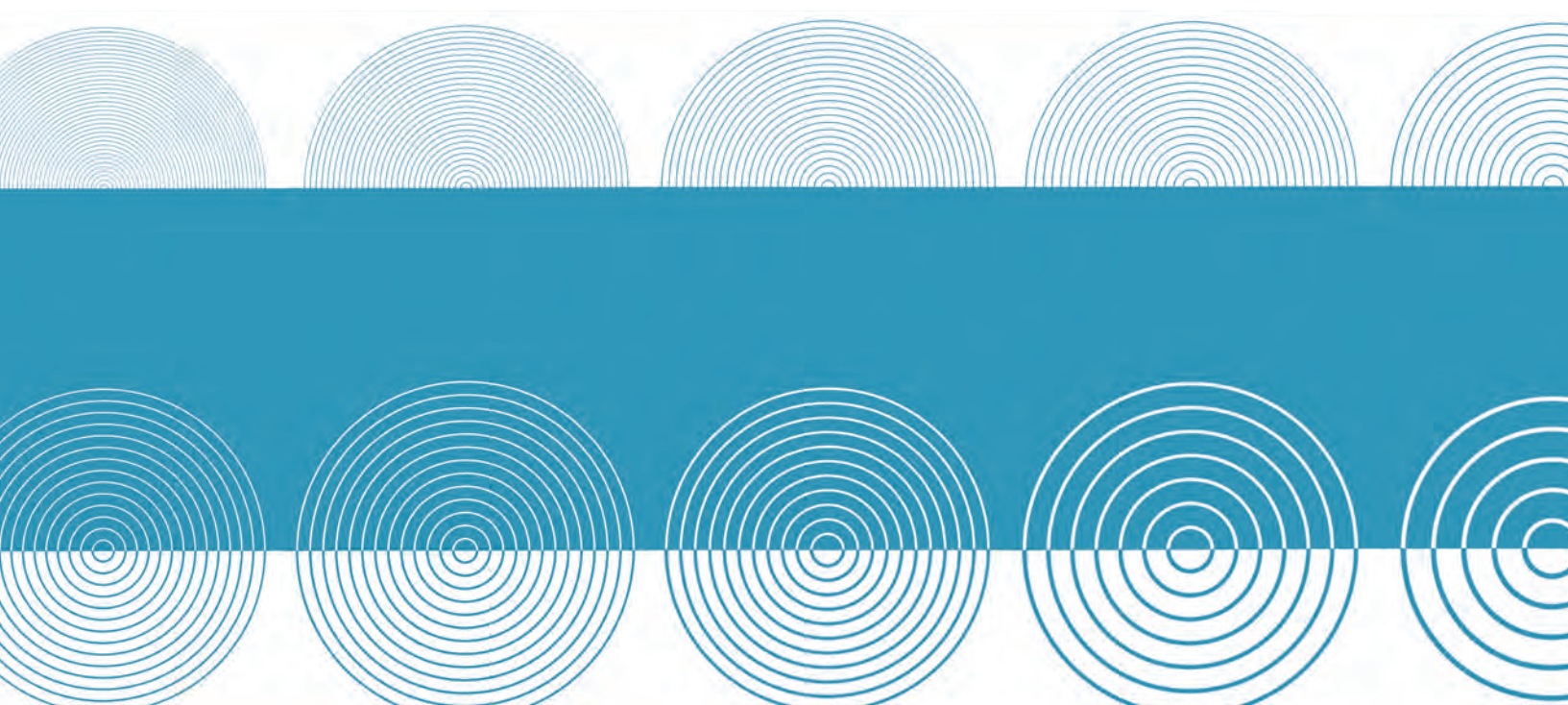




Ugra Plate Control Wedge 1982[©]

User Manual



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Description and structure

The Ugra plate control wedge (PCW) 1982 is intended for controlling the platemaking in lithography. Furthermore, it is possible to use the PCW for some evaluations in the proofing process and for printing tests. The following criteria can be evaluated on the printing plate:

- Exposure
- Exposure latitude
- Optimum resolution
- Gradation
- Rendering of halftone dots

Dimensions

Length: 174 mm
 Length exposed: 164 mm
 Width: 14 mm
 Thickness: 0.10 mm

Small dot patches

On principle, small dots can be judged in the same way as micro-lines, i.e. it is checked to what extent positive dots are reduced to zero or negative dots have turned to a solid tone.

