Product Troubleshooting Guide
Gap Fillers Thermal Interface Materials

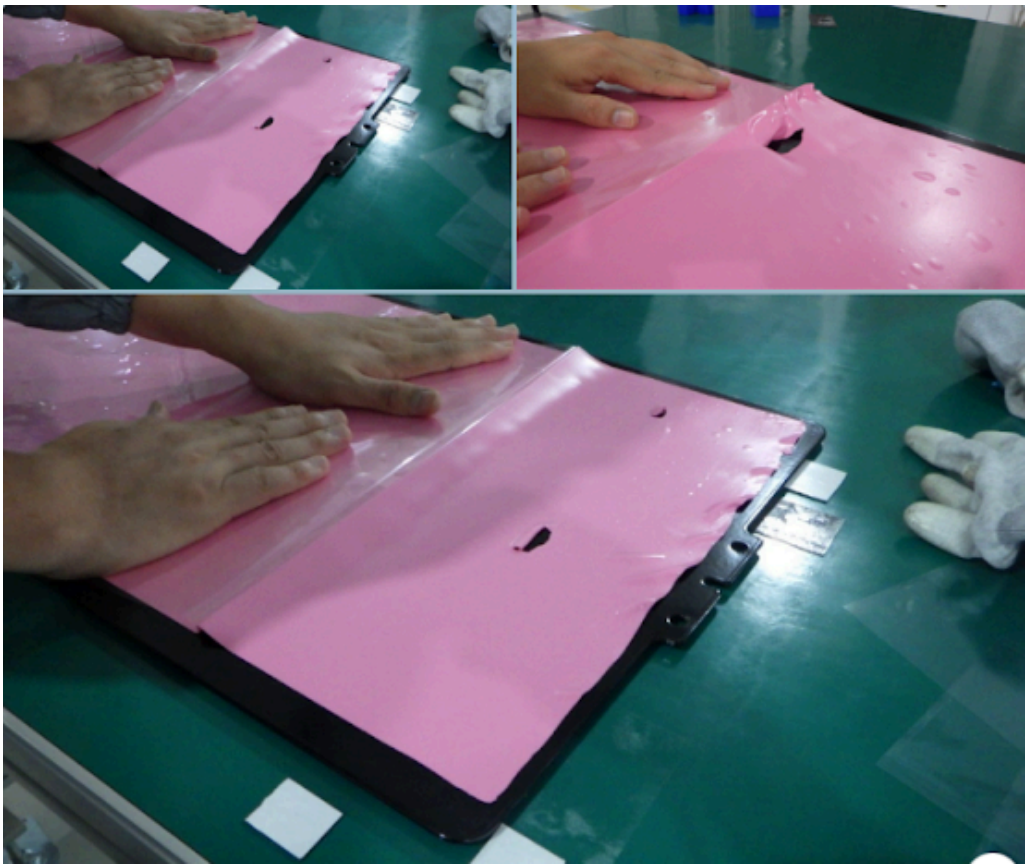
Thermal Interface Materials (TIMs) come in various forms to address different thermal and mechanical challenges. Two commonly used categories: gap fillers and thin bond line TIMs serve distinct purposes depending on the design and operational demands of an application.

Gap fillers typically used in higher thickness design gaps in ensuring reliable thermal management by bridging air gaps between heat-generating components and heat sinks or housings. Proper application and handling are essential to achieve consistent performance, but issues can arise during dispensing, curing, or assembly that may affect process efficiency and thermal conductivity.

This troubleshooting guide is designed to help identify and resolve common problems encountered when working with gap filler materials. By outlining typical symptoms, root causes, and recommended corrective actions, it serves as a quick reference for engineers, technicians, and operators to maintain optimal performance and reduce production downtime.

Thermal Gap Pads/ Putty Pads

Case 1: Tear and Bubbles during installation
Application: Battery Safety Sensor Solution for Electric Bus
Issue: Pad tearing or breaking during liner removal / handling.



A gap filler pad (TGP2000) being applied, but there are tears/holes forming while peeling off the liner. That's a typical issue in handling soft silicone pads. The tearing of the TGP2000 pad during liner removal is often caused by improper handling techniques. Pulling the liner too quickly or at a steep angle places localized stress on the pad, making it prone to tearing. Applying excessive manual force or uneven pressure while peeling can further weaken the material, especially around thin or vulnerable areas. In some cases, the pad surface may catch on sharp edges, corners, or contaminants present on the work surface, creating stress points that lead to rips. Additionally, improper storage—such as folding, stretching, or exposing the pad to unsuitable temperatures—can compromise its mechanical integrity, making it more susceptible to damage during handling.

