



# AN INVESTIGATION ON THE OFFSET PRINTING MACHINE & TECHNOLOGY

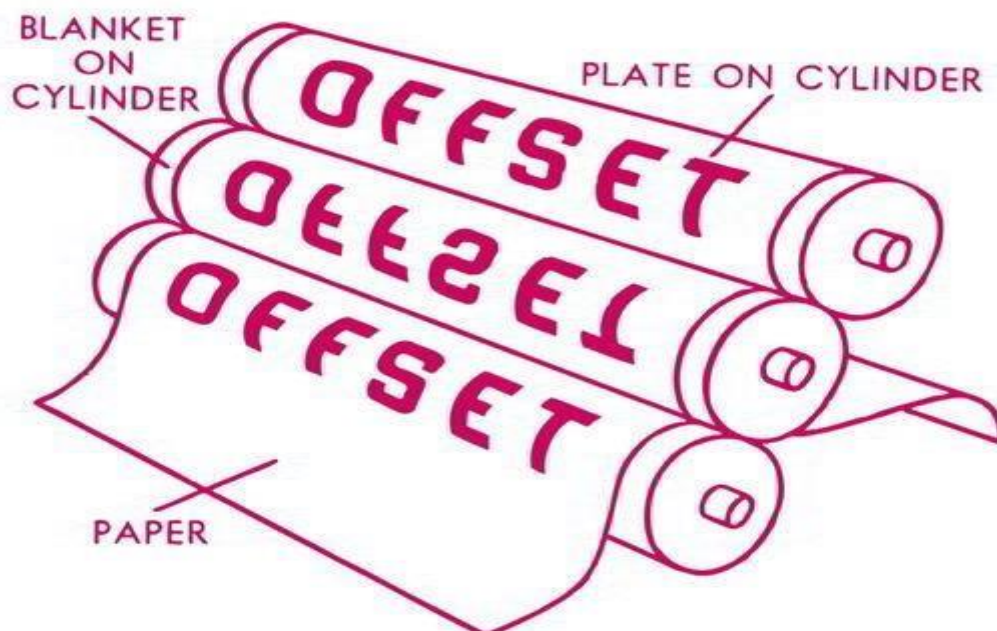
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## Introduction

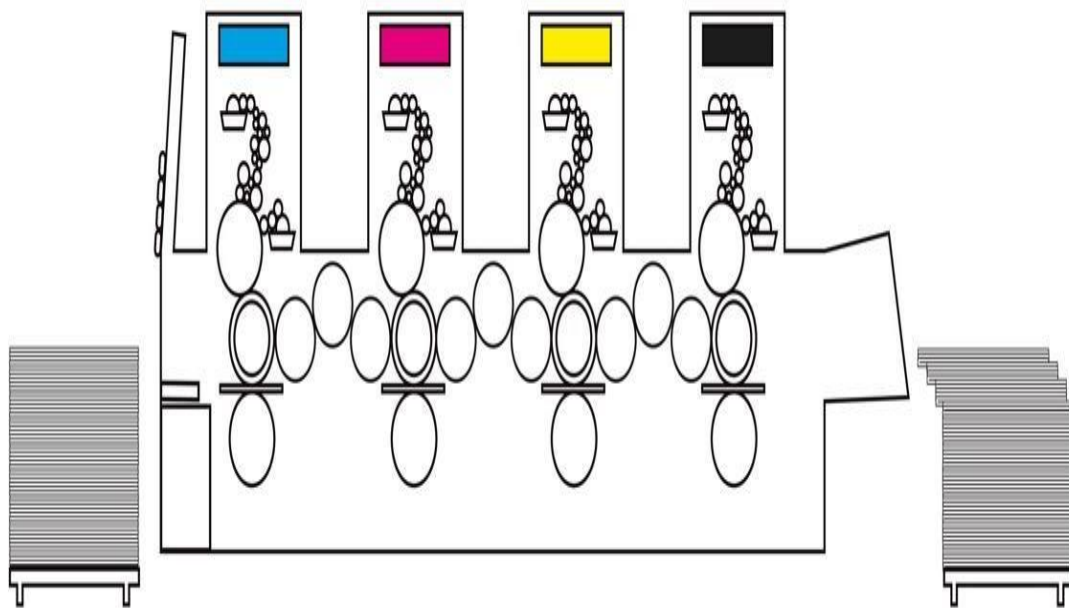
**OFFSET TECHNOLOGY** :- Also known as offset lithography, offset printing is one of the most affordable and efficient printing processes in the printing industry for the mass production of high quality and professional-looking books, magazines, calendars, brochures, flyers, business forms, business cards, letterheads, catalogues, invitations, stationery, and more. This printing method requires little manual maintenance these days as most of the work is computerized, thus increasing its productivity.

