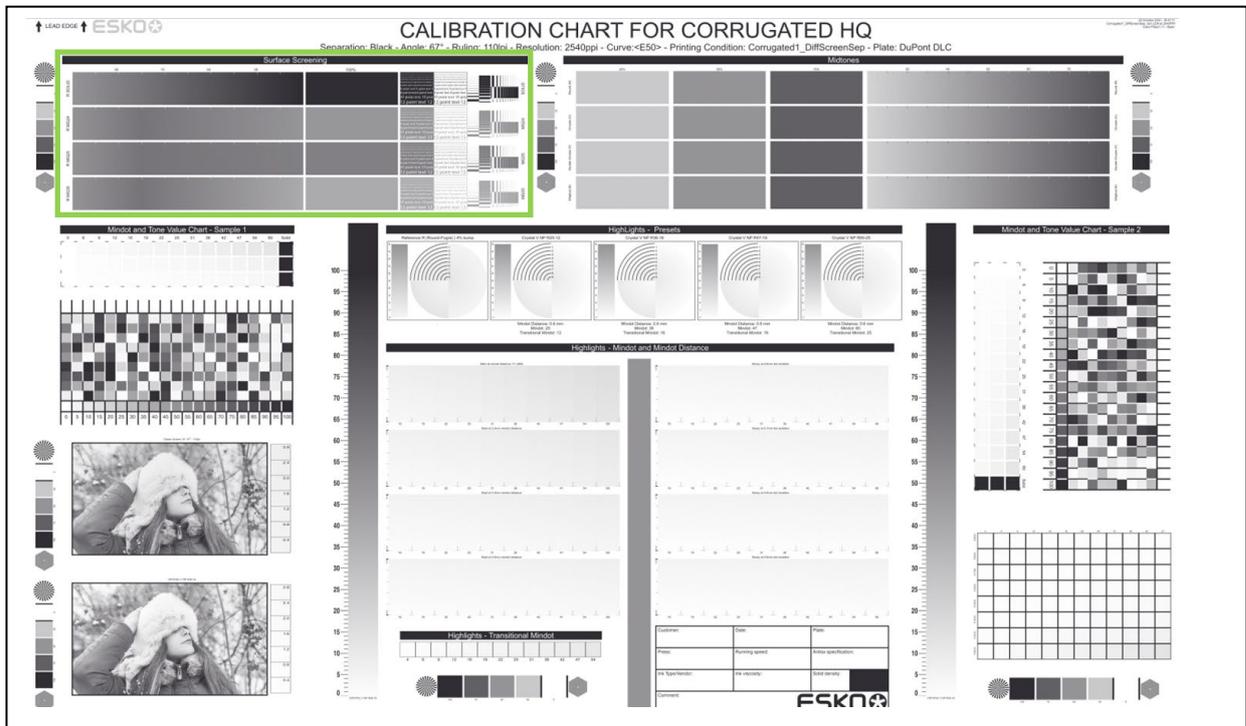


Print Control Wizard

Standard Operating Procedure:

How to Select Corrugated High Quality
Post Print Screening?

1. Surface Screening and Dot Shape



On the top left area of your printout you will find an area marked as “Surface Screening”. These patches marked above need to be checked for different aspects:

- Washboarding
- Trailing edge
- Ink lay down
- SID

! Sometimes surface screening is not actually beneficial and can even cause problems. If that is the case, you should not use it.

1.1 Washboarding

When printing on the corrugated substrate, its board structure might become visible through the ink layer, showing as darker and lighter lines. This is called washboarding (or fluting). You should choose the pattern with the least washboarding.



1.2 Trailing Edge

For some printing conditions (including some corrugated applications), the ink film has gaps near the edge of a solid area. If this happens, barcodes may not be readable, so you should not choose a pattern with a trailing edge.



1.3 Ink Lay Down

The ink lay down needs to be good: even and without mottling (cloudy structure) or pinholes. If that is not the case you should not use the pattern.



