Technical Paper

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3 Categories of Guards – their advantages and drawbacks

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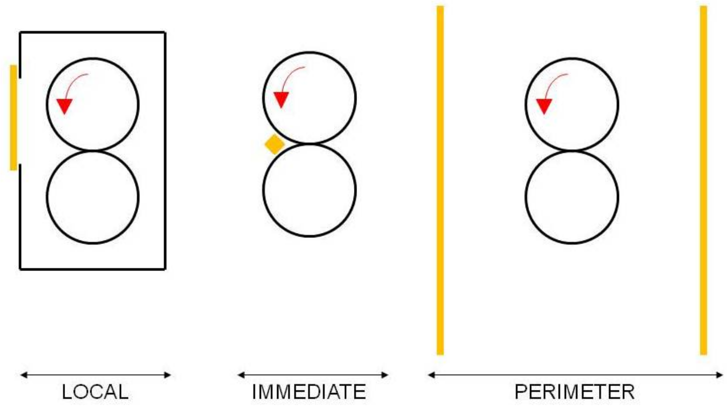
I'm sure that most people are aware of the PUWER requirements on guarding, putting fixed guards foremost and then interlocked guards.

However, many people do not realise that such guards can then be sub-divided into 3 different types which I call immediate, local and perimeter. Each has its own set of advantages and potential problems of which this article is intended to make you aware.



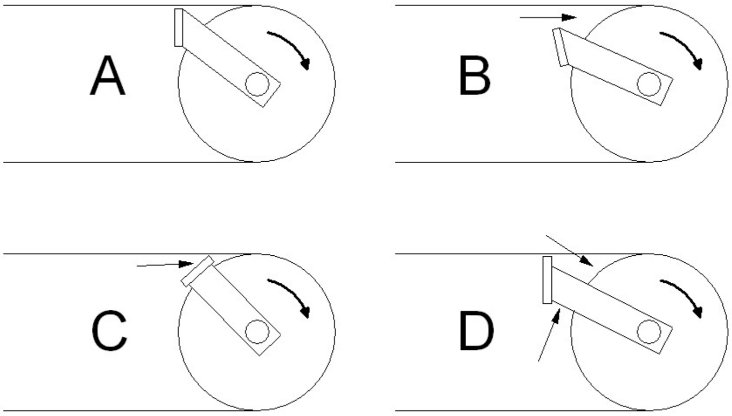
A local guard is the type of which we normally think when we consider guards. It is fitted over or around specific parts of the machine where there would otherwise be an exposed source of injury. The design of the guard and any gaps necessary in it, say for workflow, must be such that you cannot access the dangerous parts. EN 13857 covers the combination of gap and distance to the danger point, but it is fairly self-obvious. (With the power off) try and reach the danger point and if you can reach it, the gap is too big or the distance too short.

The main problem with local guards is that of installing them on existing machinery, as intricate features may need to be incorporated to ensure that they fit around bits that stick out. In addition, where the guards are interlocked, there is the problem of mounting switches and installing wiring. But local guards should be the default design choice as will become obvious.

In some cases, it is not possible to fit local guards. In this situation, an immediate guard may be an option. With an immediate guard, access to the danger point is prevented by a bar or similar feature right next to the danger point. You can still access moving machinery, but you must make sure that no such machinery poses a risk due to in-running nips, gear teeth, etc.

Immediate guards are often fitted next to a roller so that your finger cannot access the in-running nip under the roller. These require careful design and fitting. Steps must be taken so that the guard to roller gap cannot in itself pose a risk as this would be self-defeating. The 4 rules to follow are:

1. The guard should be at 90º to the moving surface, eg the periphery of a roller or belt.
2. The gap between the moving surface and the guard should be such that your finger cannot enter it. The figure of 6mm is often used, though there is some evidence that this is too large and you should make the gap as small as possible.
3. There must be no cut-outs in the roller surface. Such an undercut would increase the gap stated in [2].
4. Where immediate guards can slip and compromise [2], there must be a rigorous system of periodically checking all gaps. I normally carry a 6mm thick stick for this.



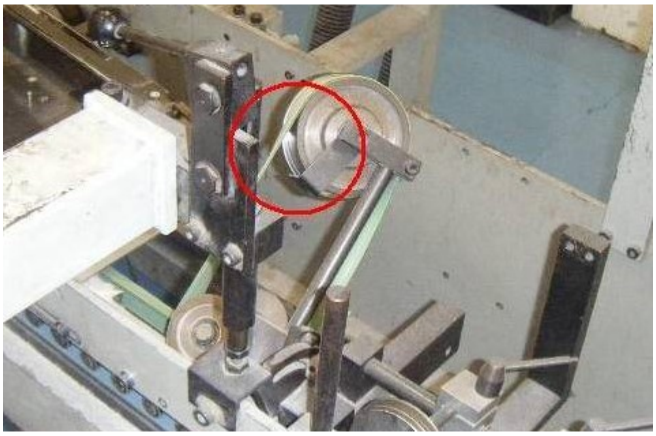
Pictures A to D show different conditions:

A meets all the above requirements and is safe.

