

When to Use a Hardcoated Film vs. Uncoated Film

When assisting customers with a film selection for their applications, one of the most common questions we are asked is, “When should I use a **hardcoated** film vs. using an uncoated film?”. To best answer this question, there are four main application characteristics or needs to consider that will assist in determining if a hardcoated film is needed.

1. Abrasion & Scratch Resistance

Uncoated films can be somewhat easily scratched or abraded. That is the nature of some raw films. A good example is **polycarbonate film** which is typically a soft film in its raw state. The film is designed this way as it is a positive characteristic for a variety of reasons, but with some applications, it can be an issue.

In contrast, a hardcoated film has a high degree of abrasion and scratch resistance. In evaluating your finished application needs, there are key evaluation categories and follow up questions you need to consider in regards to scratch and abrasion resistance. If the answer is “yes” to any of these questions, you should consider a hardcoated film for your application for best results:

- **Human Interaction** - Will there be human interaction with the finished application? Will it be touched? Will it be wiped clean? If you answered “yes”, you should choose a hardcoated film. An application example would be a microwave membrane switch or a washing machine overlay.

- **Safety Consideration** - Does your application involve safety? Is it a label, face plate, name plate, or an overlay that is required to have the reverse printed information be readable for a certain period of time? If your answer is “yes”, you should choose a hardcoated film. An application example would be a fork lift safety overlay.

- **Aesthetics Reasons** - Will your application have reverse printed corporate logos or graphics for brand recognition? The last thing your customer wants is a scratched up, unattractive and nonprofessional looking end use application with their logo on it. It reflects poorly on them and will assure that you do not get future business with them. In these cases use a hardcoated film to protect against this.

- **Base Film Needs Protecting** - Is a specific base film needed for application attributes, but the environment the finished application is in may not be suitable for the base film? Essentially, does the base film need protecting from the environment it is in? If the answer is “yes”, a hardcoated film should be used. A common example are polycarbonate film applications in industrial environments.



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When asking yourself the series of questions in the four categories listed above and determining the importance of scratch and abrasion resistance, you should easily be able to determine if a hardcoated film is necessary.

2. Chemical Resistance

The second key characteristic to consider when deciding to use a hardcoated film for your application is chemical resistance. Many applications require a certain amount of chemical resistance based on what the film will be exposed to. Common base films like **polyester** and polycarbonate can discolor and even break down and fail when exposed to certain chemicals. Most of these chemicals we see in our daily lives as we use them to clean, we put them on our skin, and we even ingest them. If your application will see any exposure to the following chemical classifications you should highly consider using hardcoated film.

- **Industrial Chemicals** - Harsh chemicals and solvents such as MEK, Acetone, and Concentrated HCl can be found in industrial or medical settings. These chemicals can easily break down and destroy uncoated films. Applications in these environments universally use hardcoated films.
- **Household Cleaners** - Common window, kitchen, and bathroom cleaners can swell, haze, or breakdown uncoated films. If your application will come in contact with these types of cleaners, you should use a hardcoated film. An example of an application example would be an appliance overlay.
- **Detergents & Bleach** - Foods and drinks such as mustard, ketchup, coffee, milk, and juices can stain or discolor the surface of an uncoated film. Any consumer appliance or electronics applications that could be exposed to food or drink should seriously consider a hardcoated film.
- **Skin Care Products** - Sunscreen, insect repellants with 25% Deet, and other skin care products that can transfer to the surface of a film by touch can stain, haze, or break down an uncoated film.



Do remember that all hardcoats only protect the surface of the film. It does not protect the uncoated edges where chemicals can seep around and attack the base film. So, if you have an application with exposed edges, you want to use hardcoated films that use a base film more inherently chemical resistant in its raw form such as polyester over polycarbonate.

Evaluating the type of chemical exposure your finished application will be exposed to in the field is the second factor in helping determine if you should use a hardcoated film.

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3. Embossing and/or Forming

The decision on what film to use for this third characteristic can be a complicated one. An uncoated film will elongate to a greater degree than a hardcoated film when embossing or forming. Hardcoated films will reach a point where it can start to micro-crack if pushed beyond its elongation point. However, many formed or embossed applications need the scratch and chemical resistance a hard-coat provides. So what do you do if the forming/embossing requirements dictate the use of an uncoated film, but the finished application needs the field benefits of a hardcoated film? It is best to look at these two processes separately.

Forming

In general, an uncoated film can be elongated further than a coated film since there will be a point that most coated films will micro-crack. However, plenty of forming applications do need the benefits that a hard coat offers in terms of scratch & abrasion resistance and chemical resistance.

Most manufacturers will look at the specs of the finished application and design parameters to determine which type of film to use. If a hardcoat is needed, they can make sure they do not reach the point where the finished part might micro-crack by working with the geometry of the part by doing things such as:

- *Changing the layout of the part*
- *Changing how close their pieces are to each other on a sheet*
- *Change parameters of the forming process*
- *Use different forming equipment*

Embossing

This is very similar to forming as the manufacturer needs to look at the features the finished product needs along with the design of the piece to determine if a hardcoated or uncoated film is needed. Uncoated films generally are easy to emboss and allow for a larger embossed button - how far away the dome is away from the surface. Hardcoated films, in general, will micro-crack when embossed although it will not be seen to the naked eye and will not affect the life of the switch. If you push the emboss limits of a hardcoated film, then you will need to determine if the emboss is still aesthetically pleasing. But, a hardcoated film will offer additional benefits as previously discussed in this article.



So a manufacturer needs to look at specific items to determine which type of film to use:

- What are the dimensions of the embossed button?
- What is the travel of the tactile device of the snap dome? Essentially, how far will the dome of the embossed button have to move down to make the circuit connection?
- What is the actuation life that is needed for the application? For example, 1 million actuations versus 5 million actuations?
- Do you need chemical, scratch, and abrasion resistance for the finished application?

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The answers to these questions will help you determine if a hardcoated film is needed and whether you need to change the design of the embossed button to meet the final application needs.

4. UV Blocking

The fourth and final characteristic to consider is the easiest to determine. Does your finished application need to have UV blocking characteristics? Essentially, will the finished application be outdoors or constantly be hit by the sun's rays? If the answer is "no", then an uncoated film is acceptable.

There are different [weatherable hardcoated films](#) designed to combat the negative effects of UV light exposure. With an uncoated film, some will not even last 1 year without failure. However, a weatherable hardcoated film can last within the range of 3 to 7 years depending on the type of hardcoat. A Xenon Arc Test is an accelerated weathering test that will show you the lifespan you can expect from a hardcoated film to assure it will meet your life expectancy needs.

Conclusion

There are many questions to be asked to determine if a hardcoated film should be used. If at the end of this four step evaluation, you are still unsure which direction you should go with your film choice, Tekra has experienced sales and customer service staff that can assist you. Just give us a call!