Pre-registering
print cylinders on press

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Those who study lean manufacturing know that waste comes in many forms. We must remind ourselves that anything that does not produce exactly what the customer values, when it is needed, is a wasteful operation. Makereadies, or press setups, are wasteful, at least in the eyes of our customers. Reducing press setup time is critical for improving customer value and making the printer more competitive on short-run work while increasing overall productivity. Even though make-ready time is built into an estimate, the bottom line is that it isn’t something a customer is delighted about paying for. Reducing makeready time, therefore, becomes a strategy that improves competitiveness in the marketplace.

Setup reduction

The process of reducing setup time includes several strategies and techniques. SHIGEO SHINGO introduced the process to the West in his 1985 book titled “A Revolution in Manufacturing: The SMED System”. SMED or “Single Minute Exchange of Dies” was a process developed over several years at the Toyota Motor Corporation as a way of reducing setup time in the manufacturing of automobiles. By using a series of structured methodologies, Toyota and others have managed to reduce makeready times for stamping equipment by drastic amounts—in Toyota’s case, from twelve or more hours to less than ten minutes. These drastic reductions result from fundamental changes and the accumulation of numerous subtle improvements. Removing 5 minutes here and 2 minutes there can take an hour-long makeready and turn it into a 12-minute makeready.

There are several prerequisites to effectively reducing setup times. If the printer has not focused attention on implementing 5S (another Toyota tool), he will want to start there to maximize the benefits of setup reduction. Also, it is critical that the production employees understand and buy into lean principles. Without their support it will fail. But even with their cooperation, a critical resource will be lacking without their full commitment to the process: their creativity and ingenuity. If the company culture is centred on top-down decision-making, the printer may want to explore an empowerment philosophy, a critical part of Toyota’s success.

One of the key tenets of setup reduction is to analyze and minimize adjustment time on machines. If a process needs adjustment, the setup team focuses on how to use jigs, fixtures, standard tools, standard processes, and the like to minimize the adjustment time. In printing, we have several adjustments that need to be made before saving product. These adjustments usually fall into one of the following categories:

- substrate handling, treatment and tension,
- impression adjustment,
- tooling registration,
- print registration,
- ink and colour adjustments,
- defect elimination.

Print cylinder pre-registration

A number of techniques have been employed to minimize adjustments for each of these areas. The purpose of this article is to discuss how to reduce circumferential registration adjustment and particularly how to pre-register print cylinders by mounting them in the press so that only micro register adjustment is needed. The goal is to eliminate the necessity to disengage a cylinder and rotate it to the correct gear tooth before commencing on micro adjustment. Even with a 360-degree gearbox, placing the cylinder in the press at the correct circumferential starting position will cut valuable adjustment time out of the make-ready process.

In most narrow-web pressrooms in the USA, it is common practice to put cylinders in the press with no regard to circumferential position. Instead, it is commonplace to insert the cylinders, print the first colour until the print is advanced entirely through all the required print stations. Then, one by one, each subsequent colour is printed. The gears of each cylinder are disengaged and rotated to the desired position for macro registration. Next, the colour is printed a second time and the macro registration process is repeated until the cylinder is within a gear tooth and ready for micro adjustments. These steps are repeated for each subsequent print station. In total, this could easily take 5 or more minutes, depending on the skill of the operator. This doesn’t seem like much time to worry about but when combined with other improvement efforts, it can make a big difference to the total makeready time.

A better practice is to insert the print cylinders in the press in the correct gear position initially so that no gear disengagement and cylinder rotation are needed. In the case of a 360-degree gearbox no macro rotation is necessary. In other words, the cylinders are pre-registered so all that is needed is minor circumferential adjustment. Then all that is needed is simply fine-tun-
ing of the image.

To install correctly the first time takes some thought. This process is more difficult than it sounds because the position of the cylinder relative to the plate seam will vary as cylinder circumference varies (repeat length). The position of the plate seams on one job will be different to the position on another unless they have identical repeat lengths.

It is relatively easy to calculate the seam location for each job. However, trying to accurately position the plate seam on press can be difficult with no scales for reference so additional adjustment is often needed. A better practice is to image a mark on each plate to indicate the 12 o’clock position so that the operator simply places that mark in the up position when inserting the cylinders.

