HD Gravure – the new quality standard for today's packaging gravure

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Color brilliance and excellent run stability are just two of the advantages gravure printing has over other printing methods. It also boasts soft vignettes down to 0 percent and ultrafine screens. Contour sharpness on linework, however, is less pronounced in gravure printing, as is detail reproduction on fine graphical elements. This can have a detrimental effect on the legibility of small text. In addition, the proof prints that are generally required are very costly.

Figure 1: HD Gravure is the perfect combination of proven engraving technology and intelligent algorithms

Source: Hell Gravure Systems

HD Gravure addresses these issues in a number of ways. Its ideal combination of innovative technologies achieves high-quality, economical results that previously required a huge amount of time and effort. HD Gravure improves contour sharpness and the reproduction of fine details. What's more, narrow engraving tolerances simplify color matching in print and result in better reproducibility. Certified engraving enhances process reliability in gravure cylinder manufacturing. It also reduces the need for proof prints and thus the costs of print forms (Figure 1) .

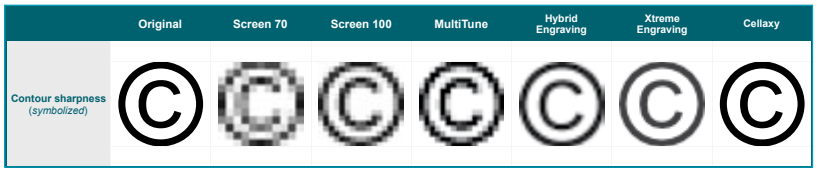
What is engraving quality?

■ Contour sharpness

Traditional engraving is characterized by a sawtooth effect. This is because screen definition and write resolution cannot be selected independently of each other. With the usual screen definitions of 60 or 70 l/cm, steppings are visible with the naked eye – even at a normal viewing distance. Higher screen definitions such as 100 l/cm come at the price of lower printing density and longer engraving times – limitations that do not apply to digital, offset, or flexographic printing. Etching used to be the only solution to this "gravure dilemma" and only in the case of linework engraving. Direct laser engraving is now the method of choice for achieving offset-quality contour sharpness. However the latest developments have also improved the results obtained with traditional engraving. Good to very good contour sharpness is achieved with the new MultiTune adjustment process, and also with the HybridEngraving and XtremeEngraving high-resolution engraving methods (Figure 2).

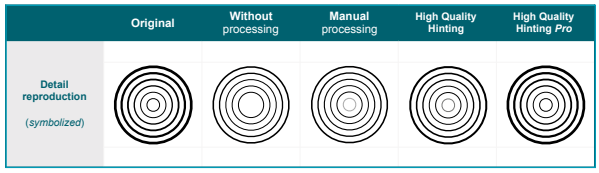
■ Detail reproduction

Fine lines and text always pose a challenge in gravure printing. This is not simply due to the above-mentioned problem with contour sharpness. Another issue in gravure printing is that fine elements are normally reproduced more thinly than in the original. This applies equally to positive and negative elements. Prepress data normally has to be corrected manually in line with specific engraving require-



