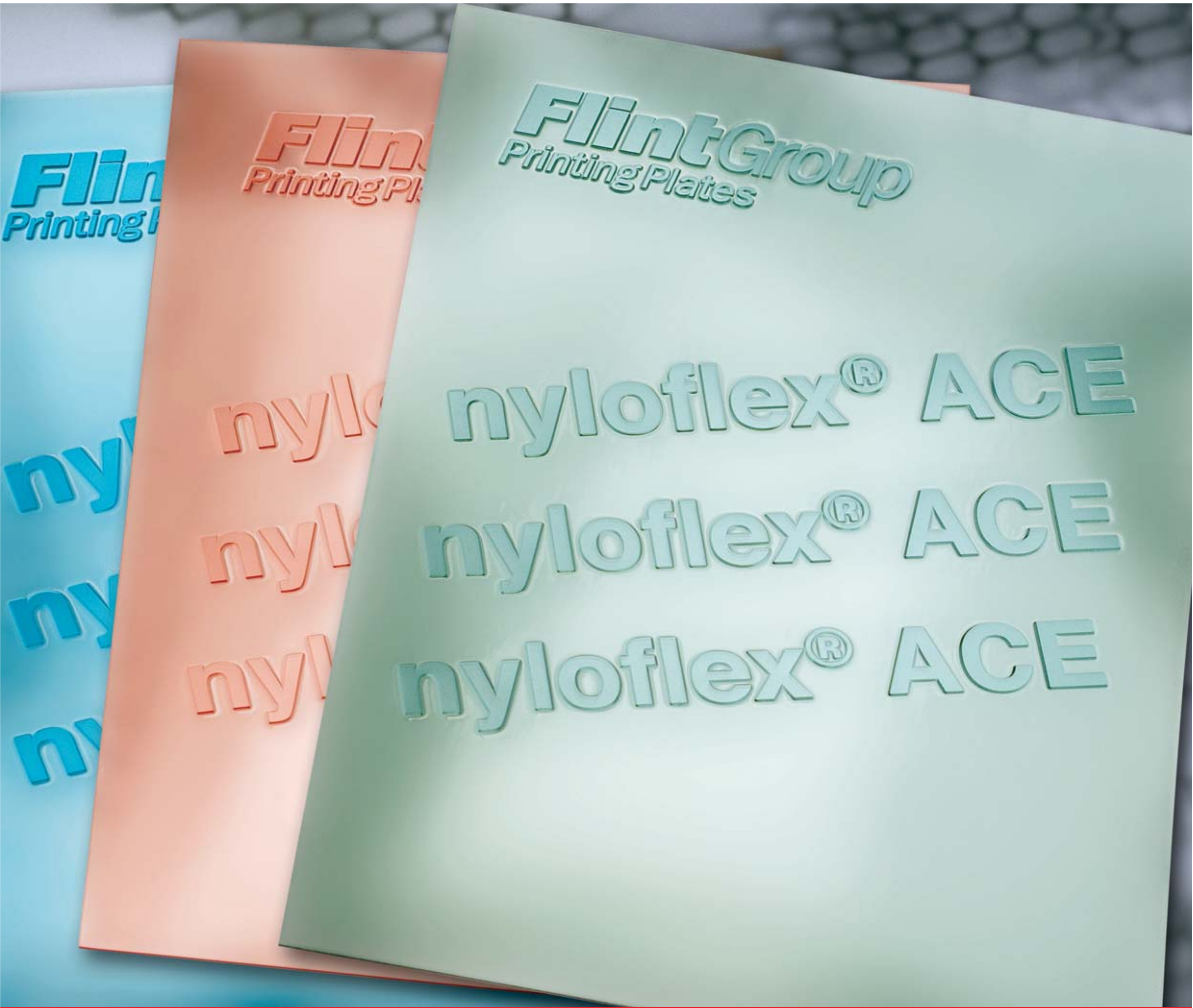
Flint Group
Printing Plates



nyloflex® User Guide

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1 nyloflex® printing plates and their fields of application

nyloflex® is the trade name for photopolymer flexo plates from Flint Group Germany GmbH.

They are:
- Soft-elastic
- Dimensional stable
- With high thickness accuracy

nyloflex® printing plates are available for various printing applications and inks in the field of flexography. The various plate types differ from each other primarily in regards to:
- Structure
- Thickness
- Hardness (polymer)

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1.1 Structure of nyloflex® printing plates

Conventional plates

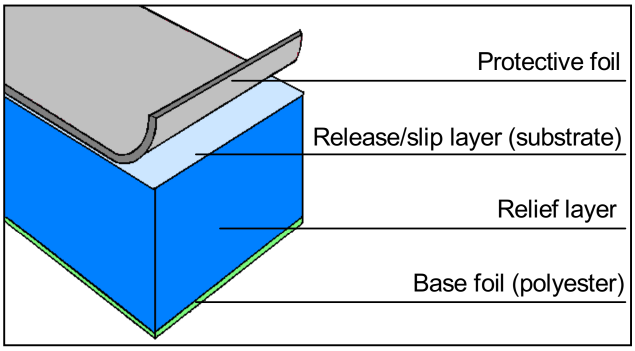

Fig. 1.1 Structure of conventional plates

Plate type	Shore A hardness
nyloflex® ACE	64 – 88
nyloflex® AFC	70 – 78
nyloflex® ACT	52 – 74
nyloflex® ART	45 – 73
nyloflex® FAC-X	31 – 38
nyloflex® FAH	63 – 77
nyloflex® FAR	52 – 73
nyloflex® sprint	77
nyloflex® FE	70

Table 1.1 Shore hardness' measured on finished plates

Digital plates

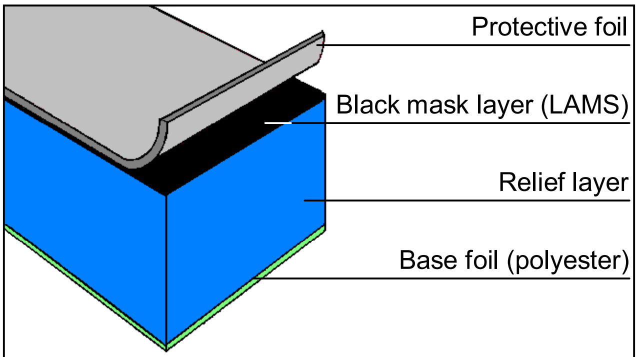

Fig. 1.2 Structure of digital plates

Plate type	Shore A hardness
nyloflex® ACE-D II	66 – 88
nyloflex® ACT-D II	52 – 74
nyloflex® ART-D II	41 – 73
nyloflex® FAC-D II	32 – 38
nyloflex® FAH-D II	63 – 77

Table 1.2 Shore hardness' measured on finished plates

The letters indicate the plate type. The figures after the letters indicate the overall thickness of the finished plates.

Example: nyloflex® FAH 284
Plate type: FAH
Overall thickness: 2.84 mm (0.112 inch)

1.2 nyloflex® printing plates, description and application

ACE
Superior printing results with 4-colour process requires a very hard printing plate. ACE, with a hardness of 62 Shore A (acc. to DIN), can cope with such a challenge. The superior ink transfer with solvent and water based inks, the high ozone resistance and resilience with long runs have made ACE well known. The potential applications for ACE is universal: flexible packaging on foil and paper, beverage carton and labels, and also printing on preprint liner for corrugated board.

nyloflex® ACE is also available as a digital plate.

AFC
nyloflex® AFC has been developed for special film calibration methods, such as FlexoCal™, in order to simulate 'digital' by reproducing very fine highlight dots using the conventional plate making method. The reverses are well defined even with a shallow relief depth due to a large exposure latitude. The hardness (62 Shore A acc. to DIN) of AFC and other characteristics are the same as with ACE. AFC can be used like ACE.

ACT
nyloflex® ACT is a medium hard printing plate for high quality printing on film/foil or paper particularly for combination jobs, where line and screen are printed with the same plate. Because of the hardness of 50 Shore A (acc. to DIN), this plate is suitable for printing on slightly rough paper where high quality printing is required. The applications where this plate can be used are flexible packaging on foil and paper, preprint for corrugated board, beverage cartons, envelopes and cartons with a smooth surface. ACT is also suitable for printing labels.

This plate is also available in a digital version.

ART
nyloflex® ART is a plate type with a variety of applications. Rather soft, with a hardness of 40 Shore A (acc. to DIN), ART suits the classical tasks for printing line work with solids primarily on paper.

The characteristic of ART is ideal for the thin-plate technology (plate + cushion layer) to print on corrugated board and preprint liner where high demands on halftone printing and printing lines is required.

This plate is also available in a digital version.

FAC-X
nyloflex® FAC-X printing plates with a hardness of 32 Shore A meet the requirements of printing on corrugated board and heavy-duty bags. Due to the excellent ink transfer, FAC-X enables superior printing results on all preprint liner for corrugated board. nyloflex® FAC-X is also available as a digital plate up to a thickness of 4,7 mm (0.185").

There is also FAC-X in a thickness of 2.84 mm (0.112") available, which suits the application of thin plate technology.

FAH
The nyloflex® FAH has a hardness of 60 Shore A and belongs to the family of hard printing plates, mainly used in the field of flexible packaging, label printing and preprint where high demands on the printing quality are required. Additional strengths of this plate includes its suitability for applications with the use of compressible cushion and adhesive tapes, and printing with UV-inks where high ink resistance is necessary.

nyloflex® FAH is also available as a digital plate.

FAR
nyloflex® FAR is an all-round plate for a variety of applications. The hardness of 50 Shore A (acc. to DIN) enables the user to print high quality multicolour halftones. This plate is suited for all kind of printing substrates used in flexible packaging.

sprint
nyloflex® sprint is an environmentally friendly, water washable, photopolymer flexo printing plate for printing with UV-inks. In comparison with solvent washable plates, the nyloflex® sprint takes only around 45 minutes to be made from the raw to the finished plate. nyloflex® sprint features an excellent ink transfer and very good results when printing fine lines and screen. The main-field of application is label printing.

FE
The nyloflex® FE printing plate has been developed for white preprint on films for flexible packaging with special inks. The most significant characteristic of this plate is the resistance against ethyl acetate (ester) and alcohols contained in 2-component inks. The high resistance of FE to ester, ketones and UV printing inks offers a long life on press. Even ink coverage on solids can be achieved with nyloflex® FE. Register problems, known from the use of rubber plates are history. FE is suited for solids, text and lines.

1.3 nyloflex® printing plates – conventional and digital

PLATE TYPE	TOTAL THICKNESS (mm/inches)	HARDNESS ACCORDING TO DIN 53505 (Shore A)	PLATE HARDNESS (Shore A)	RELIEF DEPTH (mm)	TONAL RANGE (%)	SCREEN RULING (up to l/cm)	FINE LINE WIDTH (down to µm)	ISOLATED DOT DIAMETER (down to µm)	BACK EXPOSURE (sec)	MAIN EXPOSURE (min)	WASHOUT SPEED (mm/min)	DRYING TIME AT 60 °C /140 °F (hrs)	POST EXPOSURE (UVA) (min)	LIGHT FINISHING (UVC) (min)
nyloflex® ACE	0.76 / 0.030	62	88	0.6	2 – 95	60	100	200	10 – 20	8 – 20	200 – 250	1.0 – 1.5	10	7 –15
	1.14 / 0.045		78	0.6 – 0.7	2 – 95	60	100	200	25 – 45	8 – 20	200 – 250	1.5 – 2.0	10	7 –15
	1.70 / 0.067		70	0.7 – 0.9	2 – 95	60	100	200	35 – 50	8 – 20	200 – 250	1.5 – 2.0	10	7 –15
	2.54 / 0.100		66	0.9 – 1.2	2 – 95	60	100	200	50 – 85	8 – 20	200 – 250	2.0 – 3.0	10	7 –15
	2.72 / 0.107		65	0.9 – 1.2	2 – 95	60	100	200	50 – 85	8 – 20	200 – 250	2.0 – 3.0	10	7 –15
	2.84 / 0.112		64	0.9 – 1.2	2 – 95	60	100	200	50 – 85	8 – 20	200 – 250	2.0 – 3.0	10	7 –15
nyloflex® ACE–D II	0.76 / 0.030	62	88	0.6	1 – 98	60	100	200	10 – 20	15 – 20	200 – 250	1.0 – 1.5	10	7 –15
	1.14 / 0.045		78	0.6 – 0.7	1 – 98	60	100	200	25 – 45	15 – 20	200 – 250	1.5 – 2.0	10	7 –15
	1.70 / 0.067		70	0.7 – 0.9	1 – 98	60	100	200	35 – 50	15 – 20	200 – 250	1.5 – 2.0	10	7 –15
	2.54 / 0.100		66	0.9 – 1.2	2 – 98	60	100	200	50 – 85	15 – 20	200 – 250	2.0 – 3.0	10	7 –15
nyloflex® AFC	1.14 / 0.045	62	78	0.5 – 0.7	1 – 98	60	100	200	25 – 45	12 – 20	220 – 360	1.5 – 2.0	10	10
	1.70 / 0.067		70	0.5 – 0.7	1 – 98	60	100	200	50 – 95	12 – 20	220 – 360	1.5 – 2.0	10	10
nyloflex® FAH	1.14 / 0.045	60	77	0.6 – 0.7	2 – 95	60	100	200	9 – 24	8 – 15	160 – 180	2.0	10	15
	1.70 / 0.067		69	0.7 – 0.9	2 – 95	60	100	200	9 – 24	8 – 15	160 – 180	2.0	10	15
	2.54 / 0.100		64	0.9 – 1.2	2 – 95	60	100	200	45 – 120	8 – 24	130 – 170	2.5 – 3.0	10	15
	2.84 / 0.112		63	0.9 – 1.2	2 – 95	60	100	200	45 – 120	8 – 24	130 – 170	2.5 – 3.0	10	15
nyloflex® FAH–D II	1.14 / 0.045	60	77	0.6 – 0.7	1 – 98	60	100	200	9 – 24	15 – 20	160 – 180	2.0	10	15
	1.70 / 0.067		69	0.7 – 0.9	1 – 98	60	100	200	9 – 24	15 – 20	160 – 180	2.0	10	15
	2.54 / 0.100		64	0.9 – 1.2	2 – 95	60	100	200	45 – 120	15 – 20	130 – 170	2.5 – 3.0	10	15
	2.84 / 0.112		63	0.9 – 1.2	2 – 95	60	100	200	45 – 120	15 – 20	130 – 170	2.5 – 3.0	10	15
nyloflex® ACT	1.14 / 0.045	50	74	0.6 – 0.7	2 – 95	60	100	200	25 – 50	8 – 20	200	2.0 – 3.0	10	10
	1.70 / 0.067		62	0.7 – 0.9	2 – 95	60	100	200	25 – 50	8 – 20	200	2.0 – 3.0	10	10
	2.54 / 0.100		54	0.9 – 1.2	2 – 95	60	100	200	25 – 50	8 – 20	200	2.0 – 3.0	10	10
	2.72 / 0.107		53	0.9 – 1.2	2 – 95	60	100	200	25 – 50	8 – 20	200	2.0 – 3.0	10	10
	2.84 / 0.112		52	0.9 – 1.2	2 – 95	60	100	200	25 – 50	8 – 20	200	2.0 – 3.0	10	10
nyloflex® ACT–D II	1.14 / 0.045	50	74	0.6 – 0.7	1 – 98	60	100	200	25 – 50	15 – 20	200	2.0 – 3.0	10	10
	1.70 / 0.067		62	0.7 – 0.9	1 – 98	60	100	200	25 – 50	15 – 20	200	2.0 – 3.0	10	10
	2.54 / 0.100		54	0.9 – 1.2	2 – 98	60	100	200	25 – 50	15 – 20	200	2.0 – 3.0	10	10
	2.72 / 0.107		53	0.9 – 1.2	2 – 98	60	100	200	25 – 50	15 – 20	200	2.0 – 3.0	10	10
	2.84 / 0.112		52	0.9 – 1.2	2 – 98	60	100	200	25 – 50	15 – 20	200	2.0 – 3.0	10	10
nyloflex® FAR	1.14 / 0.045	50	73	0.6 – 0.7	2 – 95	60	100	200	5 – 25	8 – 15	160 – 200	1.5 – 2.0	10	15
	1.70 / 0.067		62	0.7 – 0.9	2 – 95	60	100	200	5 – 25	8 – 15	160 – 200	2.0	10	15
	2.30 / 0.091		58	0.8 – 1.2	2 – 95	60	100	200	30 – 80	8 – 24	130 – 170	2.5 – 3.0	10	15
	2.54 / 0.100		55	0.9 – 1.2	2 – 95	60	100	200	30 – 80	8 – 24	130 – 170	2.5 – 3.0	10	15
	2.72 / 0.107		54	0.9 – 1.2	2 – 95	60	100	200	30 – 80	8 – 24	130 – 170	2.5 – 3.0	10	15
	2.84 / 0.112		53	0.9 – 1.2	2 – 95	60	100	200	30 – 80	8 – 24	130 – 170	2.5 – 3.0	10	15
	3.18 / 0.125		52	0.9 – 1.5	2 – 95	60	100	200	30 – 80	8 – 24	130 – 170	3.0 – 3.5	10	15
nyloflex® ART	1.14 / 0.045	40	73	0.6 – 0.7	2 – 95	60	100	200	15 – 30	8 – 20	130 – 190	1.5 – 2.0	10 – 15	7 – 12
	1.70 / 0.067		57	0.7 – 0.9	2 – 95	60	100	200	20 – 40	8 – 20	130 – 190	2.0 – 2.5	10 – 15	7 – 12
	2.54 / 0.100		48	0.9 – 1.2	2 – 95	60	100	200	40 – 60	8 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
	2.72 / 0.107		46	0.9 – 1.2	2 – 95	60	100	200	70 – 90	8 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
	2.84 / 0.112		45	0.9 – 1.2	2 – 95	60	100	200	80 – 120	8 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
nyloflex® ART–D II	1.14 / 0.045	40	73	0.6 – 0.7	1 – 98	60	100	200	15 – 30	15 – 20	130 – 190	1.5 – 2.0	10 – 15	7 – 12
	1.70 / 0.067		57	0.7 – 0.9	1 – 98	60	100	200	20 – 40	15 – 20	130 – 190	2.0 – 2.5	10 – 15	7 – 12
	2.54 / 0.100		48	0.9 – 1.2	2 – 95	60	100	200	40 – 60	15 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
	2.84 / 0.112		45	0.9 – 1.2	2 – 95	60	100	200	80 – 120	15 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
	3.94 / 0.155		41	1.0 – 1.5	3 – 90	48	300	750	100 –150	15 – 20	130 – 190	2.0 – 3.0	10 – 15	7 – 12
nyloflex® FAC–X	2.84 / 0.112	32	38	0.9 – 1.2	2 – 95	48	100	200	50 – 150	7 – 16	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	3.18 / 0.125		36	0.9 – 1.5	2 – 95	48	100	200	50 – 200	7 – 16	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	3.94 / 0.155		35	1.0 – 1.5	3 – 95	40	300	750	50 – 200	7 – 16	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	4.32 / 0.170		34	1.2 – 2.0	3 – 95	40	300	750	50 – 200	8 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15
	4.70 / 0.185		33	1.2 – 2.2	3 – 95	40	300	750	80 – 200	8 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15
	5.00 / 0.197		32	1.8 – 2.8	3 – 95	40	300	750	80 – 200	8 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15
	5.50 / 0.217		32	2.0 – 3.0	3 – 95	40	300	750	80 – 200	8 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15
	6.00 / 0.236		32	2.2 – 3.0	3 – 95	40	300	750	80 – 300	8 – 20	130 – 150	3.5 – 4.0	10 – 15	10 – 15
	6.35 / 0.250		31	2.2 – 3.0	3 – 95	40	300	750	80 – 300	8 – 20	130 – 150	3.5 – 4.0	10 – 15	10 – 15
nyloflex® FAC–D II	2.84 / 0.112	32	38	0.9 – 1.2	2 – 95	48	100	200	50 – 150	15 – 20	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	3.18 / 0.125		36	1.0 – 1.2	2 – 95	48	100	200	50 – 150	15 – 20	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	3.94 / 0.155		35	1.0 – 1.5	3 – 95	40	300	750	50 – 200	15 – 20	130 – 150	2.5 – 3.0	10 – 15	10 – 15
	4.70 / 0.185		33	1.2 – 2.2	3 – 95	40	300	750	80 – 200	15 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15
	5.50 / 0.217		32	1.2 – 2.2	3 – 95	40	300	750	80 – 200	15 – 20	130 – 150	3.0 – 3.5	10 – 15	10 – 15

Standard thicknesses currently available – subject to change.

All processing parameters depend on amongst others the processing equipment, lamp age and the type of washout solution. The above mentioned processing times were established on nyloflex® equipment and using nylosolv® A washout solutions. The processing times can differ from these when other equipment and washout solution is used. Therefore the above mentioned values are only to be used as a guide. We recommend our nylosolv® washout solutions.

