Offset Printing CTP

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Lasers for Offset Printing CTP

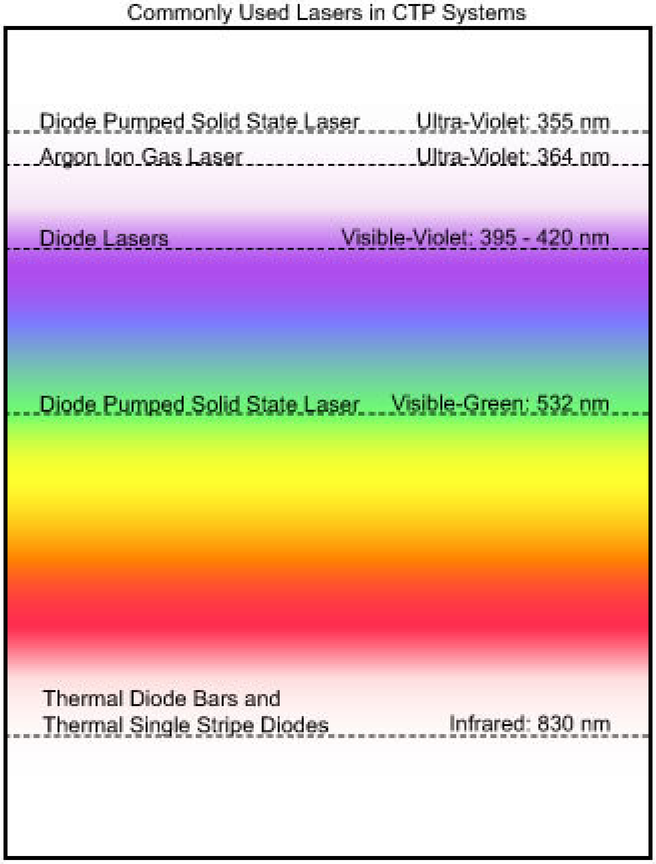
Laser Types

Different types of computer-to-plate systems require different types of laser light for proper exposure of the plates. Listed below are some of the most popular lasers used in offset printing CTP systems.

Some of the Common Lasers Used in CTP Systems		
Laser Type	**Wavelength**	**Description**
Diode Pumped Solid State Laser	355 nm (Ultraviolet)	A high-powered laser that can be used with inexpensive conventional plates. The laser itself is very expensive, but it is popular with lower volume printers because it lasts many years with limited use. The lower cost of conventional plates compared to visible light or thermal plates can pay for the added expense of the laser.
Argon Ion Gas Laser	364 nm (Ultraviolet)	A high-powered laser that can be used with inexpensive conventional plates. This laser is also popular with smaller print providers, but it is becoming less popular because of the success of the DPSS - UV laser.
Diode Lasers	395 - 420 nm (Violet - Visible)	Violet diode lasers are one of the fastest growing visible light laser technologies. They are less expensive than many other types of lasers, they are smaller, the shorter wavelength allows for a faster imaging time, and it has a long lifetime.
Diode Pumped Solid State Laser	532 nm (Green - Visible)	DPSS green lasers are used for imaging photopolymer plates and were used in early platesetters.
Thermal Diode Bars	830 nm (Infrared)	Thermal diode bars are used for imaging plates for high-volume runs

		and for imaging processless plates. They are inexpensive and are among the most popular lasers used for CTP.
Thermal Single Stripe Diodes	830 nm (Infrared)	Thermal single stripe diodes are used for imaging plates for high-volume runs and for imaging processless plates. They are inexpensive and are among the most popular lasers used for CTP.

Commonly Used Lasers in CTP Systems



GLV Technology

When GLV (Grating Light Valve) technology is used in CTP systems, it allows for the best image quality and speed in production. The technology is often used in external drum platesetters for CTP systems as well as in high definition television.

GLV technology uses Micro Electro Mechanical Systems (MEMS), which allows for microscopic structures to form on silicon chips. The structures are reflective and are constructed of several ribbon-like elements that can be moved up and down through the control of electrostatic forces. The motion of the ribbons covers only a small distance, which is equal to a fraction of the wavelength of light. The different ribbon elements are configured in a pattern that allows the structures to reflect and diffract light waves, which varies the level of light reflected from the surface of the silicon chip. In an analog system, the light is continuous, but the level of light is variable. In a digital system the light is pulsed (switched on and off). GLV is capable of handling extremely high laser power because its high reflective properties provide an efficient use of light.