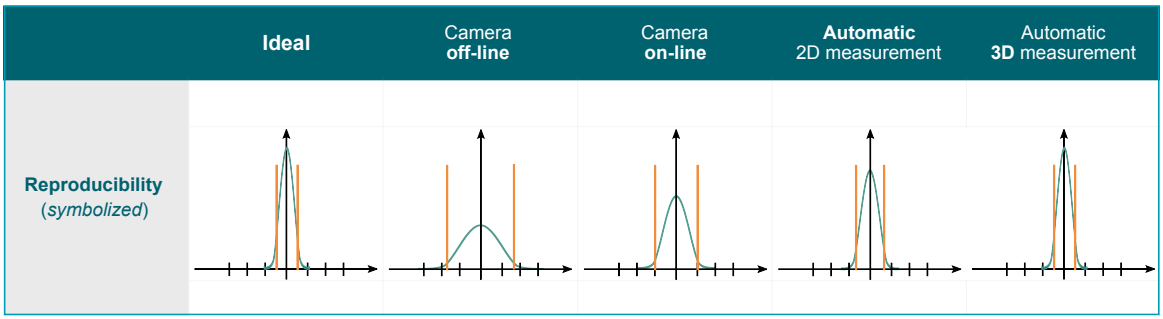
Source: Hell Gravure Systems

Figure 2: Comparison of contour sharpness with different engraving methods



Source: Hell Gravure Systems

Figure 3: Comparison of detail reproduction with various otimizing processes



Source: Hell Gravure Systems

Figure 4: Comparison of engraving tolerances for various calibration methods

ments to combat this effect. Quite apart from the time this takes and the susceptibility to errors, manual correction has another shortcoming – making very fine text thicker can cause open elements to close or individual letters to run into each other. In both cases, this has a highly detrimental impact on legibility. The High Quality Hinting process developed by HELL automatically optimizes engraving data, which ensures precise detail reproduction and optimum legibility of even the smallest text (Figure 3).

■ Reproducibility

In electromechanical engraving, it is essential to calibrate the engraving system prior to each engraving process. This measure – referred to as the "testcut" – ensures the current condition of the engraving copper, system, and stylus has no impact on the engraving result. Narrow engraving tolerances deliver high color fidelity in the proof print and production, and also enable rapid color adjustment on press. A calibration system for engraving machines consists of a camera and an algorithm that uses appropriate engraving system settings to align target and actual values for the engraved cells. Today's engraving machines have an integrated autofocus measuring camera for this purpose. Ideally, the measuring procedure itself is also automatic, but this is not always the case.

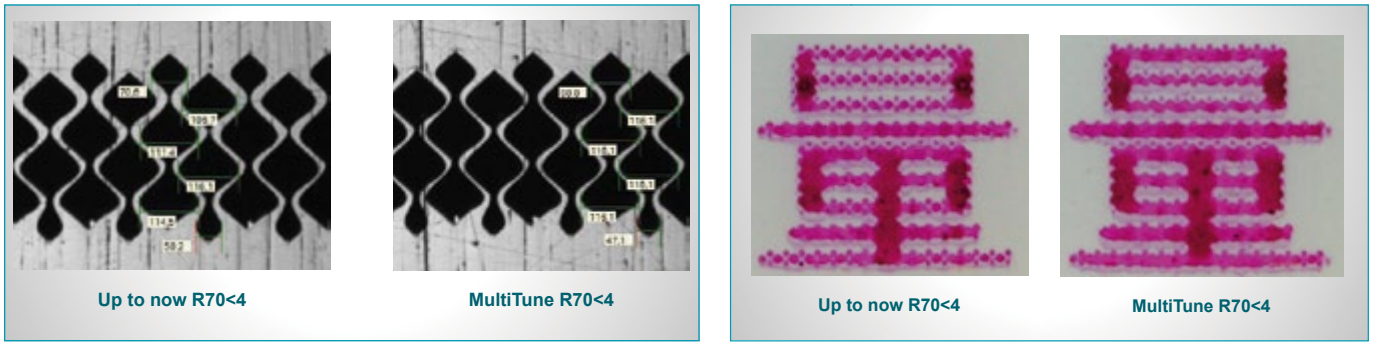
„HD Gravure improves contour sharpeness and reproduction of fine details."

Traditional 2D calibration is based on measuring longitudinal and transverse diagonals of the cell. This method does not adequately factor in geometric distortions or wear on the engraving diamond. Volume-based 3D calibration delivers the most accurate values and results in outstanding repeat accuracy for engraved cylinders (Figure 4).

