Printing Technology White Paper

Why Thermal Outclasses Laser Printer for Label Printing

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Abstract

Laser printers have long been used in label printing applications primarily because laser printer hardware was already in use and its multi-function capability made it easy to adopt into the application. Since adoption was easy, often operating costs, cost of ownership, and technology solution evaluations were overlooked.

After laser label printing applications became the norm, users began to see the shortfalls of using laser printers to print labels. Users are now demanding better label printing solutions even though they must overcome a large installed base of laser printers.

In addition, they must deal with the transition from laser to thermal. PCL – Printer Command Language – is the most common command language utilized in laser printers. Replacement of these printers requires one of three transition methods:

1. Drop PCL and reprogram in a label printer's native command language.
2. Reformat the PCL laser sheet and install PCL compatible label printing solutions.
3. Utilize a standard operating system driver and reformat the printed page.

Laser Printing Labels Issues

Laser printers can be used to print a large variety of media types, from plain paper to transparencies. However, when printing on anything other than plain paper, special precautions must be taken. These include anything from laser specific media, custom printer components, and special maintenance procedures. Laser printing labels is no exception. Special precautions must be taken to print labels reliably on a laser printer because of the way the laser printer is designed.

Laser Printer Design

Laser printers have many moving parts, path changes, and require the heated fusion of ink (toner) to paper. When printing on labels many problems can occur, from backing separation to adhesive seepage.

The diagram on the next page is a simple representation of a typical laser printer. It shows the paper path and the main components for printing.
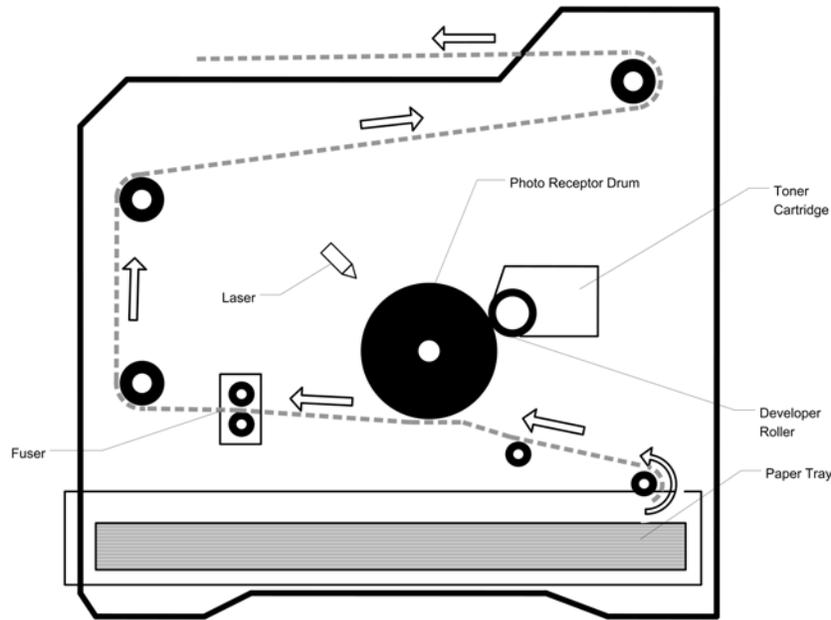
Laser Printer - Typical Paper Path and Basic Components

A. Laser Printer Paper Path

The diagram shows the media path changing directions four times, passing by the photo receptor drum and applying compression, heat and toner, and then passing by the fuser where high compression and heat are applied. Each component adds another chance for the printing process to fail.

Media Path

Each time the label changes its path direction, it separates from the silicon-coated backing. Separation is detrimental to any printer mechanism especially when dealing with labels. A label that separates from the backing while in the printer will adhere to the first surface in which it comes in contact. Recovery requires access to the failure point, removal of the label, and cleaning of the components – all of which contribute to significant downtime.

Heat and Compression

In the laser printing process, heat and compression are applied twice, first in the photo receptor drum and then with even higher heat and compression in the fuser. Heat across the whole page is necessary in laser printing. Applying heat increases the melting temperature of the label adhesive and decreases viscosity. This allows the adhesive seep out of the label's edges.