Screen ruling: 60 lines/cm
 Dot shape: circular
 Screen angle: 45°

Dot in %	Dot in %	Diameter in µm
0.5	99.5	13
1	99	19
2	98	27
3	97	33
4	96	38
5	95	42

In addition small dots indicate the beginning and the end of the reproducible tone scale. Note, however, that small dots of the Ugra PCW do not behave the same way as micro-lines having the same diameter when undercut by light. This is due to two reasons:

- The distance between the small dots is considerably larger than between micro-lines of the same diameter. (Also, the small dots in the Ugra PCW should not be compared with small dots of the same diameter in other control strips, since the distance between the dots may be different.)
- Halftone dots are undercut by light from all directions, while lines are only undercut from two directions.

This is the reason why the small dots in the Ugra PCW are more sensitive than the micro-lines having the same diameter.

Slur target

Slur is caused by a difference in surface speed between two cylinders (plate-blanket or blanket-impression cylinder) and results in a spreading of lines running perpendicular to the printing direction, while lines running parallel with it are not affected. The visual effect is that the perpendicular lines become darker. Doubling can be caused by register problems between different units on a multicolor press and results in a slightly misregistered overprint of

the same image. The visual effect is again that lines of a particular direction become darker. However, contrary to slur, doubling can occur in any direction.

Hence, slur and doubling can visually be distinguished by two criteria:

- Doubling shows two misregistered images, one usually being lighter than the other. Slur, however, makes the lines simply broader. The two images of doubling can be observed at the highlight dots.
- Doubling can occur in any direction, while slur happens only in the printing direction.

Application of the target D

The purpose of target D is solely for the visual assessment of slur and doubling. For the sake of standardization target D is the same as the one in the Fogra Color Bar (PMS). It has been shown that lines of rectangular and diagonal direction are most sensitive for the recognition of slur and doubling.

Application of the line patches 0°/90°/45°

The patches 0°/90°/45° are designed to help evaluate slur and doubling by density measurements. This can be of interest when running printing tests, while the visual control of slur and doubling is sufficient in normal production printing and proofing. The density measurements provide a numerical measure of contrast in addition to a visual judgement. This can be very useful when, for instance, the performance of different blankets is studied. In addition, it can be seen from comparison with target D, which numerical difference leads to a visually perceptible slur or doubling.

Halftone wedge 60 lines/cm

The shape of the dots was calculated and plotted using the Fogra chain dot model. (In order to use a standard halftone dot model, Ugra refrained from using its own model.)

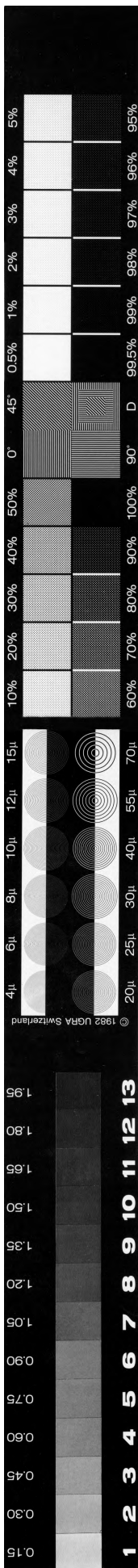
A moderate chain dot shape was chosen according to the current knowledge about the ideal dot shape. The dot areas where corner linkup takes place are symmetrical to 50%:

- First corner link-up: 42.5%
- Second corner link-up: 57.5%
- The screen angle: 45°

The purpose of the halftone wedge is to evaluate tone reproduction. As far as routine control of platemaking is concerned, micro-lines and continuous-tone wedge are better suited tools than halftone dots. The steps of the halftone wedge have been chosen such that sufficient measuring points are available to plot a characteristic curve of the printing process. As the dot areas are multiples of 10%, calculation and plotting of dot gain values is facilitated. On printing plates, only dimensional measurements are meaningful, since densitometric measurements do not provide exact values.