The technologies in detail

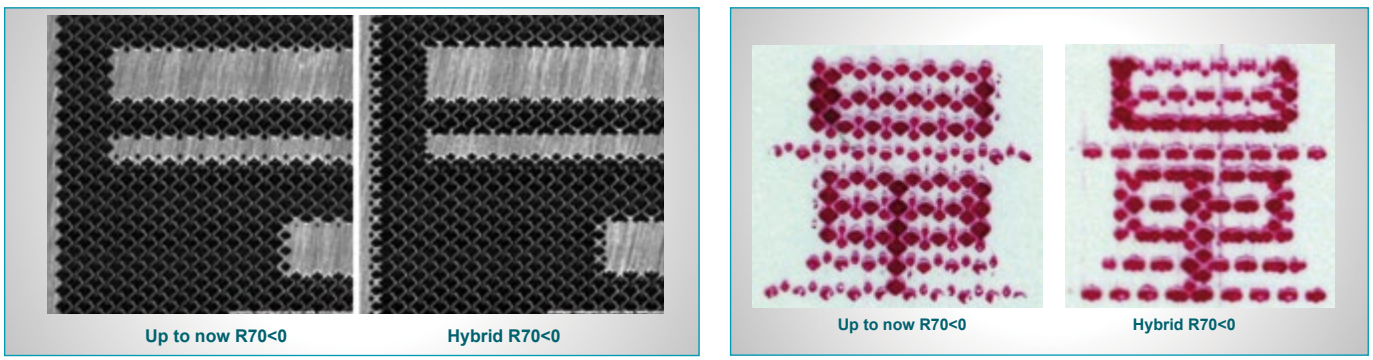
■ MultiTune

MultiTune is a newly developed adjustment process for engraving systems. The way the engraving



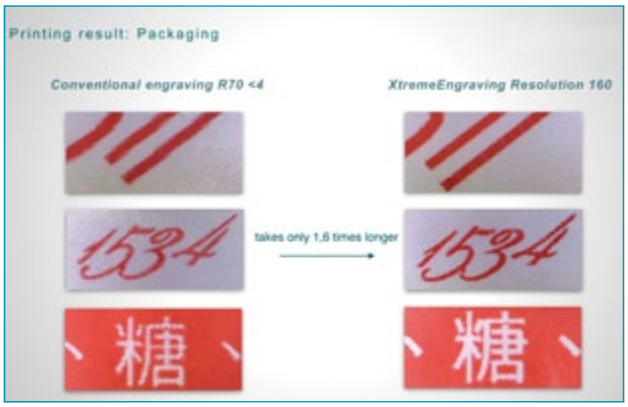
Source: Hell Gravure Systems

Figure 5: MultiTune achieves the target cell sizes much faster, the contour looks more closed. A larger amount of ink is transferred during printing, which in turn produces a stronger contour



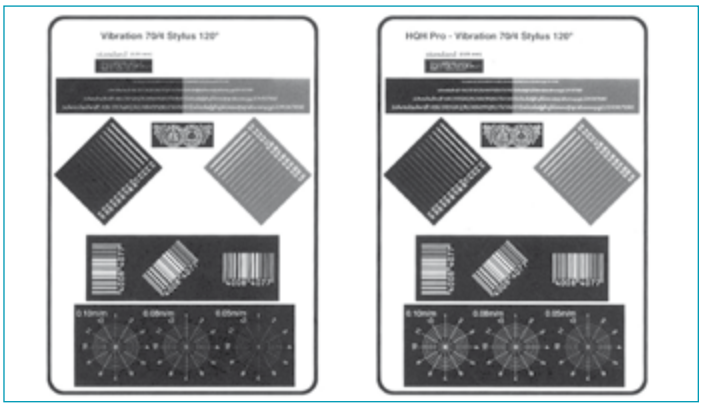
Source: Hell Gravure Systems

Figure 6: HellHybrid achieves double the engraving resolution in twice the engraving time



Source: Hell Gravure Systems

Figure 7: The results of XtremeEngraving speak for themselves



Source: Hell Gravure Systems

Figure 8: Gravure-specific data optimization with High Quality Hinting (without HQH on the left and with it on the right) boasts a unique combination of functions

system behaves can now be adapted more precisely to the relevant engraving screen, which results in sharper contours as well as less dragging and ringing. MultiTune improves the quality of horizontal contours and has no impact whatsoever on the machine's engraving speed or productivity (Figure 5).