1.4 Transition

The gradient should be linear, free of tonal jumps and without tone reversal.

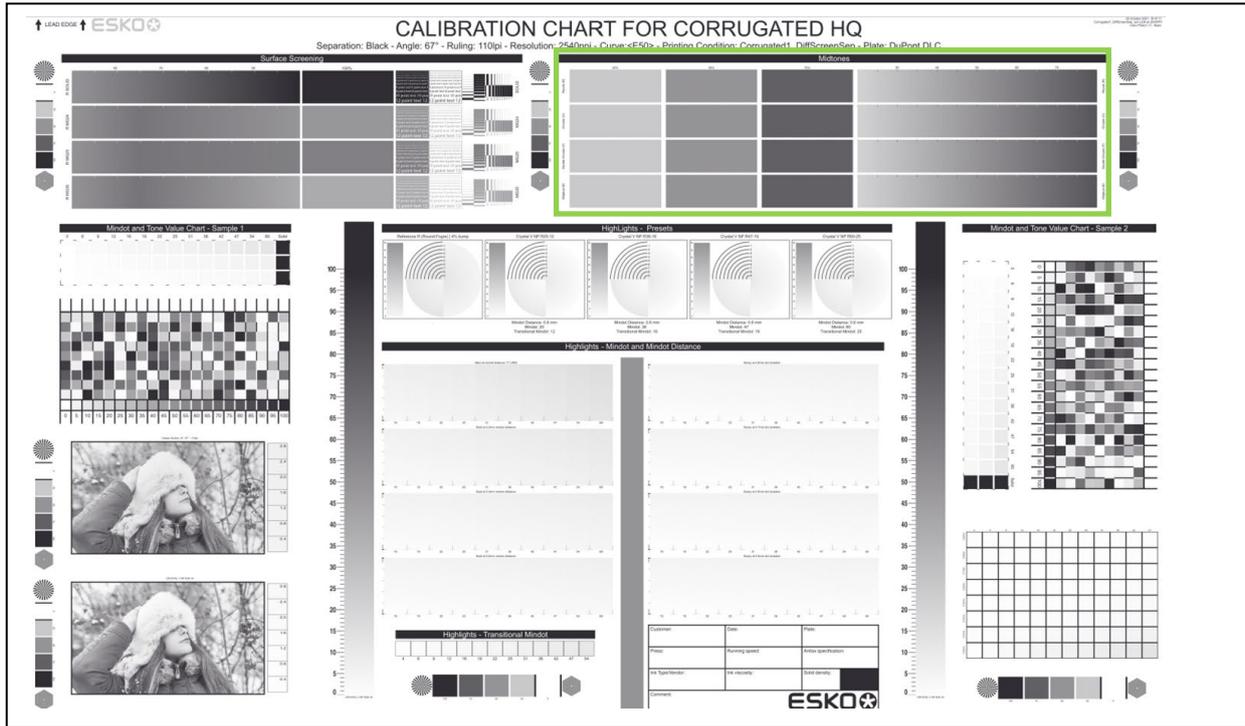
1.5 Linework and Text

Pay attention to the small elements (lines and text). If they are not stable or readable enough, you should not use this pattern.

1.6 Solid Ink Density (SID)

After you have excluded the patterns presenting any issue mentioned above (washboarding, trailing edge, ink lay down...), you should check the solid ink density (SID) of the remaining patterns. You should measure this with a densitometer (for example an X-Rite eXact), and choose the pattern that has the highest solid ink density.