1.4 nyloflex® printing plates for special applications

PLATE TYPE	TOTAL THICKNESS (mm/inches)	HARDNESS ACCORDING TO DIN 53505 (Shore A)	PLATE HARDNESS (Shore A)	RELIEF DEPTH (mm)	TONAL RANGE (%)	SCREEN RULING (up to l/cm)	FINE LINE WIDTH (down to µm)	ISOLATED DOT DIAMETER (down to µm)	BACK EXPOSURE (sec)	MAIN EXPOSURE (min)	WASHOUT SPEED (mm/min)	DRYING TIME AT 60 ºC /140 ° F (hrs)	POST EXPOSURE (UVA) (min)	LIGHT FINISHING (UVC) (min)
nyloflex® sprint	1.14 / 0.045	57	77	0.9	2 - 95	60	55	200	-	1 – 2	250	30 min.	2	-
nyloflex® FE*	1.14 / 0.045	48	70	0.7	n.a.	n.a.	300	750	20 – 30	6 – 10	80 – 100	3	10	-

* An additional front side pre-exposure is required through the cover film: 6-15 seconds

1.5 nyloflex® printing plates for coating and spot coating

PLATE TYPE	TOTAL THICKNESS (mm/inches)	HARDNESS ACCORDING TO DIN 53505 (Shore A)	PLATE HARDNESS (Shore A)	RELIEF DEPTH (mm)	TONAL RANGE (%)	SCREEN RULING (up to l/cm)	FINE LINE WIDTH (down to µm)	ISOLATED DOT DIAMETER (down to µm)	BACK EXPOSURE (sec)	MAIN EXPOSURE (min)	WASHOUT SPEED (mm/min)	DRYING TIME AT 60 ºC /140 ° F (hrs)	POST EXPOSURE (UVA) (min)	LIGHT FINISHING (UVC) (min)
nyloflex® Gold A	1.16 / 0.046	62	78	0.85	3 - 90	48	100	400	-	10 - 15	120 – 160	2	10 - 15	10 - 15
nyloflex® Gold A - DII	1.16 / 0.046	62	78	0.85	2 - 99	48	80	200	-	10 - 15	120 – 160	2	10 - 15	10 - 15
nyloflex® Seal F	1.16 / 0.046	36	72	0.9	3 - 90	48	300	750	-	10 - 15	120 – 140	2	10 - 15	10 - 20

Standard thicknesses currently available – subject to change.

All processing parameters depend on amongst others the processing equipment, lamp age and the type of washout solution. The above mentioned processing times were established on nyloflex® equipment and using nylosolv® A washout solutions. The processing times can differ from these when other equipment and washout solution is used. Therefore the above mentioned values are only to be used as a guide. We recommend our nylosolv® washout solutions.

2 General introduction to the processing of nyloflex® printing plates

When nyloflex® raw printing plates are exposed to ultraviolet light (UVA-light with 360 nm wavelength), long chains of molecules are created by polymerisation, which makes the nyloflex® layer insoluble to the washout solution. Unexposed parts of the layer can be removed by the washout solution.

Contents of this Chapter:

Plate making steps

Plate making steps

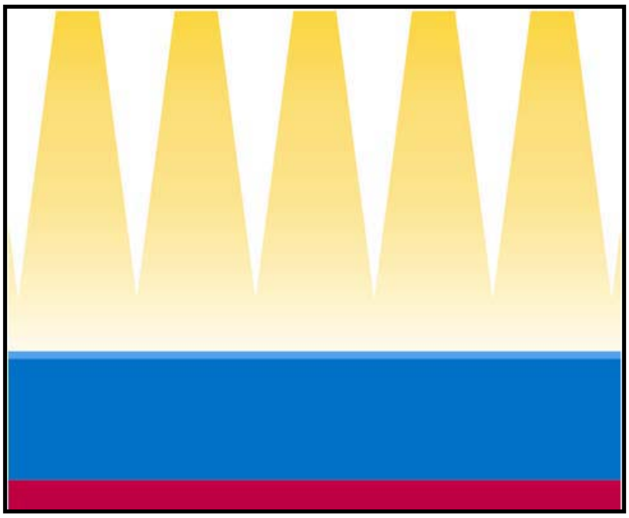

Fig. 2.1 Back-exposure

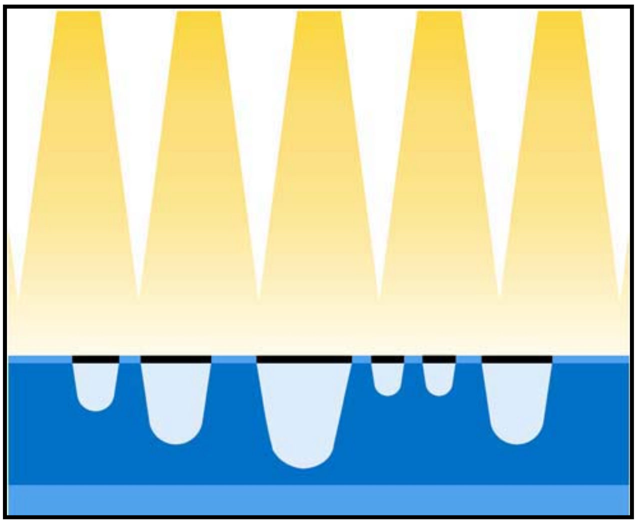

Fig. 2.2 Main-exposure

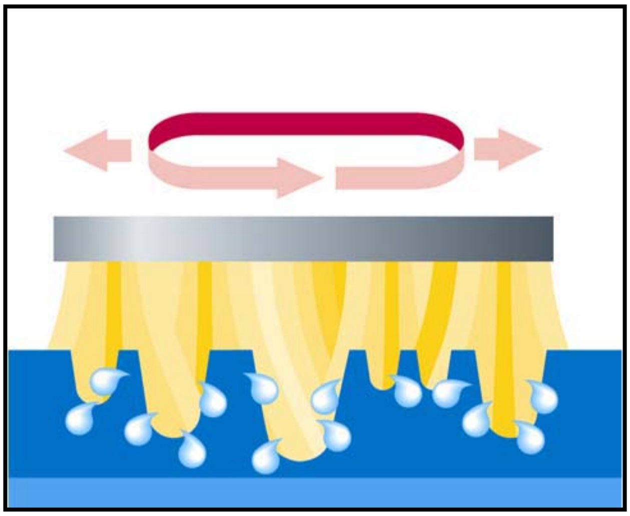

Fig. 2.3 Washout process

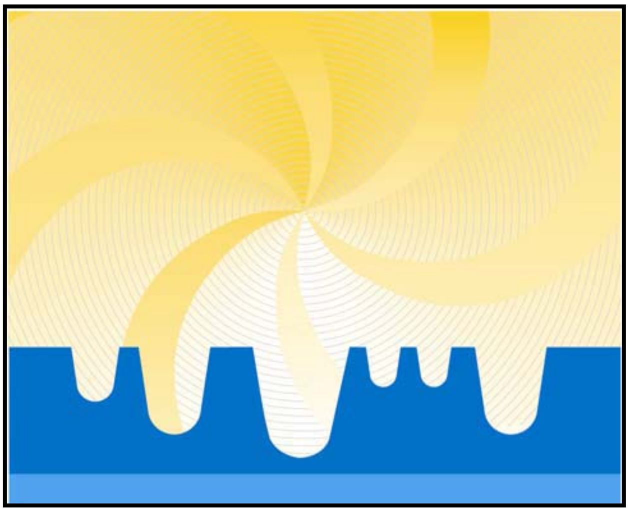

Fig. 2.4 Drying

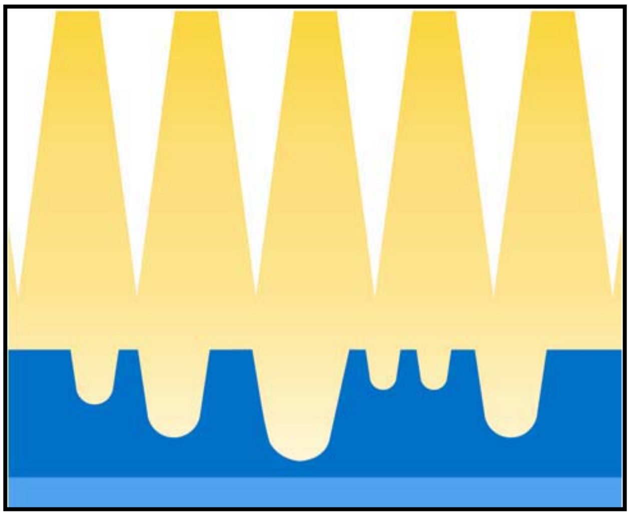

Fig. 2.5 Post-exposure

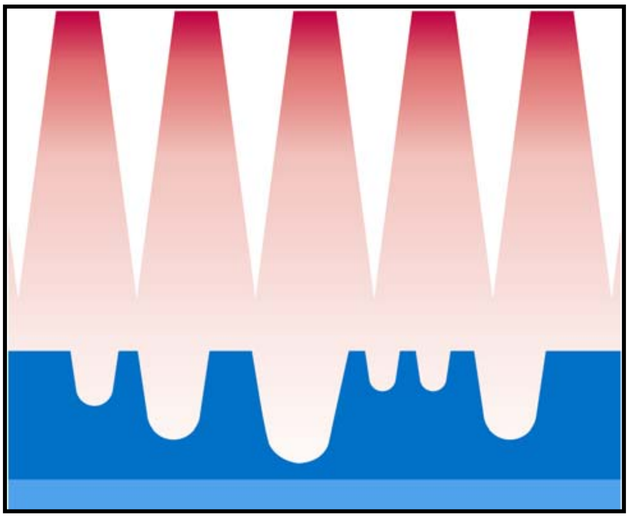

Fig. 2.6 UVC light finishing (detacking)

2.1 Effect of back-exposure (pre-exposure)

Back-exposure

The first step in plate making is the back-exposure through the plate back without vacuum. The back-exposure determines the relief depth and ensures firm anchoring of fine relief elements.

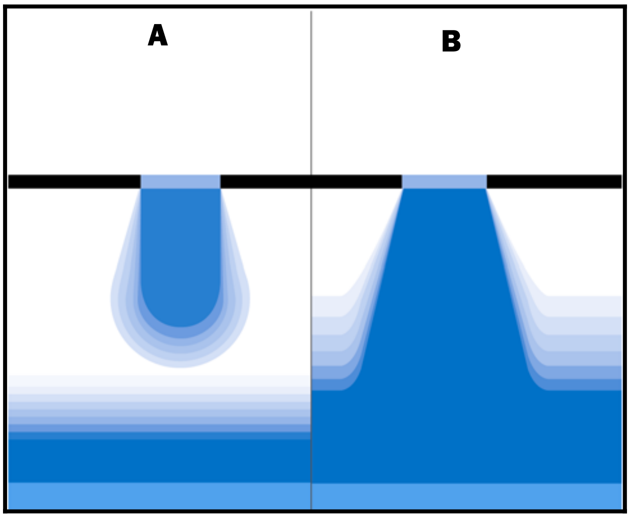

Fig. 2.7 Effect of the back-exposure

The figure 2.7 shows on the left (A) an insufficiently anchored dot. This dot will be washed off in the washout process. On the right (B): The dot is sufficiently linked to the base because of the right back-exposure. The relief depth is selected as required for the reproduction of fine relief elements.

It is advisable to keep the relief shallow if fine dots and lines are to be reproduced. This is achieved by using a longer back-exposure.

2.2 Effect of main-exposure

The main-exposure is made on the side of relief layer (front) through a film negative. The main-exposure shapes the relief by polymerisation. All details of the image, lines, characters and halftone dots, which are exposed and polymerised in accordance to the transparent parts of the negative film, cannot be altered later on.

The main-exposure time depends on:

- The sensitivity of the plate batch
- The quality of the film negative
- The type and condition of the exposure unit
- The duration of the back-exposure (relief depth)

In order to determine the correct amount of time for the main-exposure, first of all a test exposure needs to be made. Test negatives for the test exposure are available from Flint Group Printing Plates.

It is recommended to use original test negatives exclusively in order to eliminate tonal value deviations and therefore wrong evaluation.

The influence of the main-exposure time

The duration of the main-exposure time influences the

- Dot anchoring
- Shoulder angle
- Reverse image depths

Main-exposure: Dot anchoring

Fig. 2.8 shows the washed out relief after different main exposure times.

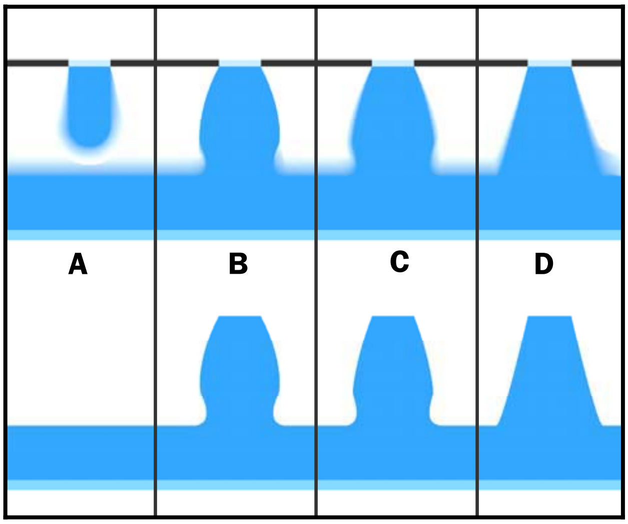

Fig. 2.8 Dot anchoring with various main-exposures

This picture exhibits the back-exposed and polymerised base layer on which the relief must be linked by the main-exposure.

Step A: Because of a too short exposure time (main-exposure), the anchoring of the isolated fine dot or line is not firm. The light does not reach the pre-exposed and polymerised layer. The dot or line is not linked to the pre-exposed base and will be lost in the washout process.

Steps B and C: Despite longer exposure times, the anchoring of the exposed parts is still insufficient.

Step D: Optimal relief shoulder and sufficient anchoring due to the correct exposure time.

Main-exposure: Shoulder angle and reverse image depth

Figure 2.9 demonstrates the change in the shoulder angle and reverse image depths in relation to the main-exposure time. The longer the main-exposure time are, the wider the shoulder angle.

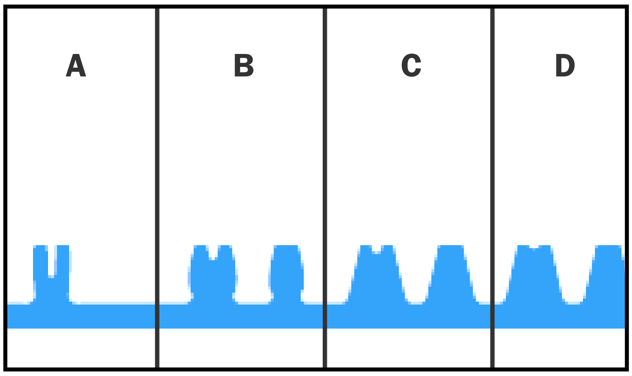

Fig. 2.9 Shoulder angle and reverse depth

Besides the optimal shoulder structure, attention must be paid to the largest possible reverse depth (step C). Reverse image details in solids are the most critical image details and become too shallow when the exposure time (step D) is too long.

The specifications for the fine relief details of the different nyloflex® printing plates are described in the instruction for the main-exposure test.

Effect of too short exposure time

Figure 2.10 demonstrates the effect of different exposure times on a line grid which is a part of the nyloflex® test negative. Due to insufficient exposure, the lines are not formed or they are wavy. A too long exposure time will not be detrimental to the fine lines of the grid.

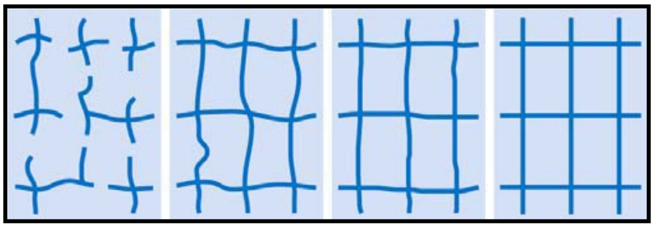

Fig. 2.10 Effect of different exposure times on a line grid

In case of too short main-exposure, orange peel might occur after washing out and drying.

Only a small amount of light passes through a film with fine lines and small dots. Light is also absorbed by the relief layer and becomes lost for the polymerisation.

The anchoring of the relief elements on the floor, which is build up by the back-exposure, becomes more difficult as the elements get finer and the relief gets deeper. (Fig. 2.11).

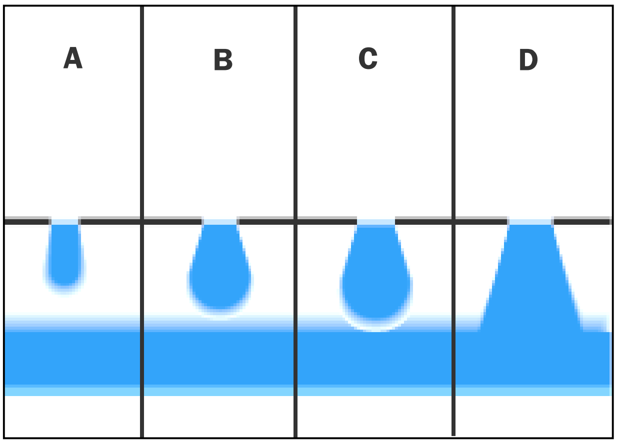

Fig. 2.11 Difficult dot anchoring due to a deep relief

If fine dots and lines are to be reproduced, it is recommended to keep the relief shallow by a longer back-exposure and a shorter washout time. The shallower the relief, the easier it is to hold fine isolated elements on the plate (Fig. 2.12).

Despite different lengths of exposure time with nyloflex® plates, there is no shifting of the tonal values as long the exposure times are within the tested limits. Only the shoulder angle of the relief will change.

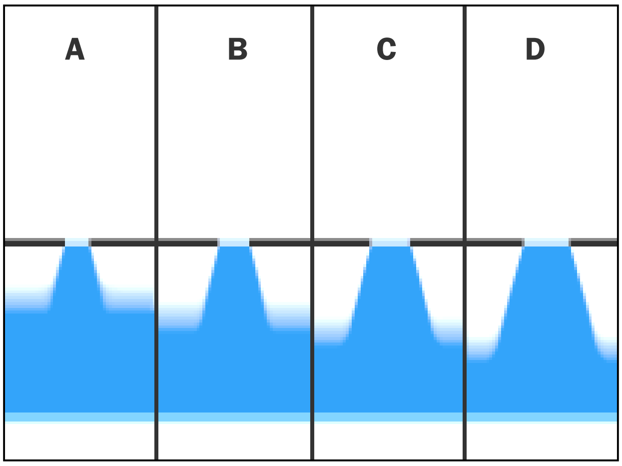

Fig. 2.12 Better anchoring of fine relief details with a longer back-exposure time

2.3 Effect of washing out

Those parts of the plate that are not polymerized become dissolved by a solvent mixture of hydrocarbons and washed out by brushes during the washout process.

With the nyloflex® ACE, AFC, ACT, ART, FAC-X, FAH, FAR, the relief depth is determined by the interaction of the washout time and the back-exposure.

The washout time must be as short as possible. Longer contact to the washout solution causes the polymerised relief layer to swell.

Too long washout and the use of unsuitable washout solutions might cause breakdown or damage to the relief. The optimal washout time is determined by a washout test.

It is recommended to use the environmentally friendly washout solution nylosolv®, a development of Flint Group. More information on nylosolv® can be found in chapter 6 of this manual. Other established washout solutions are suitable as well.

2.4 Effect of drying

The solvent, which is absorbed by the relief layer during the washout process, evaporates during the plate drying. It is necessary to observe the determined drying time and to maintain an equal drying temperature across the entire plate surface.

After the drying process, it is recommended to allow the nyloflex® printing plates to rest for approx. 12 to 15 hours at room temperature in order to ensure an even plate thickness.

If the resting period is reduced and the post-exposure or the after-treatment is made too early, thickness deviations may occur.

2.5 Effect of post-exposure

The post-exposure is made on the entire plate without a film. The light source, which is used for the post-exposure is the same as for the main-exposure.

Depending on the image, solids, fine lines and dots might only receive little light during the main-exposure. Parts of the relief become less polymerised.

The post-exposure, however, causes complete polymerisation and gives the plate equal properties, also the optimum hardness as published.

The post-exposure time should be at least equal to the length of the main exposure. Recommended post-exposure time: 10 - 15 minutes.

2.6 Effect of after-treatment

The after-treatment (finishing) eliminates the stickiness of the plate by exposing with UVC-light. It is advisable to observe the recommended finishing time in order to avoid the plate becoming brittle. Cracking may occur.

Cracks may also occur if UVA and UVC-light exposure is made simultaneously and the temperature in the light finisher is too high.

3 Processing nyloflex® printing plates

3.1 Storage and handling of raw nyloflex® printing plates

3.2 Determination of plate processing times

- nyloflex® plates from a total thickness of 1.14 mm (0.045")
- Washout test
- Note on continuous flow-line washer
- Back-exposure test
- Main-exposure test
- Important note
- Upper and lower exposure limits with ACE, AFC, ACT, ART, FAH and FAR
- Upper and lower exposure limits with FAC-X
- Upper and lower exposure limits with FE
- Exposure latitude
- Test negative for determination of the main-exposure time
- Test elements of the test negative
- Drying and checking
- Post-exposure
- UVC-light detacking

3.3 Work steps for making water washable nyloflex® sprint

3.1 Storage and handling of raw nyloflex® printing plates

nyloflex® printing plates are delivered in airtight, damp-proof, opaque black film bags in a rigid corrugated box. The plates are stacked with foamed interleaves that protect the pressure sensitive plate.

The correct delivery of plates can be seen and checked by the label on the outer package and also inside on the black packaging foil. See Fig. 3.1.

