Nordson
ELECTRONICS SOLUTIONS

Comprehensive New Solution for One-Component TIMs
ASYMTEK Helios® SD-960 Series + Valve + One-Gallon Pail Pump

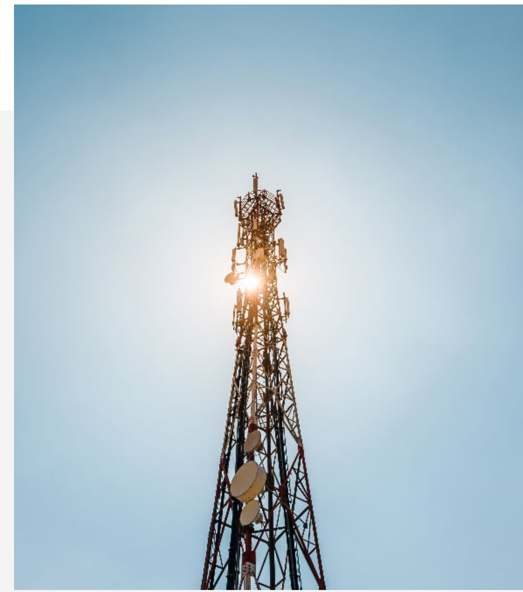
THE ESSENTIAL GUIDE TO LARGE-VOLUME TIM DISPENSING

Popular Thermal Gap Filler Equipment Configurations and Process Tips

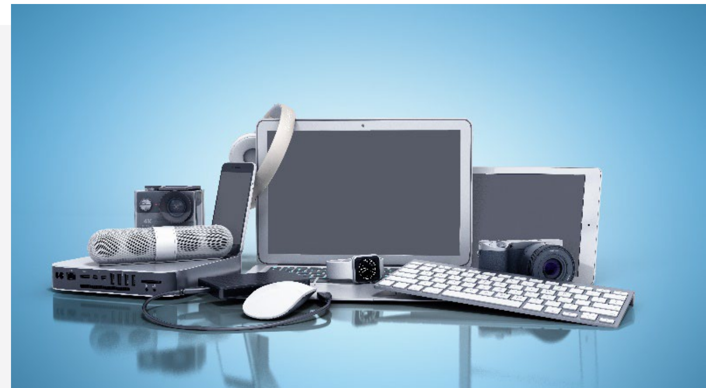
Contents

3. Thermal Interface Material
4. Efficient Heat Transfer
5. Large and Micro-Volume TIM Dispensing
6. Where is Thermal Gap Filler Used?
7. How Much Material Will You Need?
8. Choosing a Dispense Pattern
9. Equipment Guide
10. Recommended Equipment
11. Challenges and Solutions
12. Helios SD-960 Series
13. Comprehensive 1K TIM Solution
14. FS-EP1 One-Gallon Pail Pump
15. 245 No-Drip Valve
16. Vortik® VPg Progressive Cavity Pump
17. Contact Us

5G Infrastructure Applications



Consumer Applications



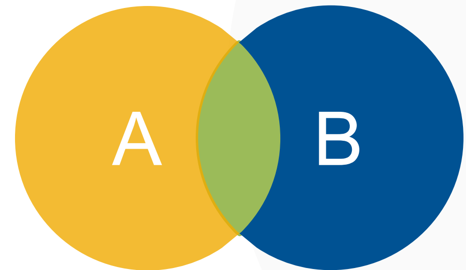
Automotive Applications

Nordson ELECTRONICS SOLUTIONS

Welcome

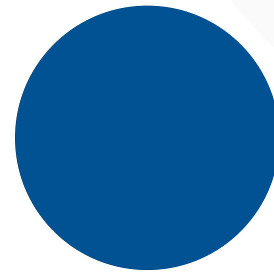
Thermal Interface Material

As electronic devices continue to get smaller and the amount of heat they generate increases, cooling and temperature control have become critical. Dispensable Thermal Interface Materials (TIMs) are an excellent solution for these applications because they provide outstanding thermal conductivity and greater process flexibility when compared to thermal pads.



Two-Component Materials

Thermal gap fillers can fill gaps between a heat source and a heat sink to lower overall thermal resistance in a range of automotive, 5G telecommunications, consumer electronics applications, and more.



One-Component Materials

You've selected the right material for your application. Now it's time to finish strong by choosing the right equipment to dispense it and the right partner to help develop your application.

