

Industrial Digital Press For Decorative Printing

Eric Van Lancker and Freddy Dolhen
N.V. Chiyoda Europa S.A.
3600 Genk, Belgium

Our Company

Chiyoda Europa is located in Genk, Belgium and belongs to the Chiyoda Gravure Corporation with head-office in Tokyo.

In addition to 8 production facilities in Japan, a European plant has been opened in 1986.

Since 1988, Chiyoda is also printing in Morgantown, P.A., U.S.A.

With its worldwide activities and more than 50 years of company history, Chiyoda has gained a leading position among the world's printing specialists of decorative papers.

Products & Applications

Trendy abstract prints or natural wood reproductions: our collection offers a variety of more than 1000 designs for the furniture industry, all kinds of interior decoration, for paneling and flooring.

Chiyoda prints on classical decorative papers as well as pre-impregnated foils and lightweight papers (30-45 g/m²).

Production and Techniques

On 4- and 5-colour hi-tech rotogravure printing lines we produce decorative papers for melamine impregnation up to 223 cm width. These papers are used for the fabrication of mainly High- and Low-pressure laminates. The first ones are for instance used as kitchen-worktops and laminate floorings, the last ones in carcassing for kitchens, bedrooms, etc....

For the production of decorative foils, Chiyoda disposes of 5- and 7-colour on-line printing and lacquering lines, which represent the world's highest standard in technology and performance. Various lacquer systems are used, among which inerted UV-curing. These foils – so called pre-impregnated papers – are mainly used for low cost furniture, do-it-yourself-market and wall paneling.

Sampling

One has to realize that, before a decorative pattern can be sold to a customer, he first requires sample reels, in 63 cm width, that will enable him to judge the possible success of this specific pattern and colour way. Therefore Chiyoda has 2 laboratory presses where we

can print sample quantities up to a width of 63 cm. These sample-presses are operated each in 3 shifts and represent a very big cost factor.

Sampling at Chiyoda is also done on flat-bed-presses, using engraved laboratory-plates. The output here however is restricted to sheets.

Comparison Between A Classical Helio Laboratory Press and the factory:

Pre-press:

The factory:

- making a digital image of an original manuscript (e.g. real wood, veneer, granite,...) by means of either a digital camera (e.g. type Dicomed) or a big flat bed scanner (e.g. C.S.T.).
- making the digital file endless, eliminate or correct "defects" or other disturbing effects. Separate the file into 3 (or 4) colours. (All by means of e.g. a Barco Creator with Arabesque MultiChannel software).
- saving the digital file electronically or on CD.

Helio Laboratory Press:

- idem above + for each separate colour:
- buying base-cylinders (iron core plus basic copper-layer).
- applying the final copper layer (galvanic process).
- bringing the cylinders to the desired circumference by means of e.g. a Polishmaster or comparable.
- bringing the cylinders to the desired roughness by means of e.g. a Finishmaster or comparable.
- engraving the cylinders electronically, according to the above mentioned digital separated data, by means of e.g. an Helio Klischograph.
- covering the engraved copper layer with a protective chrome layer (galvanic process).
- finishing the chrome layer by means of e.g. a Finishmaster or comparable .
- storing the cylinders in a big, space-consuming cylinder storage hall.

Off-line Preparation:

The factory:

- predict as good as possible an "ink formula" for the job that has to be printed. Here the best way will probably also be to create a "library" of already printed jobs – see further.

Helio Laboratory Press:

- transporting the cylinders from the cylinder storage hall to the set-up area.
- cleaning of the doctor blade holders (3 or 4) and preparing the new doctor blades.
- preparing the cylinders (mounting of the cylinder heads).
- transporting the prepared cylinders and doctor blades from the set-up area to the laboratory press.
- try to predict an ink formula for each colour separation. This is normally done by consulting our “ink formula-library” of sample jobs made in the past, of a design with a similar structure and printed in a more or less similar colour way.
- mixing virgin inks for each of the mainly 4 or 5 print stages according to above mentioned ink formula in the pre-match area.
- bring each ink formula to the desired viscosity by adding water and repetitive viscosity-measurements, until the right viscosity is reached.
- transport the 4 or 5 ink preparations from the pre-match area to the laboratory press.

Press-Preparation:

The factory:

- start ripping the file with the electronical data in the colour of the selected “ink formula”. This will take about 10 min for a file of 630 by 1244 mm. 1244 mm is one of our most used standard lengths of files. In the rotative helioprinting this length corresponds with the cylinder circumference, or, in other words, with the length of the repeat of the design.
- in the meanwhile: filling of the inktanks of the factory with virgin standard inks.
- pass the, for this particular design, best selected basepaper through the press (i.e. the standard paper, coloured in the mass, with the colour way closest to the expected colour of the subcoat).