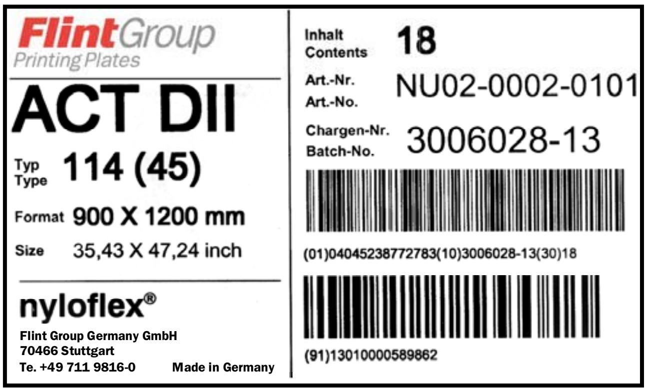

Fig. 3.1 Packaging label

The nyloflex® raw plates are pressure and light sensitive. Therefore, raw plates should never be stacked outside the corrugated box without the foamed interleaves.

When raw plates are stacked on top of each other, special care must be taken not only to keep them clean, but also to lay them flat and not on top of a smaller subject or a plate edge.

Cut off plate pieces must not lie between larger raw plates. It is recommended to store them in drawers with foam sheets and carton in between.

Unexposed nyloflex® plates must be stored cool, dry and flat. The optimum storage temperature is 15 - 20 °C (approx. 60 – 68 °F) at a relative humidity of approx. 55 %. Large temperature differences between the storage and the processing should be avoided.

The raw plates should be processed batch by batch. Remaining pieces of plates should be stored separately according to the batch. It is advisable to mark the left pieces with the batch number.

nyloflex® printing plates are sensitive to UV-light. Therefore, all areas where raw plates are stored and handled must be protected against daylight or UV-light.

3.2 Determination of plate processing times

nyloflex® plates from a total thickness of 1.14 mm (0.045")

The required relief depth of nyloflex® ACE, AFC, ACT, ART, FAC-X, FAH, FAR printing plates follows the shortest possible washout time and the determined pre-exposure time. The relief depth of FE is defined by the washout time only.

Washout test

1. An unexposed raw plate is cut into four pieces to a size of around 12 x 17 cm (4.7 x 7").

2. Each piece of the raw plate is covered with a cover plate (e.g. 60 x 150 mm) and then exposed in the exposure unit for 10 minutes.

3. The plate pieces are punched and washed out with different speeds in the flow-line washout processor. For example, the first piece of plate is washed out with 240 mm/min. (approx. 9.4"/min), the second piece with 200 mm/min. (approx. 7.9"/min), the third with 160 mm/min. (approx. 6.3"/min), and the fourth with 120 mm/min (approx. 4.7"/min). The washout speed can be different, depending on the plate type.

4. All pieces of plates are dried for at least 15 minutes (this drying time is only applicable for the test).

5. After drying, the floor thickness (base) is measured on the washed out area.

The washout depth is the difference between the floor thickness and the targeted total plate thickness.

Example for a plate 2.84 mm (0.112") thick:

Target thickness:	2840 µm (0.112")
Washed out area:	– 1640 µm (0.065")
Determined washout depth:	1200 µm (0.047")

In order to avoid this calculation, it is also possible to measure on the relief surface, reset the gauge to zero and than measure the floor. The gauge reading is the washout depth.

The area where the washout depth exceeds the required relief depth by 200 µm (0.008") is the optimal washout time.

Example: The required relief depth is 1000 µm (0.039"). The area with a washout depth of 1200 µm (0.047") reflects the correct washout time/speed.

The diagram (Fig 3.2) demonstrates the relationship between the relief depth and the washout time. The measured values are the difference between the previously determined plate thickness and the remaining thickness of the washed out plate pieces.

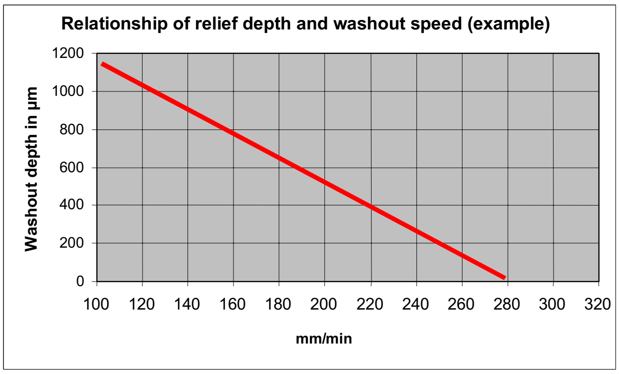

Fig. 3.2 Washout diagram

The washout curve is only an example. Since the ratio between washout time and washed out relief depths differs depending on the type of washout unit and type of plate, all products need to be tested accordingly.

Note on the continuous flow-line washer

If using the continuous flow-line washer (plate processor), the nyloflex® printing plate is first punched and then hooked on to the transportation bar which pulls the plate through the washout section, the cleaning and pre-drying section.

The pressure of the brushes, the type and condition of the solvent, and the transport speed determines the necessary washout time. The printing plates leave the washout unit usually pre-dried and clean on both sides (front and back). Additional cleaning should no longer be necessary.

While room temperature is sufficient for washing out with PERC/n-butanol washout solution, the nylosolv® II is heated up to a temperature of 30 °C ± 1°C (86° F ± 1.8 °F), nylosolv® A to 35 °C (95 °F ± 1.8 °F).

Back-exposure test

1. At first, a nyloflex® plate is cut to an appropriate size, according to the size and number of cover sheets. Then the plate is placed with the relief layer down onto the vacuum plate of the exposure unit. The protective film remains on the plate during the back-exposure test. Vacuum is not required for this processing step.

   Remark: The vacuum plate should be free of reflection and cooled. It is also advisable to warm the lamps up in order to ensure an equal start and UV-emission of the lamps.

2. Before beginning the exposure steps, the plate is covered with the cover plates, which have the size of one area of the test negative. The first area (A) remains covered all the time. The first exposure step starts with the second area B (see Fig. 3.3).

   Cover sheets for tests are available from Flint Group Printing Plates upon request.

3. The second step B is exposed (e.g. for 10 seconds for the plate thickness of 2.84 mm/0.112"), then the cover plate on position C is moved to position B that the third area is uncovered. This one is exposed for 20 seconds. Then the cover plate on position D is moved to position C and an exposure is made for 30 seconds. The result is a series of exposures in 10-second steps. Usually, 8 steps are exposed (Fig. 3.3). Depending on the plate type (plate thickness), the exposure times will vary.

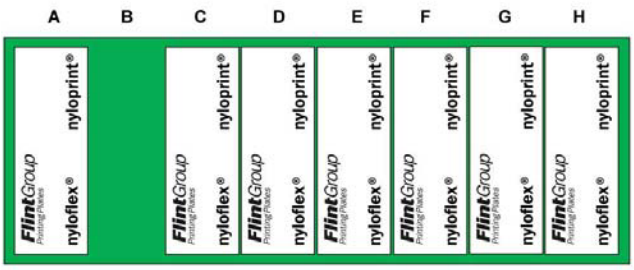

Fig. 3.3 Back-exposure test

The back-exposed nyloflex® printing plate is now washed out with the time and the speed determined in the washout test. The washed out plates must be dried for at least 15 minutes in order to get reliable results from the subsequent measurements.

The correlation between the back-exposure time, the washout time and the relief depth can be explained by the following simple rule:

Long back-exposure and short washout time = shallow relief
Short back-exposure and long washout time = deep relief

The times for the plate back-exposure and the washout time therefore must be matched to each other in a way that the plate is washed down 200 µm deeper than the required relief depth.

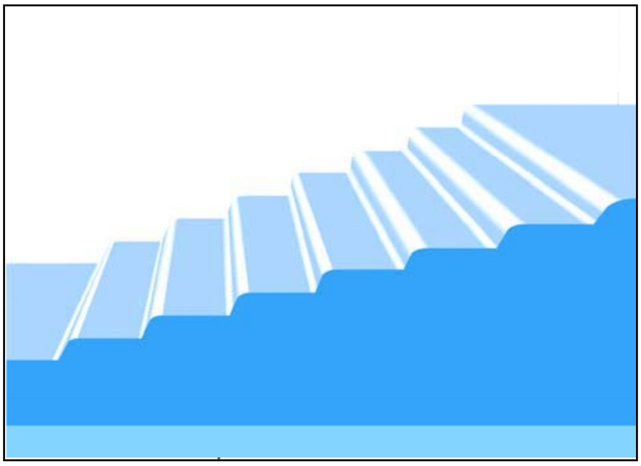

Fig. 3.4 Profile of the test plate with different back-exposure times

The recommended, additional time in order to reach 200 µm more relief depth has the following reason.

The back-exposure does not penetrate the entire relief layer and leaves a partially polymerised zone between polymerised and non-polymerised parts of the layer. This zone should be washed away in order to achieve a well-polymerised floor and relief base.

The selection of the right relief depth should be made according to the following criteria:

- Plate image elements, halftone screen or line
- Printing substrate
- Printing press conditions

Fine screen, isolated dots and lines are easier to be reproduced if the relief is shallow, such as 0.7 mm (0.028") or less. An uneven and rough surface of the substrate or dusty paper requires a deeper relief.

The back-exposure test must be made for every new plate batch.

Remark: FE-plates need an additional flash exposure (6 – 15 seconds) on the plate front (polymer side).

Main-exposure test

1. For the main-exposure test, a nyloflex® raw printing plate is cut to the size of the test negative.

2. The entire plate is pre-exposed through the plate back with the time determined before.

3. The back-exposed plate is turned and placed with the relief layer up on the vacuum plate of the exposure unit. After the protective film is removed, the nyloflex® test negative is put on the printing plate with the matt emulsion side down and the edges of the nyloflex® printing plate are covered with vacuum strips in order to guarantee a perfect vacuum and to prevent the vacuum film from sealing the edges of the plate. Then the vacuum pump is switched on and the vacuum film rolled over the plate. In order to remove air pockets under the negative quickly, it is recommended to use a squeeze roller or a similar device, or an anti-static cloth to rub out the air. Trapped dust particles will be visible after the air is completely drawn. Dust particles must be removed especially from transparent areas of the negative film. Dust and dirt on plate surface will leave holes in the plate surface. Air ionizer devices might help to control the dust problem.

   Flint Group Printing Plates provides various test negatives for the determination of the main-exposure time. The nyloflex® thin plate test negative for plates up to a thickness of 3.18 mm (0.125”) and the thick plate test negative for plates from 3.94 mm (0.155”) up to 6.35 mm (0.250”) contains different elements in 4 or 8 identical copies.

   In order to avoid tonal value deviations and wrong evaluation of the test, it is recommended not to duplicate the test negatives, but to request new ones. All image elements of the test negative are needed to determine the main-exposure time and the exposure latitude.

   The test negatives should be used up to 10 times only. Marked with a slot in the film for each use helps to keep record on the use.

4. The correct main exposure time is determined by a step exposure test (Fig. 3.5).

   Example:

   Expose 8 copies for 2 minutes (step 1). Cover the 1st copy with a cover plate; expose the remaining 7 copies for 2 minutes (step 2). Cover the 2nd copy; expose the remaining 6 copies for 2 minutes (step 3). Cover the 3rd copy; expose the remaining 5 copies for 2 minutes (step 4), etc. up to step 8. As a result, the exposure time is 2 minutes for the first copy, 4 minutes for the next one, 6 minutes for the third one, and 16 minutes for the last one.

   The times given in this guide are only for reference. They need to be increased or reduced depending on the plate type, the kind of job and its image, as well the conditions of the exposure unit. Also the kind of florescent tubes and their condition are influential factors. Recommended tubes are Philips TL 10 R or Sylvania BL 366.

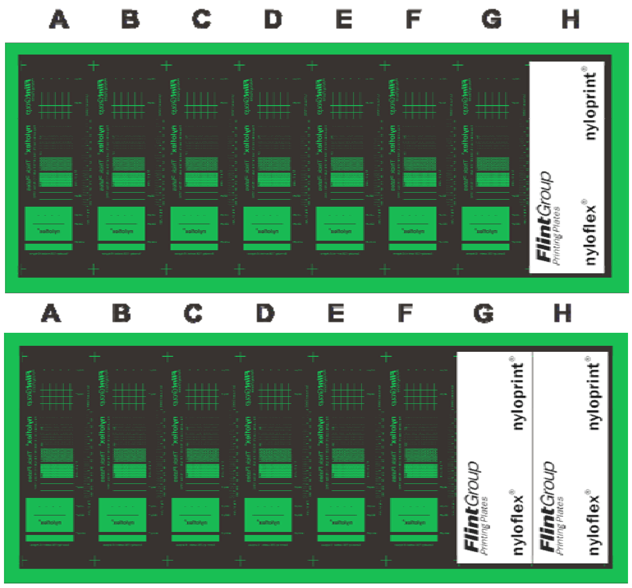

Fig. 3.5 Main-exposure test

   The UV-emission of fluorescent tubes will decrease by use, as well the transparency of the vacuum foil, which requires the exposure time to be extended. For these reasons and with the use of other plate batches, exposure tests should be made from time to time.

5. The exposed printing plate is now washed out and dried. The correct exposure time can be seen by the different development stages of relief details. Steps that received a too short exposure will show washed off or damaged elements and wavy lines.

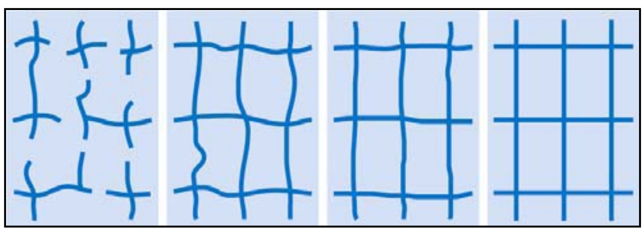

Fig.3.6 Effect of different exposure times on the line grid

Important note

Always select those times in plate making, which are close to the lower exposure limit. Select the same times for the post-exposure. This way, you will ensure that the printing plate is well and thoroughly polymerised and reached the optimal hardness, elasticity, solvent and crack resistance.

If extremely fine elements are to be held on the plate, the main-exposure time might be set to the upper exposure limit.

Upper and lower exposure limits of ACE, AFC, ACT, ART, FAH, FAR

For nyloflex® ACE, AFC, ACT, ART, FAH, FAR printing plates in thickness' from 0.76 – 3.18 mm (0.03 – 0.125"), the following limits are valid:

The *lower exposure limit* is the time where the following elements are well reproduced.

a. isolated dots with a diameter of 200 µm (0.008")
b. the line grid with 55 µm (0.002") lines, and
c. the screen of a 2 % tonal value, up to 1 mm (0,039") relief depth

The *upper exposure limit* is the time where the depth of a reverse dot with a 400 µm diameter is at least 70 µm and the negative 2000 µm line 500 µm deep (see the explanation of the test negative).

In order to aid the evaluation of the exposure limit, there is a test element with different wide negative lines in stages on the test negative.

Upper and lower exposure limits of FAC-X

For nyloflex® FAC-X printing plates in thickness from 2.84 – 6.35 mm (0.112 – 0.25"), the following limits are valid:

The *lower exposure limit* is the time where the following elements are well reproduced.

a. isolated dots with a diameter of 750 µm (0.03")
b. the line grid with 300 µm (0.012") lines, and
c. the screen with a 3% tonal value, up 2,5 mm (0.1") relief depth

The *upper exposure limit* is the time where the depth of the negative dot with a diameter of 500 µm (0.02") is at least 100 µm (0.004"). This is also the case, if the relief depth of the 2000 µm (0.08") negative line significantly fills in.

Upper and lower exposure limits with the FE

The FE is tested with the test negative for FAC-X printing plates.

The *lower exposure limit* is the time where the following elements are well reproduced.

a. isolated dots with a diameter of 750 µm (0.03"),
b. a line grid with 300 µm (0.012") lines, and
c. a halftone with a 3% tonal value, up to 0.7 mm (0.028") relief depth

Exposure latitude

The range between the minimum and the maximum exposure time is called »exposure latitude«. nyloflex® printing plates have a wide exposure latitude.

Example:
Exposure minimum: 8 minutes
Upper exposure limit: 12 minutes
Exposure latitude = 4 minutes.

The diameter of the dots and the width of the lines remain unchanged within the exposure latitude.

If the upper exposure limit is exceeded, a so-called overexposure takes place. Reverse image elements are primarily affected in case of an overexposure. The reverses fill in and become too shallow for printing. Fine positive lines are not affected.

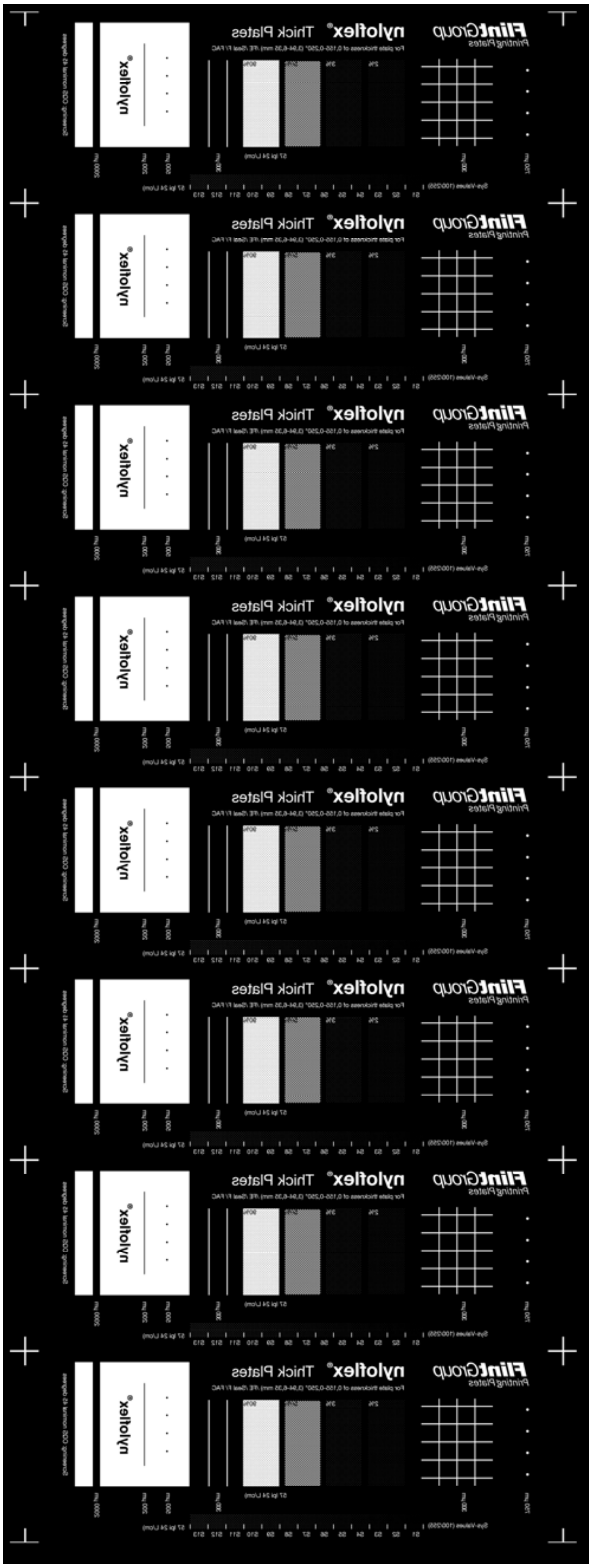

Abb. 3.7 Test negative with 8 copies, in this case for FAC-X, Seal F and FE

Test negative for determination of the main-exposure time

There are various negatives available for the test exposure according to the plate type.

The distances and sizes of the steps are matched to the customised cover plates in order to follow the description of the test procedure.

Test elements of the test negative

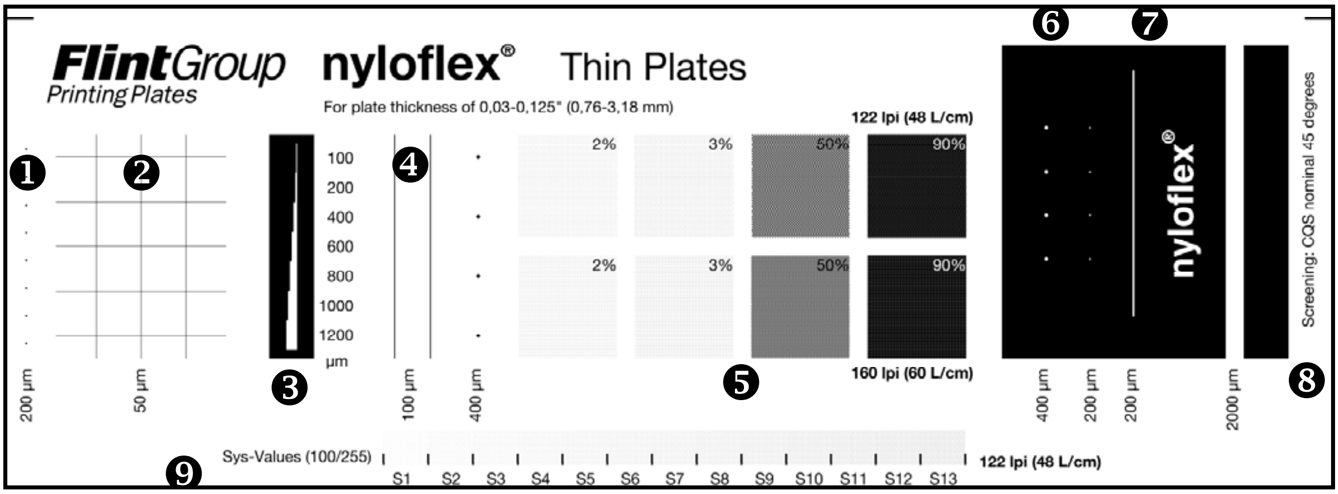

Fig. 3.8 Test elements to determine the main-exposure of thin plates

❶ Isolated positive dots of indicated diameter

❷ Positive line grid of indicated width

❸ Step wedge of negative lines of indicated width

❹ Positive lines of indicated width

❺ Fields of screen values of indicated tonal value and screen ruling

❻ Negative dot of indicated diameter

❼ Negative lines of indicated width

❽ Indicates the used screen type and screen angle

❾ Step wedge of screen with indication of the according system value.
The system value (Sys-Value) reflects the smallest difference of the tonal screen value which the software can differentiate. One Sys-Value is equal to approx. 0.39 % solid coverage (100 % / 255 shades of grey).
Example: System value S5 = 2 % tonal value (0.39 % * 5).

