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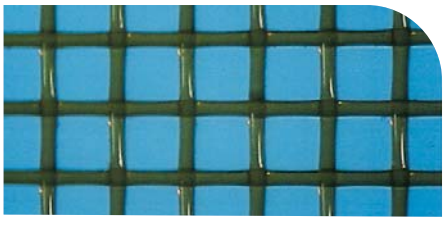
Screen Inks Consumption

Customers frequently inquire about the general yield of an ink or how much ink they will need for a print job. In this article this subject will be discussed in more detail.

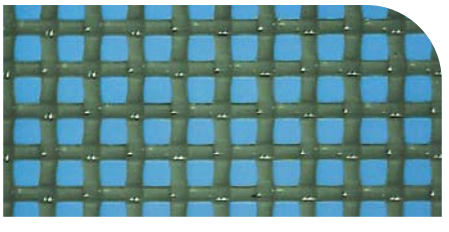
General yield of an ink usually is the number of m^2 solid tone you can print with 1 litre of ink. Several factors have to be considered in the calculation of the yield for an individual print job. These are explained in detail below.

Calculation of Printing Area

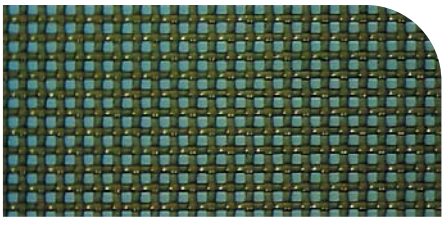
Naturally the starting point of any calculation of ink consumption is the total size of all surfaces you want to print. First you need to exactly determine the size of the print area. This is quite simple for solid prints (= length x width), however much more complicated for asymmetrical prints or details spread over the whole print sheet. In former times this was a quite time consuming measuring and calculation job, especially with large print formats. Today you can easily do this with your computer, e.g. using add-ons in Photoshop, which automatically calculate the print size of halftones, line or solid prints. The print area of one colour on a print sheet/print object is then multiplied by the number of printed objects (gross). The resulting figure will then be the total print size.



32-70 Y PW (110-fold magnification)



51-70 Y PW



120-34 Y PW

The essential parameters needed to determine yield of an ink are:

Total printing area of the job

Screen Fabric (Mesh Count)

Stencil profile

Substrate

Screen Printing Ink

Printing Equipment

Screen Fabric / Theoretical Ink Volume V_{th}

This is the most important parameter for calculation of ink yield.

The mesh count (number of fabrics/cm plus thread thickness) will basically preset the amount of ink which can be applied to the substrate with each print. Here you should refer to the information about the theoretical ink volume (V_{th} cm^3/m^2) of the stencil used in charts provided by mesh manufacturers. This value is calculated based on mesh opening percentage and screen thickness of a fabric. A 43-80 screen fabric has a Vth of 53 cm^3/m^2, a 120-34 fabric a value of 16,3 cm^3/m^2 whereas a 165-31 fabric only has a value of 7 cm^3/m^2.

When dividing 1 litre of ink, i.e. 1.000 cm^3 by V_{th} of the intended screen fineness the result will be a value in m^2. This value will indicate how many m^2 of solid area you can print with one litre of ink (ready-to-print adjustment) using this screen fabric (+/-).

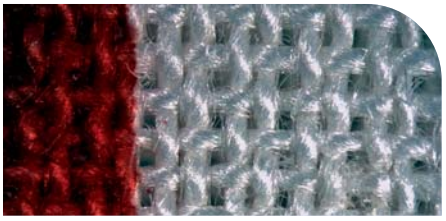
However, in practice there will surely be some deviations caused by other factors of influence.

A print technician would therefore add to this value in order to achieve exact values of consumption for future print runs or similar jobs.

Astonishingly these theoretical values are quite exact, mainly with medium and fine screen fabrics and prints on non-absorbent substrates.

However, use of coarse fabrics in combination with special printing inks (e.g. coarse texture varnishes) may result in significant deviations depending on ink properties and processing conditions (squeegee hardness, angle, sharpness, speed, type of floods bars etc.).

Klaus Hofmann (Print-Center)

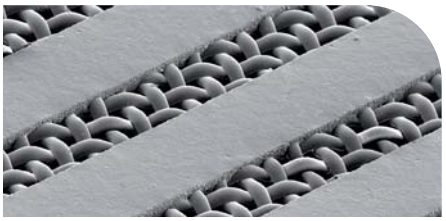


textile (cotton)

uncoated paper, Pantone colour fan "U"

coated paper, Pantone colour fan "C"

rigid PVC, white *all pictures 50-fold magnification*



"normal" coating thickness *photo: Murakami*

polyester fabric mesh count number threads/cm	thread ø in micron (µ)	weave type	theoretical ink volume V_{th}	theorectical yield m^2 litre
43 - *80*		1:1 (PW)	53,0 cm^3/m^2	14 m^2
77 - *55*		1:1 (PW)	23,3 cm^3/m^2	43 m^2
90 - *48*		1:1 (PW)	19,9 cm^3/m^2	50 m^2
100 - *40*		1:1 (PW)	21,1 cm^3/m^2	47 m^2
120 - *34*		1:1 (PW)	16,3 cm^3/m^2	61 m^2
150 - *34*		1:1 (PW)	6,6 cm^3/m^2	151 m^2
150 - *31*		1:1 (PW)	10,9 cm^3/m^2	92 m^2
165 - *27*		1:1 (PW)	9,6 cm^3/m^2	104 m^2

Source: Sefar

Regarding thread thickness please note: most well-known manufacturers of screen fabrics offer their range of mesh counts in 2, sometimes even 3 different thread thicknesses. With coarse fabrics of 10 - 70 threads/cm deviations of V_{th} within one fabric type are often very small (> 5%). Depending on fabric and thread thickness V_{th} of 70-120 threads/cm fabrics may vary up to 30%, with 120-165 threads/cm fabrics deviation may even amount up to 77% (fabrics 150-27 up to 150-34).