■ HellHybrid

HybridEngraving is an engraving method that combines excellent contour definition with high productivity.

The principle involves superimposing an offset engraving on the standard engraving, which creates very fine edge cells with double the resolution. The total engraving time is twice that of standard engraving (Figure 6).

■ XtremeEngraving

XtremeEngraving is a high-resolution engraving method that makes it possible to select screen definition and write resolution independently of each other, combining excellent contour definition with a high printing density. Boasting a write resolution of up to 540 l/cm, XtremeEngraving achieves results of close to laser engraving quality.

It can also produce coarse screens with cross-diagonals of over 900 µm and engraving depths of up to 110 µm. XtremeEngraving is only used on solids and the engraving time depends on the resolution selected (Figure 7).

„Narrow engraving tolerances deliver high color fidelity in production."

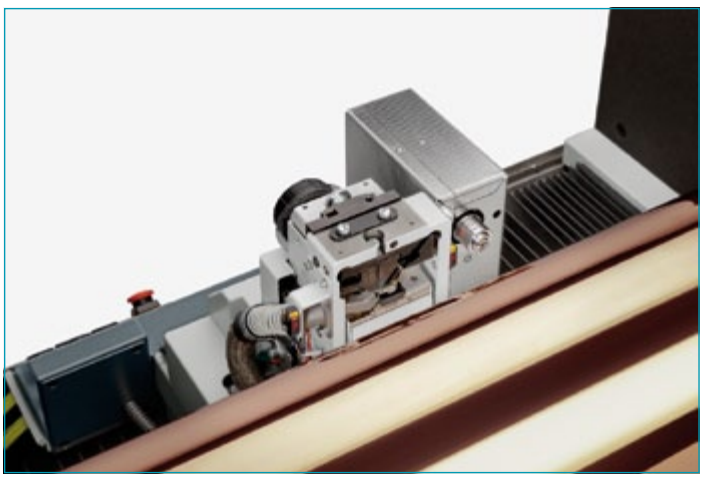
■ High Quality Hinting

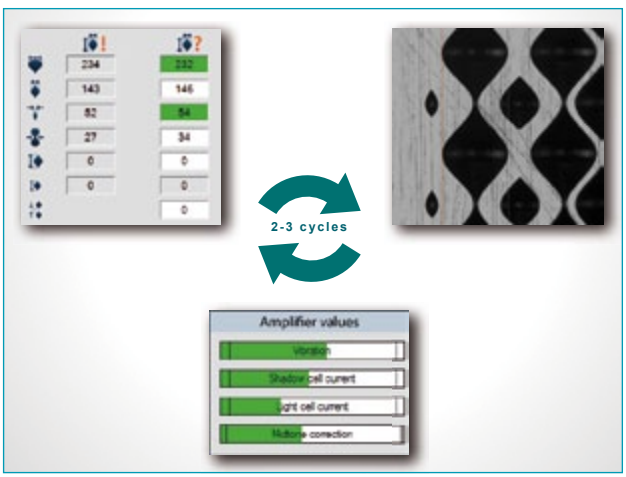
High Quality Hinting (HQH) is a data optimization process that improves the reproduction of fine text and line elements in gravure printing. Prepress data is normally corrected manually in line with specific engraving requirements. HQH automates this process by examining engraving data for fine lines and text and then automatically optimizing these elements according to preset criteria. The intelligent character recognition function ensures that the characteristics of letters and symbols stay the same. Fine text thus remains legible and small graphical elements do not vanish in print. High Quality Hinting has no impact on the engraving speed or productivity of the engraving machine.

HQH is available in three versions. HQH classic optimizes data prior to engraving on a separate computer. HQH embedded is integrated as standard in all new HelioKlischograph systems and optimizes data on the fly during the engraving process. HQH Pro works with high-resolution data and advanced algorithms, which results in a further significant improvement in output quality (Figure 8).