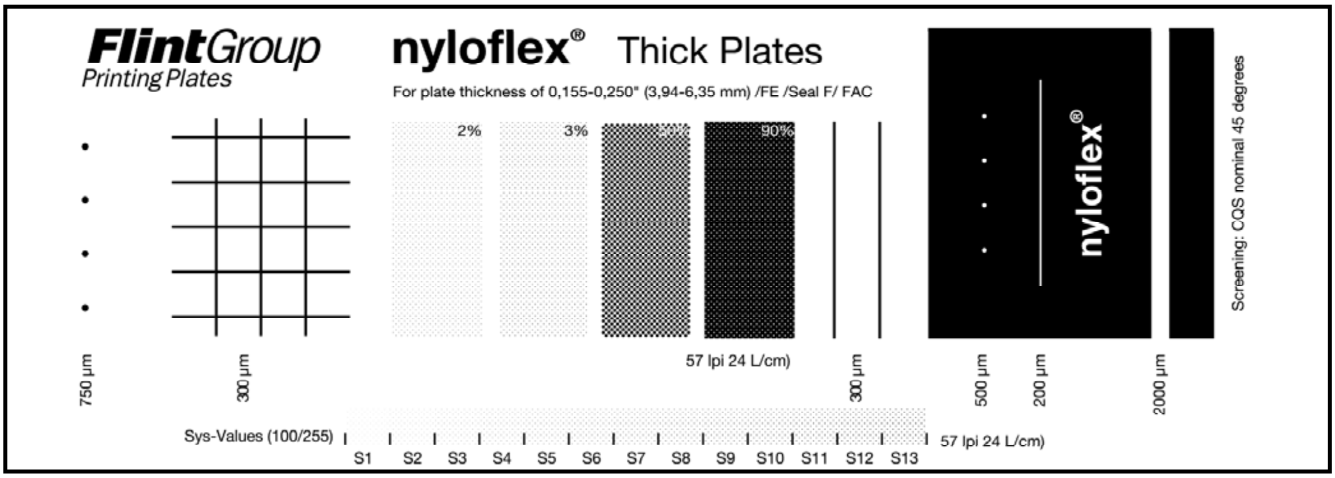

Fig. 3.9 Test elements to determine the main-exposure of thick plates (FAC-X), Seal F and FE

Drying and checking

The washed out nyloflex® printing plate is dried in a drying cabinet with circulating hot air. An overview of the drying times is given in the table below and on page 6 and 7 of this manual.

Plate type/thickness	Washout solvent		
	PER	nylosolv® A	nylosolv® II
ACE, AFC, ACT, ART, FAH, FAR 0.76 – 1.14 mm (0.030 – 0.045")	1 h 60° C (140 °F)	1.5 – 2 h 60° C (140 °F)	1.5 – 2 h 60° C (140 °F)
ACE, AFC, ACT, ART, FAH, FAR, FAC-X 1.70 – 3.18 mm (0.067 – 0.125")	2 h 60° C (140 °F)	1.5 – 3 h 60° C (140 °F)	1.5 – 3 h 60° C (140 °F)
FAC-X 3.18 – 6.35 mm (0.125 – 0.250")	3 – 4 h 60° C (140 °F)	2.5 – 4 h 60° C (140 °F)	2.5 – 4 h 60° C (140 °F)
FE 114	> 3 h 60 °C (140 °F)	> 3 h 60 °C (140 °F)	> 3 h 60 °C (140 °F)

Table 3.1 Recommended drying time

The times listed are minimum values. The temperatures are maximum values. If lower temperatures are used, the drying times need to be increased accordingly. The plates should be checked after 15 minutes drying time. Residues or streaks should be then wiped off with a lint-free linen cloth or chamois, soaked in fresh washout solvent. Allowing the plates to rest after drying for 12 - 15 hours at room temperature ensures maximum tolerance accuracy and is therefore strongly recommended.

When using nylosolv®, care must be taken that the dryer is suitable for use with nylosolv® (good temperature distribution: ± 4 °C (7.2 °F) max. per drawer).

Photopolymer printing plates shrink after they are made over a period of three months. The strongest shrinkage is immediately after plate making. Thickness measurements, made at different times, give different results. Therefore, older printing plates should not be combined with newly made ones in one printing job. Just made printing plates are always thicker than older ones.

Post-exposure

The post-exposure with UVA-light can be done before or together (simultaneously) with the plate finishing (detacking with UVC-light). For the post-exposure, the plate is exposed in a light finishing unit or in an exposure unit without vacuum. Select the same time for the post-exposure as determined for the main-exposure. This practice ensures that the plate is well and thoroughly polymerised and is optimal with regard to its hardness, elasticity, solvent and crack resistance.

Recommendation: Post-exposure time 10-15 minutes.

UVC-light detacking

Exposing the nyloflex® printing plate with UVC-light makes the plate surface non-tacky. Because the printing plate remains glossy, the state of the UVC-light finishing is difficult to be visually checked and controlled. Only by touching the plate surface, the amount of tackiness can be felt.

In order to find the point where the plate is tack-free, conduct an UVC exposure test in 3-minute steps and check the tackiness after each step. The optimal time must not be exceeded substantially, because of the risk of cracking in the relief shoulders and the floor. For the same reason, no printing plate should be exposed to the UVC light finishing immediately out of the drying cabinet, while it is still hot. The plate should be allowed to cool down before put into the finishing unit.

It is also very important that plates are thoroughly dried before they are put into the UVC-light finishing unit. A premature light finishing may trap remaining solvent in the plate and fixes the current state of plate swelling which results in thickness deviations and a softer plate. The time of the light finishing with UVC-light differs depending on the device and the plate type.

Too long exposure time causes the plate surface to become brittle. Cracks may appear. Cracks might also occur, if the UVA/UVC-light finishing is done simultaneously and if the temperature gets too high inside the unit. It is therefore necessary to keep the temperature equal and controlled. If this is not the case, deviations of the tested times may occur.

Light finishing by UVC-light should be done only in equipment that is designed for this purpose. Powerful UVC-radiation causes ozone, which must be carefully removed from the unit in order to keep off the ozone from personnel and to avoid plate cracking. Since ultraviolet light, especially UVC-light is harmful for human eyes, the equipment must be firmly sealed during operation. Just a few seconds would be enough to cause serious eye injuries.

nyloflex® FE printing plates do not require UVC-light finishing due to a low level of tackiness.

3.3 Work steps for making water washable nyloflex® sprint

The nyloflex® sprint plates are made using the same plate making sequence as for conventional nyloflex® printing plates: back-exposure, main exposure, washout (with tap water), drying and post-exposure.

1. The determination of the washout time is based on the CW, DWT processing equipment of Flint Group Printing Plates. The plates are washed out with tap water in a temperature range of approx. 25-30 °C (77-86 °F). After the cover film has been removed, a piece of the raw plate is fixed in the washer and washed out for 30 seconds. This washout process is repeated until the polymer is totally washed off from the base film. The optimal washout time is the time necessary to wash off all non-polymerized material plus 30 seconds. In the continuous flow washer, we recommend a speed of approx. 250 mm/min (9.8"/min) depending on the water temperature.

2. The back-exposure through the base film determines the relief depths and at the same time assures better anchoring of fine relief details. Important in this context is to warm up the exposure tubes before the test.

   Because of the light sensitivity of sprint 114, it is recommended to cover the plate for the back-exposure with a screened film (80 % opacity) in order to reduce the light intensity and extend the exposure latitude. It also helps to equalize the floor.

   The raw plate is placed with the milky protective foil (plate front) on the vacuum plate of the exposure unit. Then exposed in 2-second steps by using the cover plates. Then, after removing the protective film, washed out with the determined washout time and conditions. The target for the relief depth is approx. 0.5 – 0.7 mm (0.02 – 0.028"), determined by thickness measurements on the dried plate.

3. Main-exposure: The polymerisation of the relief layer takes place by exposing with UV-light and under vacuum. The nyloflex® thin plate test negative of Flint Group Printing Plates is used for main-exposure test in steps of 30 seconds (e.g. 30, 60, 90, 120 seconds). After the test exposure, the plate is washed out. The optimal exposure time is reached when the shoulders of the halftone areas and lines are not washed out below, but are well anchored, and when the critical reverse images are still open and don't fill in during the printing process.

4. Plate drying: The plate drying process removes the water from the relief layer, which was absorbed during the washout process. The drying time should be at least 15 – 20 minutes at 60 °C (140 °F). Shorter drying leaves the relief layer soft and weak.

5. Post-exposure: The post-exposure ensures that fine relief parts as well the floor are well and thoroughly polymerised. The post-exposure time might be 2 minutes.

6. Plate storage: The nyloflex® sprint 114 raw plates are stored at room temperature, i.e. approx. 20 °C (68 °F). The relative humidity should be approx. 55 %.

Suitability of solvents for cleaning of finished nyloflex® sprint plates:

- Hydrosolv / Fa. VARN
- Quick sprint / Fa. Recyl Sarl
- Aliphatic hydrocarbons
- Cyclic hydrocarbons
- Aromatic hydrocarbons

4 Processing of digital nyloflex® plates

4.1 The digital printing plate

- Fields of application
- Plate structure
- Characteristics of the mask layer (LAMS)
- Advantages/benefits of digital imaging

4.2 Workflow of plate making

4.3 Plate making steps

- Checking of the file data
- Data preparation
- Laser systems (digital imager)
- The digital test file
- The test file elements

4.4 General advantages of digital printing plates

- Measuring and evaluating of dots

4.5 Tonal value conversion

- Reduction of dot diameter in the imaged plate
- Optimisation of the file data

4.6 Elongation of the printed image

- Calculation example for FAH 114 DII
- Laser drum – impression cylinder
- Elongation constants for digital nyloflex® plates

4.7 Hardness' of various digital nyloflex® plates

- Factors influenced by the hardness of the printing plate

4.8 The print results

4.1 The digital printing plate

Digital nyloflex® printing plates consist of the same formulation and structure as the conventional (analogue) type, only with an additional black mask layer, the so called LAMS. All the characteristics of conventional plates are also found in the digital plates.

The LAMS layer on the plate surface replaces the negative film. All image data is transferred to the plate via direct ablation of the LAMS using a laser beam. This is often referred to as “digital imaging”.

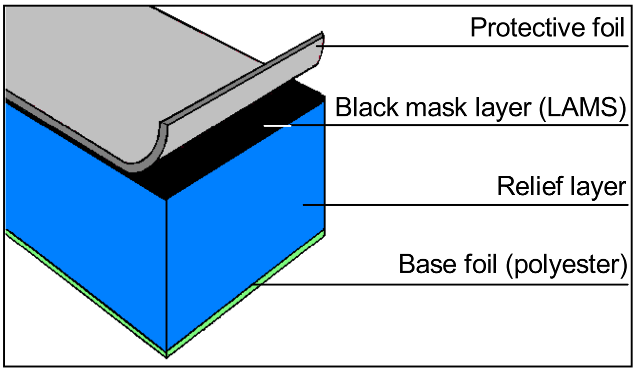

Fig. 4.1 Plate structure of digital nyloflex® printing plates

Fields of application

Because of the special characteristics of digitally made printing plates, there is a significant increase in the potential print quality compared to conventional plates. This is true for all applications.

- Carrier bags
- Flexible packaging of film/foil (PE, PP, Al)
- Corrugated board (preprint and post-print)
- Beverage packaging
- Carton products
- Labels
- Napkins
- Fine board products
- Paper and foil/film bags
- Envelopes

Characteristics of the mask layer (LAMS)

- High optical density
- Homogeneous black
- Uniform layer thickness

Advantages/benefits of digital imaging	
Digital data transfer The film negative can be eliminated, which results in the following advantages:	
▪ No influence of dust during film handling ▪ No costly film archiving ▪ No vacuum faults ▪ No film exposure unit ▪ No film mounting ▪ No contact copy	▪ No retouching ▪ No film chemicals ▪ Data transfer independent of the location ▪ Data transfer directly to the plate without any loss ▪ High resolution
Controllable tonal values by laser and exposure, up to high resolution	
▪ Very high definition of fine details ▪ Increase in contrast ▪ Low dot gain	▪ Excellent print quality ▪ Fine gradations of tonal values
Cost savings	
▪ No film material ▪ No archive facilities for film ▪ No film exposure unit ▪ Easy plate handling	▪ High reproducibility, less corrections ▪ No film chemicals ▪ No developing unit ▪ Faster transfer of data to the plate
Environmentally friendly	
▪ No film chemicals	▪ No film material

4.2 Workflow of plate making

Back-exposure
The back-exposure determines the relief depth and supports the anchoring of fine details.

Data input

Laser digital imaging
The laser beam images the black layer by ablation.

Main-exposure
The main-exposure (without vacuum) polymerizes and shapes the relief according to the image of the mask layer.

Washout
Washing away the black layer and the relief layer is made in one single step.

Drying
Plate drying removes the solvent absorbed in the washout process by evaporation.

Post-exposure
The post-exposure with 360 nm ensures the complete polymerisation of the printing plate.

Detacking
The plate finishing with UVC-light creates the tack free, none sticky printing plate.

4.3 Plate making steps

Checking of the file data

The output of digital data directly onto the plate makes it impossible to check the image visually or densitometrically as possible with film negatives before the costly plate making. Accurate and controlled work, testing and measuring of the entire plate making process is required in order to avoid faults in the printing plate and later on in the print. Complaints might be expensive.

Considering the large number of systems, the subject of checking the file data cannot be addressed in this manual. It is assumed in the following explanation and information, that all process data are correct and complete in regard to fonts and images. In addition, it must be guaranteed that the data format is fully compatible starting from the prepress system used for the RIP, and from there to the output device. The checking of the data input can be made automatically using suitable software (pre-flight check).

Data preparation

During the processing of digital plates, the diameter of dots in the highlight area and the relief height is reduced due to the influence of oxygen (see Fig. 4.6 - 4.8 on page 32). This means that in some cases, fine dots cannot be perfectly formed in the »digital« process and will spoil the print. Depending on the laser parameters, such as rotation speed of the drum, feed rate, intensity of the laser beam and the circumference of the laser drum, as well the screen ruling, a correction of the laser image is necessary.

The lowest tonal values of the image data file must be increased by a certain value (bump up) to assure good dot anchoring. The bump up value is determined by lasering an uncorrected halftone wedge, after determination of the laser capability and plate processing. Important are the tone values of 1, 2, 3, 4, 5 %, which are, among other test elements, part of the Flint Group Printing Plates test.

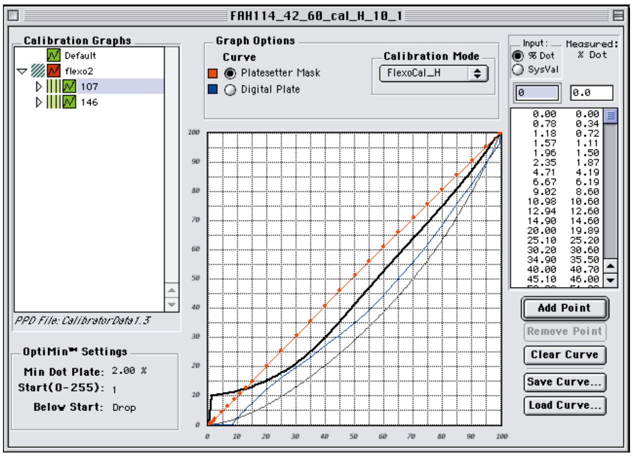

Fig. 4.2 The analogue reduction of the printing plate is counteracted by an increase of the tonal values in the highlight area.

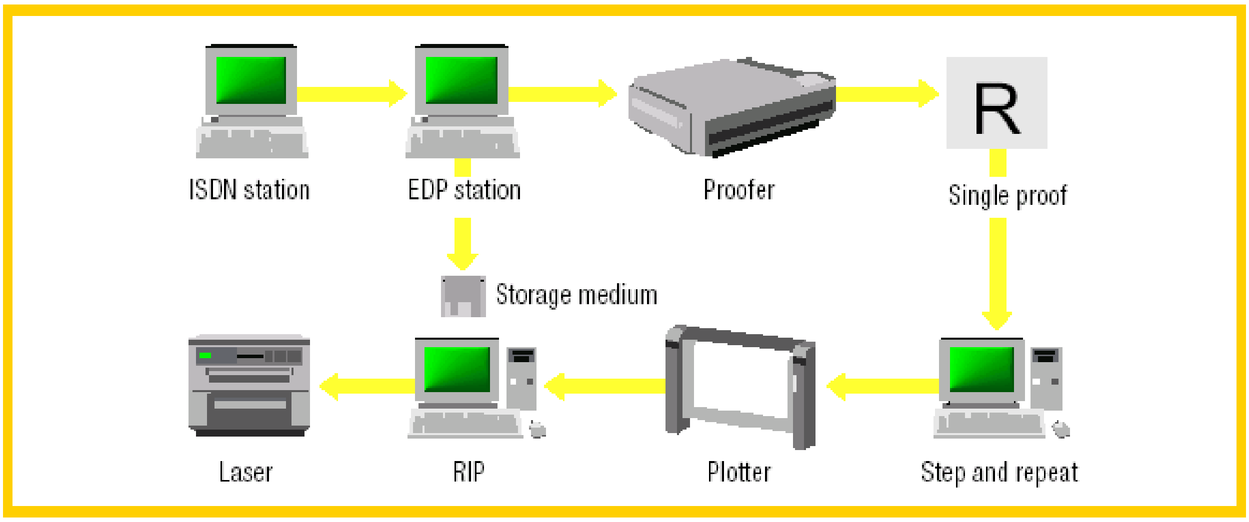

Fig. 4.3 Example of a CTP workflow in prepress

Laser systems (digital imager)

All laser systems for flexo plates presently available in the market, are external drum exposure units with different cylinder diameters. The lasers offered in the market are:

- Nd: YAG-lasers, lamp- or diode-pumped:
  wave length λ = 1064 nm
- Diode laser: wave length λ= 830 nm
- Fibre laser: wave length λ= 1110 nm

YAG-lasers have a higher output range (up to 150 W), but require water-cooling. In addition the pump source (e.g. Kr-lamp) needs to be replaced after approx. 500 to 1000 operation hours.

The YAG-laser and fibre laser drum rotates with a speed up to 2000 rpm, diode lasers up to 320 rpm. The output of diode lasers is achieved through an arrangement of multiple diodes. The quality of the ablated areas, solids, dots and lines are determined by the available laser capacity, the rotation speed, the spot size (10 - 25 µm) and the according resolution.

Further important factors for the quality of a clean and streak-free lasering process are the focus depth of the laser beam and, of course, the layer structure as well the absorption characteristics of the black layer. Every system consisting of laser and plate must properly match to each other, i.e. must be tested first.

The laser is the output device of the digital data. The compatible connection of the prepress systems to the front-end, the control unit of the laser, is therefore an additional important condition for a perfect imaging result. In connection with investments in a laser system, attention should be paid to the following points:

- Availability of the laser
- Compatibility with the existing workflow
- Plate sizes
- Price/performance
- Operation
- Functionality and reproducibility
- Service and availability of spare parts
- Sleeve adapter (option)
- Speed

Furthermore, significant price differences of laser systems must be taken into account, depending on size and thickness of the plate material, and sleeve options.

The digital test file

The test file for digital plates, available from Flint Group Printing Plates upon request, is supplied as a PDF, EPS and binary file. The converted (ripped) pixel file (e.g. TIFF) should be made according to the resolution, which will be used later on in the production. Otherwise, the tonal values will not properly computed. The screen ruling and angle should also comply with those used in the subsequent process. The evaluation relates to the optimal tested processing conditions (e.g. back-exposure, washout time). Detailed instructions are given in chapter 3 (Processing nyloflex® printing plates).

The digital test file consists of various test elements, which enables the user to check and test the laser power, the focus, the tonal value reduction of the plate and the plate making parameters in one single process.