Helio Laboratory Press:

- mounting of the cylinders (mostly either 4 or 5, i.e. subcoat plus 3 or 4 colours) into the laboratory press.
- bringing the cylinders into “dry register” one to each other.
- mounting of the blades and the – cleaned – ink pans into the press.
- passing leaderstock paper through the press. (In case of the laboratory-rotative-heliopress, we have to start on leaderstock paper - which is far less expensive than good paper stock - because otherwise we would lose too much money during the classical colour matching on the press).
- filling-up each inkpan with the appropriate pre-mixed ink and bring the pans into position.
- start running the cylinders in the stand-by mode to avoid drying-in of the cells of the cylinder.
- starting-up the ovens and waiting until each oven has reached the desired temperature.

- in the meantime, rechecking of the viscosity of the inks and correcting them by adding the appropriate amount of water, if necessary.
- starting of the press and bringing the cylinders into wet-register among each other, as well in length- as in cross direction. (This is a rather difficult job on a rotative heliopress and has to be done in the shortest possible time, as during this process one is creating a lot of wastepaper, which is not good, neither for the environment, nor for the cost of the sampling print itself. Particularly in our branch the cross register is rather difficult to catch, as we have to print on very “open” and absorbing decorative papers, which are developed to absorb at least their own weight (dry on dry) of a 50% waterbased melamine solution in a very short time. The fact that we print with waterbased inks doesn’t make it easier of course. After each printing stage the paper expands and in each oven, we have to make sure that the paper shrinks again in the same ratio as it expanded, by steering either the amount of drying air or the air-temperature).

Colour Matching:

The factory:

Selecting in a “window” the for this design most typical spot (ca. 80 mm in height and 300 mm in width). Working with such “windows” during colour matching will make the ripping time almost neglectable.

- adapting the colours by means of the software until the colour shown on the calibrated Barco-monitor corresponds with the target colour.

(The software will be written by Barco in such way, that, what you will see on the screen, will be the colour of the “end product” - e.g. the paper impregnated and pressed as a High Pressure laminate with a gloss finish LS305 - and not the colour of the printed paper, coming from the factory. This will make colour matching much easier and faster. Of course, we will have to restrict ourselves to 2 or 3 products, each in e.g. 3 gloss levels).

- now the colour matcher-operator selects e.g. 4 alternative colour ways, either automatically or – in most cases preferable – according to his own choice. He selects e.g. 2 different steps more red, less yellow and darker and 2 steps e.g. in the opposite way. By acting this way, we will be able to print the chosen “window” in 5 alternative colours at the time.

(As, for Chiyoda, the main purpose of the factory will be, replacing one or more sampling machines, the software will, in our case, be written by Barco as if we are still doing a tone/key/stipple printing job with mixed colours i.s.o. printing in RGB or CMYK.. This is of course only a software-simulation, but it makes life much easier for the colour matcher-operator, because he still can “think” about his colours as he always used to do. The software will still allow him e.g. to add yellow in the “tone” and make the “key” e.g. more red. This is not only a big advantage for the colour matcher.

Also the result – not just a print, but a by-the- end customer- accepted- finished- product – will be much easier to translate into a usable ink formula: i.e. for each printing stage of the production rotative heliopress, an acceptable start formula. This is of course our final goal. The Barco software specialists are working on a conversion-program to be able to also give us this conversion to our mixed inkformula, made with our inks and printed in the traditional heliomanner).

- starting the factory and just print the 5 “windows” with the alternative colour ways, twice. This allows us to save paper (remember we are on good stock), ink and reduce printhead wear and power consumption (every little bit helps).
- one set of the 5 colour ways will be kept “dry” (this will help us later to judge any eventual further colour adaptations) and the other set will completely be transformed into a finished product. In case of laminates (which is mostly the case on our sampling presses) the printed paper will be impregnated with a water based solution of melamine and dried (twice). After this, it will in one of our laboratory heated hydrolic presses be pressed either together with phenolic impregnated core stocks as a High Pressure Laminate (ca. 80kg/sqcm pressure) or directly onto a particleboard as a Low Pressure “Short Cycle” Laminate (ca. 20 kg/sqcm pressure).
- this laminate will be judged by the human eye under artificial Daylight and Cool White Fluorescent light (or whatever other light source, specified by our customer) compared to the target, which may be real wood, marble, a Pantone chart, textile to fit with the design, etc...
- if the colour matcher-operator feels one of the colours is O.K., he can rip the complete file in the desired colour way (this will take again about 10 min, as already mentioned) and start printing.
- in most of the cases however, he will probably be not completely satisfied with the printed colours (in our branch quality demands are extremely high).

