in the conversion tables. See sheets 1410 Conversion tables, 1412 Nomograph conversion from english units to metric units and 1413 S.I. units.
All values are given for temperature of 20°C (68°F) and relative humidity of 70%, unless stated otherwise.

GLOSS

With a 'Lange' gloss gauge 5 ranges of gloss have been determined, compared with a standard sheet of black polished glass. The gloss values are determined on Lange gloss gauge (angle 60°) according to ISO 2813 (= ASTM D-523). The expressions used in the data sheets are:

Flat	corresponds with 0- 15%
Eggshell	corresponds with 15- 30%
Semi-gloss	corresponds with 30- 60%
Gloss	corresponds with 60- 80%
High-gloss	corresponds with 80-100% (at 20° angle above 70%)

In practice, the level of gloss and surface finish will be dependent upon a number of factors, including application and the condition of the surface to be overcoated.

COLOUR

For products supplied in different colours three colour quality levels exist:

1. Good — For finishes in general, especially based on polyurethane, this quality matches the colour standard
2. Approximate — For undercoats and low gloss topcoats in general, this quality level is close to the colour standard
3. Best Match — For primers in general, this quality level is near to the colour standard

MICACEOUS IRON OXIDE AND/OR ALUMINIUM CONTAINING PAINTS

Micaceous iron oxide and/or aluminium containing paints show different appearance and colour impression depending on thickness and application method. A touch-up by brushing may be visible on a sprayed area.

SHELF LIFE

The period from the date of manufacture during which the paint can be transported and stored in undamaged and unopened packing at temperatures between 10-30°C, without any influence on the application or performance of the paint.
After exceeding this period the paint is subject to reinspection.
Water-borne products must be protected from freezing at all times during storage and/or transport.

SUBSTRATE CONDITIONS AND TEMPERATURES

Unless stated otherwise in the relevant product data sheet, the maximum substrate temperature should not exceed 40°C and/or maximum RH of 80% is allowed

see sheet 1490 – Cleaning of steel and removal of rust
see sheet 1650 – Relative humidity - Substrate temperature - Air temperature

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FULL CURE

'Full cure' means, that the properties of a paint as described in the product data sheet 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 carriage of hard angular cargoes

FLASH POINT

For paints the flash point is determined according to ISO 1523 (= ASTM D-3278, corresponding to Sigma method SM 311-41) or calculated.
For thinners the flash point is determined according to DIN 51755 (corresponding to Sigma method SM 311-42) or calculated.
Please always refer to the latest Material Safety Data Sheet for the paint and thinners.

OVERCOATING TABLE

The data given is a fair indication for normal conditions, longer drying times are necessary at lower temperatures and under unfavourable weather and/or ventilation conditions and higher dry film thicknesses.

For epoxy coatings the minimum curing time for the recommended dft is given in the data sheets.
For average dfts 50% higher, the minimum overcoating time should be multiplied by 1,5 and for average dfts 100% higher the multiplication factor is 2,5.
Recoating data are based on atmospheric exposure, for other exposure conditions contact your nearest sales office.

TOUCH DRY

The touch dry time corresponds with the tack free time measured in accordance with ASTM D-1640 (corresponding with Sigma method SM 315-01). 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 (corresponding with Sigma method SM 315-01) and indicates the time when walking over is possible.
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.

DRY FILM THICKNESS (dft) / WET FILM THICKNESS (wft)

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

$$\text{dft} = \frac{\text{wft x \% volume solids}}{100} \qquad \text{wft} = \frac{\text{dft x 100}}{\text{\% volume solids}}$$

Recommended dft

The dry film thickness for a paint system indicated in our system sheets is the recommended dft for the specific exposure conditions and based on airless spray application.

Dft specifications referred to herein are valid for the coatings and coating systems in this manual unless mentioned otherwise in the respective product and system sheets.

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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 a paint at thicknesses in excess of the dft recommended on the product data sheet may result in performance problems. Such problems 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, Sigma Coatings would restrict the dft of any primer to 1.5 times that specified on the product data sheet.
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 which exceed the recommended dfts as mentioned in the product and system sheets, the maximum dft allowed should be established per project prior to start-up.

Over-application and its consequences 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.

Please refer to your local Sigma Coatings office if you should have any questions on this important issue.

The life time 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 Sigma Coatings). Please note that if a solvented 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 over-application on critical areas during the progress of the job. Over-application does not lead to enhanced performance life time of the coating system.