Imaging optics for GLV based CTP systems provides a larger quantity of writing beams, which means that the imaging drum rotation speed can be reduced while still providing a greater degree of productivity. GLV technology is most often used in conjunction with several thermal (infrared) CTP systems.

Useful Life of CTP Lasers

The useful life of the laser in CTP imaging systems is often determined by the length of time that the laser remains on. The light emitted by various lasers is either continuous or pulsed energy, so continuous wave laser beams have a disadvantage in that regard. The life of the laser is very important to large print suppliers that may require the imaging of hundreds or thousands of plates per day. Smaller printers may have success with continuous wave laser beams because small quantities of plates are imaged per day. Limited use of continuous wave laser systems will prolong the life of the laser.

It can be very expensive to replace a laser for a CTP system, such as the diode pumped solid-state ultraviolet laser, if it fails or is damaged. A CTP system can experience a total failure of the laser unit, but more often it fails gradually over a long period of time. Some types of lasers, especially UV lasers can be reconditioned for continued use.

CTP Offset Plates

Classifications

Plates for computer-to-plate technology can be classified in several ways. They are often described by the base substrate of the plate, emulsion type, exposure effect, exposure spectrum, exposure power, and/or the property of creating debris on the plate during imaging.

- Base Substrate: the material used to construct the plate, such as metal, polyester, or paper.
- Emulsion Type: the type of material coated onto the base substrate
- .Exposure Effect: the plate is described as either a positive working plate or negative working plate.
- Exposure Spectrum: describes the portion of the electromagnetic spectrum used for imaging CTP plates.
- Exposure Power: described as either "slow emulsion" or "fast emulsion".
- Emulsion Debris: a CTP plate can be described as an ablation plate, controlled ablation plate, or a non-ablation plate, based on the material that may or may not be removed from the plate during imaging.

Base Substrates

There are three types of substrates used as a base for most digital plates: metal, polyester, and paper.

- Metal

  Plates made from metal are used for the largest print jobs because they have a much longer life than other substrates. Aluminum, which is traditionally used as the substrate for metal analog plates, is also used for digital plates. The plates are grained so they are able to hold a thin film of moisture, which keeps the non-image areas free from ink during the print run. The areas of the plate that are imaged become receptive to ink.

  Metal plates are coated with a variety of photosensitive emulsions, including silver halide and photopolymers, depending on the type of plate and process used. Metal plates are typically used for print runs ranging from 100,000 to 2,000,000 or more.

- Polyester

  Polyester or plastic plates cost less than metal plates and are a good alternative when press runs of 25,000 or less are required. Earlier versions of polyester plates produced substandard printing which has given them a poor reputation in spite of the fact that the plates have been substantially improved during the past few years. The plates are now often used for small four-color process jobs that are printed with superior quality. Some polyester plates are rated for line screens as high as 175 lpi, which produces a good quality print job. Tonal ranges of 5% to 95% are common with most polyester plates.

  Improved technology has helped to alleviate the problem of plate stretching, which in the past was a common problem with longer runs using polyester plates. Plate stretching resulted in distortion and in poor registration of the print. Improved platesetting equipment has also contributed to the success of polyester plates.

  Polyester plates are available in a variety of sensitivities, which means that they can be imaged by several different types of lasers. The plates that are most often used are suited to red and infrared lasers. Common emulsion coatings for polyester plates include silver halide, which are imaged with lasers, and toner-based coatings in which the image is fused onto the plate by heat.

  Polyester plates are not grained like metal plates during manufacturing, but are instead chemically treated so the plate surface will hold moisture during the print process. The plates come in a variety of thicknesses, usually ranging from 0.004 to 0.012 inches. The thicker plates are used for longer runs because their bulk makes them a bit more durable.

- Paper

Paper plates are made with a cellulose material and come in thicknesses ranging from 0.004 to 0.008 inches. Like polyester plates, paper plates are not grained, but are chemically treated during manufacturing so that the surface is receptive to a thin layer of moisture. The plates are used for short runs on smaller printing equipment and use a toner-based technology for imaging the plates.

