DECOTECH
Industrial Printing Solutions

TECHNICAL BULLETIN

Pad Printing

How to Select the Proper Pad for the Job

Preface: The inspiration for writing this article was from having read Peter Kiddell's article titled "Understanding the pad in pad printing". His articles are always well written, but this particular one contained subject matter that did not reflect or describe the **Deco Tech Dura Pads** and our offerings. So rather than "reinvent the wheel" - I decided not to stray far from his format and I "recreated" his article. While I agreed with most everything Mr. Kiddell stated in his article, I had a few other methods, tips and ideas that I added, that will hopefully make your job of selecting a pad, easier.

Pad printing is a gravure (offset) printing process that takes a certain amount of operator skills to properly print a given job. This article assumes that you the reader know the basic principles of the pad printing process. If you are not familiar with the basics, a recommended prior reading is an article titled Pad Printing 101 by Michael Learmouth.

One of the most frequently asked questions in the early stages of learning the do's and don'ts of the pad printing process is, "How do I know what pad to use for this part?" Literally there are hundreds of sizes and shapes of pads out there to choose from - and then add the next most important variable of determining which hardness of rubber to use - and the level of confusion is only compounded further. For experienced operators this question is rather simple, but for the beginner this is not an easy task. I believe this question, "How do I know what pad to use for this part?" is certainly not a "stupid question" - as I believe there is no such thing as a stupid question.

So lets start with the end objective in mind, and let me make this (hopefully) clear and concise statement to try and answer this often-asked question.

QUESTION: *"How do I know what pad to use for this (fill in the blank) part?"*

ANSWER: *"Select a print pad that is large enough to compress by hand over the product to be printed. Watch it roll outward and down onto the part, completely covering the printable area. Usually such a pad will suit your needs"*.

This statement of course assumes that you have a suitable pad in your supply cabinet from which you can make this hand test. If you don't, let's dig further into this subject and I will attempt to explain the basic details you need to find the right pad.

The truth is that there is not just one pad that will properly print your part, but several pads that will print your job. Thus it is important to have a good cross section inventory of pads to choose from - when faced with selecting a new pad for a new job - especially if you are a job shop or custom decorator.

The key to your printing success is to eliminate as many variables as possible and this article is meant to address just one of the key variables in the pad printing process. Using a bit of basic common sense and simple scientific principles, we can properly explain what variables are attributed to the silicone transfer pad. There is much more to "it" than just transferring the image from the cliché onto the part…

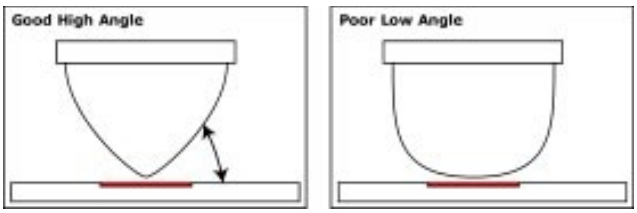
There are six factors that come into play when selecting the proper pad for the job:

- Shape of the pad
- Size of the pad (in relationship to the size of the printed image)
- Height of the pad
- Durometer (hardness) of the pad
- Surface finish of the pad
- Material(s) of the pad

The shape and size of the pad are the most important variables in selecting the right pad.

1. Shape of the Pad
In pad printing there are only a few shapes that are considered "standard" shapes. At Deco Tech we have categorized our pad shapes into five style categories - and four of which are considered "standard" shapes:

- Square or rectangular pads
- Round pads
- Loaf (like a loaf of bread) pads
- "V" shaped or bar pads
- Custom (specially designed pads for specific applications).



The pad must roll… In order to attain an acceptable quality print, the pad surface must compress and roll outward onto the cliché and it must cover the entire etched image area without distorting the image when the ink transfer is printed onto the part. The shape of the pad has a major role in determining how well the pad performs the rolling out action.

It is best to use a pad that has a high angle of attack (see illustration above) and you should avoid using flat-surfaced (or low-profile) pads whenever possible, as they will trap air when they compress against the cliché, and the ink will not be lifted out of the cliché but rather it will "smush" outward and create a poor quality print. By having a high angled pad, the greater outward rolling action that is achieved, will yield a better quality print every time.

