STEELED FOR SUCCESS

William S Kippax recounts a challenging commission requiring a custom print jig and stencil to screen print etch-resist ink onto steel discs

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Screen printing equipment manufacturing specialist H G Kippax & Sons Ltd was approached by a major manufacturer of diamond cutting tools, asking if they could commission the company to look at screen printing a fine pattern of etch-resist ink onto a steel disc of various diameters and, if successful, to supply a printing machine for their production.

The client previously tried screen printing without success and had to settle for tampo [pad] printing, but it required 10 hits to get the correct build which was uneconomical, with a high scrap rate. In this article William S Kippax describes how his company took up the print challenge.

CREATING A STENCIL

We first asked for any artwork and met with our screen, stencil and ink supplier, Screentec Print Essentials Ltd, to discuss:

- Quality of artwork
- Screen mesh count to print 15 to 20-micron deposit
- Stencil build for a 15/20-micron deposit
- Etch-resist ink that cleans off easily after etching and is health and safety approved.

[Etching involves chemical removal of material – an etch-resist substance protects the material intended to remain.]

To be able to print onto a steel disc we had to design a basic printing jig (see **Figure 1**) which would locate the steel disc with an area for run-on and run-off for the print squeegee. We also had to make sure we could remove the disc easily after printing and not touch the wet etch ink, so a wedge system was used.

The artwork was produced by our design team and sent to Screentec to print out using

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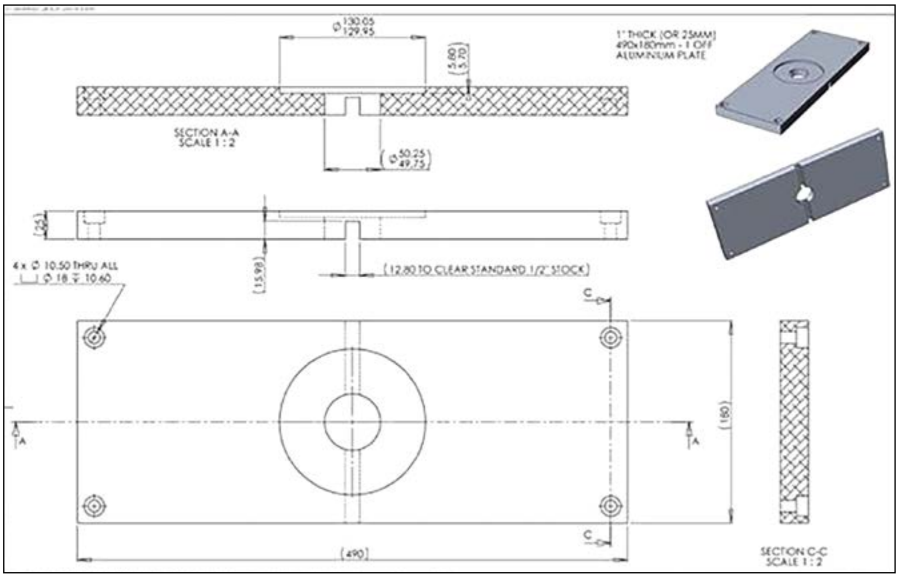

Figure 1: H G Kippax's print jig design for steel discs

Figure 2: Printing jig being used with a wedge extraction tool

Figure 3: Semi-automatic screen printing machine printing steel discs

CUTTING DISC PRINT TRIALS		
	Disc 1 (initial trial)	Disc 2 (3 month's later)
Screen Size	873mm x 873mm	873mm x 873mm
Box Section	38mm x 38mm	38mm x 38mm
Mesh	62.64 TW Orange Mesh	55.64 TW Orange Mesh
Coating Stencil	3/2 8000 Emulsion S R	3/2 8000 Emulsion S R
Print Dia	123.59mm	83.13mm
Overall Dia	130mm	89.54mm
Sq Width	200mm	130mm
Sq Blade with Radius	Red	Green
Coater	210mm	145mm
Print End Pass		
Coat End Pass		
Print Speed		
Coat Speed		
Sq Angle		
Coater Angle		
Snap Height		
Print Pressure		
Peel Off Start Position/Amount		
Resist Ink	226 Black	226 Black
Screenwash	Tec02 Low Odour	Tec02 Low Odour

Figure 5: List of requirements to allow fast set-up for each production run

a very opaque black ink to give a very sharp dot pattern (see **Figure 2**.)

Due to the design of the etch resist print, experience acquired over 55 years led us to make a screen frame 100% larger than normal for the print size. Screentec informed us that they would put a mesh count of 62.64TW on an orange mesh and advised us to put a stencil of 3/2 coats of 8000 emulsion SR to allow us to get close to 15/20-micron deposit. They also advised us to use the etch-resist ink 226 Black which will wash off with a low-odour screen wash when etching has taken place.

