The Offset Printing Unit is presented to promote a better understanding of the skill and precision required to operate and maintain the printing unit of a sheetfed lithographic offset printing press.

To review, the printing unit is composed of the plate cylinder, blanket cylinder, and impression cylinder.

The top cylinder on most single-color sheetfed offset presses is the plate cylinder. Press manufacturers place this cylinder in the most readily accessible position on the press, leaving as much visible working area as possible because the press operator makes
more adjustments and changes on this cylinder than on any other cylinder.

The functions of the plate cylinder are: (1) to hold the plate tightly and in register; (2) to carry the plate into contact with the dampening rollers that wet the nonimage area; (3) to bring the plate into contact with the inking rollers that ink the image; and (4) to transfer the inked image to the rubber-covered blanket cylinder.

The plate cylinder is a precisely machined metal member, with steel rings at each end called bearers. A gap or cutaway section across the cylinder body holds plate clamps. There is a driving gear at one end, and journals at each end that run in bearings or bushings.
The plate clamps that are set in the cylinder gap are of several different designs but they all have two basic functions. The first is to hold the plate tightly and securely against the body of the cylinder;

...and the second is to permit limited movement of the plate by the press operator in order to change the lay or position of the image.

Some offset presses are equipped with "prepress plate positioning" devices. However, prepress plate positioning can also be accomplished with simple techniques. But, this makes mandatory the preparation of plates for exact position ahead of time.
One of the most common techniques is the "cylinder mark" system. In this system, marks are scribed on both ends of the plate cylinder in the gutter of the leading edge.

A mark is scribed in the center of the cylinder lead edge for centering the plate clamps. A corresponding center mark is also scribed on the plate clamp. Before the plate is inserted into the plate clamp, the center scribe marks of the clamp and cylinder must be aligned.

Corresponding lines are put on all plates so that when mounting the plate, the press operator merely lines up these marks to register the plate image on the cylinder.
Some presses have calibrated scales at the ends of the plate clamps and also in the center to position a plate.

Another system is the "pin and punch system" in which holes are punched into the plate that line up with pins at the lead edge of the cylinder or plate clamps.

Regardless of which system is used, prepress plate positioning is an important aid for the press operator. It eliminates many makeready problems and helps the operator get off to a quicker start.

Under the plate cylinder is the blanket cylinder. There is very little difference in the construction of the blanket and plate cylinder bodies. The blanket cylinder also has bearers, bearings, and drive gears. A cylinder gap holds blanket reels. The functions of the blanket cylinder are: (1) to carry the offset rubber blanket into contact with the inked
image on the plate cylinder, and (2) to transfer or offset the ink film image to the paper carried by the impression cylinder.

The rubber offset blanket is held securely on bars that are bolted to the lead and trailing edges of the blanket.

The blanket is then secured to the cylinder by attaching one end in the cylinder gap...

...wrapping the blanket around the cylinder and winding the tail of the blanket around a reel, pulling the blanket tightly by means of a ratchet or worm gear.
The impression cylinder, the third cylinder of the printing unit, is usually located behind the blanket cylinder and is the least similar of the three cylinders.

The cylinder runs bare. Its bearers are ground so that they do not contact the blanket cylinder bearers. The impression cylinder bearers are used to adjust for parallel between the impression cylinder and the blanket cylinder.

The clearance between the blanket cylinder and the impression cylinder is variable. This is to accommodate for the thickness of stock that is being run.
The clearance between these two cylinders is adjusted manually. On most presses the blanket cylinder is moved and on others the impression cylinder is moved. A calibrated indicator helps the press operator determine the amount of cylinder movement.

Located in the gap of the impression cylinder is a shaft on which grippers are mounted. The grippers hold the unprinted paper in register as the cylinder turns and presses the paper against the inked image on the blanket cylinder.

Shortly after the lead edge of the sheet passes through the printing nip, the grippers begin to transfer the paper for delivery out of the press by means of delivery bars, or to another unit by means of a transfer cylinder. Keep in mind that the transfer cylinder is not really a cylinder.
Now, let's look at cylinder bearers.

Located at the ends of the press cylinders are the bearers. If the bearers of the plate and blanket cylinders touch, it is said that the press runs on bearers. If they do not touch, the press runs off bearers. The bearers are either narrow bands ground below the level of the cylinder body or are hardened steel rings whose diameter is the true size of the cylinder.