This guide walks you through essential process considerations and includes popular configuration options to get you started.

Nordson
ELECTRONICS SOLUTIONS

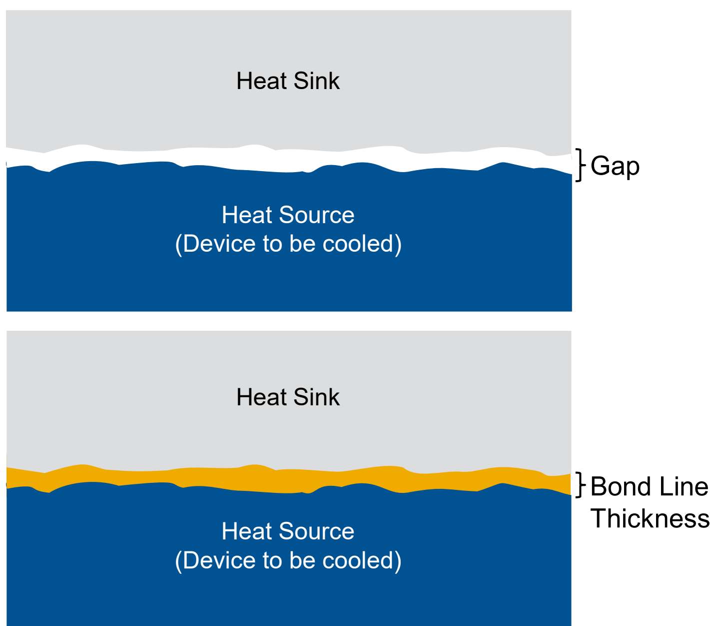
Efficient Heat Transfer

Bond Line Thickness

Upon close inspection, heat-generating devices and heat sinks do not mate up completely because their surfaces are not perfectly flat.

There are small area(s) of physical contact, but there are many gaps where the air is trapped between the heat sink and the heat source – these pockets of air act as insulation, preventing efficient heat transfer. Thermal interface materials with fillers that provide better thermal conductivity than the air are applied between the surfaces to facilitate heat transfer and avoid this issue.

The bond line describes where a material contacts two surfaces, typically where it is pressed between them. As a rule, the essential quality of a bond line is its thickness. In general, thinner bond lines reduce the distance heat must travel to escape the heat source. Therefore, a thin bond line is preferred over a thick one to minimize thermal resistance.



Filler Materials

Thermal conductivity is expressed in W/m.K (k, λ, or κ). Unfilled polymers have a thermal conductivity of approximately 0.1 W/m.K.

Filler materials offer thermal conductivity between 1-1000 W/m.K. Inorganic particle fillers include aluminum, oxide, magnesium oxide, aluminum nitride, boron nitride, and diamond powder. Metal fillers, notably silver, are also used to enhance thermal conductivity.

Polymers with fillers typically range between 1-10 W/m.K.

Thermal Conductivity at 77°F (25°C), (W/m K)	
Vacuum	0.000
Air	0.024
Paper	0.050
Cork	0.070
Rubber, natural	0.130
Water	0.580
Stainless Steel	16.000
Zinc Oxide	25.200
Aluminum Oxide	30.000
Lead Pb	35.000
Tin Sn	67.000
Platinum	70.000
Aluminum	205.000
Gold	310.000
Copper	401.000
Silver	429.000
Diamond	1000.000

Large and Micro-Volume TIM Dispensing

Nordson ASYMTEK offers large- and micro-volume dispensing of thermal gap fillers (gels and pastes). We've provided the following tables that outline key process considerations and common equipment types for both large and micro-volume dispensing solutions for contextual reference. This guide focuses on large-volume dispensing of thermal gap fillers. For information on micro-dispensing solutions for thermal grease and thermal adhesives, contact your local representative.

Material	Typical Bond Line Thickness	Abrasiveness	Typical Volume Dispensed	One Component (1K)	Two Component (2K)	Reworkable
Thermal Grease	< 250 µm	Moderate	*Low	✓		Yes
Thermal Adhesive	< 250 µm	Moderate	*Low	✓	✓	No
Thermal Gap Fillers (Gels and Pastes)	> 250 µm	High	**High	✓	✓	Yes (Typically one component)

*Syringes or cartridges.
**Large cartridges or pails.