In the printing process, the computer first digitally etches the design or text that is to be printed on to a metal plate in the printing press. The plate is coated with real printing inks, not toners, and the plate then makes an inked impression of its etching on to a rubber-blanketed cylinder. The offset paper is then processed under this cylinder and receives the inked impression. In the case of colour printing, the same process is followed, but the different colours - cyan, magenta, yellow, and black – are printed using separate cylinders. The paper is processed in sequence under each cylinder to print the details of each colour.



Since the paper or other printing media does not come directly in contact with the metal plate, it is possible to use the metal plate for a longer duration. Also, since the flexible rubberblanketed cylinder can readily roll over a variety of printing surfaces, offset printing is not restricted to printing on paper. It can be used to print on canvas, cloth, wood, plastic, etc.

Offset printing produces rich, smooth results, with no streaking, and it is scalable. That is, it can be used equally for low volume, medium volume, and high-volume printing jobs. It is more commonly used for the latter though since setting up the plates and press for printing can be a rather complex and time-consuming process. Once set up, however, it is less expensive to print large volume jobs by offset printing as compared to other printing methods, therefore, it makes economic sense to use this printing method for mass producing newspapers, magazines, calendars, brochures, stationery, and other products that have a short shelf life. The image production in offset printing is of high quality, as already mentioned, but it is not of the same high standard as images produced using the rotogravure and photogravure printing methods.



### Offset Printing Press Illustration

The two types of offset printing machines that are commonly used in publishing are sheet-fed offset printing machines and web-fed offset printing machines.

Digital or print-on-demand printing was developed as an alternative to offset printing. Offset papers may not be suitable for this type of printing.

### I. SHEET-FED OFFSET PRINTING

In sheet-fed offset printing, paper sheets are fed individually through the printing press. The paper is pre-cut before it is processed, and these pre-cut papers are called parent sheets. These paper sheets are trimmed after the printing is done. Depending on what the final product is, the cut printed pages may either be folded or bound together later.

For printing jobs of 250 to 10,000 units, sheet-fed offset printing is an excellent and inexpensive choice. Limited edition books and other comparatively low volume printing jobs completed using the sheet-fed offset printing method.

## II. WEB-FED OFFSET PRINTING

For high-volume printing jobs of more than 10,000 units, web-fed offset printing is the best printing method. Web-fed offset printing is carried out in high-speed printing machines that are often as large as buildings. Rather than using pre-cut paper sheets, these machines make use of big rolls of printing paper that are continuously fed through the presses. Once the printing is done, the printed pages are separated and cut as required.

The advantage of this type of printing method is that it is cost-effective for printing newspapers and other products that require to be printed on a regular basis and must feature different content every time. The main disadvantage of web-fed offset printing is that the initial setup cost of the large web offset printing presses can be exorbitant. Another issue is that the minimum amount of printing orders must be sizable, more than 10,000 units, as already stated. Also, as regards to the quality of the printing, it is good, but not as good as sheet-fed offset printing.

## III. SHEET-FED VS. WEB-FED

The main difference between sheet-fed and web-fed offset printing presses is that while the former accommodates small and medium printing jobs, the later requires a large volume of printing runs.

In sheet-fed offset printing, separate paper pages are fed into the printing press, while, in web-fed offset printing, a large roll of paper is continuously fed into the printing press. For sheet-fed offset printing, the advantage of separate papers is that papers of different sizes and formats can be processed without any hitch through the printing press. In web-fed offset printing, the sheets that are cut off have a length that is the same as the cylinder's circumference, and the high-speed at which the press operates ensures the printing of up to 80,000 paper cut-offs in one hour. This makes web-fed offset printing faster than sheet-fed offset printing. However, there is a fixed cut off rate that web-fed offset printing can't exceed, which puts it at a disadvantage when compared to other printing methods such as rotogravure printing and flexographic printing.