The test file elements

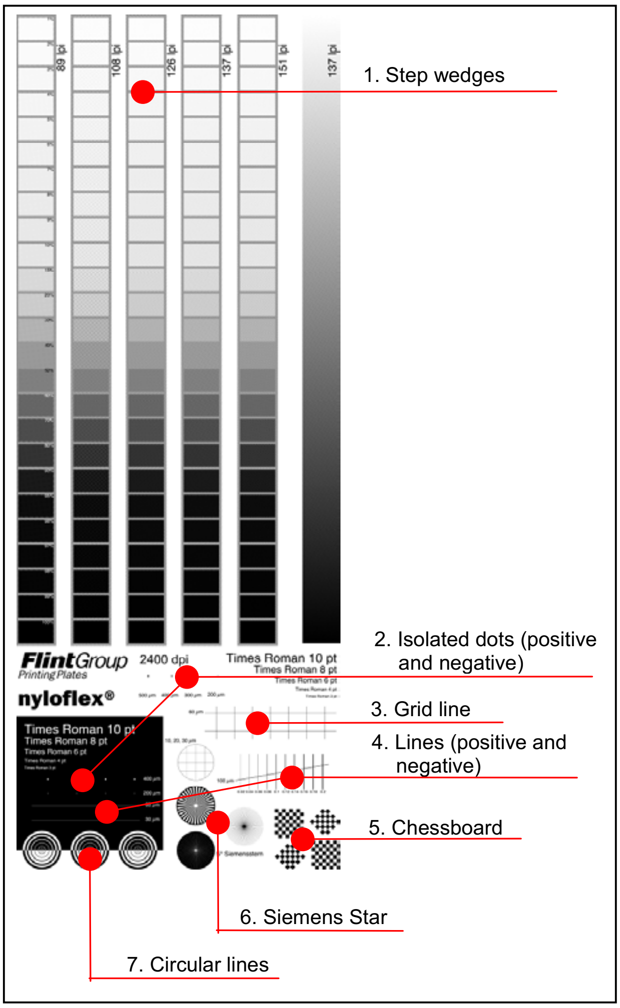

Fig. 4.4 digital test elements

1. *Step wedges*
   The screened step wedges are with different screen rulings from 89 to 151 lpi (35 – 60 l/cm) for testing the linearity of the imaging, the tonal value reduction of the processed plate and to determine the necessary bump up.

2. *Isolated dots, positive and negative*
   The positive dots must be firmly anchored on the finished plate, including the 200 µm dot. If a microscope is available, able to measure the depth, then the 400 µm negative dot must have at least a depth of 100 µm.

3. *Grid lines*
   The grid lines enables the user to check the plate making parameters. The lines in the grid must be firmly anchored on the plate and not wavy.

4. *Lines, positive and negative*
   Positive lines of different width varying from 20 µm to 200 µm are in order to test the result of the ablation and the sharpness of the line work elements on the mask layer. The negative lines with a width of 30 µm and 60 µm are used for the same function. The lines must be clearly reproduced on the imaged plate.

5. *Chessboard field*
   The corners of the squares should just touch each other without bridging, or with gaps in between. These elements are for checking the laser calibration.

6. *Siemens Star, positive and negative*
   The so-called "Siemens Star" helps to check the resolution, focus and the power calibration of the digital imager.

7. *Circular lines, positive and negative*
   Positive and negative lines must be of equal width on the black mask after imaging.

Optimal laser performance will image solids without any streaks or residue of the black mask. If a transmission densitometer is available, the solid ablated by a laser should have an optical density of D = 0.10 max. (fog). The densitometer should be calibrated by setting to zero on an area of the plate without the black layer. The black layer can be easily removed by using an adhesive tape.

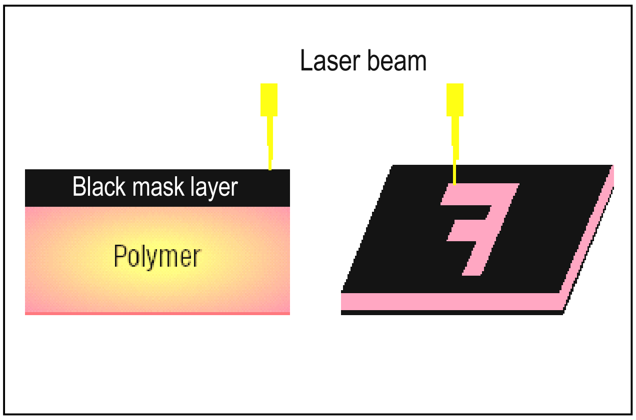

Fig. 4.5 The imaging of the printing plate by a laser beam

Fine positive and reverse elements and/or positive and reverse halftone dots must be reproduced in the mask at the same time. This visual check should be done on a light inspection table and not on the laser drum, because the positive elements are hard to see.

The actual performance of a Nd-YAG laser may fluctuate due to ageing of the krypton lamp. Periodic tests in defined intervals are highly recommended. Measurements by a laser power-measuring device can only conditionally be seen as a substitute for this test of power consistency. The quality of the output of the Nd-YAG laser depends, among other factors, on the quality of the laser beam.

If the reproduction of fine positive and negative details cannot be achieved together, a laser specialist should be consulted in order to adjust the laser.

The use of a diode or fibre laser, on the other hand, ensures a constant effective output performance. The control software of the laser helps to avoid missing spots. Despite this, it is still recommended to carry out a laser performance test with the individual plate type.

It is very important when conducting this test to keep in mind that the test result relates to the specific rotation speed, the feed rate (laser resolution), the plate type and the circumference of laser drum.

If one of these factors is changed, it is necessary to adapt the laser power to these conditions and to carry out a new performance test.

The conventional processing steps (back-exposure, washout, post-exposure and finishing) should be tested according to the test procedure for conventional plates prior to the laser process (s. chapter 3.2: Determination of plate processing times). An exception in this context is the main-exposure. There is no upper exposure limit for digital printing plates, because of the influence of oxygen during the exposure. The standard time for the main-exposure is between 15 and 20 minutes depending on the exposure unit in use. For the post-exposure, a time between 10 and 15 minutes is recommended.

4.4 General advantages of digital printing plates

A special feature of digitally made printing plates in comparison to conventional plates made with film are the sharper image, finer highlight dots and the more open reverses which results in a larger range of tonal values and an improved contrast.

The advantages in quality are primarily due to two reasons:

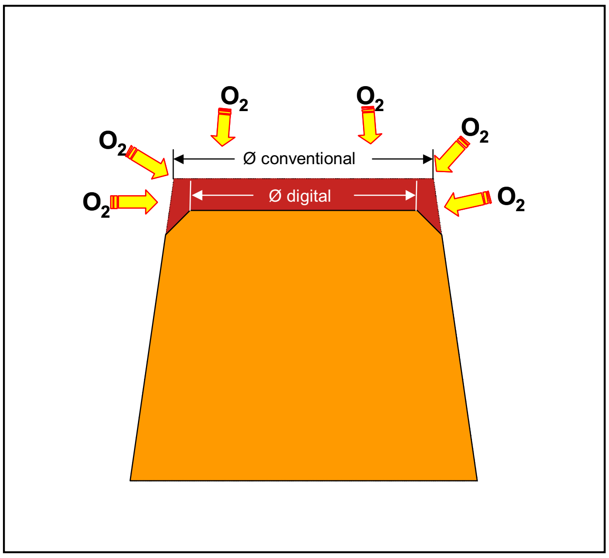

Fig. 4.6 Tonal value reduction caused by oxygen (the dot is rounded off at the relief edge)

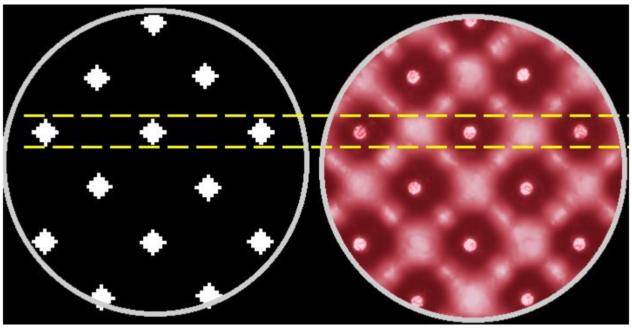

Fig. 4.7 Analogue reduction of the dot size from mask to plate

a. Oxygen inhibition during the main-exposure process causes a three-dimensional reduction of the image elements and opens up reverses. Fine highlights and open reverses increase the contrast in the print.

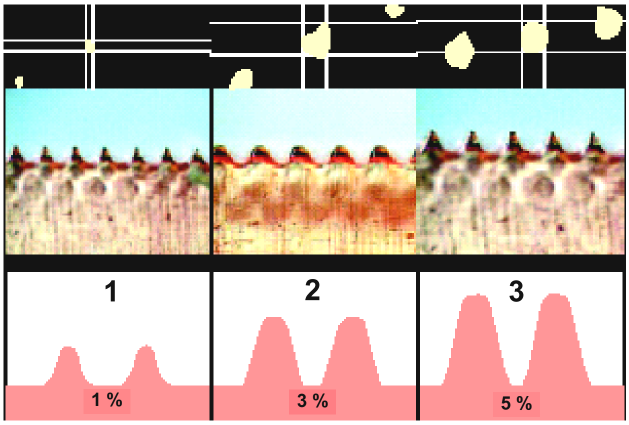

Fig. 4.8 Relief of a digital printing plate in the highlight area

The influence of oxygen has its greatest effect in the highlight area. Within the first 1 to 10 % of the tonal range (depending on the screen ruling and the resolution), the reaction on oxygen causes a significant reduction of the dots. Too small dots might break off in part. Figure 4.8 demonstrates the thickness and the dot reduction within the first 5 % of the tonal value range of a digital FAH 170. Highlight dots become sufficiently anchored on the plate if the tonal value in the highlights is bumped up.

b. Less reflection and a lower degree of scattered light, due to the elimination of the intermediate layers like vacuum film, film carrier, emulsion and substrate.

It should be mentioned at this point, that because of the precision of the digital technology, special care must be taken in the conventional plate making process. The reproduction of fine elements can only be ensured when all processing parameters such as the back-exposure time, washout and drying time are correctly determined and followed. Detailed instructions on tests for the processing parameters are given in chapter 3.

Now, it is necessary to find out which dot size is suitable to ensure good anchoring on the base of the finished plate.

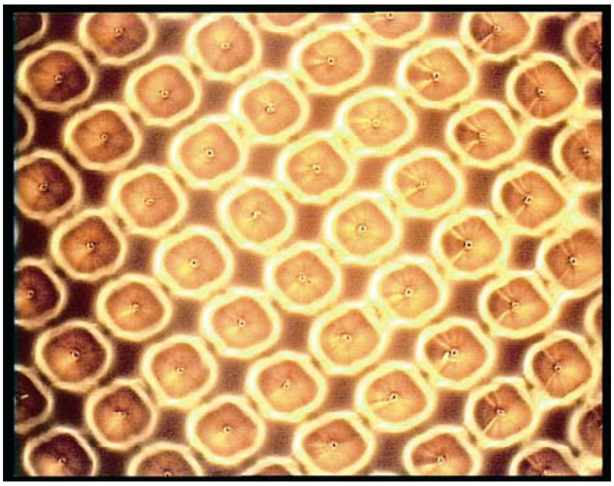

Fig. 4.9 The light microscope check

For this task, a special microscope with a magnification of 60 to 100 diameters should be used to evaluate the finished plate. The plate is put upside down on a light table.

If the focus of the microscope is set to the surface of glass plate of the light table, the dot will be clearly visible as a well defined round area. It is important that the dots are consistent. Also the dot anchoring, which is visible as a halo around the dot surface, must not be different from dot to dot. The smallest tonal value, which reaches these conditions, is the minimum value on which the bump up of the RIP or reproduction must target. Various plate measuring devices and systems (e.g. Vipflex, FlexoDot, FlexoCheck, Troika or QEA) have been proven to be useful.

In this context, it must be taken into consideration that no absolute reliable values are obtained by this measuring method. But these systems are, however, suited for an internal check to achieve a consistent plate quality and to determine repeatable control values. A printed proof of the halftone wedge is the only sure way to find out, which minimum tonal value is the first to ensure a clear print result. A control wedge might be placed in the print margin of the production job. The results and parameters should be documented and kept on file.

The test for the highlight correction must be done separately for every screen ruling, due to the different the dot sizes, which vary according to the tonal value from screen ruling to screen ruling.

4.5 Tonal value conversion

The following diagram shows the diameter of halftone dots and the corresponding tonal values for the screen ruling of 24/34/48 and 60 l/cm (58/86/122/152 lpi).

Due to the previously explained influence of oxygen during the main-exposure, the halftone dot diameter is reduced by approx. 25 µm ± 5 µm (0.001" ± 0.0002"). This means that dots with a smaller diameter than the reduction, e.g. 25 µm, can hardly be held on the plate or cannot be maintained at all. As a result, the tonal values need to be increased (by approx. 25 µm/0.001") so that the subsequent main-exposure will reproduce the target tonal value.

The increase of the tonal value, called the bump up, depends on the laser type, the laser power and the laser drum rotation speed. The bump up should be adjusted to the laser in any case.

Example: 48 l/cm (122 lpi), 1 % TV = 24 µm (0.00095"), increased to 55 µm (0.00216") mean value, equals to a tonal value of 5.5 %. The imaging is done with this value. The subsequent main-exposure will then reproduce a tonal value of 1 % on the finished plate.

Reduction of dot diameter in the imaged plate

Whether the highlights are being corrected within the application software or the tonal values are being bumped up in the RIP, depends on the workflow and prepress system. The established method is to use an uncorrected, neutral data file, which has been prepared (ripped) for the according output device (e.g. proofing device, image setter, laser). Some software suppliers offer workflow systems that can adapt an already ripped intermediate data format to the specific output device.

The values determined for the imaging and the highlight corrections are to be seen as a part of the plate processing. They are to a large extent independent of the printing application. Various RIP technologies for packaging printing enable calibrations by specific functions.

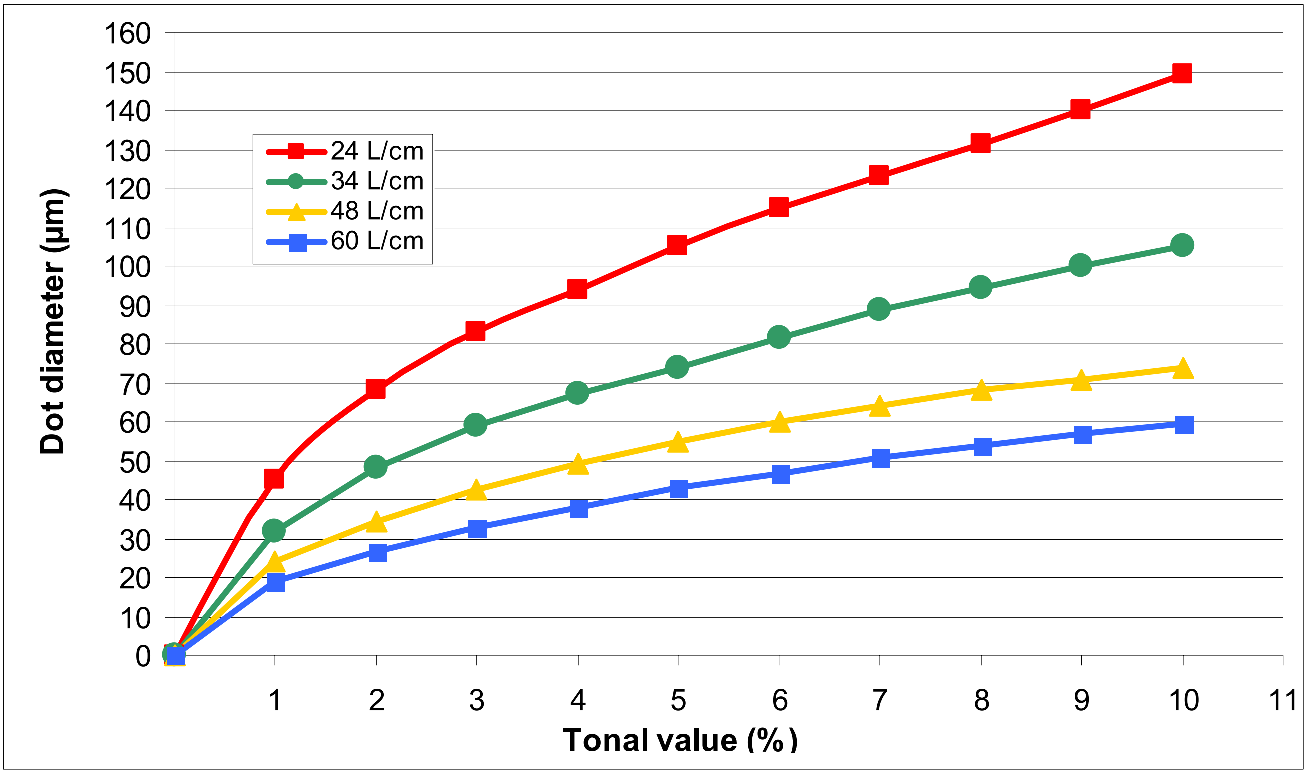

Fig. 4.10 Overview of different halftone dot sizes, depending on screen ruling and tonal value

Optimisation of the file data

Even though the print quality can be improved by using digital technology without any correction of the tonal values, optimisation of the file data is still highly recommended. The file data should be matched to the print parameters in the RIP (e.g. DGC: **D**ot **G**ain **C**om-pensation, PressGraph or PrintCurve).

This characteristic tonal value correction is made according to a printed proof of a test form, preferably under the same conditions as the job will later run with, i.e. the ink, substrate, anilox roller, etc. The optimum result can only be achieved, if the file preparation is adjusted to the printing conditions.

If laser adjustments are seen as part of the plate processing, tested for each plate type and regularly checked, the laser can be considered as output device like a film image setter, but on a higher level of quality regarding the printing result.

4.6 Elongation of the printed image

The distortion factor for the printed image is recorded into the Raster Image Processor (RIP). The distortion factor is determined by the elongation constant (C) of the individual printing plate type. Since imaging of digital plates and printing is done on a cylinder, both cylinder circumferences must be offset against each other in order to get the correct printing length.

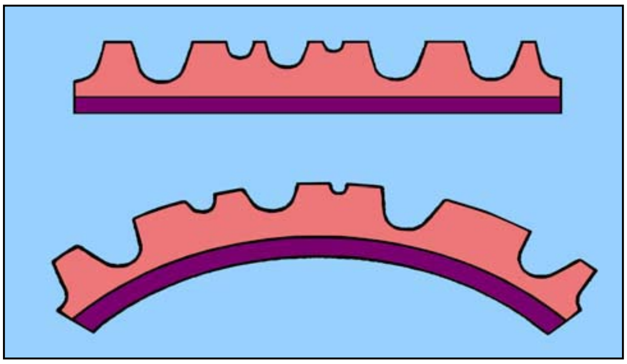

Fig. 4.11 Elongation of the printed image

Calculation example for FAH 114 DII

Circumference of laser drum:	776 mm (30.551")
Circumf. of printing press cylinder:	480 mm (18.898")
Thickness of adhesion tape:	0.5 mm (0.020")
Thickness of printing plate:	1.14 mm (0.045")

The following example shows the calculation of the distortion factor for a 1.14 mm (0.045") printing plate which is lasered on an Nd-YAG laser with a drum circumference of 776 mm (30.551"). The repeat length of the sleeve in printing is 480 mm (18.898"); the used adhesive tape is 0.5 mm (0.020") thick.

Calculation of the elongation constant C:

C = 2 x PL x π (3.14)

PL = Thickness of the polymer layer minus the polyester base; 0.175 mm (0.0069") for a plate thickness up to 1.14 mm (0.045"); 0.125 mm (0.0049") for a plate thickness from 1.70 mm (0.0067")

Elongation constant C for FAH 114 DII:

C = 2 x (1.14 mm - 0.175 mm) x π = 6.06 mm

C = 2 x (0.045" - 0.0069") x π = 0.239"

Laser drum – impression cylinder

Cylinder diameter	247.01 mm	9.7248"
+ 2 x plate thickness:	+ 2 x 1.14 mm	+ 2 x 0.0449"
= Total diameter d:	**249.29 mm**	**9.8146"**

Printing plate circumference PC = π x d

	π x 249.29 mm	π x 9.8146"
	783.17 mm	**30.8334"**

% Reduction of laser drum =
(constant C/repeat length R) x 100

(6.06 mm / 783.17 mm) x 100
= 0.77 %

(0.239"/30.8334") x 100
= 0.77 %

Elongation constants for digital nyloflex® plates

The following elongation constants are not exclusively determined by calculation, but also by numerous experimental tests. They are valid for the following nyloflex® printing plates:

ACE, ACT, ART, FAC, FAH

Plate thickness	Constant
0.76 mm (0.030")	4.30 mm (0.1693")
1.14 mm (0.045")	6.06 mm (0.2390")
1.70 mm (0.067")	9.90 mm (0.38980")
2.30 mm (0.091")	13.60 mm (0.5354")
2.54 mm (0.100")	15.14 mm (0.5961")
2.72 mm (0.107")	16.45 mm (0.6476")
2.84 mm (0.112")	17.09 mm (0.6728")
3.18 mm (0.125")	19.15 mm (0.7539")
3.94 mm (0.155")	23.94 mm (0.9425")
4.32 mm (0.170")	26.34 mm (1.0370")
4.70 mm (0.185")	28.70 mm (1.1299")
5.00 mm (0.197")	30.60 mm (1.2047")
5.50 mm (0.217")	33.74 mm (1.3283")
6.35 mm (0.250")	39.08 mm (1.5386")

Table 4.1 Elongation constants

4.7 Hardness' of various digital plates

The hardness of the printing plate is a significant influential factor regarding the technical printing properties of the various printing plates. By selecting the proper plate hardness, the print result can be clearly improved.