Compression is also applied each time the sheet changes paths, and passes by the photo receptor drum and fuser. Compression squeezes the adhesive between the label and the silicon backing forcing it out through the edges of the label.

Failures due to heat and compression require cleaning of the components, which can contribute to significant downtime. Printers that perform label printing require more service than those that only perform bond paper printing.

Special Precautions

Laser supply and manufacturing companies have addressed label printing problems with a variety of products and services. We call these "special precautions," because these activities are only necessary to increase label printing reliability. Laser printers will typically process and print on label sheets without these special precautions, but not without sacrificing volume or reliability. No matter what special precaution a company uses, all increase operational costs.

The following are examples of precautions:

Special Toner Cartridge

Some manufacturers offer oil fused wipers for customers printing high label volumes. Details on the technology and positive effects on reliability have not been publicized.

Frequent Maintenance

Certified service partners offer special preventive maintenance contracts for customers who print at high volumes.

Spot Adhesive Placement

Spot adhesives – also known as patterned or zoned adhesives – keep the adhesive away from the label edge. This helps stop the adhesive from seeping out. This is not a common practice and introduces higher label costs to the user.

Special Adhesives

Some label production companies offer a special non-ooze adhesive to prevent jams. However, this non-ooze adhesive does not offer a permanent bond.

Choosing the Right Label Printing Technology

Thermal printing is the best technology for printing labels for many reasons. The first is simplicity of design. Thermal printers do not have many moving parts and the paper path is simple and direct. Additionally, the print mechanism is extremely simple and consists of only a printhead and platen. Unlike laser printers that must heat the whole sheet to image, thermal printers only apply heat at the precise printing point.

When making the switch from laser to thermal printing, consider these limitations:

Color

Typically thermal printers only print in black. There are special thermal sensitive labels that allow the printing of two colors, but one must be black. A work-around is to preprint corporate logos and other details on the label. This does not affect printing reliability, but could increase cost. If you must print in color, laser or inkjet are your only options.

Page Size

The most common width in thermal printing is 4.2 inches, half of the standard 8.5 inches for laser printers. If printing format is flexible, rotate, resize, and reposition design and text to take

advantage of a thermal printer's capability for extremely long formats. When wider formats are needed, laser printing is the only option

Sheet Printing

Thermal printers typically use rolls of labels that have a perforation to separate labels. Options for cutting between labels or peeling the label from the liner are commonly available. However, most thermal printers do not have the capability of sheet feeding.

Exit Options

Exit options like stacking, sorting, and stapling are not typically available on thermal printers. These options will need to be developed to provide a solution for a thermal printer.

Transition Challenges

Upon the decision to change to thermal printing, you are likely to run into transitional challenges. Since installed base printers communicate in PCL, you will have to deal with reprogramming. You have three options:

1. Reprogram in a thermal printer's command language.
2. Reformat in PCL and install a thermal printer that is PCL compatible.
3. Use the host PC's operating system printer driver and select that printer. (Option C requires application runs on a host PC and utilizes the operating systems printer drivers)

The Solution – Cognitive's NEW C Series Thermal Label Printer

Cognitive's C Series printer solves all the reliability issues and supports all the transitional options. C Series printers overcome all the problems that laser printers face when printing labels. Plus Cognitive's thermal printers address integration and transition issues by being PCL compatible.
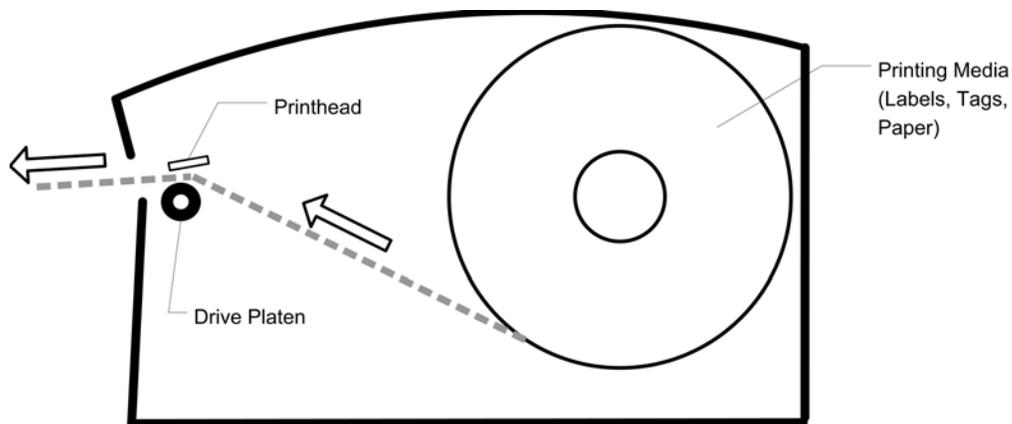
Thermal Printer - Typical Paper Path and Basic Components
B. Thermal Printer Paper Path