Emulsion Types

The plate emulsion is the material that is coated onto the base substrate, which reacts to the wavelength of light emitted by the CTP imaging laser to produce an image on the plate (either a positive or negative image). There are many different types of emulsions used depending on the type of laser used for imaging and the type of application that will be produced. Some plates are baked after imaging in order to increase their effectiveness for very long press runs.

Emulsion Type	**Positive or Negative**	**Run Length** (Depending on Brand)
Silver Halide	Positive	200,000 to 350,000 (unbaked)
Silver Diffusion	Positive	200,000
Photopolymer	Negative	100,000 to 400,000 (unbaked) 1,000,000 (baked)
Photopolymer	Positive	150,000 (unbaked) 1,000,000 (baked)
Latex Coalescence	Negative	100,000 (unbaked)
Thermal	Negative	20,000 to 300,000 (unbaked) 500,000 to 1,000,000 (baked)
Thermal	Positive	20,000 to 2,000,000 (unbaked) 1,000,000 to 2,000,000 (baked)
Emulsions for Polyester Plates	Positive	15,000 (cannot be baked)
Emulsions for Paper Plates	Positive	5,000 (cannot be baked)

- Silver Halide/Silver Diffusion

  The coating on a silver halide/diffusion plate is made of photosensitive compounds that are similar to the compounds in photographic film. The earliest type of silver halide plate was made with a polyester base and was colorblind, meaning that they were not sensitive to visible light wavelengths. They were capable of only single or spot color printing. Early metal plates were also for single and spot color and were exposed with an Argon Ion laser at 488 nm.

Metal plates are now panchromatic which means that they are sensitive to visible light wavelengths and are imaged with various lasers including 488 nm blue lasers, 532 nm FD-YAG lasers, a red lasers at 670 nm. They have a high resolution with screen rulings of 300 lpi or more. The plates are capable of long press runs.

Because the coating on the plates contains silver, which is a toxic heavy metal, any portion of the coating removed during processing must be handled as hazardous waste. The plates also tend to be more expensive than other types because of the silver content.

- Photopolymer

  Photopolymer coatings contain no silver. The emulsion contains light sensitive plastic and is exposed by Argon Ion lasers at 488 nm or double frequency YAG lasers at 532 nm. The plates are rated for up to 200 lpi and are capable of press runs of up to 250,000, but runs of 1,000,000 or more can be achieved if the plates are put through a baking process after they are developed. A big advantage of photopolymer plates is that they are manufactured without hazardous ingredients, so they can be processed with aqueous solutions and are much safer to work with. There is no silver residue and processing chemicals that require special disposal techniques.

- Hybrid

  A hybrid plate has a metal base with two different photosensitive coatings. The top coating is made with silver halide, which can be exposed optically or digitally. The bottom coating is a conventional photopolymer, which is sensitive to ultraviolet light. The top emulsion layer is exposed and the plate is processed to remove the unexposed portion of the top coating. The exposed portions of the top coat act as a mask. The plate is then exposed to ultraviolet light, which exposes the unmasked portions of the bottom coat. The mask is then remove by the processor, which processes the exposed portions of the bottom emulsion as well. This is the layer that is actually used for the printing process. Some of the resolution can be lost because of the dual exposure technique, but the plates are still rated for a 200-lpi resolution and can handle press runs of over 1,000,000 if post-baked. One drawback with a hybrid plate is that there are two separate types of hazardous waste that must be handled do to the two types of emulsion: silver and photopolymer.

- Thermal

  Instead of using visible light lasers to expose an image on the plate, infrared is used. The infrared wavelengths are beyond the visible spectrum and produce heat. Thermal plates are coated with special polymers that react to the heat of a specific wavelength within the infrared band. Heat from the infrared laser beam must reach a required level in order for the reaction to occur. Heat below the required level or wavelength will not affect the plate.

Since thermal plates are only sensitive to infrared light, they can be handled in visible light without any adverse affects. Another benefit is the "either or" aspect of the exposure. The plate can only be imaged if the heat from the laser is high enough, otherwise nothing happens. The plates can also provide a slightly sharper dot than what can be generated with a visible light system.