In B, the previously safe immediate guard has moved, allowing access to the nip.

C creates a wedge, drawing the finger into the nip between the belt and the guard.

D is to far away, and has gaps causing nips between the belt and roller and between the roller and guard.



This is an example of a poor immediate guard. It is obvious that it has slipped as in B above, but even if it were properly adjusted, it would create a wedge as in C above.

This is a terrible example, showing how maintenance crews were ignorant about the function of the immediate guard. Note that, probably following a belt-break, they have positioned the guards on the ***outside*** of the belt, rather than the inside.

The final type is the perimeter guard. Effectively, what you are saying is that it is too difficult to fit individual local or immediate guards and therefore you just put everything inside a box. Though some perimeter guards are fixed, safe access to the machinery inside the box must normally be provided using either interlock switches or key interlock systems.

Perimeter guards are fine if you have automatic equipment; robots are normally housed within such a guard. Egress of product is through tunnel guards or light curtains with suitable muting settings.

The problem arises when machines are not fully automatic or remotely controlled and access to running controls is required inside the perimeter guard. Such controls may not be in a dangerous position, but because you have installed perimeter guards for parts which are dangerous, you cannot get to the controls. What tends to happen is that holes are cut in the guard or interlocks overridden. This, of course, compromises the effectiveness of the guard. Therefore, if you are considering perimeter guards, you must determine if access is needed when the machine is running. If access is needed, then you really have to use local or immediate guards, however difficult the engineering task of fitting such guard is.

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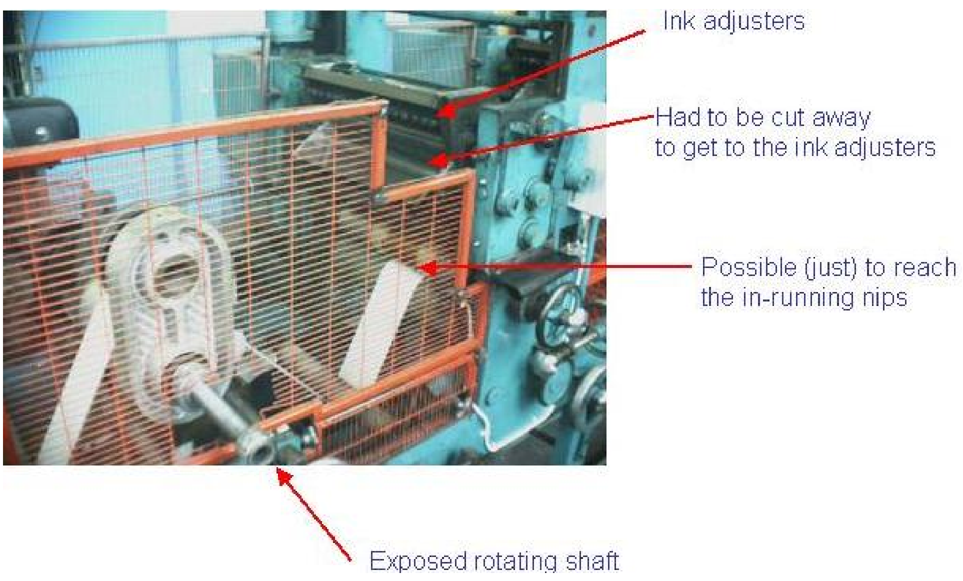

This shows an ineffective perimeter guard on a machine for producing continuous graph paper. Following an HSE visit, the company fitted perimeter guards but even this was poor; note the exposed rotating shaft.

They then found that they could not access a row of knobs which controlled ink flow and therefore cut away a corner. This meant that the guard does not comply with EN 13857 and danger point is reachable.

What we did was to throw away the perimeter guard, fit a fixed guard over the shaft and an interlocked local guard over the in-running nip. All of this required engineering effort beyond bolting on the 2-dimensional perimeter guard, but the company then had a safe and workable arrangement.

So, to summarise:

- Local guards are the preferred method.
- Immediate guards may be acceptable, but require careful design to attain and maintain a very small gap. Typically, periodic inspection of the gap is required.
- Perimeter guards are really only suited to fully automatic operations.

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