Both types of bearers are used primarily to adjust parallel alignment and distances between cylinders. The hardened steel rings on the plate and blanket cylinders also tend to smooth out the flow of power between the plate and blanket cylinder.
The diameter of the plate and blanket cylinder bodies on presses that run on bearers is less than the diameter of the bearers. This difference is known as the cylinder undercut. Thus, if a cylinder is marked undercut .075", it means that the surface of the body is .075" lower than the surface of the bearer.

The amount of undercut is greater than the thickness of the standard plate or blanket, and is usually stamped on the cylinder. Knowing the undercut, a press operator can calculate the thickness of blanket, plate, and the packing to bring their surfaces up to the required height for good transfer of ink from plate to blanket.

Offset cylinders are connected by gears located at the ends of the cylinders.
There are two types of drive gears used on offset presses--the **helical** gear that has the teeth cut at an angle, and the **spur** gear that has teeth cut straight across the gear body.

Presses with spur gears have a **split** or **anti-backlash** gear on the plate cylinder gear. This gear is actually two gears bolted together.

When set properly, the split gear smooths out the flow of power from the blanket cylinder gear, preventing "backlash" caused by any clearance between the teeth of the plate and blanket cylinder gears.
The design of the helical gear eliminates backlash because it gives an even, continuous flow of power. However, this type of gear creates side-thrust on the cylinder bearings.

The driving gear on the plate cylinder has slotted holes where the cap screws bolt it to the cylinder body. When loosened, the cylinder can be moved either forward or backward in the around-the-cylinder direction.

This shift changes the image relationship between the plate and blanket cylinder and subsequently the image on the paper. With the exception of some duplicators, a forward shift of the plate cylinder will move the image toward the lead edge of the paper and a backward shift will move the image away. This movement of the entire cylinder body
makes possible an around-the-cylinder image shift without loosening the plate clamps.

To summarize, the printing unit of an offset press is composed of: (1) the plate cylinder which functions as the plate carrier, bringing the plate into contact with the dampening and inking systems and the blanket cylinder; (2) the blanket cylinder that carries the rubber blanket, which receives the inked image from the plate and transfers it to the paper; and, finally, (3) the impression cylinder which holds the paper and presses it against the image-carrying blanket.

Maintenance of the offset printing unit is the responsibility of the press operator. The press is a precision production unit and requires good housekeeping habits, such as proper adjustments, proper oiling, and cleanliness.

Preventive maintenance insures against premature wear and excessive downtime on presses. *Strict adherence to the manufacturers' lubrication procedures must be observed.*
Some of the most important parts of the cylinder to be regularly lubricated are the cylinder bearings and journals. These are lubricated on some presses by mechanical oilers. On others, lubrication is through grease fittings, while some have sealed bearings. In any case, the manufacturers' lubricant specifications must be strictly adhered to. Bearings and journals run best, and with the least amount of wear, when lubricated.

There are other areas of the printing unit that must be properly maintained. These are: the blanket tightening reels, pawls and worm gears, plate clamp pivot points...

...and gripper shaft bushings and cam followers. When lubricating these areas, check the oil holes to see that they are not clogged.
The cylinder gears that do not run in oil baths must also be lubricated, using a grade of grease recommended by the manufacturer. Before adding new grease, clean the gear teeth down to the bottom of each tooth where particles of ink, paper line, and gum accumulate.

Bearers must be kept clean. Ink, gum, and powder which may cling to the bearers when working on the plate or blanket must be removed before bearer pressure is applied. Also remove any rust that may form from spilled fountain solution.

The cylinder bodies must be kept clean and free from ink, gum, and rust. Washup solvents will remove ink; warm water removes gum; and rust-removing solvents should be used to remove rust. Do not use files, razor blades, or coarse abrasives to clean the cylinders.
When cleaned, the cylinder bodies can be covered with a fine coating of rust preventative oils, and wiped dry.

Caution: Lubricating and cleaning must be done only when the press is stopped. Excess oil should be wiped from the press to prevent it from running on the floor causing a hazardous working area around the press.

A clean and lubricated press is a better press to run. By following the manufacturers' recommendations and good housekeeping procedures, your press will operate at maximum efficiency and make your job easier.
The End.