Equipment Types

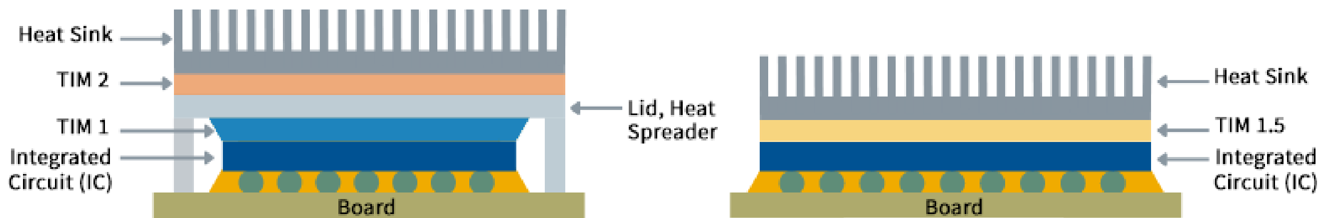
Material	Time-Pressure	Auger	Progressive Cavity Pump	Positive-Rod Metering
Thermal Grease	✓	✓	✓	
Thermal Adhesive	✓	✓	✓	
Thermal Gap Fillers (Gels and Pastes)	✓ (One component)		✓ (One and two component)	✓ (Two component)

Nordson ELECTRONICS SOLUTIONS

Where is Thermal Gap Filler Used?

In semiconductor packaging, PCBA, and precision assembly applications, TIM 1 is dispensed between a flip-chip integrated circuit (IC) and a heat-spreading lid. TIM 2 is dispensed between a finished package, component, or module and a heat spreader in the form of a case, metal housing, or heatsink. And TIM 1.5 refers to materials dispensed between an IC without a lid and a heatsink.

TIM 1, TIM 2, and TIM 1.5 examples:



Nordson ELECTRONICS SOLUTIONS

How Much Material Will You Need?

You'll need enough material to cover the component – or bond area – with a bond line that ensures proper adhesion and performance after the material is compressed. The amount of material to dispense is a simple calculation:

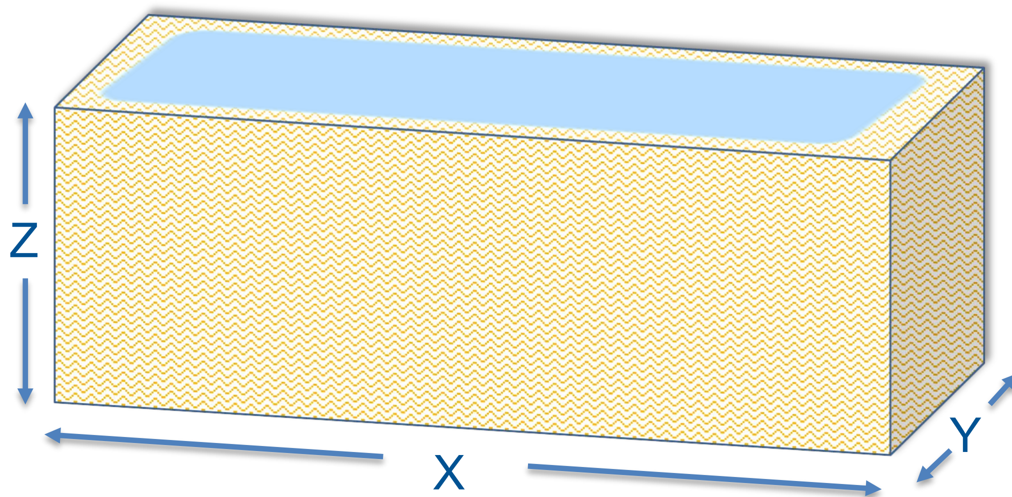
Dispense Volume = Final Bond Line Thickness x Bond Area

However, you'll need to consider other external factors such as viscosity differences, substrate material composition, and mechanical tolerances that could cause variation in the final bond line thickness. To compensate for those factors, calculate the volume using the upper tolerance limit for your application. When you calculate the volume using the thickest acceptable bond line measurement within tolerance, you'll ensure that a sufficient amount of material is dispensed between the heat source and heat sink, whether the processed part is at the lower or upper end of the mechanical tolerance spectrum.

