

# Some Heat Sealing Frequently Asked Questions

There is more to heat seal than just dwell time, temperature and pressure

## An introduction to heat sealing

Heat sealing is a critical process used for rigid and flexible packaging of all kinds. Heat conduction or heat transfer sealing uses heated seal heads or sealing bars to adhere, attach or close film to film or film to a rigid container. The results are leak-proof seals for bags, pouches, cups, trays and other packaging.

High temperature, thermally conductive silicone rubber sheets are especially useful for fabricating the heat seal tooling used in fast, high temperature automated sealing applications.



*United Silicone metal bonded silicone sheets.*

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## 1. What is the actual heat sealing process called?

The heat sealing process is usually called conductive heat sealing, direct contact thermal sealing or just heat healing. At packaging machinery sealing stations, heated tooling makes direct contact with a heat sealable film. The film heats up and this activates the film's laminate layer. The carefully chosen pressure, temperature and dwell time then causes the laminate layer to stick to the opposing film or rigid container sealing surface to create a leak-proof seal.

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## 2. What are some common types of packaging that use heat sealing?

Silicone sheets are used for sealing both flexible and rigid packaging. The most common flexible packaging types that use heat sealing include flow wrapping, bag sealing and pouch sealing. Some general types of bag and pouch sealing include vertical form-fill-seal (VFFS) and horizontal form-fill-seal (HFFS) as well as stand-up pouches (SUP). Common rigid packaging applications include cup, tray and tub sealing.

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## 3. What type of sealing machinery tooling or fixtures use high temperature silicone?

These are usually called seal bars, seal heads, support fixtures, platens or anvils. Some are also sometimes called L-bar sealers and I-bar sealers.

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## 4. What is heat seal silicone sheet material typically called?

High temperature silicone rubber sheets or pads.

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## 5. How do I attach metal backed or silicone-to-metal bonded heat seal material?

If it's bonded to metal, drill countersink holes through the top of the silicone or drill and tap holes from the back of the metal backing. This provides screw holes to align with those on the corresponding mounting surface. Metal backed or bonded silicone sheet edges can also be dovetailed to create components that are slid into and secured to dovetailed mounting plates.

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## 6. How do I attach unbonded silicone to a metal backing?

Unbonded silicone sheet material is difficult to attach because of vulcanized, cured silicone characteristics. It is almost as slippery as PTFE (Teflon™). Adhesives or glues don't work well at all.

[Get more information about high temperature silicone sheet bonding.](#)

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## 7. Why don't adhesives work for silicone-to-metal bonding?

When an adhesive is applied to a slippery (low surface tension) flat sheet, it tends to pool and create uneven pockets. In use, the pressures and temperatures of high-speed heat seal processes cause the adhesive to move around and pool up again. As this happens, the adhesive will try to pull the silicone rubber along with it. This creates warping and unevenness in the silicone sheet's surface. Heat sealing surfaces need to be as parallel and flat as possible to consistently produce leak-proof seals.

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## 8. What machine tooling is the material usually attached to?

Metal bonded silicone is cut into bars, jaws or seal heads. This heat seal tooling is then attached to mounting plates or blocks. They may also be directly attached to the heating element. These then become the heat seal bars, jaws or seal heads at the packaging machinery sealing stations.

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## 9. Why consider United Silicone rubber-to-metal bonded silicone sheets?

Modern heat seal packaging machinery needs the right combination of time, temperature and pressure to create good seals. Good seals mean no leakers and the low scrap rates. The most efficient heat seal packaging lines run fast and hot and frequent downtime is not acceptable.



*Ultrasil® (top) and Thermosil® (bottom) silicone-to-metal bonded sheets.*

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United Silicone high temperature silicone rubber sheets are

- Highly heat tolerant
- Thermally conductive
- Durable, resilient and reliable

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## 10. What high temperature heat seal silicone formulations does United Silicone offer?

United Silicone rubber sheets come in three basic formulations:

- FDA (red)
- Ultrasil® (red)
- Thermosil® (brown)

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## 11. What are the main differences between United Silicone material formulations?

For heat seal applications there are three different United Silicone rubber sheet types, Thermosil® and Ultrasil® and FDA/FDA-3A.