There are several types of thermal plates available including ablation plates and cross-linking polymer plates. Ablation plates are those in which thermal lasers actually ablates (removes) areas of the emulsion while the plate is being imaged. The removed are left as a residue on the plate that must be washed away. Cross-linking polymer plates contain emulsions that consist of two resins that are cross-linked when the plates are expose to the proper wavelengths of infrared light. The prices of thermal plates continue to fall, which makes CTP much more attractive to many print providers that have not already converted to CTP.

Exposure Effect

CTP plates can be classified into two groups based on the type of image that is produced on the plate after the imaging process is complete. A plate can be either positive working or negative working. When a positive working plate is exposed, the imaging system creates non-image areas on the plate. The laser loosens the emulsion during exposure, which is then washed from the plate revealing the metal substrate beneath. The metal substrate attracts moisture during the printing process and the unexposed areas of emulsion, which are the image areas, attract ink. When a negative working plate is exposed, the process works just the opposite and the areas of the emulsion exposed by the lasers are the areas that attract the ink during the printing process. There are many types of positive working and negative working CTP plates available, depending on the type of imaging system used and the types of photosensitive coatings applied to the plate substrates.

Exposure Spectrum

The exposure spectrum describes the portion of the electromagnetic spectrum used for imaging CTP plates, such as infrared for thermal plates, visible light for light sensitive plates, and ultraviolet for UV-sensitive plates.

Three of the most popular technologies for CTP imaging are thermal lasers (infrared), violet lasers (visible light), and DPSS Ultraviolet lasers. Thermal imaging heads generate heat because of the infrared wavelengths that are necessary for imaging. The heat from the imaging lasers changes the chemistry of thermal plates, which allows the image to appear. Violet imaging uses visible light to change the plate surface chemistry to create an image on the plate. Thermal plates require more energy than violet technology to produce an image on the plate, but the thermal technology allows for plates that are chemical-free and even plates that are process-free. Some CTP Ultraviolet imagers allow for imaging on conventional plates and while the laser is expensive, the system allows printers to continue using many of the conventional plates that have been successful for them in the past.

Various types of plate emulsions require different wavelengths of light for proper imaging. The table below shows a few examples.

Emulsion Type	Imaging Wavelengths
Conventional Offset Emulsions	355nm, 364 nm (Ultraviolet)
Silver Halide	400 - 410 nm, 532 nm (Visible Light)
Silver Diffusion	488 nm, 532 nm, 670 nm (Visible Light)
Photopolymer	405 nm, 488 nm, 532 nm (Visible Light)
Latex Coalescence	830 nm (Infrared - Thermal)
Thermal	830 nm is common, others are in 800 - 1200 nm range (Infrared - Thermal)
Emulsions for Polyester	780 nm (Infrared - Thermal)
Emulsions for Paper	780 nm (Infrared - Thermal)

Exposure Power

CTP plates can be classified into two groups based on the exposure power. Plate coatings can be described as either "slow emulsion", which require large quantities of energy for proper exposure, or "fast emulsion", which require much less energy for exposure. An example of a slow emulsion plate is a thermal plate, of which there are many varieties. The number of plates that can be imaged per hour on one machine is less than other technologies because of the increased imaging time. Conventional offset plates imaged with UV lasers have a fast emulsion and require much less energy than thermal and many more can be imaged per hour.

Emulsion Debris

When certain types of CTP plates are imaged, material is removed as a result of the imaging process and debris is created on the surface of the plate. There are other types of CTP plates, in which no material is removed from the plate and no debris is formed. There are three categories under which CTP plates can be classified with debris formation as a criterion: ablation plates, controlled ablation plates, and non-ablation plates.

- Ablation Plates

  When ablation plates are imaged, a residue is formed on the plate from the areas of the plate emulsion that are ablated, or removed, during imaging. The residue must be washed from the surface of the plate before it can be used for printing at the press. Ablation plates are the dominant CTP plate type.

- Controlled Ablation Plates

  During the imaging process, the laser loosens areas of the plate emulsion, but rather than washing it off manually, the fountain solution at the press further loosens the unwanted material from the plate. The debris is carried away by the ink and is then deposited onto the paper as the first few impressions are printed at the press, which is faster than having to clean the plates manually before printing. This system helps to eliminate the accumulation of debris from the lens of the laser and from the press.

- Non-Ablation Plates

  When non-ablation plates are imaged, there is no residue left on the plate. Many of the plates are constructed of traditional grained aluminum and require less energy for imaging than ablative plates. There are also no environmental concerns because there is no ablated emulsion material that requires disposal.