In that case he will electronically create, by “keyboard”-matching the same “window” in 5 alternative colour ways, slightly different from the best one out of the first print, corrected in the colour direction he feels he has to go. (Here the automatic generation of alternative colours just by the software itself, will have no sense anymore). Then again he prints the 5 “windows” with the alternative colour ways twice.

- one set will be compared dry to the remaining dry set of the first print to see the real impact of the changes on the printed paper itself.

The second set will be completely transformed again into the desired end product, which will be judged again by eye under the desired artificial light sources.

If the colour matcher-operator has done a good job, one of the colours will fit to the target. This will most probably be the case, as, thanks to the concept of the factory, in only 2 prints and by making only 2

laminates of 40 x 30 cm, he will have the opportunity (or should we say the luxury) to choose out of 10 slightly different colour variations, all turning closely around the desired colour.

- at this point, the colour matcher-operator will be in the occasion to rip the complete file in the selected colour way. In the worst case, he will have to make a third trial print, again with 5 alternative colours.
- a certain amount of the desired colour can be printed (normally about 200 lm), at a speed of 21 lm/’.

Helio Laboratory Press:

- sticking of some good-stock paper onto the leader stock.
- start running the machine and lower the impression rollers.
- stop the press when the good-stock has passed the last printing stage.
- switch-off the press, including the ovens.
- part of the strike-off is kept as dry paper (to be able to make comparisons afterwards) and the rest of the strike-off will be transformed into the desired end product (impregnated and pressed).
- the end product is compared to the target under the specified artificial light source.
- the colour matcher-operator decides how he will correct the colour and in which stage(s). Therefore he writes down the changes he has in mind on the appropriate form. He weights physically the desired amounts of virgin ink for each stage he wants to correct.
- he adds these ink amounts to each stage of the printing machine, if necessary including an estimated amount of water to keep the viscosity at the desired level (this depends on how important the correcting amount of ink is in correlation of the amount of ink into the machine and also on the type of ink which is added. White e.g. is much more viscous on its own than black).
- the ink is well mixed to make sure that the added inks are well divided over the rest of the formula (very important, because when this is not the case, one will draw wrong conclusions and colour matching will never come to an end. Reason for this is, that part of the correction will in that case only become visible during the next strike-off).
- starting-up of the ovens and wait until the desired temperature is reached.
- in the meantime the viscosity is checked and again corrected if necessary. Good-stock paper is stuck onto the leader stock.
- the press is started and a new strike-off is taken, which can be treated and compared to the target.
- this process continues until the desired colour is almost reached on good stock stuck onto leader stock. Then good stock paper is taken into the press and colour matching continues described as above, until the desired colour is reached.
- now, a certain amount of the desired colour can be printed. Normally this will be about 200 to 300 lm.

- after printing, wash-up of the cylinders, blades and ink pans is done in the press (further cleaning is done, after transport, in the set-up area by means of an ultrasonic bath and in the washroom).

The Advantages of the factory In Sampling Work

Now that you are a little bit familiar with the way we print our colour samples, you will see it is obvious that the factory has an enormous advantage for us over the classical helio rotogravure-baby press:

- **no fabrication of baby cylinders**, saving time, manpower, costs and storage room. Chiyoda spends yearly about 130.000,- €, only on baby cylinders (baby cylinder bases, engraving and manpower).
- **the off-line time will strongly be reduced** from ca. 90 or 120 min (for a 3 or a 4 colourjob) to around 15 to 20 min at the max).
- less obvious, but nevertheless important is, no cylinders, thus **no cylinder storage, no cylinder transport, thus no cylinder damages** (which is a non neglectible yearly cost anyway). Similar for the doctor blades: **no doctor blades**, thus no handling of the doctor blades, thus **no accidents (any cuttings)**.

(Personnel cutting themselves by handling the doctor blades – although well protected by personal safety anti-cutting-gloves – is always the major part of the accidents, causing personnel damage and absence on the workflow).

- most important of course is the press time itself: with the factory, in 2 strike-offs and 2 laminates, one gets 10 different colourways. This will normally largely be sufficient to be at the right colour. As there is almost no handling needed for the factory between 2 strike-offs, except for the making of the laminates, we can estimate the lost time between 2 S.O.'s at about 30 min. This means that after only 1 hour, we will be able to print (in the worst scenario, if we would need 3 S.O.'s, this would become ca. 1h30').