For heat seal applications there are different United Silicone sheet types that can be used for the heated side or the non-heated side of the sealing jaws/bars or seal heads of a sealing station.

Ultrasil® is generally recommended for non-heated applications. Ultrasil® is stronger than Thermosil® but not as thermally conductive. If you don't need the heat recovery properties of Thermosil®, then Ultrasil® is your best bet.

United Silicone FDA and FDA-3A sheet materials are similar to Ultrasil® because of their red color. They are heat tolerant to 550°F, just like Thermosil® and Ultrasil®, but they are actually stronger than either Thermosil® or Ultrasil®. These FDA and FDA-3A silicone sheets are not as thermally conductive due to their composition, which makes their formulation FDA Compliant.

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## 12. Which formulation should I use?

Heat sealing applications typically have heated and non-heated positions for the various tooling components: seal heads, support fixtures and seal jaws or bars.

United Silicone Ultrasil® is generally recommended for non-heated applications. Ultrasil® is stronger than United Silicone Thermosil®. If you don't need the heat recovery properties of Thermosil®, then Ultrasil® is your best bet

In many heated applications, cycle times can be fairly short. Shorter cycle times, about one second or less, are usually associated with high volume production. If short cycle times are being used and the material is on the heated side of the seal station, use Thermosil®. If it needs to be safe for food contact, use United Silicone's FDA or FDA-3A sheet material.

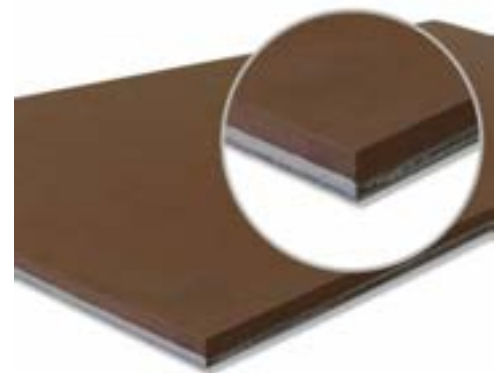
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## 13. What durometers are available?

United Silicone sheets are available in a range of durometers: 40, 50, 60, 70, 80 and 90 based on the Shore A scale.

60 durometer material is similar in hardness to a pencil eraser. 70, 80 and 90 durometers are harder and 40 and 50 durometers are softer.

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*United Silicone Thermosil® silicone sheet material.*

## 14. Which durometer should I use?

In general, harder durometer United Silicone sheets provide better heat transfer properties than softer durometers. For this reason, we recommend that you use material in 70 to 90 durometer range for heated applications. Use 60 durometer or lower for unheated applications. This is because you won't need the faster heat recovery you get with the higher durometer or harder sheets.

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## 15. Which silicone thickness should I use?

1/16" to 1/8" thick 80 durometer sheets are a good choice when you need good heat recovery. 1/8" and 60 durometer material is generally best when you don't need to be concerned about heat recovery.

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## 16. Why shouldn't I start with something thick and soft?

Users frequently start their search for silicone heat sealing materials by thinking they need to use a sheet that is thicker and softer, say 1/4" thick and 40 durometer. This is understandable because this seems like it would guarantee leak-proof seals. The reality is that this is overkill and thick and soft is not the best way to go. The reason is the silicone will actually roll over what is being sealed instead of creating a pressure point, which is necessary to create a good seal for the package. Remember, it's the right combination of dwell time, pressure and temperature that creates a good, leak-proof seal.

The truth is silicone sheet material is by its nature a conformable or flexible material. Even at harder durometers, say 70 to 80 durometer material, you'll achieve the pressure point needed to get a good, leak-proof seal.

A good analogy for this is imagine what it's like using a thin, soft dish sponge versus a stiffer one to clean a surface. To get into all the nooks and crannies, a soft sponge needs a lot more pressure and squeezing than the stiffer sponge to get down into all the pockets and grooves. Another way to think about this is to remember what it's like using a big, thick, open cell carwash sponge. It's hard to clean out grooves and folds with this because it takes so much twisting and crumpling to get the sponge down in there.