2. Dot Shape



On the top right of the printout, you will find an area marked as “Midtones”. Different dot shapes are used here:

- Round (R)
- Circular (C)
- Double Circular (F)
- Elliptical (E)

They have different behaviors/shapes at the tonal value where the dots are starting to connect. This causes a visually different appearance (independently of the surface screening used). Please check the gradient for:

- mottling
- smoothness
- dot bridging

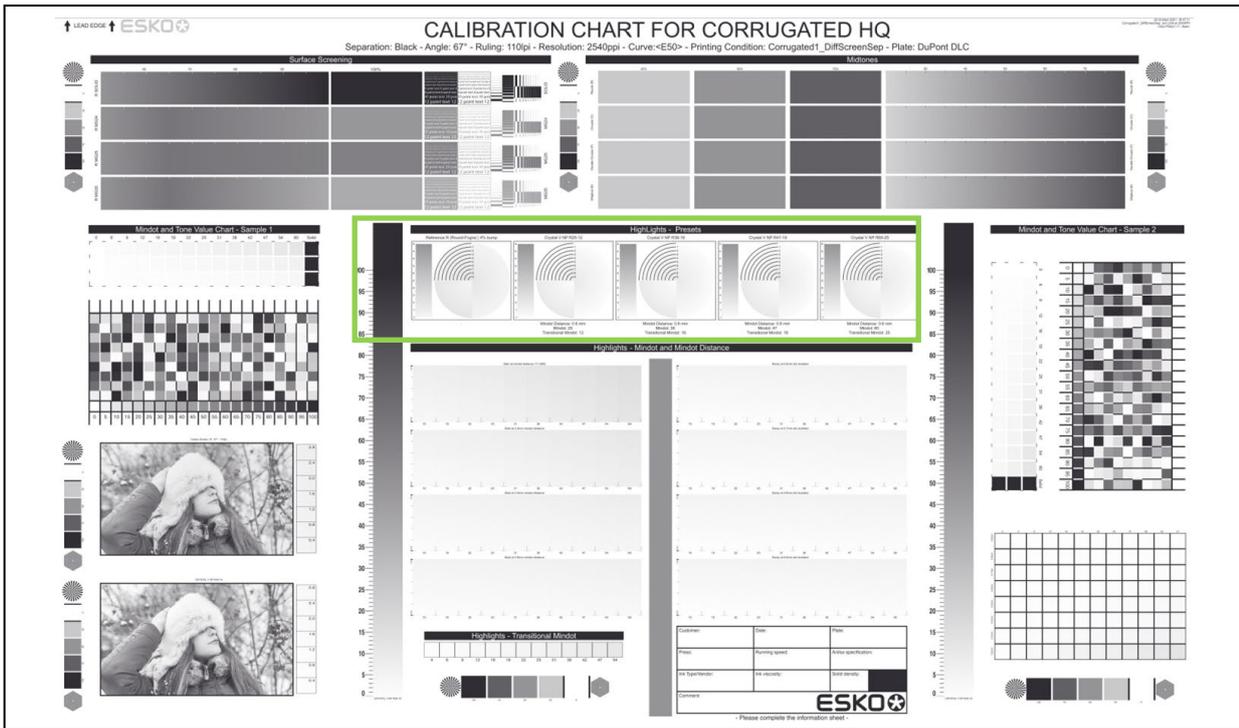
and select the cleanest pattern.

!

If you decide to use another surface pattern or dot shape than the one you used to make this chart, you should stop here, enter the new settings and start over again (make a new chart), otherwise the results will be inaccurate.

To see what you used to make the chart, check the label of the bottom sample picture, in the lower left corner of the chart. For example, “Crystal V NP **MG24 R36-16**” used **MG24** as surface pattern and **R** (Round) as dot shape.

3. Highlights Presets



The highlights of Corrugated High Quality printing conditions are set by 3 parameters: Mindot, Mindot Distance and Transitional Mindot. A range of optimal values for these parameters has been found by experience, resulting in screen presets.

In the center of the chart you will find an area marked as “Highlights – Presets”, with 5 circular gradients. The first circular gradient is screened with standard screening and used as a reference, the others use preset Crystal V screens.

Visually inspect the gradients and select the one that prints with the best balance between good fade-to-zero (larger mindot) and least graininess (smaller mindot). The values of the 3 parameters are indicated below the circular gradient. Copy the 3 values to Color Pilot/Print Control Wizard in the “Set Highlight Settings” wizard step.