C Series – A Superior Label Printing Design

Cognitive's C Series is designed to handle and print labels reliably, and addresses each of the design shortfalls that contribute to label printing problems in laser printers.

Media Path

Unlike laser printers, the C Series printer has a very simple media path – labels travel from the label roll to the printhead and image then exit the printer. The labels change media path direction one time and only slightly at that. The C Series printer's simple media path eliminates failures due to label separation.

Heat

Heat is only applied at the point that imaging takes place. By not heating the entire label and decreasing the adhesive viscosity like laser printers, the C Series does not promote adhesive seepage. Standard labels and adhesives can be used to avoid higher operational costs.

Compression

There is only one compression point in a C Series printer, where the printhead compresses the label against the drive platen at the printer's exit point. Without heat or a media path change, there is little chance that label separation will occur.

Maintenance

Because the C Series printers are designed to print on labels, the printhead assembly is built to allow easy access to the label path, for easy cleaning and maintenance. The figure below shows how the printhead assembly opens.
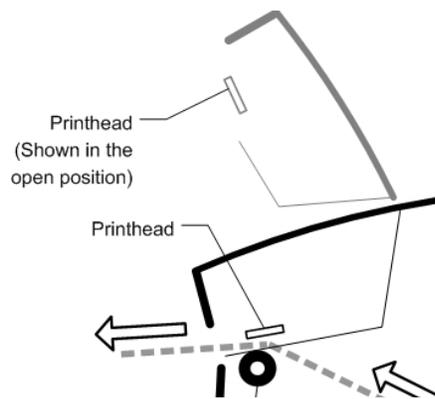
C. Easy Maintenance High Lift Printhead

PCL Compatibility

C Series printers are PCL5 compatible. The immediate benefit is that programming resources do not have to learn a proprietary language. Compatibility is only limited by the physical constraints of the printer. Exception rules built into the firmware allow for commands that are not within the printer's capabilities.

Thermal Printing Methods

There are two types of thermal printing methods – direct thermal and thermal transfer. Both methods use a printhead that generates heat at the precise printing point to create dots as the label passes by the printhead.

Shown in the diagram above, direct thermal printing requires a thermal sensitive label which turns black when heat is applied.

Thermal transfer printing uses a ribbon to transfer thermal sensitive ink between the printhead and label. The ink is transferred when heat is applied as it passes under the printhead.

Both thermal print methods are offered in C Series printers.

Transition Option A – CPL (Cognitive Programming Language)

Transition Option A calls for programming in the thermal printer's command language. This requires learning a new programming language and committing to a specific manufacturer's hardware CPL (*Cognitive Programming Language*). Programming in the native language may result in the benefit of better performance.

Transition Option B – PCL5 Compatibility

Transition Option B utilizes the existing laser printer command language, PCL. Resizing and reformatting the PCL page is required to fit the thermal printer's envelope. Or the existing PCL page may be sent to the printer and the printer can determine what area to print. The C Series printer is capable of cropping, rotating, and placing the full PCL page for proper printing within the thermal printer's envelope.

Reformat

Reformatting requires PCL reprogramming to select the desired print information, size to fit in the thermal printer envelope, and orientate the print area properly.

Crop, Rotate and Placement

C Series printers have the capability to crop a specific area of the laser sheet, rotate to proper orientation, and move to the origin. No changes to the original programming are necessary using this method. A print definition file must be sent to the printer to set up the parameters of crop, rotate, and placement before printing.

Page Sizing – Special Note

The page size or length for a thermal printer can be over 100 inches long, essentially having an unlimited print size capability. This can be advantageous when dealing with additional print requirements like text size, promotions, duplicates, and application growth.