Here we must realize that we benefit simultaneously of 2 advantages: first we get 5 corrections at the same time and secondly, we can always “go back in time”. Let me explain this: sometimes, during a conventional colour matching on a helio-laborator ypress, we are very close to our target, but we still believe we can get a better result by still changing the colour slightly. Sometimes however, at the contrary, this correction ruins the colour and, as we can not “undo” the last change, we sometimes need 2, 3 or 4 extra S.O.'s to get back where we were some hours ago. I don't have to explain this is very discouraging.

So, let us make the calculation: the press-time on the factory to make 200 lm will be around 1 hour (until max 1h30') colour matching time plus ca. 2 x 10 min ripping time plus ca. another 10 min to print about 200 lm at a speed of 21 m/min. In total, we come to a figure

of 1h30' (or 2 hours at the max). On our conventional press, the runtime is shorter of course, because these presses can run faster, but all the rest takes much longer. On a sampling press we have an average of 7 to 8 hours per job (one has to realize that the colour matching time on a sampling press is in average much longer than on a production press, as on the baby press one always has to start from scratch and on a production press one can either start from the formula of the baby press, in case of a first production, or from the formula of the last run, in case of a repeat order).

So, the estimated gain of time – and I believe we really did not exaggerate – will be between 5 and 6h30 per sampling!

In other words, with the factory we will be able to do **3 to 4 times more samplings at the same time**, thus, **the response time to our customers will be much faster** and this is of an extreme high importance in this highly competitive world. The impact on first samplings of a new design will even be bigger, as here we also save the production time of the baby cylinders.

- the impact on the environment will not be neglectable either. As an average, one can say, that on the helio laboratory press one creates 800 to 1000 lm of printed wastepaper (leader stock and good stock together). For the factory we expect **10 times less wasted paper**, as we don't need to regulate the press into wet register and for each strike-off we only just print a little more than 2 x 5 “windows” of 400 by 300 mm each.

As on the factory we don't need to clean any cylinders and pans, contaminated with water based inks and we don't have rest-inks (“drop on demand”), **less wastewater will flow to our water treatment**, which will also have a positive impact on the environment.

- **energy consumption will also be lower** (on those 2 last items, no study was made yet).
- **the space needed for the installation of the factory is about 4 times less, compared to a 5-colour helio sampling press** (independent of the space saved due to the absence of a cylinder storage).
- **only one man will be involved for the operation and daily maintenance of the factory**, whereas for the helio sampling press people from engraving, set-up, pre-match and washroom are involved.
- **used as a sampling press, we arrive at an operational cost for the factory of 2,21 €/m² compared to a cost per produced m² on our 2 classical sampling-presses of 4,75 € (this, of course, including the production of baby cylinders).**

Possibility for Personalization

Out of the last paragraph, although the factory has a big number of advantages, it is also obvious that the factory can not be used, in our branch, as a normal production machine. Therefore the speed of 21 lm/min is far too low

and the cost of the inks (although including print head costs) is still far too high (ca. 150,- €/liter compared to ca. 5,- €/liter now, the last one cylinder-, blade- and impression roller costs not included).

Personalization however will very well be possible:

- one can print very small jobs (which are costwise impossible to print now) of “unique” designs or of a common design with a company-logo incorporated into the design.
- one can also print “endless” designs: 10, 100 or more linear meters with no real repeat in it. This is possible because the.factory can work with variable data. This feature makes it possible to print on a width of only 63 cm the same variations as on a width of 223 cm of a classical helio-production press, as in the last case the circumference of the cylinders (= design repeat) is restricted to a maximum of 1600 mm. So, theoretically, one could already print parquet-floorings on the.factory with the same or even bigger design variation as now on an helio-production press, if, of course, someone is prepared to pay the price for it.

Why Did Chiyoda Choose For the.factory And Not For Another Digital Press:

- due to the Single Pass System with fixed piezoceramic Drop On Demand-heads, a speed of 21

m/ at a width of 63 cm is possible. Lower speeds and smaller widths are of no interest for our application.

- the resolution of 360 DPI in combination with greyscale inkjet heads, guarantee the same print quality as what our customers are used to.
- it is also a must for our customers, that we can print on our normal substrates, because the printed product must behave as a normal helioprinted product in their industrial environment.

Chiyoda only found the combination of these - for us very important - parameters in Barco’s “the.factory”

Summary

- No more need for engraving expensive sampling-cylinders.
- Short lead times: no set-up, no wash-up, no rest-inks.
- Fast colourmatching through “keyboard”-matching and immediate register. Less waste.
- Possibility of printing variable data (very large repeats) and of personalization.