It must be considered that the shore hardness of the printing plates measured directly on the finished plate differs considerably from the DIN ISO values (see table below). Only a general statement can be made at this point: »The thinner the measured printing plate, the harder it is«.

Factors influenced by the hardness of the printing plate

- Adaptability to the substrate surface
- Wear of the printing plate surface
- Rebound resilience
- Tonal value transfer

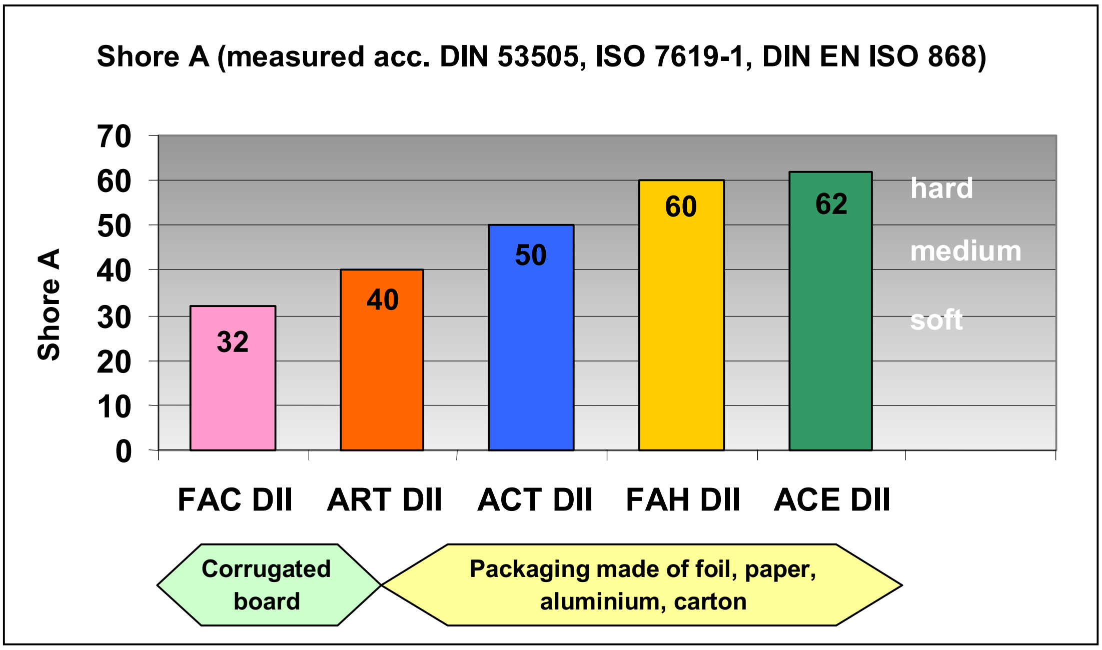

Fig. 4.12 Shore hardness' of nyloflex® digital plates

The hardness of the printing plate measured directly on the finished plate											
Printing plate	**DIN-hardness**	**0.76 mm 0.030"**	**1.14 mm 0.045"**	**1.70 mm 0.067"**	**2.54 mm 0.100"**	**2.72 mm 0.107"**	**2.84 mm 0.112"**	**3.18 mm 0.125"**	**3.94 mm 0.155"**	**4.70 mm 0.185"**	**5.50 mm 0.217"**
ACE DII	62 Sh A	88	78	70	66						
ACT DII	50 Sh A		74	62	54	53	52				
ART DII	40 Sh A		73	57	48		45		41		
FAC DII	32 Sh A						38	36	35	33	32
FAH DII	60 Sh A		77	69	64		63				

Table 4.2 The information on the hardness' relates to average readings - these values might deviate by ± 2.

4.8 The print results

Processing of digital plates

After calibration of the laser and establishing the optimum plate making times and conditions, it is possible to achieve printing results featuring a low dot gain, a wider tonal value range and excellent contrast.

Fig. 4.13 Print sample

It must be taken into consideration that dot gain (tonal value) can be caused by the printing press, the ink and the substrate. These have to be corrected in the data file. It is therefore recommended, especially for critical designs like in figure 4.13, that a fingerprint of the printing press is made where the job will later run. Based on this printing test and the acquired print characteristic curve, the optimum dot gain compensation can be made in the data file.

5 Processing nyloflex® coating plates

Contents of this chapter:

5.1 nyloflex® coating plates and their fields of application

The nyloflex® coating plates from Flint Group Printing Plates are intended for inline and offline coating with flexo coating units in sheet fed offset presses, as well special coating machines.

Fields of application

Spot coating in commercial and packaging printing on coated paper and carton board
Full surface coating in commercial and packaging printing on coated paper and carton board
High-resolution image printing with water-based metal pigment and pearlescent inks in packaging printing (folding boxes/labels)

Plate types

nyloflex® Seal F 116
nyloflex® Gold A 116

The nyloflex® Seal F 116 is particularly suited for full surface and spot coatings with water-based dispersion varnish and UV varnish. Also with water-based pearlescent inks, water based scented inks and tinted dispersion varnish.

The nyloflex® Gold A 116 is not only suited for water-based dispersion varnish and UV-varnish, but above all, for printing high-resolution images with water based metal pigment and pearlescent inks, where high register accuracy (register with pre-printed offset) is required.

Plate structure

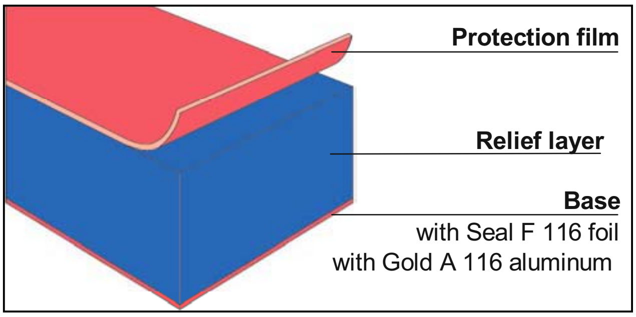

Fig. 5.1 Plate structure of the nyloflex® coating plate

The nyloflex® Seal F 116 and the nyloflex® Gold A 116 are made of a light-sensitive photopolymer layer, bonded to a 250 µm (0.0098")polyester base (Seal F 116) or a 300 µm (0.0118") dimensional stable aluminium base (Gold A 116).

Hardness of the nyloflex® coating plates

nyloflex® Seal F 116: 36 Shore A (DIN hardness),
72 Shore A (finished plate, average)
nyloflex® Gold A 116: 62 Shore A (DIN hardness),
78 Shore A (finished plate, average)

The figures given after the plate name relate to the total thickness of the finished plate.

5.2 nyloflex® coating plates – product description

Seal F 116 and Gold A 116

- High-contrast colour change
- Wide exposure latitude
- Good resolution
- Excellent ozone resistance
- Good varnish transfer
- High print contrast with the Gold A 116
- High register accuracy with the Gold A 116 due to the metal base
- Finest reproduction in gold varnishing with the Gold A 116

Plate thickness' and sizes*

Seal F 116		Gold A 116	
Thickness	Size	Thickness	Size
1.16 mm (0.045")	865 x 1060 mm (34 x 42") 1270 x 1473 mm (50 x 58") 1100 x 1325 mm (46 x 52")	1.16 mm 0.045“	700 x 800 mm (27.5 x 31.5") 790 x 1050 mm (31 x 41") 840 x 1045 mm (33 x 41") 865 x 1060 mm (32 x 42")
Other sizes upon request			

**Current standard sizes – subject to change.*

Plate processing/main-exposure test

nyloflex® coating plates are processed in nyloflex® processing equipment. The back-exposure is usually not necessary with the Seal F 116. When very fine isolated details must be held, a plate back-exposure can improve the anchoring of the relief. Due to the aluminium base of Gold A 116, a back-exposure is not possible. However, the anchoring of very fine isolated details (0.10mm (0.0039")) can be improved by a flash exposure through the protective film. nyloflex® coating plates are washed down to the base material. For the determination of the processing times (exposure/wash-out), the nyloflex® Gold A test negative should be used or the nyloflex® thick plates test negative for Seal F. The test procedure is the same as described for flexo plates.

The exposed printing plate is then washed out and dried. The correct exposure time can be seen from the different development stages of the relief details. Steps, which have not been exposed long enough, show too strong washed-out halftone areas and wavy lines.

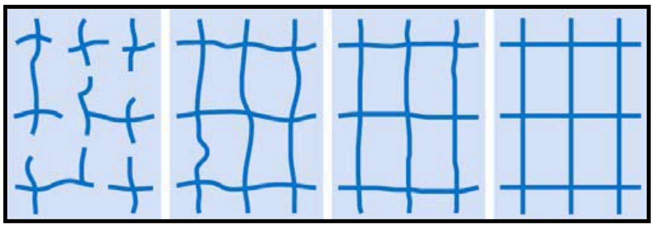

Fig. 5.2 The effect of different exposure times on a line grid

Important hint

Always select those times for plate making which are close to the lower exposure limit and select the same time for the post-exposure. This way, you will ensure that the printing plate is well and thoroughly polymerised in order to reach the optimal hardness, elasticity, solvent and crack resistance.

A main-exposure time close to the upper exposure limit is necessary, if extremely fine elements need to be anchored.

Upper and lower exposure limits of the Gold A 116

For the nyloflex® coating plate, the *lower exposure* limit is the time where the following elements are well anchored:

a. isolated dots with a 400 µm (0.016") diameter,
b. a line grid of 100 µm (0.0039") lines, and
c. a halftone of a 3 % tone value.

The *upper exposure limit* is the time where the depth of a reverse dot with a diameter of 500 µm (0.02") is at least 100 µm (0.0039").

Upper and lower exposure limits of the Seal F 116

For the nyloflex® Seal F 116 coating plate, the *lower exposure* limit is the time where the following elements are well anchored:

a. isolated dots with a 750 µm (0.03") diameter,
b. a line grid of 300 µm (0.012") lines, and
c. a halftone with a 3 % tone value.

The *upper exposure limit* is the time where the depth of a reverse dot with a diameter of 500 µm (0.02") is at least 100 µm (0.0039").

Exposure latitude

The time between the lower and the upper exposure limits is called the »exposure latitude«. nyloflex® coating plates have a wide exposure latitude.

Example:

Lower exposure limit:	10 minutes
Upper exposure limit:	18 minutes
Exposure latitude	= 8 minutes

The width of the lines and the diameter of the dots on the surface do not change within the exposure latitude.

If the upper exposure limit is exceeded, we talk about over-exposure. In case of an over-exposure, the reverse details in solids are the most affected parts. Too shallow reverse depths will occur. Fine lines and line grids are not affected.

Production/processing times*

Processing steps	Values/times
Seal F 116	
Plate back-exposure	To be tested
Main-exposure	10 - 15 min.
Washout (mm/min)	120 - 140
Drying at 60 °C (140 °F)	2 hours
Post-exposure (UVA)	10 - 15 min.
Detacking (UVC)	10 - 20 min.
Gold A 116	
Flash exposure	To be tested
Main-exposure	10 - 15 min.
Washout (mm/min)	120 - 160
Drying at 60 °C (140 °F)	2 hours
Post-exposure (UVA)	10 - 15 min.
Detacking (UVC)	10 - 15 min.

* The processing parameters depend amongst others on the processing equipment, the lamp age and the type of washout solution. The above mentioned processing times were established on nyloflex® equipment and nylosolv® A washout solution. The processing parameters might deviate with the use of other equipment and washout solution. The above mentioned times are only to be used as a guide. The use of nylosolv® A is recommended.

nyloflex® Gold A test negative

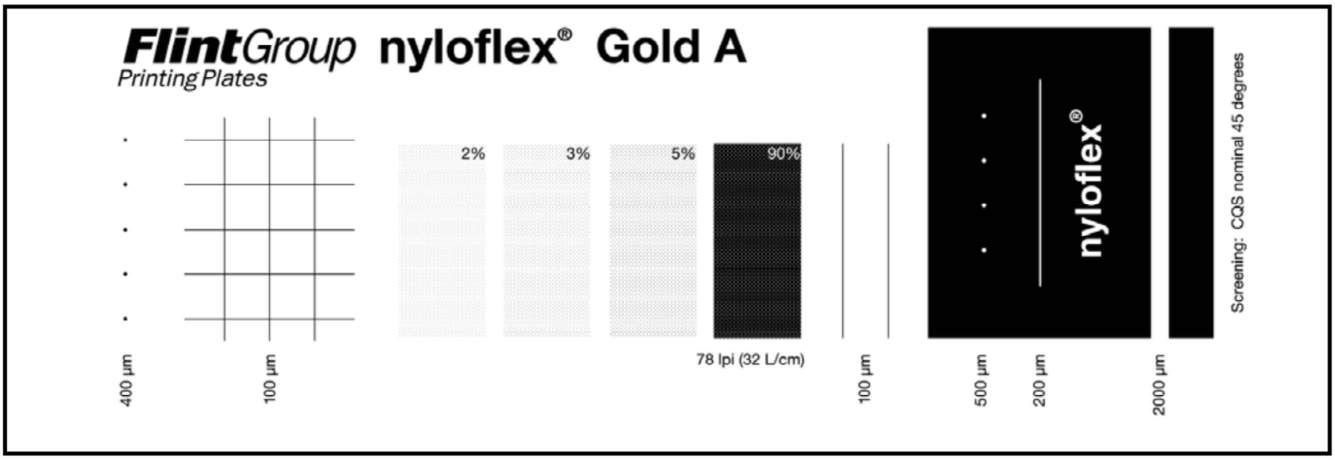

Fig. 5.3 Test elements of the test negative for Gold A 116 to determine the main-exposure time.

nyloflex® Seal F 116 test negative

In order to determine the main-exposure time for Seal F 116, the test negative for thick plates is used.

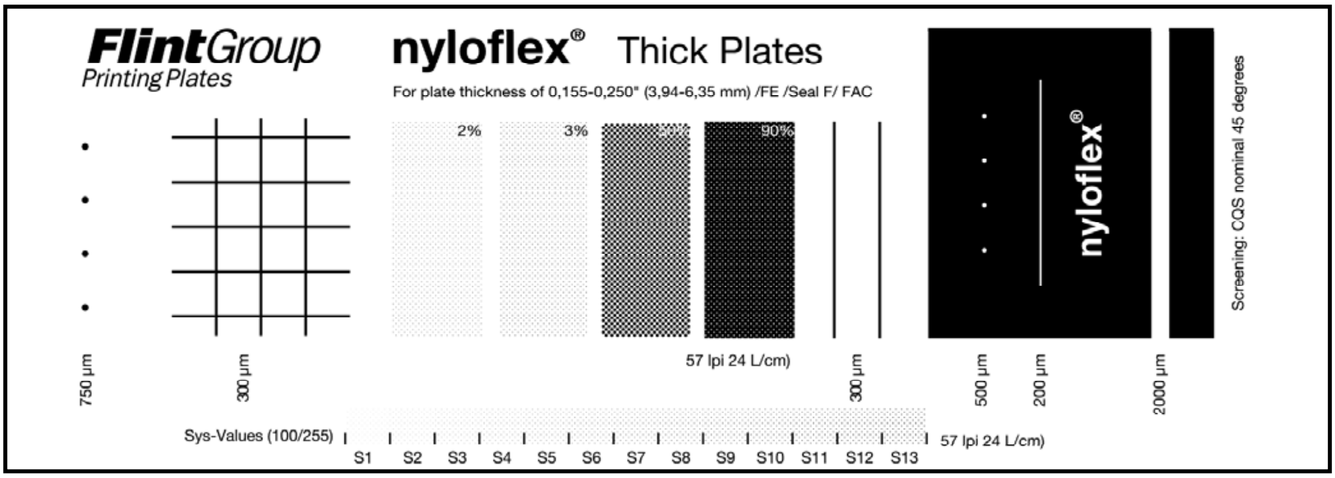

Fig. 5.4 Test elements of the test negative to determine the main-exposure time for Seal F 116.

Evaluation

The lower exposure limit is reached when all positive details of the test negative are securely anchored on the coating plate.

The upper exposure limit is reached when the reverse depth of the reverse dots is only 100 µm deep. The difference between the lower and the upper limit value is the exposure latitude.

Elongation constants of nyloflex® coating plates

Seal F 116	5.72 mm (0.225")
Gold A 116	5.40 mm (0.213")

Washout solution

We recommend the use of nylosolv®. Other organic washout solutions for flexo printing plates might be used as well.

Swelling resistance

nyloflex® coating plates feature a high resistance to all varnishes, inks and cleaning agents with a water based formulation. The plates are usually resistant to UV-varnish, depending on the binder and compound. In case of any doubt, we recommend to test the compatibility.

Organic binding agents in varnishes and inks, cleaning agents with higher ester compounds, benzene, toluene, ketone and similar solvents are not suited for use with nyloflex® coating plates.

5.3 Plate storage

nyloflex® Seal F 116 and Gold A 116 printing plates should be stored flat in a cool, dark and dry environment at 15 - 20 °C / 59 – 68 °F (room temperature) and a relative humidity of approx. 55 %. If the temperature of the plate making room differs significantly from that of the storage room, the plate temperature should be adapted to the temperature of the plate making room prior to their use. The windows must be covered with suitable, tested UV-protective film. Also the lightning must be UV-light protected.

Storage and re-use of printed coating plates

Coating plates, which have been cleaned and are ready for archiving should be stored hanging in a cool, dark and dry environment. To protect the relief surface, the plates should be covered with a foil sheet.

Hints for the disposal of exposed and raw coating plate materials: Exposed nyloflex® coating plates are not soluble in water and therefore can be deposed in landfill.

In case of disposal, we suggest the following waste keys, which are valid in EU countries. Individual cases will, however, require arrangements in coordination with the waste collecting company.

Gold A 116:

Exposed plate pieces: EAK 170402
Type of waste: Aluminium

Raw plate pieces: EAK 200106
Type of waste: Other plastics

Seal F 116:

Exposed plate pieces: EAK 120105
Type of waste: Plastic parts

Raw plate pieces: EAK 200106
Type of waste: Other plastics

Residues from the recycling of the washout solution can be disposed under: EAK 070208
Type of waste: Other reaction and distillation residues.

This waste is hazardous waste and must be burned in suitable incinerators or disposed in other suitable ways in agreement with the local authorities.

5.4 nyloflex® Gold A digital

The nyloflex® Gold A 116 DII is the same as the conventional plate, only furnished with a black mask layer (LAMS).

The characteristics and properties of the LAMS is identical to all other digital nyloflex® printing plates. Therefore, there are no special adjustments of the laser necessary.

However, special care is necessary when the plate is mounted on the laser drum. Because the aluminium base of the plate is rather stiff, the vacuum of the laser drum cannot firmly hold the plate.

It is therefore advisable to fix the plate additionally with adhesive tapes and eventually, depending on the laser type, to reduce the rotation speed of the laser drum. Consultation by the laser manufacturer is highly recommended in order to avoid damage to the laser head.

After the black layer is ablated (imaged), the plate is put in an exposure unit and exposed for 15 to 20 minutes without vacuum. Then washed out, dried and finished like the conventional plates.

6

Washout solutions for nyloflex® printing plates

Contents of this chapter:

Washout solutions for nyloflex® printing plates

There are various solutions available in the market in order to washout nyloflex® printing plates. These solutions are mixtures of two or three components. One component, an alcohol, is in order to dissolve the slip layer (release layer). The other components are a mixture of hydrocarbons in order to dissolve the relief layer.

Flint Group Printing Plates offers nylosolv® II and nylosolv® A, two washout solutions, environmentally friendly and less harmful to users health.

The well-known perchlorethylene/n-butanol mixture, which is still used in some cases, is addressed in this chapter for information only.

6.1 The washout solution nylosolv® II

nylosolv® II is a washout solution which is composed of two hydrocarbons and alcohol. nylosolv® II can be reclaimed, using a suitable distillation unit (under vacuum). Depending on handling and distillation, the mixture ratio of individual components in the mixture can change. It is therefore recommended to check the mixture and add the individual components (additives) as necessary.

Additives

The additives can be ordered under the following names:

- Additive A
- Additive B
- Additive C

nylosolv® II also contains a conductivity agent in order to prevent static charge of the washout solution during handling (e.g. pumping). In order to ensure a constant quality and because some amount of the conductivity agent remains in the sludge in the distillation unit, the individual components might need to be added. In case the mixture solution is correct and there is no need to add any of the components, at least 2 litres of fresh nylosolv® II per 100 litres distillate must be added.

Checking and re-balancing

Before checking the distillate, it is highly recommended to mix the solution in the distillation tank for about 10 minutes. The temperature of the solution should be between 20 °C and 30 °C (68 – 86 °F).

The following check is done in two steps as described below.

<u>1. Determination of the alcohol content (additive B)</u>

Fill exactly 100 ml of the washout solution (distillate without any solid), which needs to be checked into the 250 ml glass measuring cylinder. Then add exactly 100 ml of the test solution (methanol/water 8:2 by vol.) and mix it by turning the glass cylinder twice. Let the mixture settle at least 15 min. until it separates and shows a clearly visible phase separation line. Read the position of the lower edge of the separation line from the measuring scale on the cylinder.

<u>2. Determination of the hydrocarbon solvent mixture</u>

As result of mixing the test solution with the distillate, there are two solvent phases visible. The upper phase is the hydrocarbon mixture. Open the lid of the prism, take a few drops of the hydrocarbon mixture with the pipette from the upper phase and put on glass plate of the refractometer. The prism must be completely covered by the mixture. Close the lid of the prism with slight pressure and hold the refractometer against a bright light source. By looking through the lens, read the position of the half-shadow, which can be seen on the display. The reading on the scale presents the refraction index.