The square and round shaped pads are considered the most popular pads on the market and these two shapes can often times be interchanged and print the same products. As a general rule, I prefer round shaped pads whenever possible because they provide concentric compression that is not distorted in one direction or the other. A square shaped pad also has these same concentric compression characteristics, and sometimes a square shaped pad (with near 90 degree side walls) is all that will fit into the dimensions of a particular pad-printing machine. This is especially true in small compact sized printers.
A loaf shaped pad is a modified rectangle pad that is designed to allow for linear type or straight-lined graphics. A classic use of a loaf pad is pad printing on pen barrels. A V shaped pad is a pad that is a long bar like pad that is typically molded to have a sharp V shaped bevel. With most V shaped pads you want to print on one side or the other side of the apex of the pad. With V shaped pads you can get double the life from that pad by using both sides of the pad. When the first side of the pad wears out, simply turn it around and use the opposite side for printing the same graphic.

In general, most pad printing production facilities will have a half a dozen "favorite" standard pads that will cover nearly all of their printing needs. But standard shapes don't always meet the needs for every application and that is where custom pads come into play. A special pad is typically a hybrid design and it may encompass any one or more of the other four basic shapes in its design. One classic example is creating a pad that has two round shapes molded in a side-by-side manner. That way there is no need for any special set up when printing the particular project. Another example of a custom pad is one to print onto a control knob. The custom pad has a machined recess or hole in it to accommodate the raised portion of the knob.

2. Size of the Pad
As stated above, the shape of the pad plays a large role in determining how well the pad will achieve this rolling out action. In determining the size of the pad for the product I preach one rule always and that is, "When it comes to pad selection, BIGGER IS BETTER". However more times than not, your printing machines dimensions and pad compression (force) will determine the size pad you can use. The bigger the pad, the less the image is likely to distort. For the best possible results, use the largest pad possible that your cliché size and machine size will allow.

Even though we recommend using a large sized pad, we also recommend that you use the minimum amount of pad stroke pressure to pick up and print the image. By using a small amount of force you create less wear on the pad and you have less chance of distorting the image by "over-driving" the pad. An easy way to determine how little force is enough. When you are printing the image satisfactorily simply back off on the pad force until you stop printing the entire image and then work your way back up in pad force so that you are making a full transfer every cycle.

3. Durometer or Hardness of the Pad
The hardness of the pad is determined by the content of silicone oil that is used in the pad formulation. The rule goes like this, the harder the pad, the less silicone oil that was added to the formulation. In our Dura pad program we offer five (5) different pad hardness's from 65 shore to 20 shore (00 scale). The most popular hardness's tend to be in the 40 to 55-shore range (green and yellow), but there are applications that use harder rubber and there are applications that use softer durometer. At Deco Tech we use always the same color rubber - as we don't add colorants to our rubber formulation. This is done in an interest to keep our rubber formulations "pure" and without a chance of contaminants. On both our wood and aluminum bases we color-code them by painting or staining them and all pads are clearly marked with a part number. Our base color-code designations are as follows:

Base Color	Hardness (00 Scale)
Red	60-65
Yellow	50-55
Green	40-45
Blue	30-35
Orange	20-25

As a general rule, the harder the pad, the better the performance. However, a hard pad may prove to be impractical for certain applications, such as when using a low-power (pad compression) machine or when printing on a fragile object, such as when pad printing onto a glass Christmas ornament.

4. Surface finish of the Pad
In the industry the common practice for pad manufacturers is to provide silicone pads with a high gloss surface finish. Before these pads can be run effectively they usually have to be "broken in" - or have the excess silicone oil (which creates that glossy appearance) removed to allow for good pick up and ink transfer during the printing process. Typically, a strong solvent is used, such as a fast speed thinner (accelerator) for initially removing that excess silicone-oil. But if you use too much of this solvent, you can damage the pad and shorten its life expectancy. The need to "break in" a pad prior to use is more prevalent on softer pads, because they contain more silicone oil.

After you have broken in the pad and removed the excess oil, the next step should be to gently wipe the pad with an alcohol-based pad-cleaning fluid before going into production. This removes any free silicone oil that can sometimes leach out of the pad. Once you begin production the best cleaning method (to remove solid debris, dried ink, and dust) is to use a quality "shipping tape" and the adhesive surface of the tape to lift off any contamination.

By following these simple steps, you will improve your print quality, reduce downtime, and prolong the life of the pad.

Many pad suppliers offer a "pad rejuvenator". A pad rejuvenator is a silicone oil based material that is designed to penetrate the surface of the pad and extend the life of the printing pad. This is usually a spray that can be applied to the pad surface when it becomes dry due to the loss of silicone oils during production. The oils are pulled from the pad by aggressive thinners. While a pad rejuvenator can indeed help to prolong the life of a pad, it is important to not spray this oil anywhere near a surface that has to be decorated.

Peter Kiddell states, "We have come across two extreme cases of pad abuse: The first company soaks their new pads in a solvent tank for four hours prior to use, while the second company has a press dedicated to "running in" new pads before they are used in production". It is a shame to hear that such instances occur in the field, considering the cost of silicone pads and the fact that they have a limited print life already. Such extremes make poor use of your investment.