Relationship between dot area and dot diameter:

The important advantage of plotted halftone dots is that there is a known mathematical relationship between dot area and dot diameter. Based on dimensional measurements it is possible to draw conclusions as to changes in the tonal values. (When halftone dots are printed on paper the diffusion of light has to be also considered.)



Functionality

12 small dot patches 5x5 mm
Indication of the beginning and the end of the reproducible tone scale

4 slur and doubling patches
Recognition of slur and doubling visual and/or density measurements

10 step halftone wedge 60 lines/cm
Evaluation of tone reproduction
Evaluation of dot gain

Micro-line patches
Determination of resolution of printing plates
Determination of optimum resolution
Determination of exposure latitude

Continuous tone wedge
Daily production control

Ugra Plate Control Wedge 1982®

The diameter values are (in µm):

Dot in %	Horizontal*	Vertical	Diagonal
10/90	61	59	58
20/80	91	84	81
30/70	118	105	96
40/60	149	128	107
50	167**	149	118

* horizontal relative to the screen direction

** not measurable because of the corner linkup, the value is identical with the length of one side of unit area.

Micro-Lines

The 12 micro-lines patches consist of positive and negative circles lines with a width of 4 to 70 µm.

Width µm	Distance µm	Area covered* %	Resolution Lines/cm
4	36	10	250
6	54	10	167
8	72	10	125
10	90	10	100
12	108	10	83
15	135	10	67
20	120	14.3	71
25	135	15.6	62
30	150	16.6	56
40	200	16.6	42
55	275	16.6	30
70	350	16.6	24

* Negative lines have the complementary values to 100%

The micro-line patches of the Ugra PCW have the same values as the micro-line patches in the FOGRA-PMS K-patch. Compared with the K-patch in the FOGRA-PMS, the Ugra PCW has additional line widths of 4, 25, 40, 55 and 70 microns. Therefore, the microlines of the Ugra PCW can be evaluated according to the same guidelines as the ones established for the FOGRA K-patch.

Determination of optimum resolution

In order to determine the optimum resolution of a plate (or film), a series of exposures is made such that each following exposure time is the double of the preceding one.

Example for a series of five exposures:

20 – 40 – 80 – 160 – 320 s

The aim is now to find the exposure time at which the positive and negative lines are lost simultaneously at the same line width. The optimum resolution is then specified as the line width of the lowest step where positive and negative lines are still just visible. A line patch is considered to be reduced to zero or to be a solid-tone, if less than a third of the lines is left. The determination of the optimum resolution has to be made on the finished plate, i.e. on multi-metal plates after etching.

The optimum resolution of direct printing plates ranges from 4 to 8 µm, mostly being about 4 to 6 µm. This is valid for diazo coatings and photopolymers. Multimetal plates have an optimum resolution ranging from 9 to 14 µm, and this independent of which light-sensitive coating is used.

The exposure time to achieve the optimum resolution for different printing plates may differ by a factor of 4.

Determination of exposure latitude

The exposure to achieve the optimum resolution can be considered as the minimum required exposure. A further increase of exposure results in an undercutting by light yielding a dot loss on positive working plates and a dot gain on negative working plates. Thus, exposure latitude can be defined as the difference between the minimum required exposure and the exposure at which undercutting does not exceed a certain degree. In this manual, exposure latitude is defined as the range where the degree of undercutting does not exceed 5 µm. Starting from the exposure time to achieve the optimum resolution, the exposure time is determined where the width of the positive lines being reduced to zero has increased by 5 µm. (This applies for positive working plates. On negative plates, the width of the negative lines being turned to solid tone has to be judged.)

Continuous-tone wedge

The density values are labelled on top of the continuous tone patches. These values are correct for a densitometer that is zeroed on the film base.

Tolerances:

- Deviation from the specified density values: ± 0.02
- Difference between two steps: 0.15 ± 0.02

Relation between exposure time and rendering of the continuous-tone wedge

For a given type of light sensitive material, the continuous-tone wedge indicates differences in exposure according to the following rule:

- If a higher step of the continuous tone wedge should print on the plate, the initial exposure time has to be multiplied with the above indicated factor.
- If a lower step is desired, the initial exposure time must be divided by the factor.

Example:

To proceed from step 5 to step 7, the exposure time should be doubled. To go back from step 4 to step 3, the exposure time must be divided by 1.4.