Processless CTP Plates

Processless CTP plates have several advantages over chemically processed plates. Processless CTP plate systems require a lower initial investment, the plates are daylight safe, and because the system requires fewer steps than chemically processed CTP plate systems, processless plates are less labor intensive. Less equipment is necessary because there is no need for large processing units. There are no chemicals needed for development of the plates and so there are no environmental issues with the proper disposal of chemicals, (which can be expensive). All of these advantages add up to a significant long term cost savings, a process that is environmentally friendly, and a system that is easier, safer, and less time consuming for people to use. However, it is worth noting that the chemistry is continually improving for chemically processed CTP plates, which makes the chemicals safer and helps to alleviate some of the environmental issues concerning the chemicals.

Lower volume printers have much to gain from using processless CTP plates. Although the plates are more expensive than chemically processed CTP plates, there is a smaller initial investment, an expensive processing machine does not have to be maintained, and a constant supply of chemicals does not have to be purchased. At the press, using processless plates usually requires only some adjustments in rebalancing the fountain solution. The print quality with processless plates is often equal to that of chemically processed CTP plates.

As good as processless plates are, there are issues where further development is necessary in order to compete with traditional CTP plates. An increased rate in the number of press ready plates that can be produced per hour must be achieved as well as the maximum number of impressions that can be printed per plate. Processless plates are ideal for smaller print providers that often produce jobs under 100,000 impressions.

Ink-Jet Plates

Plates for computer-to-plate applications can also be created with ink-jet technology. A proprietary fluid is sprayed onto a metal base to create the image from a digital record. Creating the image form a digital record means that imaging can take place without the use of lasers or any other type of exposure. The plates require no processing or post baking and can be used immediately after the imaging is complete. Another advantage is that the platesetters for ink-jet systems are less expensive than laser or thermal equipment. Although the quality of items printed with ink-jet systems is very good, it still cannot match the quality achieved by laser or thermal technology. This may be the only drawback of the ink-jet plate.

"No Plate Required" CTP Systems

Offset printing systems have been developed that not only eliminate film from the workflow, but also eliminate the plate as well. These systems are known as computer-to-press offset printing systems. The Man-Roland DICOweb (DICO stands for "Digital Changeover") is one such system. The DICOweb uses lasers and a thermal ribbon to create images on removable cylinders.

Each of the cylinders (one for each process color) is imaged in one step with a direct thermal transfer process. A thermal material, which becomes the image area, is transferred to the plate. A wetting agent keeps the non-image areas of the plate cylinder clean during the print run. A short run of 500 impressions can be produced immediately after imaging is complete. When a longer run is required, the thermal material must be baked onto the cylinder, but this additional step requires only two minutes. When the printing is complete, the thermal image material is automatically cleaned from the plate cylinder so that the cylinder can be ready for reimaging for the next job.

The cylinders can be reimaged several hundred times before they require replacement. The entire process of imaging and cleaning requires less than 12 minutes to complete and a resolution of 3200 dpi can be achieved.

Production Steps for Different CTP Plates

Plate Type	Imaging	Pre-Baking	Developing	Washing	Post-Baking	Finishing	Printing
Thermal Pre-Baked	X	X	X		X	X	X
Visible Light	X		X	X		X	X
Thermal	X		X			X	X

No-Bake Chemically Processed							
Thermal Chemical-Free	X			X			X
Thermal Process-Free	X						X