To achieve this, a couple of variables must be identified. First, the plate or colour sequence must be known. If that sequence later changes, the marks become invalid. Fortunately, it is not difficult to recalculate the mark position and to simple mark the plates with a pen.

A second variable is the distance the web travels between print stations. This will vary between presses but usually doesn’t vary between units (assuming no turn bars or other unusual situations).

The third item is the type of gearing (1/4” cp, 10 dp, 1/8” cp, etc or even metric!). Many companies use one standard gearing – 1/8” cp being most common for narrow-web converters. Finally, the repeat length of the job must be known.

With those four bits of information, it is simple to determine where the marks should be imaged. Multiple repeats will fit into the web distance between print stations. If it happens to come out as a whole
The operator installs the second plate. The operator installs
is imaged at the 7.5" mark on the
other words, on a 10" repeat, a mark is imaged
in the web distance between the
circumferential adjustment should
registered. At that point the make-
pre-registration mark at 12 o'clock and the marks on subse-
mark can be routed or scribed into
risk of the web distance changing, a
the same. If a die will run on a spe-
dies have a seam and in these cases,
with the dies, though it is a little
more complex because there is of-
web distance from the first plate
The question needed to be
newly is initiated and only micro
to how a single station fits into
the web distance between the first
mark at 12 o'clock. As an alternative, a
A simple spreadsheet can be de-
parameters and the location of the
mark position on any
by angled lines. The operator
up to how a single station fits into
pressing high quality labels at good
prices. That means focusing on the
narrow-web converting indus-
to improve the bottom line. More impor-
big ones. Try these techniques and
improvements as well as the
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- India Label Show
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number (i.e. exactly ten repeats fit
between the impression nip of sta-
tion 1 and the impression nip of sta-
tion 2) then put all the plate seams
at 12 o'clock and the images are pre-
registered. At that point the make-
ready is initiated and only micro

to calculate mark position on any
job. The operator simply types in the
parameters and the location of the
marks are calculated. A Magenta
mark is positioned at 7.5" (from lead
eedge), a Cyan mark is position at
5.0", a Black mark is imaged at 2.5",
and no Yellow mark is imaged (1st
down positions seam at 12 o'clock). This example assumes a
colour sequence of YMCK, 9.75 re-
peats between stations. 1/8" cp
gearing, and a 10" repeat.

The little improvements
matter

It is possible to do the same thing
with the dies, though it is a little
more complex because there is of-
ten no seam for reference. Magnetic
dies have a seam and in these cases,
there is a natural reference point
to focus on. Either way, the principle is
the same. If a die will run on a spe-
cific press all the time and there is no
risk of the web distance changing, a
mark can be routed or scribed into
the die itself as a 12 o'clock refer-
ence point. It is more flexible to
avoid permanent marks in the die
and simply draw on it with a pen.

The relationship of the various
die cavities will need to be consid-
ered. In other words, if the graphics
are 4-up (2 x 2) on the 10" repeat,
then consideration should be given
to how a single station fits into
the web distance from the first plate
seam. The question needed to be
solved mathematically is what por-
tion of a single die station will be
positioned at 12 o’clock when the
die is registered to the first down co-
lour with its plate seam positioned
at 12 o’clock. As an alternative, a
simple set of protracted lines can be
painted on the gear side-wall of the
die station and align a mark on the
die to the appropriately angled line.
In this case, the mark is usually po-
sition between die cavities where
the beginning of an image repeat
would occur. Give it some thought
and it will be surprising how tooling
can also be pre-registered.

Pre-registering tooling

It is natural to scoff at these small
improvements and discount them
as too much work with too little
payback. But in reality, the leaders
in the narrow-web converting in-
dustries around the globe are focus-
ing on customer value and doing
everything possible to improve the
things that customers want – print-
ing high quality labels at good
prices. That means focusing on the
little improvements as well as the
big ones. Try these techniques and
see how even cutting five minutes
out of every makeready will im-
prove the bottom line. More impor-
tantly, teach employees the value of
setup reduction and watch them
come up with a million more im-
provements that will delight cus-
tomers as well as the stakeholders.