Control of exposure

The correct exposure can not be determined from the continuous-tone wedge alone. It is necessary to make a series of exposures and evaluate the reproduction of the micro-lines. Once the correct exposure for a certain plate has been determined, it then can be maintained by keeping the reproduced continuous-tone step constant.

If two tests show a difference in the wedge of:	then there is a difference in exposure by the factor:
1 step	1.4
2 steps	2.0
3 steps	2.8
4 steps	4.0
5 steps	5.6
6 steps	8.0
7 steps	11.2

This rule holds for any continuous-tone wedge having a step increment of 0.15

In general, optimum exposure is applied, when the first printing step in the continuous-tone wedge for the different light-sensitive coatings is as follows:

- diazo coatings (positive working): step 4 to 5
- diazo coatings (negative working): step 3 to 5

These specifications refer to the reproduction of the continuous-tone wedge after developing. If the light sensitive coating is removed (e.g. in multi-metal platemaking), then the evaluation of the continuous-tone wedge on the finished plate becomes meaningless.

Evaluation of gradation

The gradation of a light-sensitive coating can be judged by counting the number of continuous-tone steps that are neither fully solid nor fully non-printing. The following values are typical for the different light-sensitive coatings:

- diazo coatings (positive working): step 4 to 7
- diazo coatings (negative working): step 5 to 8

Again, these specifications refer to the light-sensitive coating after developing.

Application of the Ugra PCW on negative working plates

In contrast to positive working plates, on negative plates the dot areas of all image elements increase with increasing exposure time. Difference between positive and negative working plates:

With increasing exposure, the following occurs:

Effects of increasing exposure	on negative working plates	on positive working plates
positive lines and dots on plate become	larger	smaller
negative lines and dots on plate become	narrower	wider

The design of the Ugra PCW is such that it is suited equally well for positive and negative working plates. Micro-lines and the continuous-tone wedge can be applied without regard as to the type of plate. However, the labels on the halftone scales, are no longer correct. (The correct values are obtained by subtracting the label values from 100%).

When printing the slur target from a negative plate, the dot area is 40% rather than 60%. This causes a somewhat smaller sensitivity. Therefore density measurements from negative working plates should not be compared with measurements from positive working plates.