Recommendation:

- Peel liner slowly and evenly at a low angle to reduce stress.
- Use both hands or apply support while peeling to prevent pad deformation.
- Ensure pad is placed on a flat, clean surface before liner removal.
- Avoid stretching or pulling the pad during handling.
- Store pads flat under recommended temperature and humidity to maintain integrity.

Case 2: Expired Gap pads
Issue: Usability of expired gap pads

Expired gap pads generally lose their designed mechanical and thermal properties, making them unsuitable for reliable use in applications. Over time, the material can harden, become brittle, or fragment when peeled from the liner, as shown in the image. This deterioration leads to difficulties in handling, incomplete coverage on the substrate, and higher risk of tearing during assembly. Even if some portions of the pad appear usable, the uniformity and consistency of thermal conductivity can no longer be guaranteed. Using expired pads may result in poor surface contact, higher thermal resistance, and potential device overheating or reliability issues.

For critical applications, expired pads should not be used. They may only be considered for non-functional testing or fit-checks where thermal performance is not required. To prevent recurrence, it is essential to follow the recommended shelf life and storage conditions provided by the manufacturer, ensuring pads are stored flat, at the proper temperature, and within their expiry period.

Recommendations:
To prevent recurrence, ensure that pads are stored under the manufacturer's recommended conditions and that inventory management practices (e.g., FIFO – First In, First Out) are followed to minimize the risk of material expiration.

Case 3: Oil Bleeding on Pads

Oil bleeding refers to the migration of base oil from the gap pad, often visible as a shiny residue on the pad's surface or surrounding components. A small amount of bleed is normal and generally does not impact thermal performance, but excessive bleeding can contaminate nearby parts, attract dust, or alter the pad's mechanical properties. This phenomenon is most often observed in silicone-based gap pads under high temperatures, long-term aging, or when pads are compressed beyond their recommended deflection range.

Oil bleeding may result from extended thermal exposure, where heat accelerates the mobility of silicone oil within the pad. Over-compression can also force oil out of the matrix, particularly if the pad is thinner than required for the application. Material incompatibility with adjacent substrates may encourage oil migration as well.

To minimize oil bleeding, ensure that pads are used within their specified thermal limits and compressed within the recommended range. Selecting the correct pad thickness and hardness helps avoid excessive stress on the material. For applications sensitive to contamination, low-bleed or silicone-free gap pad formulations are available and should be considered during the design phase.

Hybrid Gels

Case 1: Oil Separation

Description: One common issue encountered is oil separation. This occurs when the base oil begins to migrate out of the gel matrix, often visible as a slight greasy residue on the surface or in the surrounding area of the interface.

Factors: Over-compression, where the gel is squeezed beyond its recommended deflection range, forcing the base oil out of the matrix. Another cause is thermal stress, as long-term exposure to high operating temperatures or repeated thermal cycling accelerates oil migration. Material incompatibility with substrates or adjacent surfaces can also draw out the oil, particularly when in contact with porous or absorbent materials. Finally, improper storage conditions, such as high humidity or temperature fluctuations, may weaken the gel network and encourage oil bleed.

Solution: Keep compression levels within the manufacturer's specifications and ensure uniform pressure across the interface. Operating temperatures should remain within the stated working range of the gel, and designs should avoid sharp thermal gradients when possible. Compatibility testing with adjacent materials should be performed early in the design process to prevent absorption or chemical interaction with the gel. For storage, hybrid gels should be kept in a controlled environment, ideally in their original packaging until use, to maintain stability and prevent premature degradation.

Case 2: Adhesion Loss or Poor Surface Contact

Adhesion loss or poor contact can occur when the gel does not fully wet the substrate, leading to increased thermal resistance and reduced overall performance. This issue may appear as visible gaps, air pockets, or partial detachment of the gel from the surface. Unlike pads with tacky surfaces, hybrid gels rely more on conformability than adhesive strength, so any reduction in surface contact can significantly affect heat dissipation efficiency.

Factors: Adhesion loss or poor surface contact is often caused by surface contamination, such as dust, oil, or residue, which prevents intimate contact between the gel and the substrate. Uneven or rough surfaces can also hinder full conformity, leaving micro-gaps that reduce thermal efficiency. Under-compression is another common issue, as insufficient pressure may prevent the gel from spreading and filling surface irregularities.

To resolve these issues, substrates should be cleaned thoroughly to remove contaminants before application. Ensuring that surfaces are relatively smooth or well-prepared will promote better conformity. Compression should be applied within the recommended range to achieve full surface contact without overstressing the gel. During assembly, handling should be minimized, and if repositioning is required, it should be done carefully to avoid surface damage. Where stronger adhesion is required, a thin tacky coating or primer may be used to improve interface bonding without affecting the thermal properties of the gel.