5. Material of the Pad & Base
In this section we will discuss both the silicone pad itself and the mounting bases.

Regarding the pad itself, virtually all pads today are made of silicone rubber. At Deco Tech we use only the best quality silicone rubber materials available. In the past, the first printing pads were made of gelatin and in these early days there was a limited range of pad shapes available due to the poor mechanical properties of gelatin, and these pads were designed much flatter than modern day silicone pads, because of gelatins lack of elasticity.

At **Deco Tech** we provide both wood and aluminum bases - and ALL of our bases are mounted accurately and all wooden bases can be equipped with either a standard SAE 3/8”-16 threaded insert (US standard) or with a metric insert 6 x .1mm course thread. All Deco Tech pads with wooden bases are supplied with pre-drilled holes in the bases for attaching to the pad holder of the machine. All of our wood bases are made from only the best select grade of Baltic Birch marine grade plywood - which has no laminate gaps and is very flat and solid.

We do not recommend having the operator use wood screws to mount the pad to his pad holder, as this old-school method makes it very difficult to get repeatable pad positioning and it results in lengthy set-up times. Furthermore if you use wood screws to mount your pads, after you have taken the screws in and out several times, the wood is quickly stripped out and will no longer firmly hold the pad to the mounting bracket. On many occasions, I have seen pads literally fall off the machine during production because of this problem. **If you need a special pad holder machined to accept either the 3/8” - 16 insert or the 6mm metric insert please let us know and we will modify your pad holder to accept these inserts.**

Our aluminum bases are also pre-drilled with a tapped and threaded hole. Usually with a 10-32 tapped hole. Similarly, if a setup requires multiple pads (such as found on a keyboard matrix), aluminum bases are preferable because they will make pad positioning easier and more repeatable. Another advantage to using aluminum bases is that they can be recycled with Deco Tech and we can remount these bases for you onto new silicone rubber.

Use these guidelines when selecting the proper pad shape for a particular job:

- First, select a print pad that is sized large enough to compress by hand over the product to be printed. As you are squeezing it down, watch it roll outward and down onto the part, completely covering the printable area. Usually such a pad will suit your needs. Do this with a few pads that you can later mount onto the pad printing press.
- Next, try printing with each of the pads that you have hand selected. A little trial and error is the best method and actually printing with the pad(s) is most often the only way to really determine if that pad is going to deliver the required results. When sample printing, make sure that you are accurately transferring the artwork onto the part without distortion or pinholes.
- If the pad shape you have chosen prints only part of the image area properly, look for similar shaped pad that is larger in the direction that the image is not printing. Having a distorted image around edges is almost always a sign of having a pad that is too small for the job.
- Don’t be afraid to try pads that might seem too large or have too steep of an angle- strange things can happen and remember the **#1 rule… BIGGER IS BETTER**. An unusual shaped pad just might solve your printing problem.
- Poor quality or irregular ink pickup during the test printing usually means that air is trapped between the pad and the cliché- not enough rolling action! To prove this theory watch carefully as the pad is being compressed onto the cliché to pick up the image - be certain that you see a good rolling out action from that pad. **No rolling = no quality printing**.
- Whenever it’s possible, try to set up the pad so that the apex (the point) of the pad does not come into contact with the image area on the cliché. Air tends to get trapped at the apex and the ink deposit is not always consistent at the contact point.
- Distortion will occur if the pad is “overdriven” because it is really too small for the image to be printed or if the transferred image is too close to the edges of the pad. Remember to ALWAYS USE AS LITTLE PAD FORCE AS POSSIBLE, both on ink pick up and on ink transfer.

Use these guidelines for pad hardness when selecting your pads:

- Hard pads are most suitable for heavy textured surfaces you can also use them when you need to print an image in a recessed area next to a raised surface and a hard pad will roll over this “step”.
- You can also use hard pads in a pad adapter or matrix, when you must fit a single machine with numerous pads that are spaced with small gaps between them (for example, when printing computer keyboards or calculator keys).
- Use softer pads when printing onto heavily contoured surfaces and when printing on fragile items.

- You must use a softer pad if the power of your machine can't compress the pad sufficiently to achieve a satisfactory rolling action - or use a dual durometer pad.
- Avoid using pads of radically different hardness's for the same part / application, or else the thickness of the ink deposit may vary. This is particularly true when dealing with a pad matrix.