Maximum dft for application - Linings
For linings for severe exposure conditions or reinforced solvent free systems, the dft of the primer and the subsequent coatings can be more critical. Dft limitations are detailed in the respective system / product data sheets.

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VOC

Until further notice, the heavy duty Marine and PC coatings industries in Europe must comply with the VOC Directive 1999/13/EC (SED).

VOC values (in g/kg) to assist with the annual calculation of the solvent limits related to the SED requirements, are mentioned on each Product Datasheet as well as on the label of all products.

For decorative, functional and protective coatings used in 'buildings,' the VOC Directive 2004/42/EC applies. This is based on compliant coatings.

Label Example:

1999/13/EC : 320 g/kg
2004/42/IIa (i) 600 (2007) 360

Explanation Label Example:

1999/13/EC : 320 g/kg	Max VOC according to Directive 1999/13/EC for material in the can.
2004/42/IIa (i)	Reference to the sub-category according to Directive 2004/42/IIa
600 (2007)	Threshold limit for sub-category according to Directive 2004/42/IIa from 1.1.2007 till 1.1.2010
360	The max content of VOC in g/l of the product in a ready to use condition (including maximum amount of thinner according to Product Datasheet).

SOLIDS CONTENT BY VOLUME

This value is given in the product data sheet. It can be determined by a laboratory test, Sigma Method 314-10 corresponding to ISO method 3233 (= ASTM method D 2697) or calculated from the formulation.
The calculated theoretical solids content by volume is in general lower than the determined solids content by volume. The latter approximates best to practice, assuming that the table for spreading rate losses is used correctly. Diluents with a high boiling point and low vapour pressure are widely used in solvent free coatings, they will remain in the cured film under normal ambient conditions and will therefore have negligible effect on the volume solids of these specific products. Furthermore, due to the relative high boiling point and rather low vapor pressure of these diluents, the ventilation requirements when using solvent free coatings in confined spaces to maintain the internal atmosphere at 10% of the Lower Explosion Limit, will be unchanged.

TOLERANCES

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

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VENTILATION

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

Stagnant air/high vapour concentrations in confined spaces must be avoided. Forced ventilation will help to avoid high vapour concentrations and possible solvent entrapment in the coating which may produce a temporary plasticising effect. Ventilation with cold, humid air in the drying stage should be avoided.
Also avoid ventilation with heated air during the wet film forming stage as this approach may give skinning and increased solvent entrapment.

For more information, see the following data sheets:
1430 Safety indications
1431 Safety in confined spaces and health safety, explosion hazard - toxic hazard
1434 Directives for ventilation practice

THEORETICAL SPREADING RATE

The theoretical spreading rate m²/l for a given dry film thickness can be calculated from:

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

PRACTICAL SPREADING RATE

The practical spreading rate depends on a number of factors:
surface condition and profile, application method, normal, high build or solvent-free paint, skill of labour 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. For calculation purposes the following table has been composed in which spreading rate LOSSES are compiled.
Substrates like wood and concrete are not included because they present too many other variable factors, especially in the preparation, the filling of pores, etc.

RECOMMENDED THINNERS

This product must only be thinned using the recommended Sigma thinners. The use of alternative thinners, particularly these containing alcohols, can severely inhibit the curing mechanism of certain coating types and will influence the performance. In case of the use of other thinners than adviced, Sigma Coatings will not accept any responsability.

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ESTIMATED LOSSES IN PERCENTAGES

ALL FIGURES ± 10 DEPENDING ON CIRCUMSTANCES (AS GUIDE ONLY)

Type of surface and application method		BARE STEEL/FIRST COAT 4)				COATED STEEL/NEXT COAT			
		NEW blast-cleaned A-B-C ISO-Sa2½		OLD derusted C St 3 / D ISO-Sa2½		NEW including shop primer		OLD due for maintenance	
		inside	outside	inside	outside	inside	outside	inside	outside
LARGE 1)	airless spray	30	40	40	50	25	35	35	45
	air-spray	40	50	50	60	35	45	45	55
	roller	35	35	40	40	30	30	40	40
SMALL 2)	airless spray	45	55	55	65	40	50	50	60
	air-spray	50	60	65	65	45	55	60	60
	roller-brush	25	25	25	30	20	20	30	30
FRAME-WORK 3)	airless spray	85	85	85	85	85	85	85	85
	brush	20	20	20	20	20	20	30	30

