

Selecting the Best Direct Thermal Paper for Your Mobile Application



A ZEBRA WHITE PAPER





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Selecting the best thermal material for printing load manifests, proof of delivery documents, invoices, payment receipts, pick lists and many other documents is very important. Direct thermal material is engineered much differently than the standard paper used in dot matrix printers and hand-written documents. It contains chemicals that allow the paper to produce an image once heat is applied to it, and there are many paper and synthetic formulations to choose from. While they look similar, the chemical make-up of each material affects its resistance to moisture, heat, and other external factors. The thickness of the paper, and the lifespan of images printed on it, also vary. All of these attributes are very important to consider to ensure documents remain intact and readable during their useful life.

Serious problems can arise when a document needs to be retrieved but the print is no longer legible. Most documents look fine when they come out of the printer, but the true test is how they will hold up during their expected life. Readability and durability depend on matching the material to the conditions where the document will be produced, used and stored. When the printed data is lost, companies and their customers lose important documentation, which can cause problems with returns, service, warranties and compliance.

To determine the best material for the application, you need to consider the environment the document will be subjected to after it is issued, and how long it needs to remain readable. This white paper educates you on how moisture and heat affect direct thermal materials, the impact of paper thickness, recommended storage conditions to maximize image life, the role of protective coatings, and benefits to using preprinted media.

Key Considerations When Selecting a Material

Thermal media is by definition heat sensitive, so heat, light and other storage and environmental conditions can affect its performance. Many types of thermal paper and synthetic stocks, as well as coatings, are available and provide varying degrees of protection from degradation caused by heat, light, moisture and abrasion. The following sections discuss key considerations when selecting the best thermal material for your application.

Heat

Problems typically occur when a document is used or stored where temperatures exceed 140° F (60° C). That may seem like plenty of heat resistance because temperatures in retail stores and other facilities are kept well below that level, and outside temperatures only get that high in a few places. However, usage conditions are often different than storage conditions. Documents are left in vehicles, where temperatures can climb over 150° F (66° C) in the summer. Since direct thermal materials are heat sensitive, exposure to extreme heat will cause the chemicals in the material to react. The result is a document that turns black and is unreadable. To avoid this problem, some thermal materials are specially formulated to withstand higher temperatures.

Moisture

Exposure to moisture, whether it be rain or humidity, can cause serious performance and readability problems. Certain material formulations and coatings provide additional protection against moisture, but most paper materials on the market have limited durability to moisture and degrade once subjected to it. Synthetic materials, often made with a polypropylene film, offer a waterproof solution. Therefore, if your document will be subjected to moisture, either because it will be issued outdoors or it will be stored in a humid or wet area, it is recommended that you select a paper material with additional moisture resistance or a synthetic material.



Thickness

In the U.S., thickness is typically expressed in mils, with each mil equal to 1/1,000th of an inch. Thicker materials tend to be more durable and are perceived by customers as higher quality. However, the thicker the material, the less paper per roll, resulting in fewer documents that can be printed before the roll needs to be changed. For example, the following products are the exact same size, but the number of documents that can be printed is different:

Zebra's Material Name	Mils	Feet/Roll	# of 6" Documents Per Roll
Z-Perform™ 1000D 2.4 mil Receipt	2.4	100	200
Z-Select™ 4000D 3.2 mil Receipt	3.2	81	162

Therefore, you should prioritize durability, feel and the number of documents per roll prior to determining the mil thickness requirements for your application.

Archivability

The longer documents need to be referenced and stored, the more durable they need to be, and the more protection they require from heat, moisture and other environmental factors. Storage is an important and often overlooked factor in a document's lifespan. Archivability is a term used to specify how long a material will remain legible under proper storage conditions. To reach published archival duration specifications, documents need to be stored with compatible materials in a dark place with relative humidity between 45 and 65 percent, and temperatures below 77° F (25° C). Storing a document next to a non-compatible material will either cause the document to darken and become unreadable or the image to fade. Examples of non-compatible materials include carbon papers, cellophane tape, PVC film, water and chemicals. Make sure the material you choose is rated to meet your archival requirements.