If you are still uncertain about which durometer to use, we recommend that you get some United Silicone samples and try them out for yourself. This way you can be sure which durometer works best. You can also have a conversation with one of ISM's product specialists. They can help you spec out your application.

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## 17. What are the tolerances of United Silicone rubber-to-metal bonded silicone sheets?

United Silicone metal bonded silicone sheeting has thickness, length, width and durometer tolerances:

- Durometer tolerance is  $\pm 5$  points.
- Thickness tolerance is  $\pm 0.010$  inches.
- Length and width tolerances are  $\pm 0.062$  inches

If an application requires tighter or finer tolerances, this could be a situation where custom tooling will be more appropriate than standard sheets. Call us and let us know what you are looking for and why. We will find a solution that meets your application needs. [Contact one of our product specialists to get more information.](#)

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## 18. What's the shelf life?

United Silicone's sheet material should be stored in a relatively cool, dry environment that is not dusty. This provides a life expectancy of about one year. Cooler, drier conditions can extend this shelf life.

It is always important to protect the sheets from prolonged exposure to sunlight. Also, when storing multiple sheets, store them silicone face to silicone face. This prevents burs on the metal edges from possibly scratching the rubber.

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## 19. How do you clean high temperature silicone rubber material?

The recommended method to clean silicone sheets is to use a non-abrasive, soft cloth with soap and water. Acetone or other cleaners that evaporate or "flash" quickly can also be used. Acetone is an example of a commonly available cleaner that dries quickly and won't absorb into the silicone.

Using a chemical that flashes or dries quickly prevents it from being absorbed into the rubber. If an alcohol is used it will have a tendency to absorb into the silicone rubber over time. This can lead to swelling. For this reason, alcohols should not be used as cleaners. Also, heat seal silicone should not be soaked in any cleaner. Use only a non-abrasive, soft cloth with soap and water or a cleaner that flashes and dries quickly.

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## 20. How many cycles will I be able to get out of a piece of United Silicone material?

There is not a really good definitive answer to this question. It all depends on your application and its configuration. You should always optimize for the minimum amount of heat, pressure and dwell times you need. With this as the starting point, you can then identify the average sealing tool's lifespan based on how the silicone actually performs under real operating conditions. This will provide you with a good basis point for setting up a reliable preventative maintenance schedule.

Heat seal silicone rubber lifespan is determined by the temperatures, pressures and how 'friendly' your part is. Lots of product contamination and sharp edges will decrease its lifespan. The range is pretty wide: from as low as 5,000 to as high as 100,000 compressions or cycles.



**United Silicone Ultrasil® silicone sheet material.**

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## 21. How do you know a United Silicone heat seal silicone rubber is failing?

This can be described as two general types of failure: premature failure and end-of-life failure.

### Premature failures

If the mating surfaces of the heat seal tooling or jaws are not installed properly so that they are not parallel, there may be premature or uneven wear on one side of your sealing tool. Using too high of a pressure for a silicone's durometer rating and thickness can potentially cause the silicone to eventually start pulling away from the metal. Runaway heat spikes or too much heat can cause cracking.

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### End-of-life failures

There tend to be two common types of normal end-of-life failure. One is where an even compression set or hardening develops across the face of the silicone. This is similar in some ways to a trampoline that someone has bounced the heck out of. The trampoline will have spots where you can actually see some discoloration. At these spots the trampoline material simply no longer bounces back like it used to.

Another type of normal end-of-life failure usually shows up in applications that consistently run at temperatures higher than 500° F. These higher running temperatures can cause cracking over time.

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## Takeaways and conclusion

The right compliant material for your heat seal tooling and pads needs to perform well under your dwell time, pressure and temperature requirements. Different flexible packaging formats may require multiple film layers at package seams and transitions. Resilient high temperature United Silicone bonded sheet material can compensate for all of this and provide the uniform pressure necessary for reliable, leak-proof seals.

[This technical data sheet](#) provides details on the United Silicone Ultrasil®, Thermosil®, FDA and FDA-3A heat seal silicone rubber formulations. These include mechanical as well as other properties.

[Get the data sheet](#)



[High temperature silicone sheets technical data.](#)



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