When calculating volume, consider the:

- Dimensions of the component generating heat
- Required bond area coverage
- Upper tolerance limit for your application
- Desired final bond line thickness after the material is compressed

Tip: When mechanical tolerances result in a bond line at the lowest acceptable thickness within range, inspect the bond carefully to learn how it could fail and whether performance is affected. Adjust the bond line thickness as necessary.



Choosing a Dispense Pattern

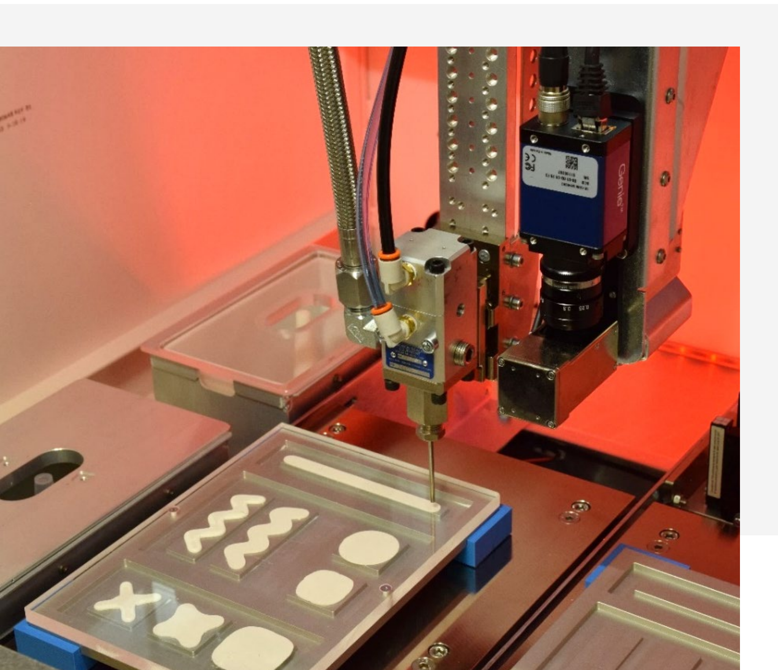
Dispense pattern geometry has a significant influence on process efficiency. Choose a dispense pattern that balances the:

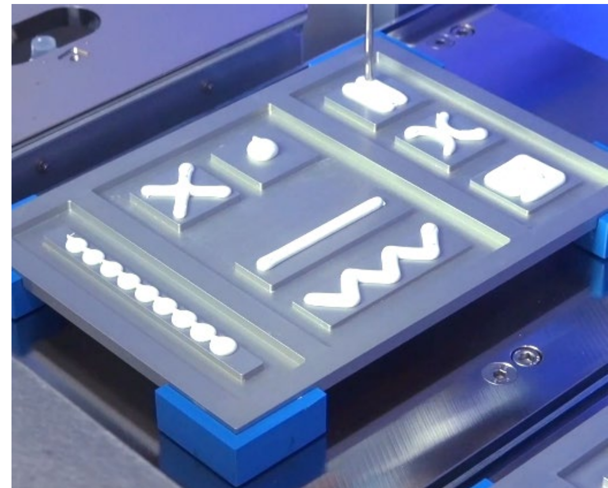
- Dispense speed
- Force required to achieve bond line thickness
- Material usage
- Dispensing equipment capabilities and wear