## IV. WHAT CAN YOU PRINT WITH OFFSET PRINTING?

Offset printing is quite versatile, as we have already seen. It can be used to print both monochromatic and full-color CMYK (cyan, magenta, yellow, and black) printing projects. You can use it to print on almost any type of surface including paper, cardboard, cloth, and plastic. It is necessary to mention that while the printing process for different materials may be similar, the post-press production for each may widely differ.

## V. ADVANTAGES OF OFFSET PRINTING OVER OTHER PRINTING METHODS:

### a. High Image Quality

A principal benefit of offset printing is the production of consistently high-quality images and type. This becomes especially obvious when the printing is compared to printing done by letterpress.

### b. Low Printing Costs

When it comes to commercial printing in bulk, printing with an offset press is much less expensive than the other printing methods.

### c. Longer Life for Printing Plates

In offset printing, the printing plates transfer the inked etched print on to the rubber surface and that, in turn, transfers the image and text on to the offset paper. Since the printing plates and the printing paper never come in direct contact with one another, the printing plates can last longer and be used longer than in the case of



direct lithograph presses. If the printing plates are well-etched and are well-maintained, it is possible to use them to print more than a million prints.

#### d. The Ability of Ink Adjustment

In offset printing, the printing ink is stored in an ink trough and, from here, it is transferred to the fountain roller. For correct printing, it is essential to control the amount of ink that is so transferred. This control comes from a metal blade that can be adjusted as required with the help of screws. The screws may be manually or electronically operated; it is the latter in modern printing presses and this reduces errors and results in more precise printing.

By opening or tightening these adjustable screws, it is possible to increase or decrease the distance between the fountain roller and the metal blade. The alteration in this distance alters the amount of ink that is transferred to the fountain roller and this, in turn, affects how much ink is transferred to the printed paper areas. The amount of transferred ink affects the amount of color concentration on the paper and result in differences in image and text appearances.

### VI. DISADVANTAGES OF OFFSET PRINTING COMPARED TO OTHER PRINTING METHODS:

#### a. Less Sharp Images

While of high quality, the images produced by offset printing methods lack the sharpness and clarity that is seen in images produced by rotogravure and photogravure printing.

#### b. Oxidation of Printing Plates

The aluminum printing plates may undergo oxidation and become less capable of printing images clearly and correctly.

#### c. High Set-Up Costs

The time and expense required for the initial setup of an offset printing press are high as compared to other printing methods.

### VII. PAPER RELATED PROBLEMS FACED IN OFFSET PRINTING:

In offset printing, it is crucial to use a paper that has undergone surface sizing in order to have a high surface strength and dimensional stability. The paper also needs to have a low linting level to keep foreign bodies from settling on the paper surface. It is equally important that the paper be correctly cut or that it comes in tightly wound rolls.

If there are issues with any of these factors, the following paper-related problems can arise during offset printing:

#### a. PEEL-OFFS

Peel-offs happen when incorrectly-cut offset papers are processed in a sheet-fed offset printing press. Due to the uneven and unaligned paper edges, the paper layers may develop thickening in some areas and not in others. This disparity means that there is likely to be an unequal pressure on the paper sheets in the printing press. The rubber blankets are unable to contend with this, and the paper sheets may suffer from compression damage. This, in turn, may produce gaps between the rubber blanket and the paper surface as well as gaps between the rubber blanket and the metal printing plate, and, as a result, there will be erratic ink transfer in all cases, leading to printing problems.

## **b. BLISTERING**

The offset paper surface can blister and become unsuitable for printing. This can happen when the moisture content in the paper fibers cannot escape, and vapor pressure within the fibers of the paper rises steeply, and the paper is mechanically disrupted through the tearing of its fibers while the paper is undergoing drying in the web-fed offset printing press's™ oven. This rapid vaporization can break up the paper surface sealing and damage the paper. The result is blistering of the paper.

To prevent blistering, the moisture content of the paper used in heatset drying must be lower than that normally used for sheet-fed offset printing, and the coatings themselves must be porous enough to enable the water vapor buildup to diffuse through the surface of the paper. Blistering occurs less in papers with lower basis weights, as the lighter paper has less moisture than heavier paper.