Platesetters

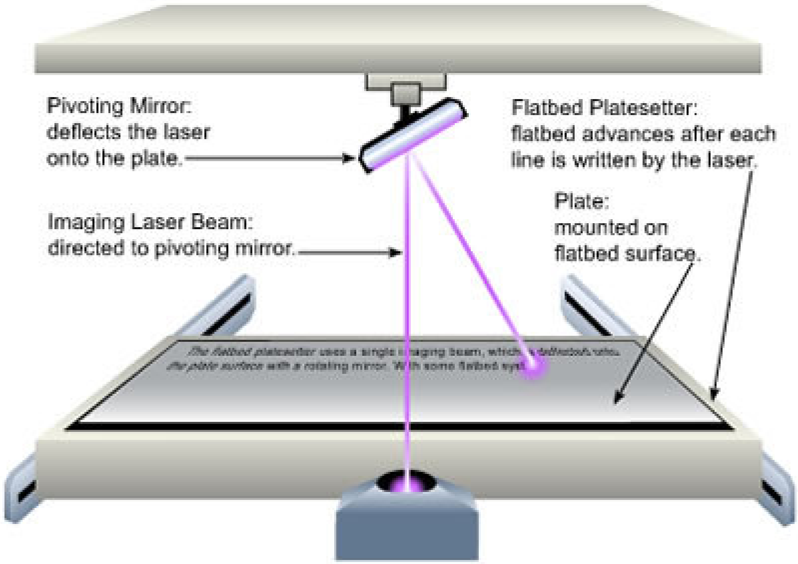
There are many different types of platesetters used for offset printing CTP systems and there are many manufacturers, but all of the platesetters are of three basic designs: flatbed, internal drum, and external drum. Each design has its advantages and each one is accurate in its imaging capabilities.

Flatbed

As the name implies, plates that are imaged on a flatbed platesetter lie on a flat surface. The flatbed system allows for easy loading of the plate. Most flatbed platesetters use a single imaging beam, which is deflected onto the plate surface with a rotating mirror. With some flatbed systems, the flatbed moves as each strip of the image is being written onto the plate by an imaging beam that is deflected by a mirror. The mirror remains centered over the plate, but pivots to write the full line. With other flatbed systems, the flatbed remains stationary as the imaging beam, which remains centered on the plate, advances along the plate to write each line. Like the moving plate bed version, the mirror pivots in order to write the full length of the line.

Since the imaging beam does not travel side to side, the distance between the laser and the plate changes as the laser is beamed across the width of the plate. The distance is shortest when the laser is directly overhead and it is longest when the laser is imaging the left and right edges of the plate. To ensure that the dot size and shape is not distorted across the width of the plate (due to the varying distance between the laser and the plate), the laser is directed through a special lens that compensates for this.

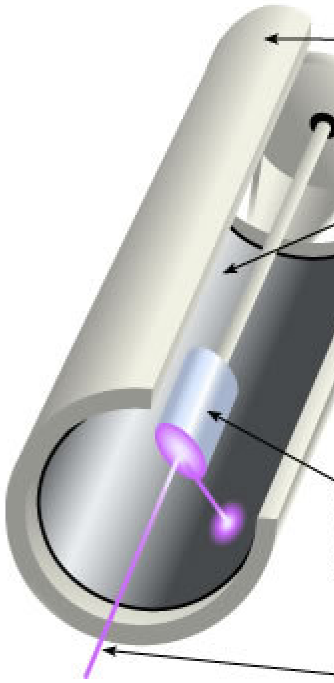
The design of the flatbed unit allows for efficiency in plate handling and high production rates, but the imaging technique used with flatbed systems limits the width of the imaged area. Flatbed systems are most often used for imaging visible light plates.



Internal Drum

The internal drum platesetter design resembles the letter "C" because of its open concave design. The plate is mounted on the inside of the drum and is held in place with a vacuum that draws the plate to the curved surface. A single laser beam is used to write the digital image onto the plate. The laser beam is projected onto a spinning mirror that rotates at a very high speed. The spinning mirror deflects the laser beam onto the plate at a 90° angle. As the mirror travels down the axis of the drum, one scanned line per revolution of the mirror is written onto the plate. The concave drum remains stationary. In order to change the resolution of the image on the plate, the diameter of the laser beam is changed.

When imaging thermal plates on an internal drum platesetter, there may be limits on how fast the mirror can spin when deflecting the laser light onto the plate. This is because the slower emulsion of the thermal plates requires high energy and a long imaging duration, which means that the production will be slower compared to that of other types of plates.