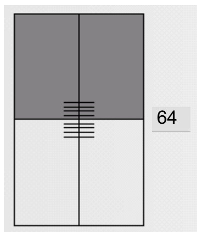

Fig. 6.1 Refractometer and Refractometer display

The found values (phase interface and refraction index) are used to determine the amount of additives required per 100 litres of distilled washout solution, using the correction table.

Use of the correction table

Look for the value of the determined phase interface on the left-hand side of the table. The refraction index can be read in the head of the table. By determining the refraction index and the phase interface, the adjustment parameters can be read in x/y direction - the values always refer to 100 litres of solution.

The values for a correctly adjusted solution are as follows:
Phase interface: 120 ml
Refraction index: 64

Remark: The correction table is shortened in this manual. The complete table is found in the work manual for nylosolv® II.

Accuracy of measurement

Considering the accuracy of the measuring devices and the simple but practical analysis, experience has shown that there may be a tolerance of ± 2 % (volume) per each component. This slight deviation will not affect the washout quality of the solution.

The addition of components according to the table might change (slightly) the ratio of the mixture. This deviation will stay within the tolerance of ± 2 % in most cases. Re-adjustment should not be necessary.

Safety information

The following safety information is taken from the material Safety Data Sheet which needs to be read in full before using nylosolv® II.

Safety information nylosolv® II:
- Mixture of hydrocarbons and aliphatic alcohol
- Flash point 46 °C/114 °F (according to Abel-Pensky), danger class VbF A II, ignition temperature 255 °C/491 °F according to DIN

Avoid contact with the eyes and the skin. Do not breath fumes and mist. Do not eat, drink or smoke in the work place and whilst handling the solution.

Wear safety goggles and gloves during handling and working with solutions.

More safety information is given in the Safety Data Sheet for nylosolv® II.

Refraction index	61			61,5			62			62,5			63			63,5		
Phase-interface	Additive A	Additive B	Additive C	Additiev A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C
108		24	35		22	30		21	23		20	18		18	12		17	7
110		21	34		20	29		18	23		17	18		15	11		14	7
112		18	33		17	29		16	22		14	18		13	11		12	7
114		16	32		14	28		13	22		12	17		10	11		9	6
116		13	32		12	27		10	21		9	17		8	11		7	6
118		10	31		9	27		8	21		7	16		5	10		4	6
120		8	30		7	26		5	20		4	16		3	10		2	6
122		5	29		4	25		2	20		1	16			10	2		8
124		2	29		1	25			19	2		18	5		15	7		13
126	1		29	3		27	6		24	8		22	10		20	12		18
128	7		34	8		32	11		29	13		27	15		25	17		23
130	12		38	14		36	16		34	18		32	21		29	22		28
132	17		43	19		41	21		39	23		37	26		34	27		33
134	23		47	24		46	27		43	28		42	31		39	32		38
136	28		52	30		50	32		48	34		46	36		44	38		42
138	33		57	35		55	37		53	39		51	41		49	43		47

Continues next page

Refraction index	64			64,5			65			65,5			66			66,5		
Phase-interface	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C	Additive A	Additive B	Additive C
108		15		5	16		12	18		16	19		23	21		28	22	
110		13		5	14		11	15		16	16		23	18		27	19	
112		10		4	11		11	13		15	14		22	16		26	17	
114		8		4	9		11	10		15	11		22	13		26	14	
116		5		4	6		11	8		15	9		21	10		25	11	
118		3		4	4		10	5		14	6		21	8		25	9	
120				4	1		10	3		14	4		20	5		24	6	
122	5		5	7		3	10			14	1		20	2		23	3	
124	10		10	12		8	15		5	17		3	20		1	23		
126	15		15	17		13	20		10	21		9	24		6	26		4
128	20		20	22		18	25		16	26		14	29		11	31		9
130	25		25	27		23	29		21	31		19	34		16	36		15
132	30		30	32		28	34		26	36		24	39		22	40		20
134	35		35	37		33	39		31	41		29	43		27	45		25
138	45		45	47		43	49		41	50		40	53		37	54		36
140	50		50	51		49	54		46	55		45	58		43	59		41

Table 6.1 Addition (litre) for 100 litre distillate nylosolv® II (table shortened)

Determination of the solid content (saturation)

The following devices are used for determining the solid content of nylosolv® II:

- Immersion flow cup
- Solid content table
- Stop watch
- Diagram

The flow cup has to be completely immersed in the nylosolv® II so that the cup is filled to the top. Remove the flow cup out of the solution and immediately start the stopwatch and measure the flow-out time.

The actual solid content level can be determined (with a tolerance of ± 0.5 %) by measuring the flow-out time and reading the calibration curve accordingly.

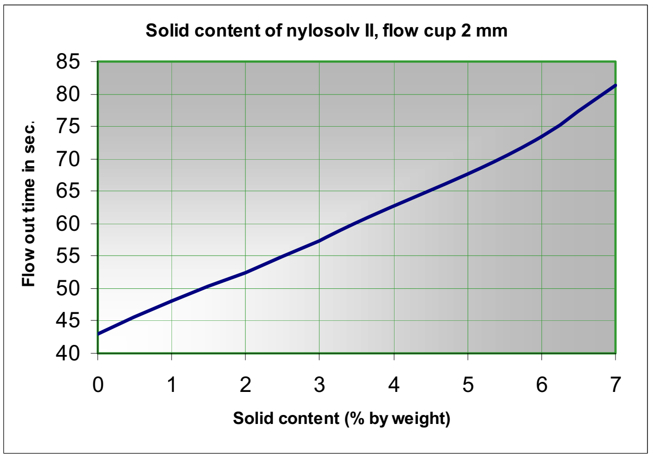

Fig. 6.2 Solid content curve

6.2 The washout solution nylosolv® A

nylosolv® A is also a washout solution which is composed of three components, a mixture of hydrocarbons and alcohol. nylosolv® A can be also reclaimed after use in a suitable distillation unit (under vacuum). Based on the handling and the distillation, the mixture ratio of individual components can change. It is therefore recommended to check the mixture and add the individual components (additives) if necessary.

Additives

The additives can be ordered under the following names:

- Additive A
- nylosolv® A Premix
- nylosolv® A Isomix

nylosolv® A also contains a conductivity agent in order to prevent static charge of the washout solution during handling (e.g. pumping). In order to ensure a constant quality and because some amount of the conductivity agent remains in the sludge in the distillation unit, the individual components might need to be added. In case the mixture solution is correct and there is no need to add any of the components, at least 2 litres of fresh nylosolv® A per 100 litres distillate must be added.

Checking and re-balancing

The checking and re-balancing process for nyloprint® A is the same as for nylosolv® II and is described on page 45.

Use of the correction table

The re-balancing parameters are determined by measuring and reading the phase interface and refractometer index, then finding where they meet in the x/y direction on the correction table. The values in the table always refer to 100 litres of solution.

The values for a correctly adjusted solution are as follows:

Phase interface:	130 ml
Refraction index:	61,5

Remark: The correction tables are shortened in this manual. The complete tables are found in the work manual for nylosolv® A.

Accuracy of measurement

Considering the accuracy of the measuring devices and the simple but practical analysis, experience has shown that there may be a tolerance of ± 2 % (volume) per each component. This slight deviation will not affect the washout quality of the solution.

The addition of components according to the table might change (slightly) the ratio of the mixture. This deviation will stay within the tolerance of ± 2 % in most cases. Re-adjustment should not be necessary.

Safety information

The following safety information are taken from the material Safety Data Sheet which needs to be read in full before using of nylosolv® A.

Safety information nylosolv® A:

- Mixture of hydrocarbons and aliphatic alcohol
- Flash point 64 °C/146 °F (ISO 3679), danger class VbF A II, ignition temperature 200°C/392 °F

Avoid contact with the eyes and the skin. Do not breath fumes and mist. Do not eat, drink or smoke in the work place and whilst handling the solution.

Wear safety goggles and gloves during handling and working with the solution.

More safety information is given in the Safety Data Sheet for nylosolv® A.

Determination of the solid content (saturation)

See the description for nylosolv® II on page 47.

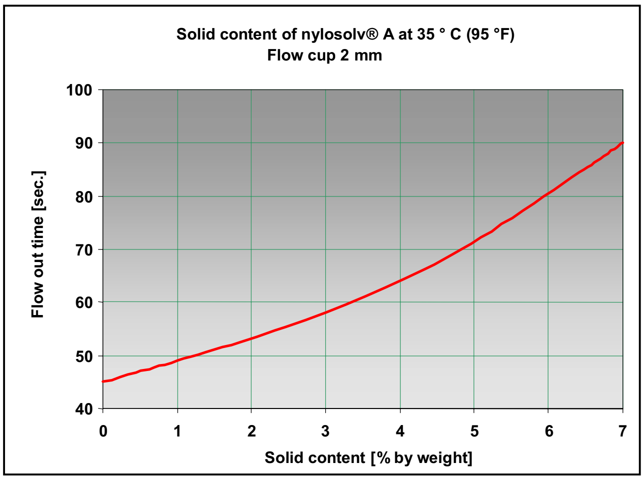

Fig. 6.3 Solid content curve

Refraction index	58,5			59			59,5			60			60,5			61			61,5		
Phase - interface	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*
116	57		24	55		21	54		19	51		15	49		12	46		10	44		6
118	51		23	48		20	47		18	45		14	43		11	40		9	38		5
120	46		22	42		18	41		17	39		13	37		10	35		8	31		4
122	39		21	35		17	34		15	32		12	30		9	29		7	25		3
124	33		20	29		16	28		14	26		11	24		8	23		6	19		3
126	26		18	22		15	21		13	19		10	17		7	16		5	13		2
128	20		17	16		14	15		12	13		9	11		6	10		4	6		1
130	13		16	10		13	9		11	8		8	5		5	4		3			
132	6		14	5		12	4		10			7			5		3	4		5	2
134			13		2	11		3	10		5	9		7	7		8	6		10	4
136		5	15		7	13		8	12		10	10		12	8		12	8		14	6
138		10	16		12	15		13	14		15	12		16	10		17	9		19	8
140		15	18		17	16		18	16		20	14		21	12		22	11		24	10
142		20	20		22	18		23	17		24	16		26	14		27	13		29	11
144		25	21		27	20		28	19		29	17		31	16		32	15		33	13

Refraction index	62			62,5			63			63,5			64			64,5			65		
Phase - interface	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*	*Premix*	*Additive A*	*Isomix*
116	38		2	38			44	7		49	13		52	16		57	23		62	30	
118	32		1	34	1		39	8		44	14		47	17		52	24		57	30	
120	27			29	2		34	9		39	15		42	18		47	24		52	31	
122	22			25	3		30	10		35	16		37	19		42	25		47	31	
124	18	2		20	5		25	11		30	17		32	20		37	26		42	32	
126	13	3		16	6		20	12		25	17		28	20		32	26		37	32	
128	9	4		11	7		16	13		20	18		23	21		27	27		32	33	
130	5	6		7	8		11	14		16	19		18	22		23	28		27	33	
132		7			8		7	15		11	20		13	23		18	28		22	33	
134		11	2		12	1	2	16		6	21		8	24		13	29		17	34	
136		16	4		17	3		19	1		21		4	24		8	29		12	34	
138		21	6		22	5		23	3		25	1		26	1	3	30			30	
140		26	8		26	7		28	5		30	4		31	3		32	1		34	
142		30	10		31	9		33	7		34	6		35	5		37	3		39	1
144		35	12		36	11		37	9		39	8		40	7		41	5		43	4

Table 6.2 Addition (litre) for 100 litre distillate nylosolv® II (table shortened)

6.3 The nylosolv® test kit

Fig. 6.4 nylosolv® test kit

In order to check the ratio of the mixture of nylosolv® II and nylosolv® A, the nylosolv test kit is needed. Flint Group Printing Plates offers this test kit, complete in a case.

This case contains necessary instruments for the test and for the adjustment (re-balancing) of the solvent mixture.

Content of the test kit:

- 1 litre of test solution (methanol/water 8:2)
- 1 pipette for applying the test sample
- 5 pairs of disposable gloves
- 1 pair of safety goggles
- 1 handheld refractometer
- 1 glass measuring cylinder, 250 ml
- 1 work manual with table for balancing the mixture
- 1 safety data sheet for the test solution

6.4 The washout solution perchlorethylene/n-butanol

Perchloroethylene (PERC) is considered hazardous for the environment and human health and therefore restricted in use in European countries.

n-Butanol, also known as normal butyl alcohol, is added to the perchloroethylene to dissolve the slip sheet (substrate, release layer). The usual composition of the washout solvent with PERC and n-butanol is 4:1 and 3:1.

Checking of the mixture ratio

The washout solution can be checked by means of a density areometer in the following measurement ranges:

4:1 = 1.45 – 1.50 g/cm³ at 20 °C (68 °F)
3:1 = 1.40 – 1.45 g/cm³ at 20 °C (68 °F)

The exact mixture ratio exhibits the following values (specific gravity):

4:1 = 1.46 g/cm³ at 20 °C (68 °F)
3:1 = 1.42 g/cm³ at 20 °C (68 °F)

Application note

Perchloroethylene/n-Butanol causes stronger swelling than nylosolv®. This accelerates the washout time but can also cause the so called »orange peel“, which interferes ink transfer.

Safety information

Perchloroethylene is a solvent, which belongs to the group of chlorinated hydrocarbons.

Chlorinated hydrocarbons must not be drained into the sewerage system since they are dangerous to the groundwater.

The Bundesgesundheitsministerium (German Federal Ministry of Health) put PERC on the List III B of substances known to be a carcinogen since 1988. In any case, the handling of chlorinated hydrocarbons requires strict compliance with precautionary safety measures, given by manufacturer of hydrocarbons as well by the authorities of the respective country.

Efficient exhaust of the solvent vapour from the equipment and efficient ventilation of the working area must be guaranteed. It is recommended to exchange the air in the working room about 5 – 10 times per hour.

Due to the strong degreasing effect of chlorinated hydrocarbons, direct contact to the skin makes it brittle and cracked. As a result, it will be susceptible to bacterial and fungal infections. Direct contact of the skin with the solvent must be avoided by wearing solvent tight gloves. Good care of the skin is needed by using a nourishing cream.

The eyes must be protected from solvent splashes by wearing goggles.

Breathing large amounts of solvent vapour has an intoxicating and anaesthetizing effect. This may cause liver damage in the longer term. Clothes saturated in solvent must be removed immediately. Chlorinated hydro-carbon lowers the alcohol tolerance.

Smouldering fire in the presence of chlorinated hydrocarbon may cause the formation of phosgene. Smouldering fire occurs, among other things, as a result of welding and smoking. Smoking is strictly forbidden. Welding must never be done in such an atmosphere.

When a large amount of solvent vapour escapes into the working room, because of a solvent spill, handling accident or by opening the washout unit for cleaning, a respiratory protective filter (e.g. Auer filter A) must be used. Note that such a filter has only a limited absorbing capacity and therefore provides only a short time of protection.

First aid

In the event of an accident with intoxication symptoms or a suspected intoxication despite all measures of precaution, the following »First Aid Measures« must be applied:

In the event of an acute accident, bring the victim to the open air or into a well ventilated room as fast as possible. Take off all solvent-saturated clothes and remove them from the room.

In order to avoid hypothermia, wrap the victim in blankets and call a doctor immediately. Never leave the victim unsupervised. Inform the doctor which solvent was used.

If there is a reason to suspect that chlorinated hydrocarbons did get into the stomach, make sure that the solvent is excreted by vomiting. Do <u>not</u> administrate ricinus oil or milk!

Splashes of chlorinated hydrocarbons in the eyes can be blown out by an aide or fanned out by the victim himself. Then flush well with water. Do not wipe with cloths.

Safety Data

Composition perchloroethylene: n-butanol	4:1	3:1
1. Flash point Abel-Pensky DIN 51755 Danger class	50 °C (122 °F) VbF A II	45 °C (113 °F) VbF A II
2. Ignition temperature according to DIN 51794. Ignition temperature class according to VDE 0165	305 °C (581 °F) T 2	290 °C (554 °F) G 3 (formerly G2)
3. Explosion limits in air lower upper	 43.5 °C (110.3 °F)/7.7 vol. % 59.5 °C (139.1 °F)/16.1 vol. %	 39.2 °C (102.6 °F)/6.9 vol.% 60.3 °C (140.5 °F)/17.6 vol.%

7 Processing aid and application of nyloflex® printing plates

Contents of this chapter:

7.1 Requirements of the negative film

The quality of the film negative is very important and strongly influences the final plate quality, because any tonal value corrections on photopolymer plates are not possible.

Therefore, the negative film must meet following strict criteria:

In order to achieve perfect contact between the negative and the nyloflex® printing plate, the film layer side (emulsion side) must be highly matted.

The film negatives must reach an optical density (opacity) of more than 3.50 $_{log}$ when developed in the film processor. Insufficient opaque negatives can be penetrated by UV light, which results in unwanted polymerisation of the nyloflex® printing plate.

The transparent areas must not have more than 0.06 $_{log}$ of density.

Grey or yellow fog leads to faulty results during the plate exposure. Fog can be caused by:

- Too bright illumination of the dark room
- Too long film developing
- Used up developer
- Too high temperature of the developer
- Too long exposure time
- Insufficient fixing and rinsing

Standardising the film developing by using a film processor is recommended.

Face printing, which is usually done, requires a right reading negative film, reverse printing a wrong reading negative.

Right reading means readable from the matt (emulsion) side of the film. Wrong reading means readable from the gloss film side.

In order to avoid faults in plate making, the following limits should be observed.

Example for a nyloflex® printing plate with a relief depth up to 1.0 mm (0.03937"):

- Isolated dots with a 0.20 mm (0.007874") diameter
- 0.10 mm (0.003937") positive lines
- Halftone value of 2 % (equivalent to a density of 1.70 $_{log}$ measured in the negative)

Example for a nyloflex® printing plate with a relief depth between 1.0 and 3.0 mm (0.03937 and 0.1181"):

- Isolated dot with a 0.75 mm (0.02953") diameter
- 0.30 mm (0.01181") positive lines
- Halftone value of 3 % (equivalent to a density of 1.50 $_{log}$ measured in the negative)

By following all above mentioned points, optimum conditions for correct plate making are achieved. The halftone values can be measured with a trans-mission densitometer. If the available devices are only equipped with a logarithmic display, a conversion to halftone percentages can be done by means of the table below (Table 7.1). The values under the logarithm are the tonal values in %, which appear in the positive image.

All tonal values, which are less than 10% in positive, should be calculated with this table in order to reach more accuracy.

Flint Group Printing Plates provides an actual film list upon request.

0.00 100%	**0.01** 98%	**0.02** 95%	**0.03** 93%	**0.04** 91%	**0.05** 89%	**0.06** 87%	**0.07** 85%	**0.08** 83%	**0.09** 81%	**0.10** 79%
0.11 78%	**0.12** 76%	**0.13** 74%	**0.14** 72%	**0.15** 71%	**0.16** 69%	**0.17** 68%	**0.18** 66%	**0.19** 65%	**0.20** 63%	**0.22** 60%
0.24 58%	**0.26** 55%	**0.28** 52%	**0.30** 50%	**0.32** 48%	**0.34** 46%	**0.36** 44%	**0.38** 42%	**0.40** 40%	**0.42** 38%	**0.44** 36%
0.46 35%	**0.48** 33%	**0.50** 32%	**0.54** 29%	**0.58** 26%	**0.62** 24%	**0.66** 22%	**0.70** 20%	**0.74** 18%	**0.78** 17%	**0.82** 15%
0.86 14%	**0.90** 13%	**0.95** 11%	**1.00** 10%	**1.10** 8%	**1.20** 6%	**1.30** 5%	**1.40** 4%	**1.50** 3%	**1.70** 2%	**2.00** 1%

Table 7.1 Conversion table

7.2 Useful information on processing equipment

Exposure unit

The exposure unit should be switched on for at least 10 minutes before the plate exposure takes place. Only then will the maximum light intensity of the exposure tubes be reached.

The optimum exposure time in order to achieve an accurate relief will change in the course of time. This is influenced by the following points:

The fluorescent tubes loose their UV-light intensity over time; therefore, the operating hours of the tubes should be recorded. A general statement, when and for how long the tubes emit efficient UV-light cannot be given. It depends on the type of tube and the kind of exposure unit. We recommend consultation by Flint Group Printing Plates. The loss of intensity can be measured with an UV-measuring device. The recommendation of the tube supplier regarding the operation life of the tubes should be followed.

Constant cooling causes dust to accumulate on the exposure tubes, so regular cleaning is necessary.

Blackened ends of the tubes (sockets) are signs of age and cause loss of light at these areas.

The tubes can also overheat and loose intensity of UV-light if the exposure unit does not work properly, or some cooling fans fail.

If single tubes fail, the total set of tubes needs to be replaced. Replacing only the failed tube will result in an unequal exposure. Tubes, on which the operating hours are recorded, can be mixed with tubes of similar capacity.

Vacuum foils become dirty, leading to different transparencies in the foil. Regular cleaning of the Vacuum foil is recommended.

Vacuum foils also become aged by UV-light. Therefore, the vacuum foil should be replaced regularly.