Reformatting Laser Sheets to Thermal Continuous

By changing the PCL programming, laser sheets can be reformatted and resized to print on a narrow format thermal printer. The figure below demonstrates a standard 8½″ x 11″ sheet with four print areas being transitioned to 4¼″ wide media.

- Print area ① represents the label area of dual web form that is part label and part bond paper. It is transitioned to a dedicated label printer. This area could contain the destination and tracking information that is typically found on a shipping label.
- Print area ② is the bond paper portion that is being transitioned and printed on thermal paper. This area could contain invoice or receipt information.
- Print area ③ may have additional shipping information, special instructions, or customer information.
- Print area ④ represents a long document that could contain warning information or large print to catch the attention of the recipient.
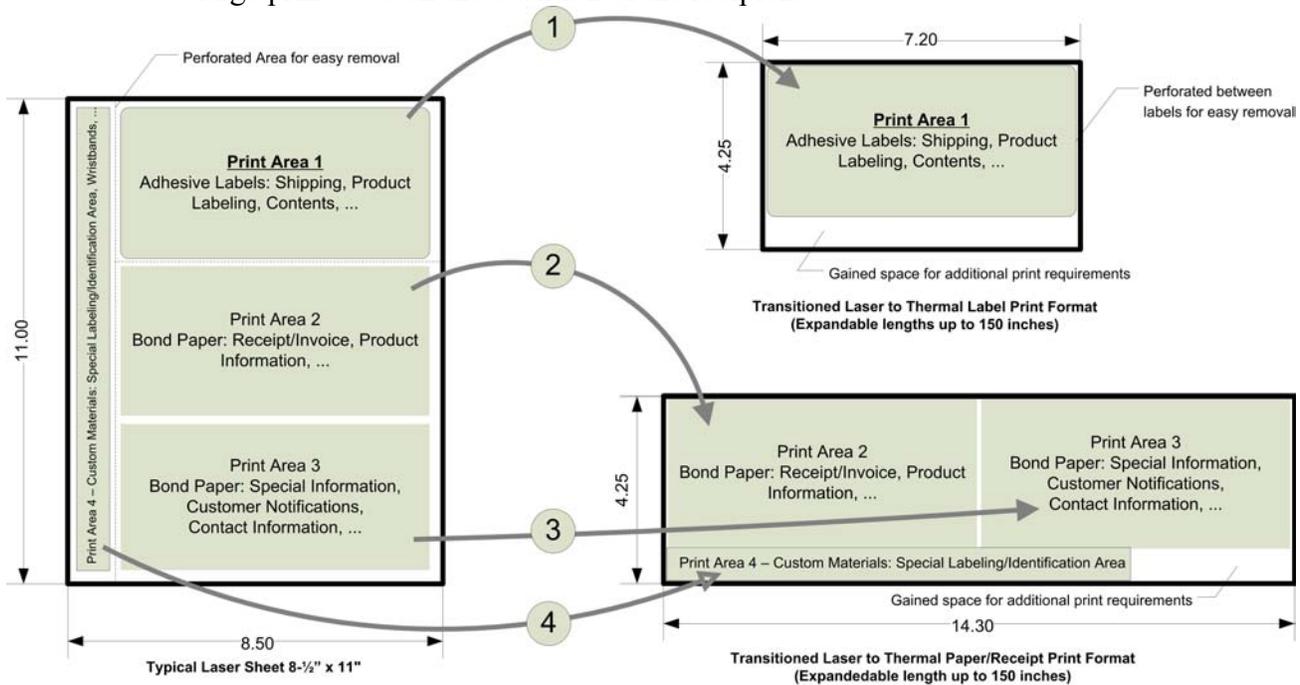
Sample Transition Laser to Thermal Print Formats
D. Example: Standard Laser Sheet to Thermal

Transition Option C – PC Host Operating System Drivers

Transition Option C requires the application to run in a Windows operating system and utilize the printer driver.

Conclusion

There are several reasons to select thermal over laser printing ranging from simple hardware design to low ownership costs. However, the best reason to select Cognitive's C Series thermal printer is because thermal printing is the most reliable label printing application. In addition, the C Series is PCL5 compatible, making it the easiest to integrate into your application.