External Drum

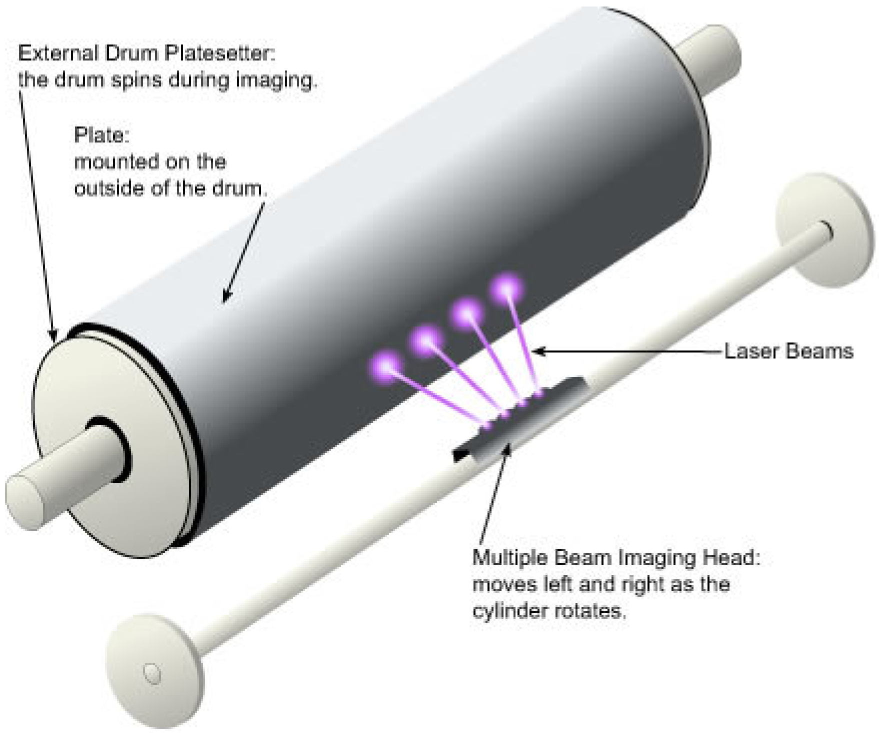
External drum platesetters are designed to have the plate mounted on the outside of the drum. As the drum rotates on its axis, a multiple beam laser head moves parallel to the drum and burns the image on the plate.

The external drum system does not require any mirrors for the lasers and it allows the imaging head to be placed closer to the plate surface. This is beneficial for imaging thermal plates, which require high-energy output for proper results.

Some external drum systems require counter balancing measures because the weight of the plate mounted on the drum can throw the drum out of balance when it spins at high speed, due to centrifugal force. To achieve high quality results, the drum must spin accurately in order for the imaging head to maintain optimum beam intensity. A wobbly drum can change the intensity of the light hitting different areas of the plate.

Some manufacturers avoid the imbalance problem by designing platesetter drums that rotate slowly, but are equipped with multiple imaging heads. A different type of problem, known as stitching, can potentially occur with multiple imaging heads. Stitching occurs in areas where the first imaged line of one laser abuts the last imaged line from another laser. A distinct line between the two areas may be noticeable on the printed page because of a slight overlap between the areas imaged by different laser heads or because the dots may not be as sharp in adjacent areas because of one the characteristics of one laser changing more rapidly the another. Periodic adjustments may be necessary for multiple imaging heads to maintain proper quality.

In order to change the resolution when using external drum systems, the distance between the multiple beams must be changed. Unlike internal drum systems, the diameter of the beams cannot be changed.



Advantages of CTP for Offset Printing

- CTP eliminates the steps required for conventional platemaking, which requires a film workflow. The elimination of the steps required for producing and stripping film for plate production saves a considerable amount of time.
- Human error is reduced with the elimination of manual stripping and platemaking.
- Storing digital images is easier and more efficient than storing film and flats, which can require large amounts of physical space.
- Film can get scratched and damaged, even in storage, but digital images will always look consistent, clear, and sharp.
- Print quality is improved because the dot gain associated with imaging plates from film is eliminated. In fact, with a film workflow, dot gain may be as much as 5 or 6 percent.
- The reduction in potential dot gain allows denser inks to be used at the press, which provides improved color saturation and print quality.
- Because film substrates are affected by temperature and humidity changes, the film may stretch or shrink resulting in registration problems at the press and substandard quality. CTP eliminates these problems because no film is involved.
- Copy changes are much easier with CTP because changes are made to a digital file, which is imaged onto a plate rather than having to produce new films and strip them into a flat for burning onto the plate.

- Film and conventional platemaking can create large quantities of hazardous waste as byproducts, such as silver and developing chemicals. The hazardous waste materials must be disposed of properly, which can be costly. CTP technology eliminates much of the hazardous waste problems.