■ CellGuard

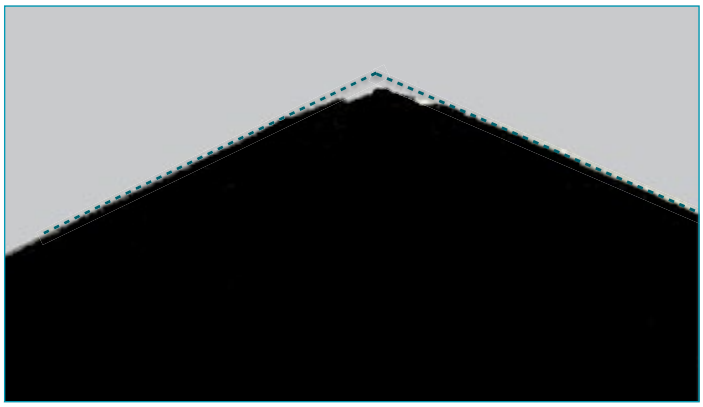
CellGuard is the automatic calibra-





Source: Hell Gravure Systems

Figure 9: Today's engraving machines are equipped with an autofocus camera (left). CellGuard automatically measures the test cells and sets the engraving amplifier both quickly and precisely (right)



Source: Hell Gravure Systems

Figure 10a: Conventional calibration does not factor in wear on the engraving diamond

Source: Hell Gravure Systems

Figure 10b: CellEye ensures reliable color results that match the original with the proof print and on press. Greatly simplified color matching on press dramatically reduces the amount of waste. Serials can be printed in succession with virtually no additional color matching

tion system for the HelioKlischograph. It combines measurement using an autofocus camera with an algorithm that automatically aligns the target and actual engraving values. CellGuard logs all measurements and camera images, which means they are permanently available for quality control purposes (Figure 9).

■ CellEye

Conventional calibration systems for engraving utilize 2D measurements and do not factor in geometric distortions of cells or the level of wear on the engraving diamond. CellEye, on the other hand, uses volume-based 3D measurement, which is not subject to the same limitations.

CellEye meets the prerequisites for production to the narrowest of tolerances, which lays the foundation for successfully tackling the latest quality challenges such as first-time-right prints, dispensing with a proof print, and seven-color printing (Figure 10).

■ CellCreator

CellCreator is an optional tool for direct laser engraving of gravure cylinders. It generates Helio-compatible screens as a basis for imaging linework and contone cylinders that can easily be combined with electromechanically engraved cylinders. The option of assigning a separate cell description to each density value is unique. It means a screen structure can be more conventional (depth modulated) or autotypical (area modulated) depending on the job. Different cell geometries (e.g. hexagon or diamond shapes) are possible as well. This paves the way for smooth vignettes on aluminum surfaces and perfect ink layers when printing metallic colors.

CellCreator runs on the Cellaxy direct laser platform, which also means the quality features available extend far beyond electromechanical engraving. Examples include algorithm-controlled variation of cell geometries to improve vignettes (Supercell), shaping laser pulses for better depth control (PulseShaping), automatic compensation of specific weaknesses in the cylinder geometry, and resolutions of up to 5,080 dpi (Figure 11).