Stencil Profile

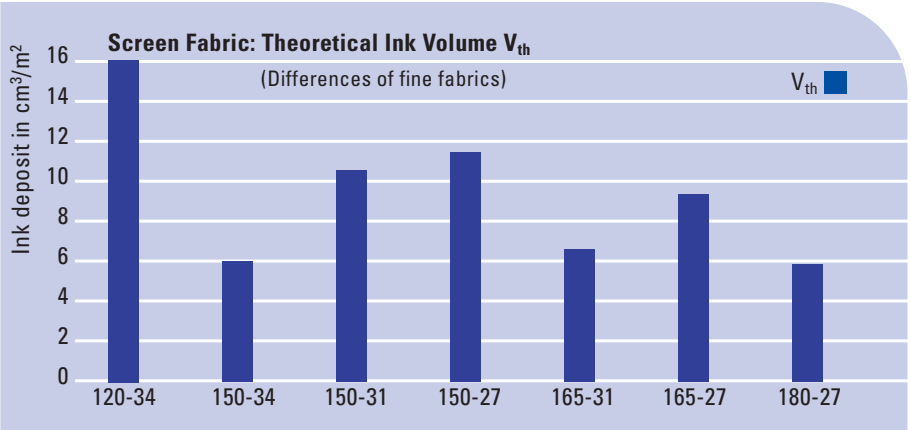
Stencil profile does not have any relevant influence on ink consumption when printing full solid areas.

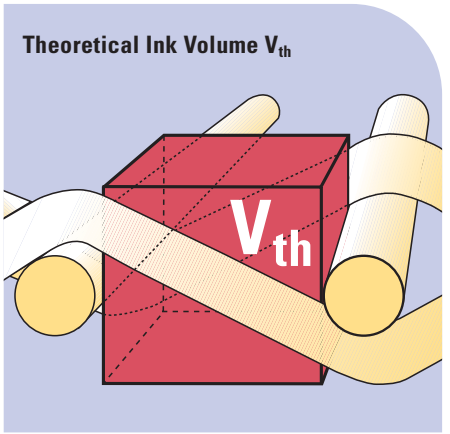
On the other hand stencil profile will influence ink deposit to a certain degree with higher coating thicknesses (> 10% of screen thickness) when printing motives with lines below 2 mm or in process printing applications.

Relief and effect prints require stencil coating thicknesses of up to 400% above screen thickness, thus in those applications a much higher influence on ink consumption has to be taken into consideration.

Substrate

The absorbency of the substrate is also an important factor. Non-absorbing materials such as most plastics only have little or no influence on ink consumption. More absorbent materials such as paper, above all absorbing textile materials may even increase the ink consumption (as calculated above) by up to 40%.





Screen Printing Ink

"Normal" screen inks processed under standard conditions such as our types HG, CX, UVX etc. will not have any significant "increase" of ink yield to be considered in the calculation. This is different with special inks, such as our coarse texture varnishes (e.g. MLS 70/02) or relief varnishes (like UV 70/511 or UVX 70/750-BL). Also other special adjustments (such as highly thixotropic adjustments according to customer requirements) may, in combination with printing conditions, result in "more or less" of the ink consumption calculated based on screen fabric data. Naturally calculations of ink consumption and yield values should always be based on readily mixed ink adjustments. This is no problem with UV inks as they usually are delivered ready for use. Prior to ordering the calculated amount of ready-to-print solvent based inks however, you should split the amount of ink and auxiliary agents (thinner, retarder, possibly hardener).

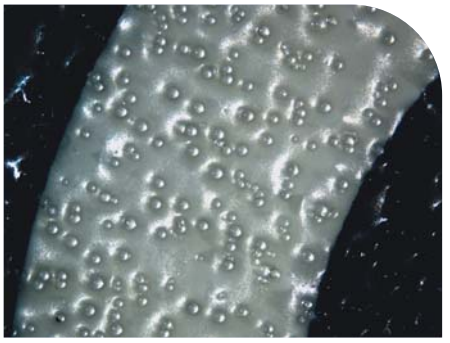
Printing Equipment

Type of printing equipment used, again also has an influence on ink consumption, deviation will be up to 10%. Machine type such as flat/flat, flat/round or round/round as well as machine adjustments like printing speed, type of squeegee or flood bar and sharpness and angle of the latter are all factors to be considered. Even machines of the same make may show significant differences in brightness or darkness of a colour shade (especially transparent shades) depending on machine adjustment. Therefore the required minimum amount of ink necessary for printing also has to be taken into consideration; medium to large format equipment require between one and five litres of ink on the stencil in order to print efficiently; this factor is independent from the calculated ink consumption.

Summary

Consumption or yield of a screen printing ink can never be determined exactly and there is no universal formula. The most important factor to determine consumption is the theoretical ink volume (Vth) of the screen fabric to be used in combination with the total print area and the number of prints. More exact values can then be re-calculated under local printing conditions.

MLS 70/00, UV Floor Graphic Varnish fine
Printed with fabric 90-48
May slightly deviate from V_{th} depending on printing conditions.



MLS 70/02, UV Floor Graphic Varnish coarse
Printed with fabric 24-100
May significantly deviate from V_{th} depending on printing adjustments.

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