## **c. GHOSTING**

Printing inks may undergo oxidation as they dry in the sheet-fed offset printing presses, and the oxidation process can cause the ink ingredients to decompose as the inks become dry. This can lead to problems like contact phenomena or chemical ghosting. If this happens when one-sided printing is being carried out, the front printed matter becomes visible in yellowish mirrored outlines on the reverse side of the paper. In front and reverse printing, the reverse side of the paper shows matt or gloss disparity marks. Aside from the oxidizing inks, the type of offset paper used for the printing may also be responsible for ghosting, although it is yet to be conclusively determined as to how exactly the paper causes ghosting. The phenomenon may also be influenced by how the blanket cylinder is arranged in the press. Whatever the exact causes of ghosting, it can be an exasperating problem, mainly when it occurs after a large amount of printing has been done. To avoid this, the Fogra Graphic Technology Research Association has developed a new and reliable method of pre-testing in the laboratory.

## **d. MOTTLING**

Mottling in offset printing is unwanted uneven print density and color variations leading to spotty & cloudy appearance.

If the paper surface is not uniform and experiences uneven pressure, there is likely to be an irregular absorption of dampening solution and printing inks in the different areas of the paper. As a result, the ink film layers on the paper end up having different thicknesses, and the paper becomes cloudy or mottled. This defect can adversely alter the appearance of the printed matter.

Mottling may also occur due to offset printing related issues like Back trap mottling and water repellency mottling. Back trap mottling can arise due to uneven ink setting resulting due to printing speed variations and ink setting speed, and due to back trapping sequence with difficult inks. Water repellency mottling arises due to water film on paper, or due to the uneven porosity of paper.

## **e. IMPROPER THICKNESS OF PAPER**

Offset paper should have just the right caliper, neither too thick nor too thin, for correct printing. If the offset paper is very thick, the sheet-fed offset printing press may have trouble processing it. To get around this problem, it may be necessary to modify the packing and see to it that there is a requisite amount of pressure between the blanket and the cylinders. It can take time to ascertain this, and it may lead to an increase in the overall printing cost.

Very thin papers, on the other hand, are difficult to feed into the sheet-fed offset printing press. They will do better with web-fed offset printing. Issues can arise here as well though. The use of very thin papers in web-fed offset printing presses can result in web tensions and subsequently web breaks. A lot of papers and inks may get wasted in this, increasing the general cost of the printing job.

#### **f. INADEQUATE OPACITY**

A paper's opacity depends on its grammage and composition, and papers with different grammage and compositions, therefore, have different opacities. Papers that have low opacity may prove to be troublesome for reverse side printing. The front side printed matter may be too clearly visible on the reverse side.

#### **g. PICKING**

Due to Non-conformity of paper surface to the tackiness of the printing ink, paper fibers may get ripped off the surface during the printing process and result in unwanted white areas. The paper may also end up getting torn.

#### **h. DUSTING AND LINTING**

Due to the inadequate coating of pigment binder and/or use of short fibers in paper production, the paper may suffer from linting. The lint mostly gathers on the paper edges and separates from the paper if the paper is sized or cut with a blunt knife as opposed to a sharp one. The lint particles fall and accumulate on the blanket, and this affects the proper transfer of ink from the blanket to the paper.

#### **i. DIMENSIONAL STABILITY**

For proper offset printing, the offset paper must be dimensionally stable, durable, and cut to the correct size or wound into a tight roll. When the paper is dimensionally stable, it will not get affected too much by the dampening solution that is used in offset printing or by the climatic humidity. Since paper has a hydrophilic character, it tends to absorb water and air moisture. If it absorbs too much of both, it can swell up and alter in size. Such alteration can create a problem with the color register in the printing press. This is known as a fan-out. When the paper absorbs water, the fibers that make up the paper swell width-wise, rather than length-wise. Most of the papers used in a sheetfed offset press have fibers that are placed crosswise to the printing direction and, on absorbing, water, it is the paper length that changes more than the paper width.

Paper is also affected by climatic humidity and can stretch or shrink as a result. This causes waviness or cockling of the paper surface before the printing process. It may also cause already bound papers to buckle and stretch. During paper manufacturing, if the fibers shift in direction, an increased humidity can lead to diagonal tensions and cause the paper edges to curl. In web offset printing, fluctuations in humidity can cause slack webs and result in web breaks.

Papers must be cut to the correct size and at right angles if they can be processed through the printing press feeder without causing stoppage before the printing process even starts. In web-fed offset printing, it is crucial that the paper rolls are tightly wound to avoid the problem of telescoping.