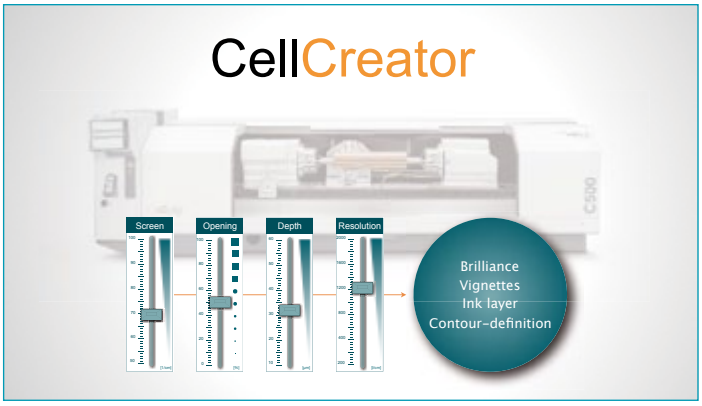
■ Certified Engraving

Certified engraving improves process reliability in cylinder manufacturing and will significantly reduce the need for proof prints. The critical production parameters for cylinder and engraving are measured automatically in the engraving machine for this purpose. One particular highlight is automatic documentation of pre-determined measuring points on the cylinder surface. All measurements are included in a report that can be structured in line with a customer template. Certified engraving will be available from January 2020.

Comparison of technologies

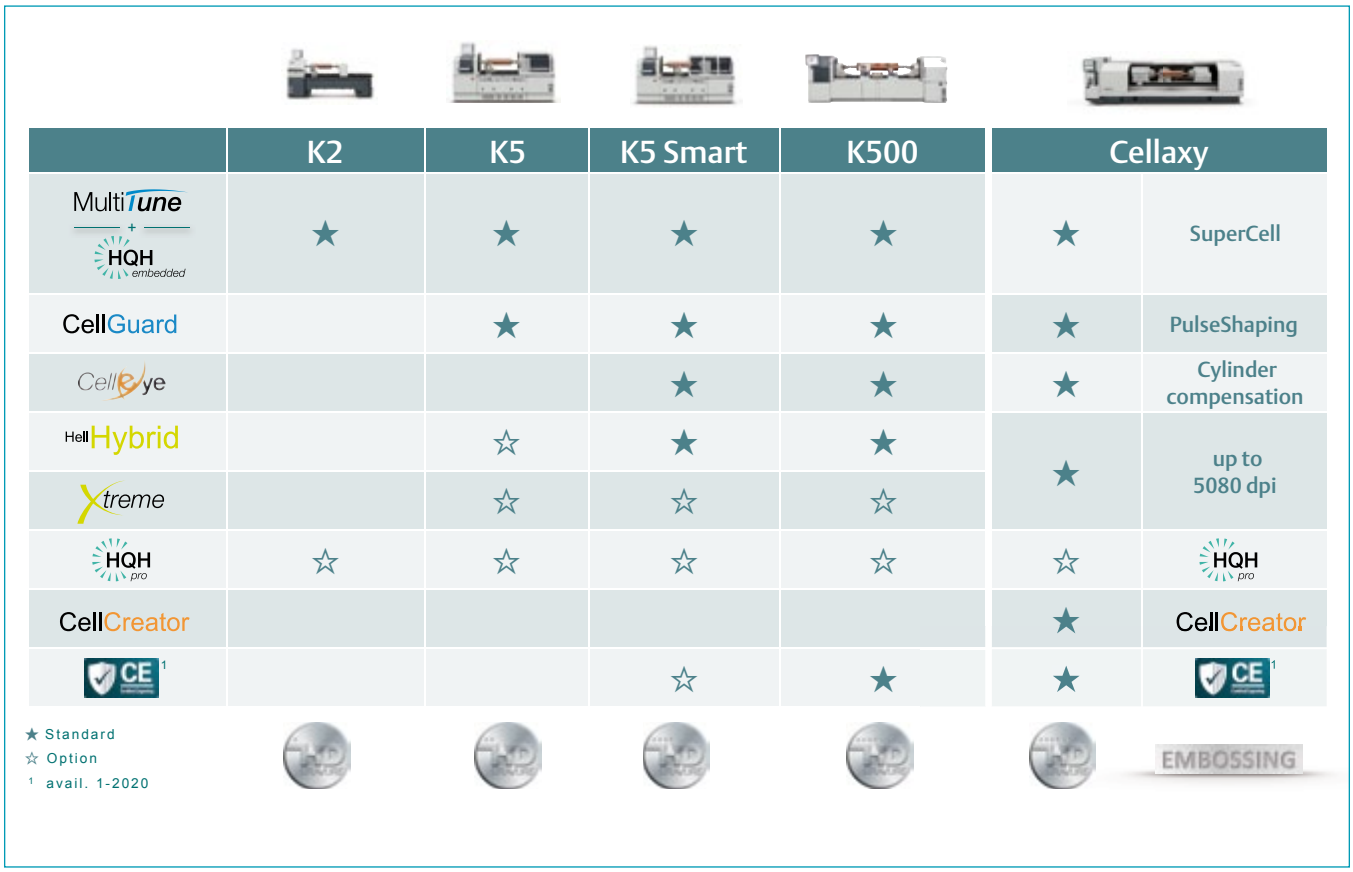
MultiTune and HQH are integrated in all new HelioKlischograph systems as standard for entry-level HD Gravure and can be retrofitted on many older systems. The benefits of these processes in terms of contour sharpness and detail reproduction can be harnessed without any impact on the engraving time.