1) LARGE SURFACES : hull, decks, deckhouses, tanks, holds
2) SMALL SURFACES : masts, water ways, machinery, structural steel and complex structures
3) FRAMEWORK : ladders, piping and railings
4) PRIMERS : consumption of first coat is always higher than for subsequent coats because of the steel profile

Estimation of volume of paint necessary for a paint job can be calculated from:

$$\frac{10 \times A \times DFT}{VS \times (100-W)} = Q$$

Q = quantity in litre
A = area in m²
DFT = dry film thickness
VS = % volume solids (see data sheet)
W = estimated losses (see table)

EXAMPLE

Q = to be calculated
A = 1000 m²
DFT = 100 µm
VS = 50%
W = 40%

$$Q = \frac{10 \times 1000 \times 100}{50 \times (100-40)} = 333 \text{ ltr.}$$

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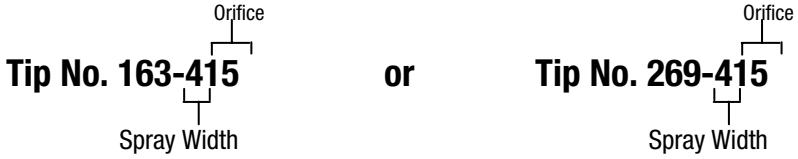
NOZZLE ORIFICE AND SPRAY ANGLE

In the product data sheets only the recommended orifice is stated. The choice of the spray angle depends very much on the practical situation. The table below compares orifice and angle with the corresponding codes of various manufacturers. Please consult other manufacturers for their corresponding codes.

ORIFICE			WIWA - Spray Tips [1]	GRACO - Spray Tips [2]	
Inches	mm's	Angle		Contractor	Finish
0,007	0.18	40°	018/40	--	163-407
0,009	0.23	40°	023/40	--	163-409
0,009	0.23	65°	--	--	163-609
0,011	0.28	25°	028/25	269-211	163-211
0,011	0.28	40°	028/40	269-411	163-411
0,011	0.28	65°	028/65	--	163-611
0,013	0.33	25°	033/25	269-213	163-213
0,013	0.33	50°	033/50	269-513	163-513
0,013	0.33	65°	033/65	269-613	163-613
0,013	0.33	80°	033/80	--	163-813
0,015	0.38	40°	038/40	**269-415**	**163-415**
0,015	0.38	65°	038/65	269-615	163-615
0,015	0.38	80°	--	269-815	163-815
0,018	0.46	65°	046/65	--	163-618
0,018	0.46	80°	--	--	163-818
0,021	0.53	65°	053/65	269-621	163-621
0,021	0.53	80°	--	269-821	163-821
0,026	0.66	40°	066/40	--	163-426
0,026	0.66	65°	066/65	--	163-626
0,026	0.66	95°	--	--	163-926
0,036	0.91	40°	091/40	--	--
0,036	0.91	80°	091/80	--	--

[1] In the **WIWA** number the relation between orifice and angle is clear

[2] **Orifice Size** determines how many liters per minute can be atomized through the airless spray tip. The last two digits of the part number tell the Orifice Size in thousandths of an inch. In this example, the orifice is 0.381 mm (015"). For ordering use the complete number.



Spray Width is based on spraying distance 305 mm (12") from the surface. Double the fourth digit of the tip part number to determine the approximate minimum Spray Width in inches. Add two inches to that number for maximum width. In this example, this tip size produces a 203-254 mm (8-10") spray pattern (width) at 305 mm (12") distance from the surface.

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MIXING RATIO - twin-feed products

The mix ratios in volume for twin-feed applied products should be retrieved from specific data sheets. It is very important that right ratios are maintained but deviations up to max. 3% are acceptable unless otherwise stated on specific data sheets.
These products are generally supplied ready for use after mixing of components as extra diluting is not allowed.

INDUCTION TIME

If mentioned on the product data sheet the coating should be thoroughly mixed and left for the recommended time for the particular temperature conditions at application. This induction time or pre-curing of the product ensures that the coating will give the required performance and application properties.

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. For solvent containing coatings an extra addition of thinner up to 5% is allowed. For solvent free coatings addition of thinner is not permitted. For solvent free and high solid coatings an exothermic reaction occurs, resulting in gelation shortly after reaching the end of the pot life. It is important to clean equipment with the recommended cleaning thinner before the pot life has expired and/or directly after completion of application of the paint.