Crystal V NP R47-19

Mindot Distance: 0.6 mm
Mindot: 47
Transitional Mindot: 19

Set Highlight Settings

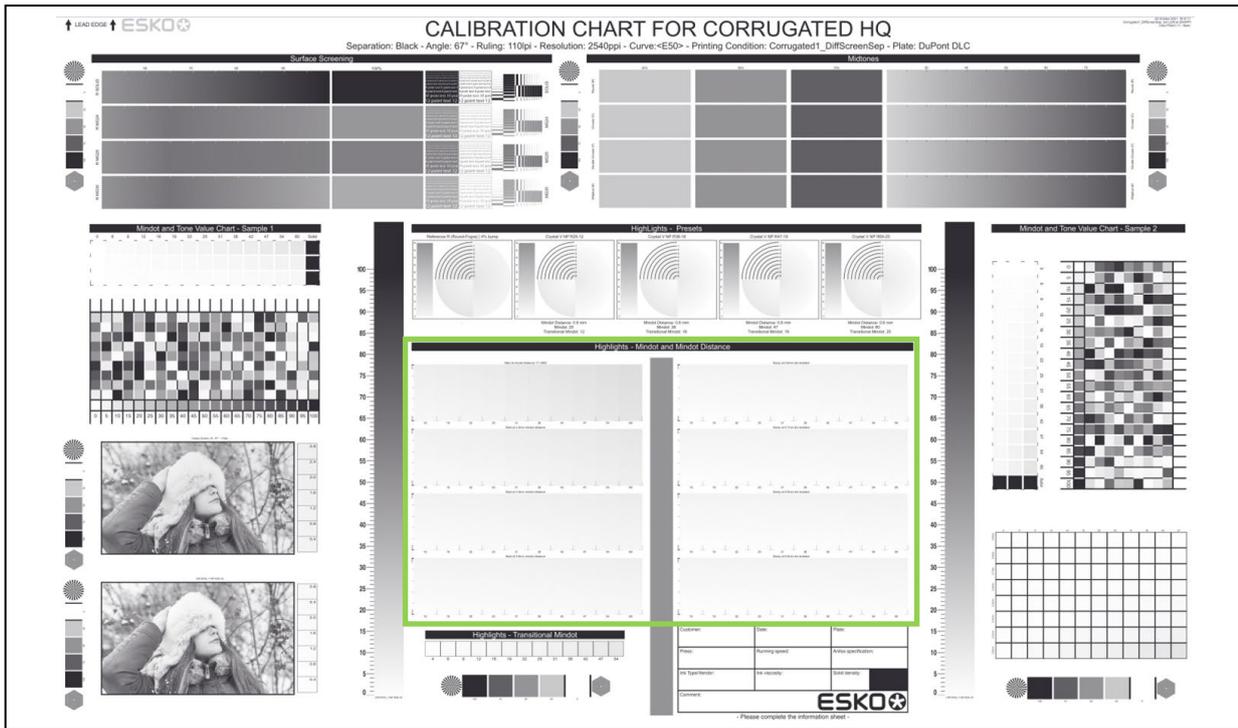
For guidelines on how to make the optimal selections from your

Mindot Distance:

Mindot:

Transitional Mindot:

4. Highlights Mindot and Mindot Distance



The highlight parameters can also be determined more precisely. On the Corrugated High Quality chart, below the presets, you can find an area called “Highlight Mindot and Mindot Distance”, where Mindot and Mindot Distance parameters can be determined more accurately.

Mindot size:

- To print lighter tints, a classic screen uses smaller dots, but due to plate making and printing limitations there is a minimum dot size to keep. This minimum dot size limit is set in the adjustment curve: the curve “bumps” the highlights up so that smaller dots are not used, but this bump also causes highlights to print darker.
- Alternatively, stochastic screening can be used to print lighter tints. The screen goes from AM (amplitude modulation = the dot size changes to alter the tone) to FM (frequency modulation = the number of dots changes to alter the tone).

From a certain gray level onwards, the dot size is no longer reduced to further lighten the tone, but instead dots are gradually removed from the screen grid.

