THERMAL TRANSFER LABELS & TAGS

Thermal and thermal transfer printing began their rapid growth in the mid 1980s, driven by the implementation of automatic identification systems utilizing bar code. These systems make possible the fast and reliable collection and transfer of information. As a result, this is the preferred method for on-demand printing requirements, given its relative low cost and reliable process.

Both direct thermal and thermal transfer printing technologies use heat to create an image. The printers employed in both technologies use the same type print head, with the media used determining the process employed. In fact, most thermal transfer printers can be converted to direct thermal printers by disabling the ribbon mechanism.

PRINTER TECHNOLOGY

The print head is the key to the process. They are solid state and designed to operate in warehousing and manufacturing environments. Print heads are stationary and the media advances past it. They contain a line of tiny, single controlled elements (hot dots), numbering 200 to 400 per inch arrayed across the face of a ceramic carrier plate. The number of elements in a print head determines print resolution (DPI), with most being 203, 304, and 400 DPI.

The elements in the print head are square whereas laser and ion deposition utilize round dots. This is a key difference that allows thermal and thermal transfer to print straight edges. This allows these printers to print higher density bar codes. Because of the difference in dot shape, direct thermal and thermal transfer technology provides higher quality bar codes than laser or ion deposition technologies, despite having similar DPI resolution.

As the media passes under the print head, the heated elements are turned on and off by impulses from the computer.

THE THERMAL TRANSFER PROCESS

In thermal transfer applications, a ribbon is used to create the image. The ribbon is coated on one side with a black or colored heat sensitive coating. This side of the ribbon is against the surface of the print substrate. The other side of the ribbon has a protective coating and is flush against the print head. The heated elements of the print head come in contact with this side of the ribbon, melting the coating off the other side of the ribbon onto the surface of the substrate.

The key is to have the ribbon as close as possible to the surface of the substrate. In order to accomplish this, the substrate must be as level as possible. While this may sound extreme, print quality is completely dependent upon it. As such, substrates with level surfaces are a virtual requirement to ensure good print quality. Usually, but not always, substrates with smooth and/or coated surfaces create this levelness.

SUBSTRATES

To create a successful thermal transfer image, the substrate must receive the imaged ink transferred from the ribbon. In order to achieve image receptivity, thermal transfer papers and tags are coated with an image receptive coating. There is a range of coated thermal transfer papers and tags available. The current standard is 2C…a twice coated surface. 1C coated grades are available, but do not provide the same print quality at higher print speeds. While this coating creates a level surface and correct level of thermal conductivity for thermal transfer printing, it provides less than average print quality for flexographic printing. Furthermore, this coating is abrasive, requiring more durable dies for label production. As a byproduct of creating substrate levelness, paper and tag based thermal transfer substrates have lower than average stiffness.

Certain coated and high gloss papers as well as UV coated surfaces may not print at all because of the low surface tension. At the other extreme, textured or rough surface substrates will not consistently result in satisfactory print quality. Some standard tag substrates can work, but require frequent manipulation of the printer controls and ribbon.

Synthetic substrates with a low surface tension like polyethylene and polypropylene must be, at a minimum, corona pretreated for successful thermal transfer printing. Although standard top coatings can generally be printed on, they may cause some problems or may not print at all.

Metalized papers and films are not recommended because of their poor printing characteristics. Since metal is an excellent heat conductor, it absorbs the heat of the print head elements before the ink is successfully transferred from the ribbon to the substrate surface.

RIBBONS

There are three primary types of ribbons available for thermal transfer printers, the use of which is dependent upon the type of media being used: 1) wax ribbons, 2) wax/resin combination ribbons, and 3) resin ribbons.

PRINT QUALITY

While the process is very simple, problems occasionally occur due. The vast majority of problems are due to the incorrect use of the products…usually because the ribbon and substrate have not been properly matched. Typically the substrate is carefully selected, but little there is little awareness to the importance of matching the correct ribbon with the substrate. As a result, the printed image does not satisfy the requirements of the end user.

Print quality depends on several factors:

1. The type of printer. There are two primary types of printers; flat head and near edge. Near-edge printers process thick and/or stiff substrates better.