The surface of the vacuum plate should be free of reflection. Light reflection can cause faults, especially with thin plates (0.76 mm (0.030”)/1.14 mm (0.045”)).

The vacuum plate should be sufficiently and equally cooled. Overheated vacuum plates cause the polymerisation to accelerate, leading to a faulty exposure.

Washout unit

If the washout unit is out of operation for a long time, the brushes may be hardened and might damage the relief. The washout unit must therefore be run for a few minutes until the solvent can dissolve the dried residue and the brushes are soft again.

It is recommendable to maintain a solid content of maximum 5 % (saturation) in the washout solution.

Washout units should be equipped with a saturation metering device and automated replenishment.

Polymer residue and other contents of the plate material gradually accumulate in the interior of the washout unit. The washout unit should be cleaned regularly.

Because a saturated washout solution causes a longer washout time, more effort to rinse and clean the washed out plate is needed. Replacing the solution in time is necessary.

Automated plate processors must be regularly checked that no rinsing nozzles are clogged and the plush in the pre-drying section is clean. Both tasks are necessary to ensure a plate back which is dry and clean.

Dryer unit

When loading the dryer with plates that are dripping wet, take care of the plates drying in the drawer below, surface faults can be caused. An absorbing underlay might be used.

It is recommended to record the time of plate input on the plate or to use the timer of the drying unit in order to control the drying time.

In order to ensure an even and effective plate drying, the temperature distribution inside the cabinet should be well controlled, also the thermostat control should be as exactly as possible.

Light finishing unit

The light finishing device must be equipped with an efficient and well controlled exhaust system.

Not exhausted ozone, created by the UVC-exposure, causes headaches and creates cracks in the plate surface.

The safety lock, which switches off the UVC-tubes by opening the unit, must never be put out of function.

In case the unit must be opened for maintenance or repair, safety goggles must be worn. UVC-light cause severe sun burn.

As UVC-light causes severe eye injury, even blindness, the eyes must never be exposed to UVC-light.

7.3 Cleaning of nyloflex® printing plates

After finishing the print job and before storing the printing plates for later re-use, careful cleaning of the plates is necessary in order to avoid plate damage. Thinner for inks, which are compatible with nyloflex® might be used. Residue of the ink can cause plate cracking.

Benzene, toluene and ketone must not used to clean nyloflex® plates. Only FE can be cleaned with pure ethyl acetate, but not nyloflex® ACE, AFC, ACT, ART, FAC-X, FAH and FAR. A mixture of ethanol/ethyl acetate 80 : 20 is recommended.

As cleaning agents alone are not effective enough, a soft brush or a lint free cloth can be used for cleaning. Hard brushes, sponges or other aggressive tools must not be used in order to avoid plate damage.

After cleaning and before stacking, allow the printing plates to air dry.

7.4 Storage and re-use of printed plates

The cleaned printing plates should be stored in a cool and dry storage area, away from sunlight. Storage in a box or wrapped should be preferred rather than leaving it unprotected.

If the plates are stored on the cylinder or a sleeve, make sure the plates are protected against sunlight and other environmental influences by wrapping them with airtight and opaque material.

In case the plates are staged for storage, interleaves should be used in order to avoid that the plates stick together.

Because the printing plates usually become thinner when stored for time, the thickness might be out of specification. But this is only true for the overall thickness of the plate, not for thickness tolerances.

The shrinkage of the relief layer within one colour set is equal and comes to rest after around three month. If the set of plates is made from one batch and the plates are equally stored, faultless printing from is possible. This is not the case if one plate of the set must be re-made. The new plate would be thicker than the other plates of the set. In this case, the entire colour set must be made again, at least all plates from the concerned cylinder.

In regard of these circumstances, re-use of nyloflex® printing plates can be done without facing any problems. Other limits are not present if printing conditions, ink, cleaning agent and plate storage are correct.

7.5 Hints for the disposal of plates and plate material

Exposed or used printing plates are usually disposed as commercial waste by a waste collecting company, according to the regulations of the individual country.

The following waste codes are suggested which apply in the countries of the European Union. Arrangements can be made in coordination with the waste collecting company:

Exposed plate pieces: EAK 120105
Type of waste: Pieces of plastic material

Raw plate pieces: EAK 200106
Type of waste: Other plastics

Residues from recycling, specifically the sludge from distillation can be disposed of under:

EAK 070208
Type of waste: Other reactive and distillation residues

Reactive and distillation residue is hazardous waste and must be incinerated in suitable incinerators or disposed in other appropriate ways in agreement with local authorities.

7.6 Surface elongation of plates and film distortion

The surface of a relief printing plate becomes longer in circumference when mounted round on a cylinder. Every nyloflex® plate has a constant elongation factor, which depends on the plate thickness. The elongation factor results from the difference of the following two distances.

- Distance from the centre of the cylinder to the plate surface
- Distance from the centre of the cylinder to the neutral phase of the plate (see Fig. 7.1)

The neutral phase is the point within the plate where no elongation or reduction takes place. This point is usually in the position of the base foil. The adhesive tape and the radius of the cylinder are therefore not relevant. The difference of the distances is determined by the plate thickness.

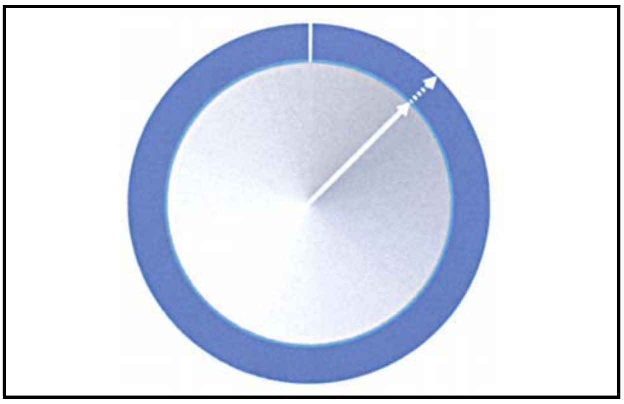

Fig. 7.1

If the nyloflex® printing plate is exposed flat, as usual, the elongation of the relief on the cylinder must be compensated by a reduction of the image on the negative film.

The determination of the amount of reduction (distortion factor) is done by a calculation with the formula below and by means of the elongation constant (C) from the table.

C = Elongation constant
PL = Printing length (repeat)

$$\frac{C \times 100}{PL} = \%\ \text{Distortion factor}$$

The distortion factor is the reduction per cent of the image to be used for the film imager.

Important note

The elongation constants listed in the table are only a guide. Because the image elongation depends on various influential factors such as the proportion of the relief and impression, it is recommended to check the distortion with a printing trial.

Elongation constants of nyloflex® printing plates

Plate	Constant mm (inch)
ACE, AFC, ACT, ART, FAC-X, FAH, FAR, FE, Seal F, Gold A	
076	4.30 (0.1693)
114	6.06 (0.2390)
Seal F 116	5.72 (0.2252)
Gold A 116	5.40 (0.2126)
170	9.90 (0.3898)
230	13.60 (0.5354)
254	15.14 (0.5961)
272	16.45 (0.6476)
284	17.09 (0.6728)
318	19.15 (0.7539)
394	23.94 (0.9425)
432	26.34 (1.0370)
470	28.70 (1.1299)
500	30.60 (1.2047)
550	33.74 (1.3283)
635	39.08 (1.5386)

Table 7.2 Elongation constants

Calculation example of distortion factor

A nyloflex® ART 284 printing plate shall be mounted on a cylinder with a print length of 420 mm (16.54"). The elongation constant of the ART 284 is according to the table 17.09 mm (0.6728"). Based on these numbers the distortion is calculated as following.

$$\frac{17.09 \times 100}{420} = 4.07\ \%$$

The image of negative film needs to be reduced in this case to 100 % - 4.07 % = 95.93 %.

7.7 Checking and measuring of nyloflex® printing plates

One of the most important quality characteristics of flexo printing plates is the accuracy of thickness and thickness tolerances. nyloflex® raw plates are exactly calibrated in production. Finished plates are of the same accuracy. Washing out, drying and finishing influence the thickness accuracy.

It is therefore recommended to check the thickness of the plate with a suitable device.

Raw plates should always be measured with the protective film included. In order calculate the thickness of the finished plate, the thickness of the protective film must be deducted from the total thickness. In addition, the shrinkage of the polymer which takes place with plate processing, depending on the plate type and washout solvent, must be taken into account.

Comparison of measuring results from different devices

Using different measuring devices (construction, size and weight of the measuring foot) will result in different values. But still, they are comparable if the standard deviation is known. If a printing plate is measured with different devices at the same spots, the thickness deviation within the plate will be the same.

This is not true if screens are measured. A measuring foot with higher weight will show less thickness and more deviation by decreasing tonal value. Measurements should be taken only from one single device.

Thickness measurement on solids only

Because screens are more compressible according to their tonal value than solids, the thickness will be lower and unreliable. It is therefore not recommendable to evaluate the plate thickness based on such measurements.

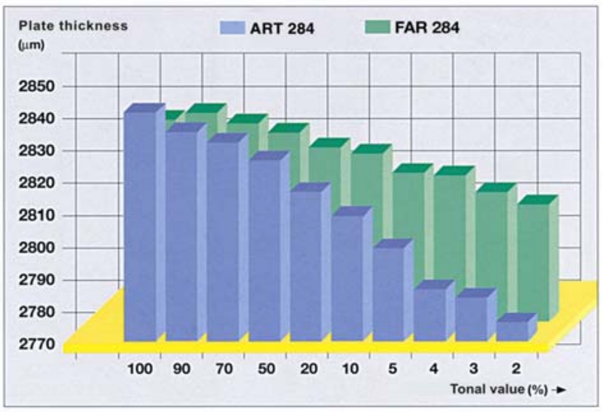

Fig. 7.2 Possible measuring results relating to tonal value

Criteria for measuring devices

The pressure (weight) of the measuring foot should be rather low. 1 N/cm² has been proven to be best in practice. The measuring foot must be flat.

In case the measuring gauge is unable to meet the requirement of low weight, the diameter of the measuring foot should be enlarged in order to spread the weight over a larger area.

For Raw plates, the measuring foot should have a diameter of 3 cm (1.18"). Finished plates are measures with a measuring foot of 1cm (0.4”) diameter. Exact measurements are made on solids only.

These criteria are important because the raw plates are plastic and the finished ones are elastic. The plates become deformed by the shape and the weight of the measuring foot. Different measuring feet and weight result in different values.

The area which needs to be measured must never be smaller than the measuring foot and should be solid.

The plate that is measured should sideways overlap the measuring foot 5 mm (0.2”).

Faulty values maybe occur if the measuring foot overlaps the edge of the solid area, or if halftone areas are measured. Measuring fine lines, letters and highlight areas e.g. 10% tonal value will always result in a minus deviation from the real thickness.

Basically: the lower the weight of the flat measuring foot, the more accurate the measurements are.

The measuring foot must be adjusted exactly parallel to corresponding measuring base. Even a small tilt results in wrong measurements. The threat of wrong measurement increases with larger measuring feet.

The scale reading accuracy of the measuring gauge should be less than 5 µm (0.0002”)

The mounting bracket for the measuring gauge, as well the measuring table must be stable. Wrong measurements may occur even in case of a small impact.

The mounting bracket for holding the measuring gauge should be at least >40 cm (15.75”) long in order to allow also larger plate sizes to be measured. Large plate sizes should not hang over the table becoming deformed. It is crucial that the plate, which needs to be measured, lays flat on the table. A vacuum feature which is built in the measuring base is very helpful.

7.8 Hardness measurements

Hardness checks on finished plate material are generally made in accordance to the standard Shore A DIN 53505. Various measuring device are available in the market. The specimen should be at least 6 mm (0.2362") thickness and 30 mm (1.18") in diameter. The Hardness values are read 3 seconds after the feeler pin is pressed into the relief layer. The optimal plate hardness can only be reached by correct exposure, drying and finishing. Shortening one of these plate making steps results in softer plates. In case the measurements are made on a plate with a thickness less than 6 mm (0.2362"), the result is considered as »on measured on plate« in opposite to »measured according to DIN«.

7.9 Resistance of nyloflex® printing plates to solvents

	ACE	AFC	ACT	ART	FAC-X	FAH	FAR	sprint	FE
Demineralised water	R	R	R	R	R	R	R	NR	R
Demineralised water + 1 % Amin	R	R	R	R	R	R	R	NR	R
Methanol	CR	CR	R	R	R	R	R	NR	R
Ethanol	R	R	R	R	R	R	R	NR	R
n-propanol	CR	CR	R	R	R	R	R	NR	R
Isopropyl alcohol (i-propanol)	CR	CR	R	R	R	R	R	NR	R
n-pentanol	CR	CR	R	R	CR	R	R	NR	R
Methoxy propanol	NR	NR	CR	CR	NR	CR	CR	NR	R
Ethoxy propanol	NR	NR	NR	NR	NR	NR	NR	NR	R
Toluene	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ethanol + 15 % ethyl acetate	CR	CR	R	R	CR	R	R	NR	R
Ethyl acetate	NR	NR	NR	NR	NR	NR	NR	NR	R
n-propyl acetate	NR	NR	NR	NR	NR	NR	NR	NR	R
Butyl diglycol acetate	NR	NR	NR	NR	NR	NR	NR	NR	R
n-butyl acetate	NR	NR	NR	NR	NR	NR	NR	NR	CR
i-butyl acetate	NR	NR	NR	NR	NR	NR	NR	NR	CR
n-hexane	NR	NR	NR	NR	NR	NR	NR	R	NR
Cyclohexanone	NR	NR	NR	NR	NR	NR	NR	NR	CR
Methyl ethyl ketone	NR	NR	NR	NR	NR	NR	NR	NR	R
White spirit 40/60	NR	NR	NR	NR	NR	NR	NR	R	NR
White spirit 140/180	NR	NR	NR	NR	NR	NR	NR	R	NR

R =	resistant.	Swelling < 50 µm and/or hardness loss < 3 Shore A
CR =	conditionally resistant.	Swelling 50 – 80 µm and/or hardness loss 3 – 7 Shore A
NR =	not resistant.	Swelling > 80 µm and/or hardness loss > 7 Shore A

7.10 Reduction of relief deformation by compressible layers

One typical characteristic of flexo printing process is the amount of impression, which is usually more than necessary. The causes for this are the technical conditions of the printing press and thickness deviations of the printing plate.

Over-impression is usually compensated by the plate, which results in dot gain.

Significant improvements can be made by using a compressible cushion layer between plate and cylinder (Fig. 7.3). The compressible layer is made of foamed elastic material, which reduces its volume under pressure.

Examples of such cushion layers are:

- Foam adhesive mounting tapes
- Compressible sleeves
- Cushion for printing on corrugated board

By combining a flexo-plate with one of the above mentioned layers, over-impression is absorbed by the compressible layer. This enables a significant improvement of quality concerning dot gain, open reverses, equal and smooth gradient of tonal values and impression.

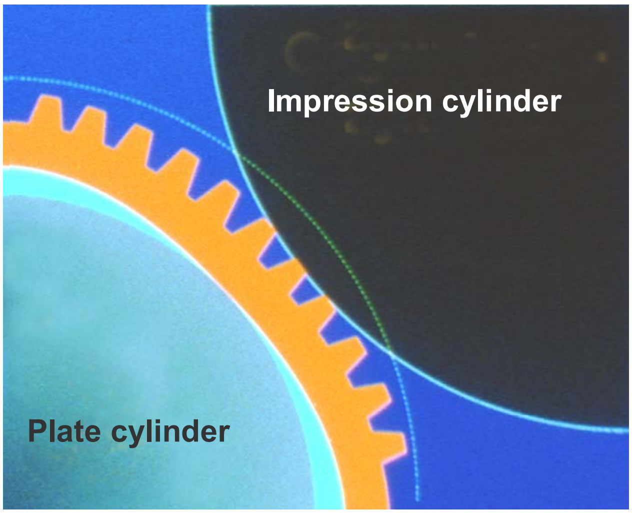

Fig. 7.3 Optimal compressibility of a thin nyloflex® plate and a suitable cushion.

7.11 Test forms

Special test forms have been developed for the different fields of application in flexo printing. These forms allow the user to find out data of the printing press like ink transfer, dot gain and print performance.

These test forms can be made available as a set of films or plates upon request. Also support in evaluating the print can be given.

Also digital files in various resolutions, already in RIP format, are available for plate making.

Standard test forms:

- Test form for label printing 4-colour process
  Screen rulings: 54/60 L/cm
  Size approx. 24 x 40 cm (approx. 9.5 x 15.5")

- Test form for flexible packaging 4-colour process
  Screen rulings: 36/42/48/54 L/cm
  Size: 42 x 60 cm (approx. 17.0 x 23.5")

- Test form for corrugated board 4-colours
  Screen rulings: 16/22/28/32/36/40 L/cm
  Size: 65 x 90 cm (approx. 26 x 35")

- Basic test form 1-colour process
  Screen rulings: 42/48/54/60 L/cm
  Size approx. 20 x 29 cm (approx. 8 x 11.5")

The description of the test forms can be requested from Flint Group Printing Plate.

8 Suppliers of accessories

Available from Flint Group Printing Plates:

- nylosolv® washout solutions
- Test solution and accessories for nylosolv®

Flint Group Germany GmbH
Printing Plates
Sieglestraße 25
D-70469 Stuttgart
Germany
Tel. +49 [0]711 98 16-0
Fax +49 [0]711 98 16-801
E-Mail: info@plates.flintgrp.com
www.plates.flintgrp.com

Further addresses for accessories:

- Distillation units for washout solutions
- Thickness measuring devices
- Vacuum foil/spare part/accessories
- Adhesive tape (also foamed)
- Plate edge sealing material
- Compressible cushion material
- Sleeves (sleeve systems)
- Plate mounting units
- UV-light measuring devices
- Fluorescent tubes
- UV protection films/protection varnishes
- Densitometer

Distillation units for washout solutions

IST
Italia Sistemi Tecnologici
I-41100 Modena
Tel. +39 059 314305
Fax +39 059 315726

D.W. Renzmann GmbH
Industriestraße 1
55569 Monzingen /Nahe
Phone +49 [0]6751 878-0
Fax +49 [0]6751 878-111

Ofru-Recycling GmbH & Co. KG
64832 Babenhausen
Phone +49 [0]6073 7203-0
Fax +49 [0]6073 7203-90

LÖMI GmbH
Am Gemeindegraben 10
63741 Aschaffenburg
Phone +49 [0]6021 418-320
Fax +49 [0]6021 418-330

Thickness measuring devices

J. Käfer Messuhrenfabrik
Postfach 3380
78022 Villingen-Schwenningen
Phone +49 [0]7720 8341-0
Fax +49 [0]7720 21868

Vacuum foil/spare part/accessories

Polysale GmbH
Peter-Henlein-Straße 22
50389 Wesseling-Berzdorf
Phone +49 [0]2232 5799-0
Fax +49 [0]2232 5799-29
Mr. Huthmacher

Adhesive tape (also foamed)

Beiersdorf AG
Tesa Sparte
Unnastraße 48
20245 Hamburg
Phone +49 [0]4049 09-101

Lohmann GmbH & Co. KG
Postfach 2343
56513 Neuwied
Phone +49 [0]2631 34-0
Fax +49 [0]2631 34-6661

3 M Deutschland GmbH
Carl-Schurz-Straße 1
41453 Neuss
Phone +49 [0]2131 14-3236
Fax +49 [0]2131 14-3817

Rogers R/bak
HATEC Handelsgesellschaft mbH
Müllerweide 20 c
22391 Hamburg
Phone +49 [0]40 5 36 04 98
Fax +49 [0]40 5 36 06 05
Mr. Appel

Plate edge sealing material

MR-Chemie GmbH
Nordstraße 61-63
59427 Unna (Massen)
Phone +49 [0]2303 95151-0
Fax +49 [0]2303 95151-10
Mr. Brandt

Compressible cushion material

Rogers R/bak
HATEC Handelsgesellschaft mbH
Müllerweide 20 c
22391 Hamburg
Phone +49 [040] 5360498
Fax +49 [040] 5360605
Mr. Appel

Sleeves (sleeve systems)

Polywest Kunststofftechnik
Saueressig & Partner GmbH & Co. KG
Ridderstraße 42
48683 Ahaus
Phone +49 [0]2561 9321-0
Fax +49 [0]2561 9321-40

Rossini GmbH
Toni Bauer Strasse 8
D-53894 Mechernich
Phone +49 [0]2443 314759
Fax +49 [0]2443 902348

Rotec GmbH & Co KG
Solmsstr 83, 48683 Ahaus
Phone +49 [0]2561 9826-0,
Fax: +49 [0]2561 9826-789

Plate mounting units

BIEFFEBI S.p.A.
Via Frullo, 1
I-40050 Quarto Inferiore BO
Phone +39 051 6069011
Fax +39 051 767508

UV-light measuring devices

Kühnast
Strahlungstechnik
Poststraße 56
63607 Wächtersbach
Phone +49 [0]6053 9650
Fax +49 [0]6053 4636

Fluorescent tubes

Kühnast
Strahlungstechnik
Poststraße 56
63607 Wächtersbach
Phone +49 [0]6053 9650
Fax +49 [0]6053 4636

UV protection film/protection varnish

Schlotterbeck Glasbeschichtungen
Höhenweg 21
73773 Aichwald
Phone +49 [0]711 369850-0
Fax +49 [0]711 369850-22

Densitometer

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