The point where AM changes into FM is called the transition point.

The dot size at which this transition starts is the “Mindot size”. This parameter is critical because a mindot size that is too small prints unstably, and a mindot size that is too big prints grainy.

Mindot Distance:

The downside of using FM to modulate tone in highlights is graininess. By lowering the number of dots to obtain lighter tones, the distance between the dots increases, making the dots more visible to the human eye.

Also, when the distance between the dots increases, the floor between the 3D dot structures formed on the flexo plate becomes deeper, making the structures weaker against the printing pressure.

Because of this, there is also a lower limit for FM modulation: the distance between the dots must be kept below a specific “Mindot Distance”. This limit is also set from the “Minimum” gray level of the adjustment curve. However, this “minimum” no longer corresponds to a minimum dot size but to a maximum allowed “Mindot Distance”.

The “Mindot Distance” and “Mindot Size” parameters are dependent from each other: when a large “Mindot size” is selected, dots can be used further away from each other because they are stronger. When a small “Mindot size” is used, dots must be placed closer to each other. This “Mindot Distance” – “Mindot Size” relation is mainly

dependent on the plate's hardness and thickness. When using soft and/or thick plates, mindot size and distance influence each other more compared to plates that are harder or thinner.

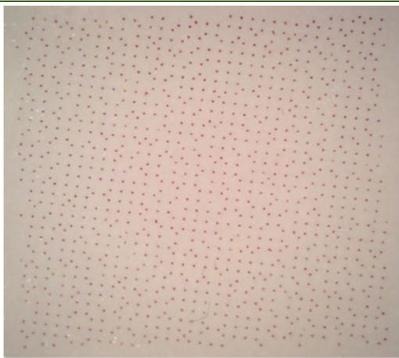
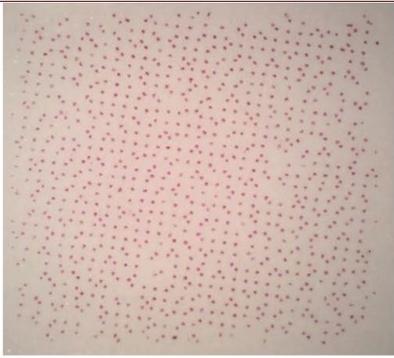
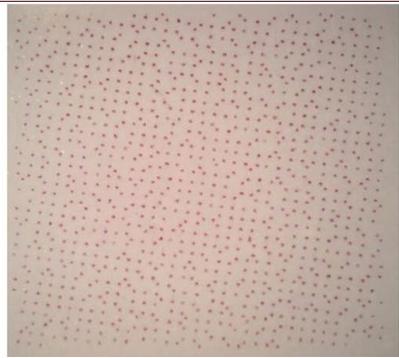
Finding the correct values for both parameters can be challenging. It is finding a balance between lightest density and graininess, also keeping in mind stability. The best way to determine these parameters is by visually inspecting printed samples:

There are seven rows of strips, each row using a different mindot distance (from 0.3mm to 0.9mm). Within a row, each strip contains different gradients going to zero, and each gradient uses a different mindot size.

Check which of the gradients is printing stably to the edge, with:

- no hard edge (the highlights fade to the substrate color)
- no tone reversal (the highlights print linearly)
- dots printed with same size and shape

Use a magnifier or microscope to check this. You can use the images below as reference (for simplicity, the images don't show a wedge).