Topcoating

One of the biggest differences among thermal papers is their coatings, which go unseen to the naked eye. All thermal papers have a basecoat and a thermal coat, but not all of them have a topcoat. A topcoat provides an extra layer of protection for the image. Coatings can be formulated to provide protection against specific materials (e.g., water, alcohol, oil), exposures (e.g., sunlight, fluorescent light) and environmental conditions (e.g., dampness, high humidity, hot or cold temperatures). The material and coating formulations dictate how the media will perform in specific environments. Non-topcoated materials are acceptable for applications requiring limited resistance properties.

A Brief Overview of Offerings

Zebra Technologies is a leading developer of thermal printer supplies and has created thousands of different products to satisfy specific usage and environmental requirements. Zebra offers multiple material options that have been formulated for different applications. The table below provides a brief overview of Zebra's standard direct thermal materials and highlights the range of features available.

Material Name	Paper/ Polypropylene	Topcoated	Archivability	Moisture Resistance	Chemical Resistance	Scratch Resistant	Service Temperature
Z-Perform™ 1000D Receipt 2.4 mil	Paper	No	7 years	No	No	No	-40° F to 140° F (-40° C to 60° C)
Z-Select™ 3000D Receipt 2.3 mil	Paper	No	25 years	Yes- Limited*	Some weak chemicals	No	-40° F to 140° F (-40° C to 60° C)
Perform 1000D Receipt 3.5 mil	Paper	No	10 years	No	No	No	-40° F to 140° F (-40° C to 60° C)
Z-Select 4000D Receipt 3.2 mil	Paper	Yes	25 years	Yes- Limited*	Some weak chemicals	Yes	-40° F to 140° F (-40° C to 60° C)
8000D High Temp Receipt 3.2 mil	Paper	Yes	20 years	Yes- Limited*	Some weak chemicals	Yes	-40° F to 194° F (-40° C to 60° C)
Polypro™ 4000D Receipt 3.8mil	Polypropylene	Yes	10 years	Waterproof	Some weak chemicals	Yes	-40° F to 140° F (-40° C to 60° C)

*These paper products have moisture-resistant features which combat humidity and minimal exposure to water.

Getting More from Your Document

Another consideration is whether to purchase blank material or have it pre-printed with your company logo, watermarks, fields or other text.

Including a company logo or other graphics is an easy way to make your document stand out and reinforce your company image. Watermarks are a great security feature that can reduce counterfeits. Documents can also be pre-printed with return policies and instructions, warranties and other terms and conditions. Preprinting standard fields, as in the example below, is especially valuable for mobile printing because it can extend battery life by reducing the printer workload.

The below example shows an organization's logo, standard fields and instructions, all pre-printed on the thermal material before it's even loaded into a thermal printer. All the thermal printer has to do is fill in the variable data on the front.

Front				Back																																															
 Cornell University Parking Violation				<p>You have been charged with violating the lawfully adopted parking regulations of Cornell University. Failure to comply with Cornell University's parking regulations and the accumulation of tickets and fines may result in the towing of your vehicle, whether it is legally or illegally parked on University property. For complete parking regulation information, call Commuter & Parking Services at 607.255.PARK (7275), or visit the web at www.parking.cornell.edu.</p>																																															
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Conclusion

There is much more to thermal materials than meets the eye. Therefore, it is important to take into consideration your application and whether the document will be subjected to heat and moisture, what mil thickness is most appropriate, how long you need to archive the document and if a top-coated material is best. Once you answer these questions, you will be prepared to choose a material that will not only meet the requirements of your application, but save you the time and money choosing the wrong material would cost in lost documentation, decreased productivity and customer dissatisfaction. Zebra has a large selection of thermal materials, including paper and synthetic products that will meet your needs. In addition, you can maximize the functionality of the document by pre-printing it with your company logo, instructions, terms and conditions and/or standard fields.

Zebra Technologies Corporation improves customers' business performance through products and solutions that identify, track and manage assets, transactions and people. In more than 100 countries around the world, more than 90 percent of Fortune 500 companies use innovative and reliable Zebra printers, supplies, RFID products and software to increase productivity, improve quality, lower costs, and deliver better customer service. Information about Zebra and Zebra-brand products can be found at www.zebra.com.



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