Determination of the exposure series

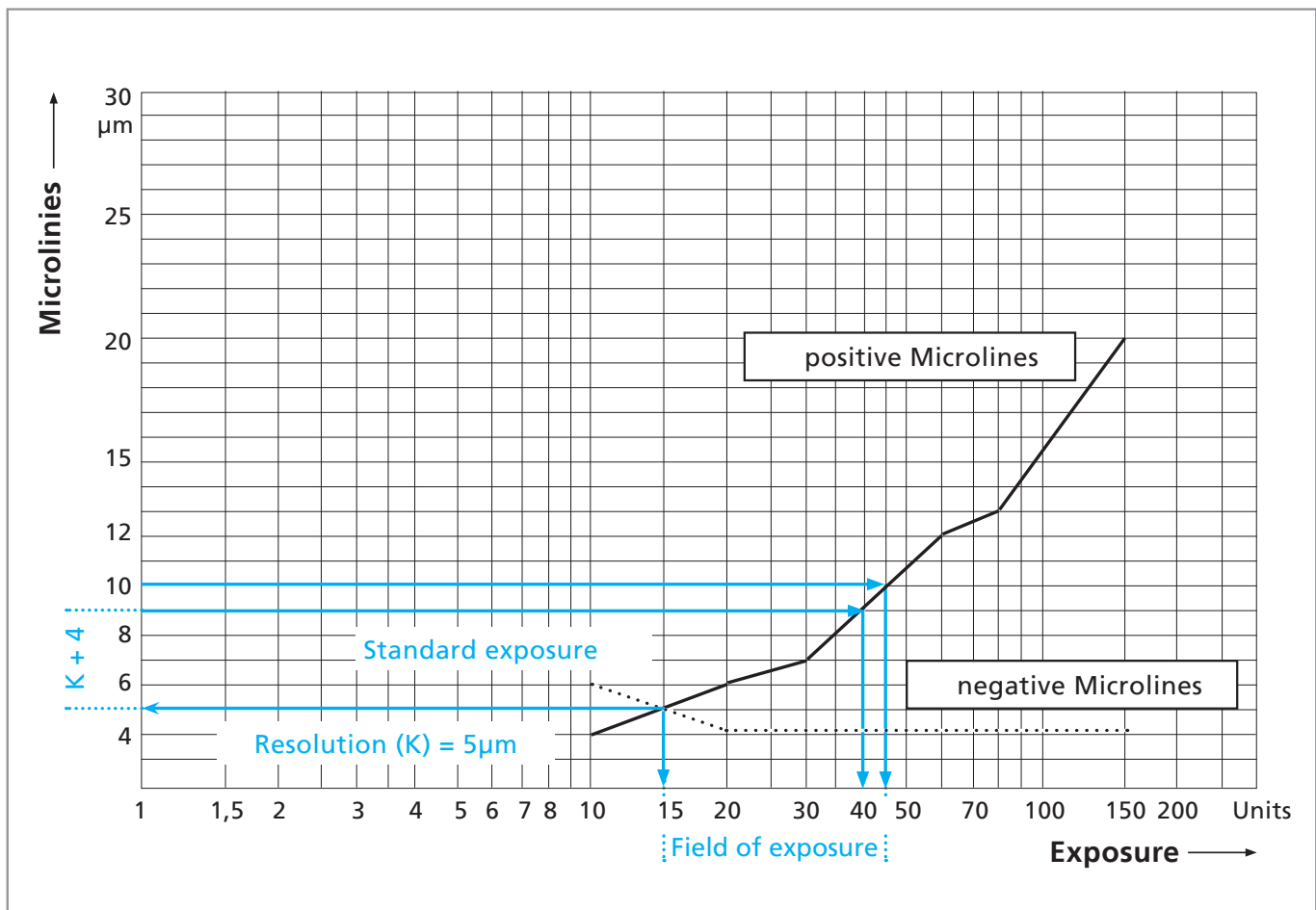
Users of the Ugra Offset Plate Control Wedge 1982® must determine the parameters for their printing plates themselves using an exposure series. Ugra provides a spreadsheet for this purpose, as shown on the illustration below.

The printing plate parameters are easily determined with the PCW, using an exposure series. For each exposure the finest positive and negative micro-line values still visible are entered in a chart. The results are specified in the following example (see also illustration below).

Resolution (K value): It shows the thickness of the finest positive and negative micro-lines, rendered on the printing plate with an identical thinning. The said value appears right on the intersection point of the two curves. As the micro-lines with a 5 µm thickness are merely discernible; on the plate they are rendered with an error of about 4 µm. Our example shows a resolution or K value of 5 µm.

Standard exposure: The printing plate on the example presents a 5 µm resolution. According to Ugra recommendations add 4 µm to the K value, enter the chart on the 9 µm line and follow it up till getting to the standard exposure time. In the present case the latter comes to 40 exposure units.

Exposure latitude: Its lower limit is at the intersection point of the two curves, with an exposure time of 15 units for the example below. In entering the chart on K + 5 µm, as marked, follow up the line to find the upper limit. It counts 45 exposure units in our example. Consequently, the exposure latitude reaches 15 to 45 exposure units.



Standardization of the platemaking process

Although the exposure time required to achieve the optimum resolution and the exposure latitude are objective criteria, the "correct" exposure time can not be directly derived from it. The exposure time to achieve the optimum resolution can be considered as the minimum required exposure. If this exposure time is exceeded, the positive halftone dots become smaller, which may not be desirable. Simultaneously the negative halftone dots become more open, which is usually desired. Also, film edges are reduced with increasing exposure time.

Hence, the "correct" exposure time is a compromise. Depending on the image, it may be desirable that

- the shadows are sufficiently open
- the highlights are not too much undercut
- the film edges are eliminated to an extent that only few corrections on the plate are necessary.