2. Print head resolution. The higher the resolution, the better the print quality.

3. Printer adjustments. Heat, speed, and impression pressure controls will impact the quality of the printed image.

4. Type of ribbon. Matching the correct ribbon with the substrate is critical to image quality. Each ribbon type is best suited for particular handling environments. Image durability from physical and chemical elements (scratching, UV radiation, head, oil, solvents, etc.) primarily depends upon the choice of ribbon and its compatibility with the substrate. There are significantly more ribbons at more economical prices available for flat-head printers than near-edge printers. As a result, it will be easier and less expensive to use a flat-head printer for applications requiring chemical or heat resistance, where substrates have a rougher surface, or where consumption is high. Ribbons should not be stored for more than 12 months prior to use.

5. Substrate characteristics. The substrate must have the correct smoothness and surface tension to accept the transferred image.

6. The image being printed. Images with curved edges, such as type and artwork, are difficult to print because of the square dot shape. Other images, such as ladder orientated bar codes or heavy solids can only be printed adequately at slow speeds.

7. Printing environment. The optimal printing environment is between 41-95 degrees F and between 45-85% humidity. This environmental latitude enables thermal transfer printers to be used in a broad range of indoor/outdoor settings.

ADVANTAGES OF THERMAL TRANSFER PRINTING

1. Consistently high print quality. Because the ribbon is used only once, high contrast, high quality print can be consistently achieved. This is particularly important in printing scannable bar codes.

2. Fade and chemical resistant. Ribbon images are fade resistant and chemical resistant.

3. Ribbon images can be abrasion/scratch/smudge resistant when the materials and ribbons are properly matched.

4. There are a wide variety of substrates available, all of which are less expensive than direct thermal.

5. Reliable mechanical operation. The mechanical printing design is simple, minimizing potential complex problems.

6. Because the printers are small, they require little space for operating.

7. Print images can be scanned in visible and infrared light.

8. Because the ribbon acts as a barrier between the print head and the substrate, there is less wear on the print head compared to direct thermal. As a result there is longer print head life.

DISADVANTAGES OF THERMAL TRANSFER PRINTING

1. Changing ribbons is timely and messy.

2. Matching the correct ribbon with the substrate can be confusing.

3. While ribbon lengths are generally consistent, they rarely equal the length of substrate on the roll or fanfold pack.

4. Premium thermal transfer substrates are coated to provide ultimate smoothness for the best image transfer from the ribbon. This coating is abrasive.

DESIGN CONSIDERATIONS

1. Print registration: In order to register the start of printing to the top of the label or tag, the printer must be able to identify the start of the label or tag. A sensor that scans the substrate for a change in opacity typically determines this identification. This difference in opacity can be achieved in a number of ways.

In the case of die cut labels, the sensor will sense the space between the labels as having lower opacity and hence the end-beginning of labels.

In the case of tags a dark stripe is printed across the back of the tag, typically near the between set perf. The sensor will sense the higher opacity across the area with the stripe and hence the end-beginning of the tags.

With some printers, the sensor requires a clear, open space. In such cases, the label or tag stock will need a sensing hole die cut between sets or an edge notch between sets to create this clear path.

2. Matching the ribbon to the media: A general rule of them is that paper and tag substrates utilize wax-based ribbons while synthetic based substrates utilize resin-based ribbons. Wax-resin combination ribbons are also available. They may be used for durability requirements or better matching to the substrate. If the printer is intended to print multiple types of substrates with the same ribbon, a combination wax-resin ribbon and a near-edge printer.

3. Substrate quality per roll or flat pack: Standard printers will accept rolls with outside diameters up to 8 inches. The quantity per flat-pack may be determined by whether the pack is loaded inside the printer casing or is fed from outside the printer casing.

4. Matching media and ribbon length -Econo-packing: Thermal transfer ribbons are used once. When they are used, they must be replaced. Obviously, when the substrate runs out, it must be replaced. When these two consumables do not run out at the same time, waste occurs. One of the key opportunities to minimize cost is to minimize this waste.

When one of the consumables (ribbon or substrate) runs out before the other, operators typically dispose of the balance of the remaining consumable in order to avoid stopping again in the near future to replace the other consumable. As a result, the balance of the unused consumable is wasted. If the operator does not dispose of the balance of the remaining consumable, then time is wasted when the process must stop to separately replace the remaining consumable.

They key is to match the length of the substrate to the ribbon. Most ribbons come in a few different lengths (i.e. 980 feet). Typically, the number of labels or tags should be in a roll or flat-pack should equal the length of the ribbon.

 12807 Airport Way Portland, OR 97230 503.257.5097