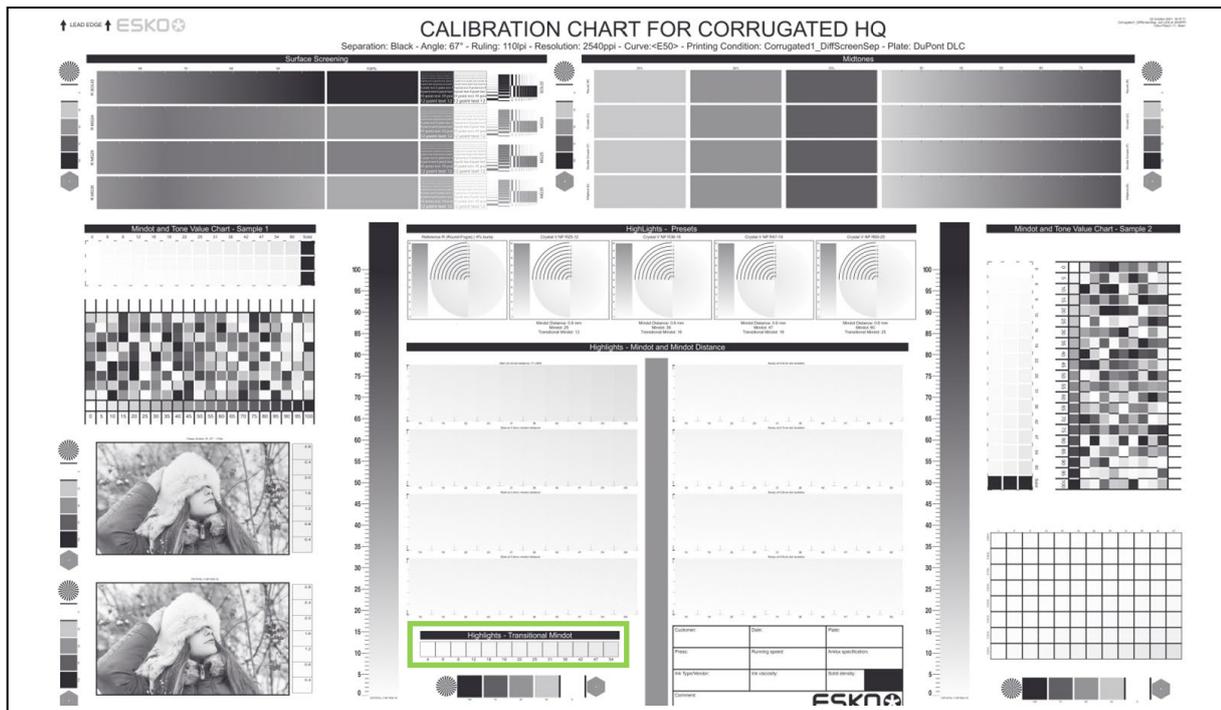
What is a stable patch field ?		
Stable patch field	Unstable patch field	
		
- Homogeneous dot structure - No missing dots	- Unstable dots - Large gaps between dots	Unequal dot size

For each block, mark the stable patch that has the smallest mindot size.

Now visually inspect and compare the seven wedges that you marked. Take the following into account:

- Bigger mindots can be used with bigger mindot distances and will print lighter (better fade-to-zero), but they will make the individual dots more visible (more graininess).
- Smaller mindots will need smaller mindot distances, they will print darker (which can cause a hard edge) but the highlight dots will be less visible (less graininess).
- For production stability it might be a good idea to select a mindot that is one step larger than you determine.

5. Highlights – Transitional Mindot



When using standard FM modulation in highlights, you must select a mindot that is large enough to print stably at the lightest tint, when dots are the furthest away from each other.

However, near the transition point (from FM to AM), the dots are closer to each other, and smaller dots could be used to make the transition print smoother.

Crystal V screens use a mix of screen dot sizes near the transition point. The “Transitional Mindot” is the smallest dot size that is used, and the “Mindot” is the largest one.

By using this sizes mix, the transition point of Crystal V screens will be at lighter tones, making the FM (potentially grainy) area smaller.

The optimal “Transitional Mindot” of a screen is the dot size that prints stably when the dots are not isolated (when none of the dots are removed from the screen grid).

This parameter can be determined from the area called “Highlights – Transitional Mindot” on the Corrugated High Quality calibration chart. In that area, each patch uses a different mindot size, and all the dots are kept on the screening grid. Select the patch with the smallest mindot that still prints stably. Use the “What is a stable patch field” table above for reference.