Since there are no objective criteria for the "correct" exposure time, it is reasonable to define an arbitrary criterion in order to standardize the platemaking process. Ugra established the following guidelines, which are in line with the Fogra recommendations:

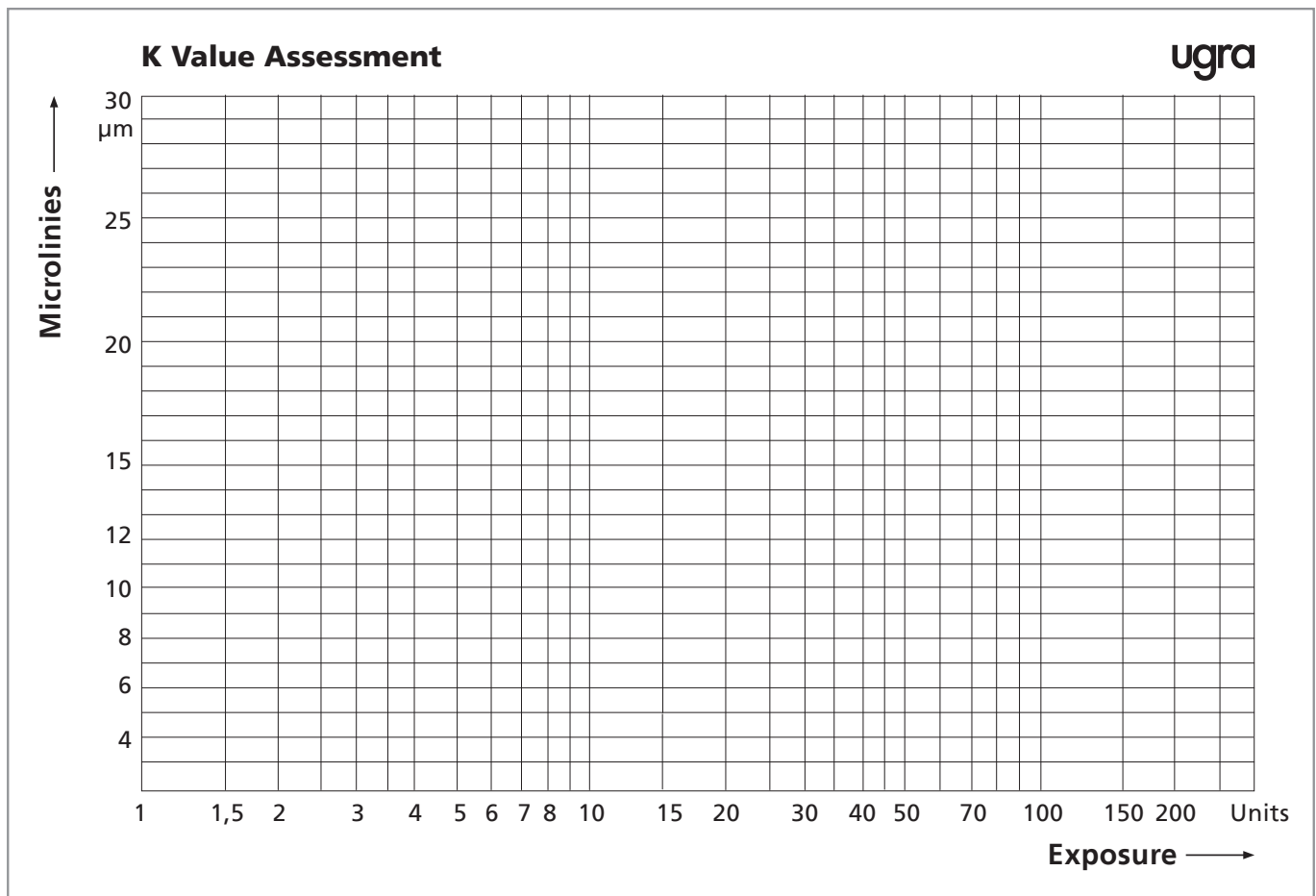
Recommendation for a standardized platemaking process

The exposure time has to be chosen in such a way that the last reproduced patch of micro-lines is 4 µm above the optimum resolution. The reproduction of the micro-lines must be judged on the finished plate.

Investigations of Ugra and Fogra showed that, if a positive working plate is exposed at 4 µm above the optimum resolution, the dot area of halftone dots in the middletones is reduced by 2 to 4%. On negative working plates the dot area increases by about 3 to 5%.

Spreadsheet for the exposure series

The worksheet (PDF) can be downloaded under:
www.ugra.ch/k-chart





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