Special pad designs for printing large images
In some applications a large graphic image must be printed and your machine does not have the power to compress such a large pad in a smooth motion. Three solutions to this problem are available; 1) Use a pad with a hollow interior that provides the same surface hardness. This hollow area will allow the machine to compress this pad further because there is no extra silicone material to provide resistance. This molding technique also reduces the cost of silicone rubber for such a large pad. 2.) Use what is called a "dual-durometer" pad. A dual-durometer pad is one where the core of the pad is made of a softer durometer material (easier to compress) and the outer layer is of a harder rubber (yielding quality printing results). Both of these methods can help, but the second produces a more stable pad. 3.) Use a pad of the same shape but of a taller design. This taller shape will allow for more compression with less machine force. And yet a fourth option is to look at a different printing method altogether such as screen-printing. Remember, pad printing was not originally designed for printing very large images- it was first developed for printing the fine graphic details found on Swiss watch dials.

Quality Control of Pads
We all know that poor-quality consumables products can ruin your chances for getting quality printing results on press. All Deco Tech pads are made in a near clean room environment. Prior to shipping, all Deco Tech pads are 100% hand inspected. Below we outline what our quality control people look for when inspecting. We also recommend that when you receive pads (from us or anybody else), you also check them for the following:

- Blemishes on the print surface
- Foreign particles in the print surface, such as wood splinters or other defects
- Firm attachment of the pad to the backing plate (The pad should be secure, with no air bubbles that will cause the rubber to come away from the base.)
- Hardness within ± 5 Shore (using your 00 durometer gauge)
- Positioning on the backing plate (It should be concentric, with its vertical center line at a 90° angle to the backing.)
- Uniform height (This is particularly important in multiple-pad applications).

Please report any found defects to your Deco Tech customer service representative immediately so that we can promptly replace the defective pad.
Call us toll free at (800) 300-3326.

Pad Life
Next to "What pad should I use?" the next question is usually "How long should a pad last?" Pads are like most things in life: Just like the human body, the better you treat it; the longer it will last (exception to this rule was George Burns). Mechanical damage (sunshine), aggressive solvents (booze), and poor storage (living in a flop house) all take their toll on pad life. But the real killer in pad life is a careless operator.

Use a softer durometer pad if the power of your machine cannot sufficiently compress the pad to achieve a satisfactory rolling action.

In many applications, it is not unusual for a silicone pad to last up to 50,000 imprints, but going much beyond 50,000 prints is not commonplace. Conversely, some pads are completely ruined before they even print a single part. This disaster usually happens during set-up, when the downward motion of the pad (either during ink pickup or transfer to the part) has been set at too long of a stroke distance and the pad crashes hard into the cliché or part. The end result can be the total destruction of the pad.

Always remember to back-off the stroke distances when setting up any new project.

Although no hard and fast guidelines regarding pad life are available, you can take a number of steps to get the most life from all your pads:

- Use a li solvent only for the initial removal of the excess silicone oils on the surface.
- Use a mild solvent such as alcohol, or preferably adhesive tape, if the pad must be cleaned during production. All microPrint machines have built-in tape cleaning for longer pad life.
- Always use tape to remove debris and dried ink before starting a production run.
- Don't use too much pad pressure.
- Never print onto an empty nesting fixture, sharp edges can cut your pad.
- Ensure that the substrate is free of debris, particularly sharp particles, before printing.
- With wood backed pads (those without a threaded insert), don't let the wood screws penetrate into the rubber.
- Whenever possible, avoid printing near sharp substrate edges.
- Use as large a pad as is reasonable for the job at hand.
- Never store a pad on top of another one.
- If pads are shipped with a vacuum formed plastic protective covering - remove them from the plastic immediately. Do not store the pads with the covering on them.
- Handle and store the pads very carefully. Keep them in a storage cabinet at room temperature.

Another point about pad life: Certain inks have aggressive solvents that will be absorbed by the pad during printing, much like in screen printing, when a squeegee will absorb solvents during a long print run. This solvent absorption will cause the image area to "swell" on the pad, to the point where it will eventually affect the print quality. At this point, stop the machine and replace this swollen pad. This isn't a permanent condition, and if you allow the pad to stand unused, the solvents that have penetrated the rubber surface will evaporate and the swelling will go down to the original size.

In Closing
Often times the importance of the pad itself - in relationship to the pad printing process - is often times overlooked, remember that the process itself is name "pad printing" for a reason. Proper pad selection is paramount to obtaining good printing results and proper care of the pads is essential to getting sufficient pad life. As with any printing process, pad printing has its strengths and its limitations and its best to understand those before you even begin to select a pad. Common sense, hands-on experience and continual experimentation will mold you into a quality pad-printer.

Bibliography:
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