"With a 130mm diameter disc, the print must be centred perfectly as it would immediately be seen by the naked eye"

Figure 7: 200 of production run at 130iph

Figure 8: Quality prints produced with a 25-micron deposit

Figure 6: Steel disc printed with etch resist ink

TEST PRINTS

To do the test prints we chose our semi-automatic screen print machine 2000T, with HMI control and memory setting recall (see **Figure 3**). From previous tests of printing 20-micron and above ink deposits, we chose a 2mm off contact (snap off height) with a slow squeegee print speed to allow the ink to transfer onto the steel cutting disc as the snap off of the screen is minimal.

We set the automatic peel off (the lifting of the screen which pivots from the front of the machine) to commence just after the print squeegee has completed the print. This gives a maximum deposit with a very clean edge of the print (see **Figure 4**.)

To set the machine up for testing we used a standard list of adjustments (see **Figure 5**). These are all critical for industrial printing and allow a print operator to set up the machine in the minimum time and achieve a perfect print on the first print.

"To be able to print a steel disc we had to design a basic printing jig"

With all settings configured, we placed the jig on the print table and inserted a steel disc. We registered the stencil image to the steel disc by adjusting fine pitch x-y register adjusters on the printing. With a 130mm diameter disc, the print must be centred perfectly as it would immediately be seen by the naked eye.

TRIAL AND ERROR

The first print produced a substandard print but, by adjusting print pressure angle of the coating blade and print speed, we achieved an 'acceptable to the eye' print on the 9th print. We printed 10 off and dispatched them to the customer. Their immediate thought was 'good print quality but will it etch?' (See **Figure 6**.)

The result of the etch was poor and the customer said it needed a thicker deposit; maybe 40% more. We discussed this with

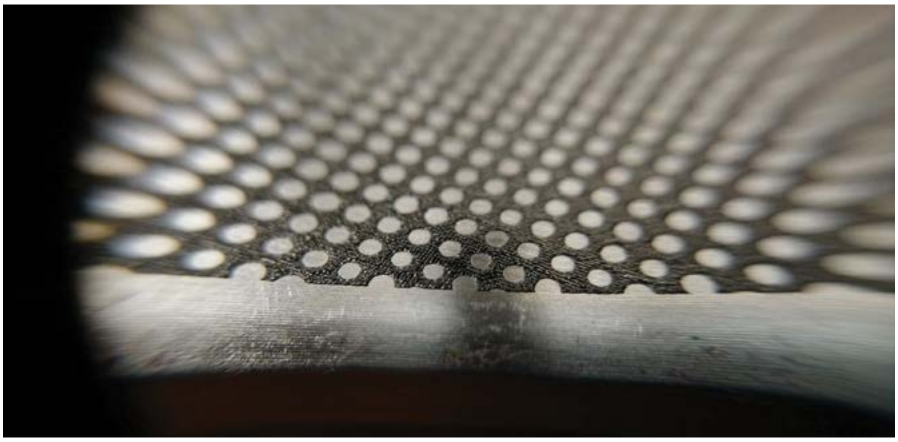

Figure 4: Close-up showing sharp design detail of the etch ink deposit

> *"We knew we could not go any coarser with the screen mesh or the shape of the print would deteriorate with less mesh count"*

Screentec and they advised trying a coarser 55.64TW orange mesh.

We repeated our trial again with 10 steel discs, no machine adjustments, just a more open weave mesh; this time the etch was much better but required slightly more ink deposit. We knew we could not go any coarser with the screen mesh or the shape of the print would deteriorate with less mesh count. We decided to put a slight radius on the polyurethane printing blade, which will tend to give a greater ink deposit (which is used in textile printing).

INTO PRODUCTION

We printed 20 discs which measured at 25-micron. This time our customer said 18 out of 20 were perfect and the two faulty ones were an etching error – Eureka!

The customer then asked us to run a full production run of 200 discs; this proved very successful. (See **Figure 7**.)

Finally we were asked if we could print a smaller diameter (89.5mm) disc for which they sent us the artwork and we repeated the test procedure – screens, stencil, printing jig. We ran an 80 off-production run very successfully with the customer having a 2.5% failure due to etching, not printing! (See **Figure 8**.)

The customer informed us that they wished to place an order for a Model 2518T with a specialised printing base with interchangeable jig fixtures. The machine was supplied with a special squeegee drive reduction gear box to allow the customer freedom to make their own printing test on future new cutting tools.

This was a most educational experience, using all the materials, skills and personal knowledge that screen printing can offer. Our sincere thanks go to Screentec Print Essentials Ltd for supplying their product knowledge on screens, stencils and inks.

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