CellGuard is the 2D calibration process for HelioKlischograph systems. It can measure engraved cells automatically and perform calibration processes. However, the CellEye 3D calibration process achieves the narrowest engraving tolerances. HellHybrid and XtremeEngraving



Source: Hell Gravure Systems

Figure 11: CellCreator enables users to adapt gravure forms very specifically to customer requirements and fully utilize the potential of direct laser engraving



Source: Hell Gravure Systems

Figure 12: HD Gravure gives cylinder engravers the freedom to decide the quality level of production operations for themselves

are capable of improving contour sharpness further still. The very easy to use HellHybrid doubles the engraving resolution in twice the engraving time, produces sharp edges and works in both linework and continous tone applications. XtremeEngraving multiplies the engraving resolution, with the engraving time extended accordingly. XtremeEngraving is a more universal solution than HellHybrid, but it only works in solids. In addition to flexible packaging, it is also suitable for microtext and technical cylinders. Cellaxy engraves with a resolution of up to 5,080 dpi and maximizes contour sharpness.

Detail reproduction can be enhanced further still with HQH Pro, which can also be used in combination with XtremeEngraving and Cellaxy. HQH Pro has no impact whatsoever on the engraving machine's productivity.

CellCreator is an exclusive direct laser engraving tool and the key to perfect line and contone cylinders, which can easily be combined with electromechanically engraved cylinders. Certified engraving improves process reliability and will significantly reduce the need for proof prints. It will be available for all high-end engraving systems.

One thing all the processes covered have in common is that quality-relevant production parameters can be controlled and archived using a job ticket (Figure 12).

Summary

HD Gravure from Hell is the perfect combination of proven engraving technology and intelligent algorithms that enhance quality. New engraving machines are already equipped with MultiTune and High Quality Hinting as standard for significantly improved contour sharpness. These technologies constitute the entry level for HD Gravure. HybridEngraving, XtremeEngraving, and HQH Pro are options that reproduce ultra-fine details with sharp edges. When it comes to premium machines, CellGuard and CellEye simplify color adjustment on press and improve reproducibility. CellCreator elevates direct laser engraving to high-end HD Gravure by adjusting gravure forms very specifically to the relevant printing requirements – an absolute first. Certified engraving boosts process reliability throughout the gravure cylinder manufacturing process and reduces the need for proof prints.

„HD Gravure is the perfect combination of proven engraving technology and intelligent algorithms."

MultiTune and HQH make it easy to get started with HD Gravure while maintaining the full productivity of engraving systems. The modularity and combination options of all the various methods and processes give cylinder engravers the freedom to decide the quality level of production operations for themselves. Many older systems can also be retrofitted with HD Gravure (Figure 13).

As a result, HD Gravure provides impetus for the major developments in packaging printing – from finer text and shorter print jobs to first-time-right prints, seven-color printing, and efforts to find an alternative to proof prints.

Figure 13: HD Gravure ensures problem-free compatibility, producing top-quality linework and contone cylinders regardless of whether conventional or laser engraving is used

Source: Hell Gravure Systems