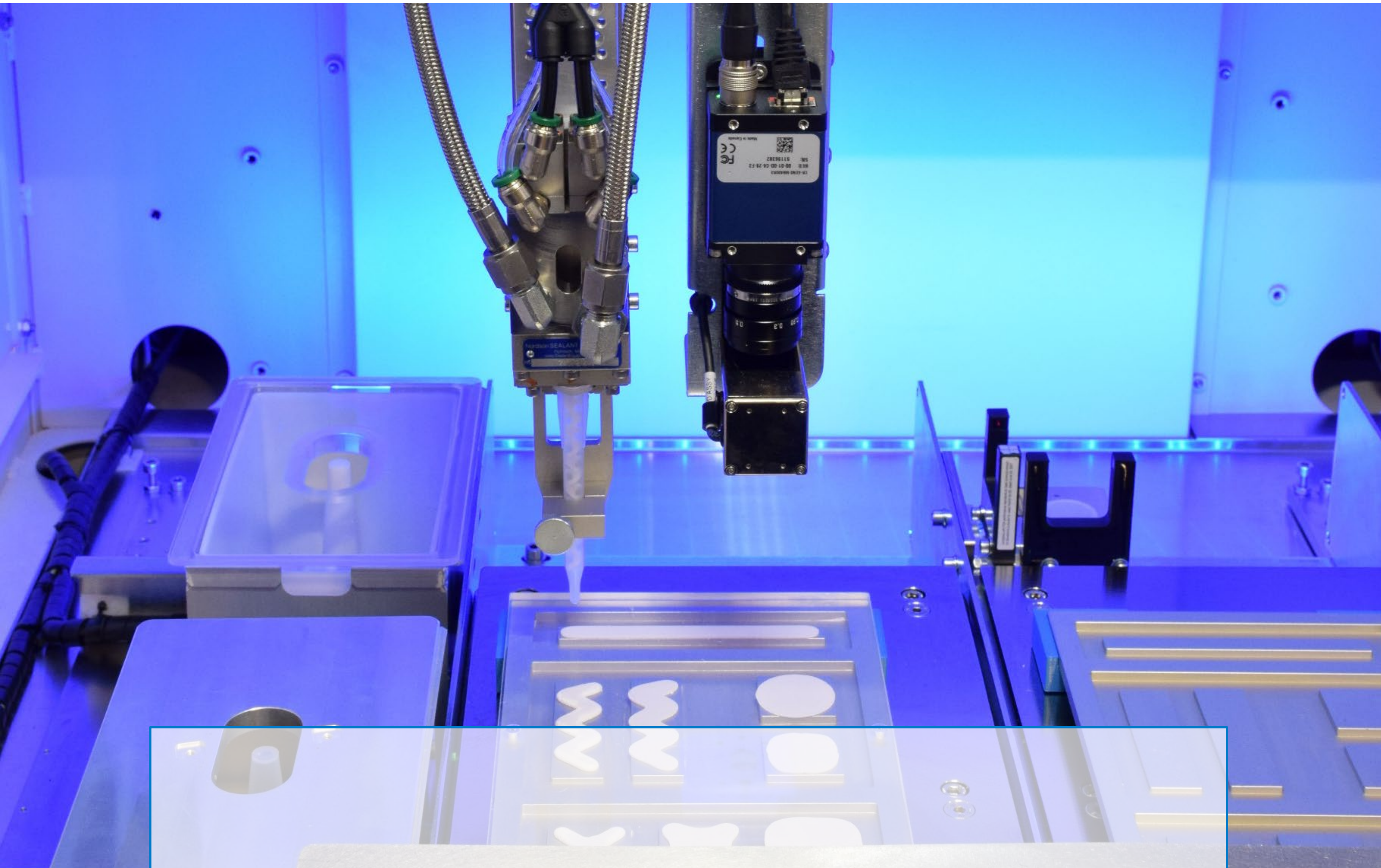
Make strategic choices. For example, you might choose a more complex spiral pattern that takes more time to dispense if you're dispensing on a part that has a low tolerance for mechanical stress. In this case, the gain in quality could out weight the impact on UPH.

Our expert applications engineers can help you navigate the options and develop your application to achieve the perfect balance.

Pattern	Air Entrapment Risk	Programming Difficulty	Common Use
Dot	Low	Easy	A single dot per component
Line	Low	Easy	A single line covering one or more close-set components
Cross	Low	Easy	A combination of two lines covering a large component
Wave	Moderate	Moderate	A wave-shape line covering a large area, often between a heat spreader and a heat sink
Spiral or Serpentine	Higher	More Complex	These patterns are used to limit mechanical stress on parts. The dispensed shape immediately covers the part, requiring minimal force to achieve the target bond line thickness.







Equipment Guide

Large-Volume

Thermal Interface Material Dispensing

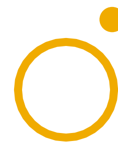
Nordson
ELECTRONICS SOLUTIONS

Recommended Equipment

To dispense large volumes of thermal gap fillers, we recommend the Helios SD-960 Series.

This section covers popular solutions and key areas to consider as you evaluate equipment options:

- Will you be dispensing a one or two-component material?
- Do you have an inline or batch process?
- What are your flow rate requirements?
- How thick and abrasive is your material?
- How important is process control and traceability?



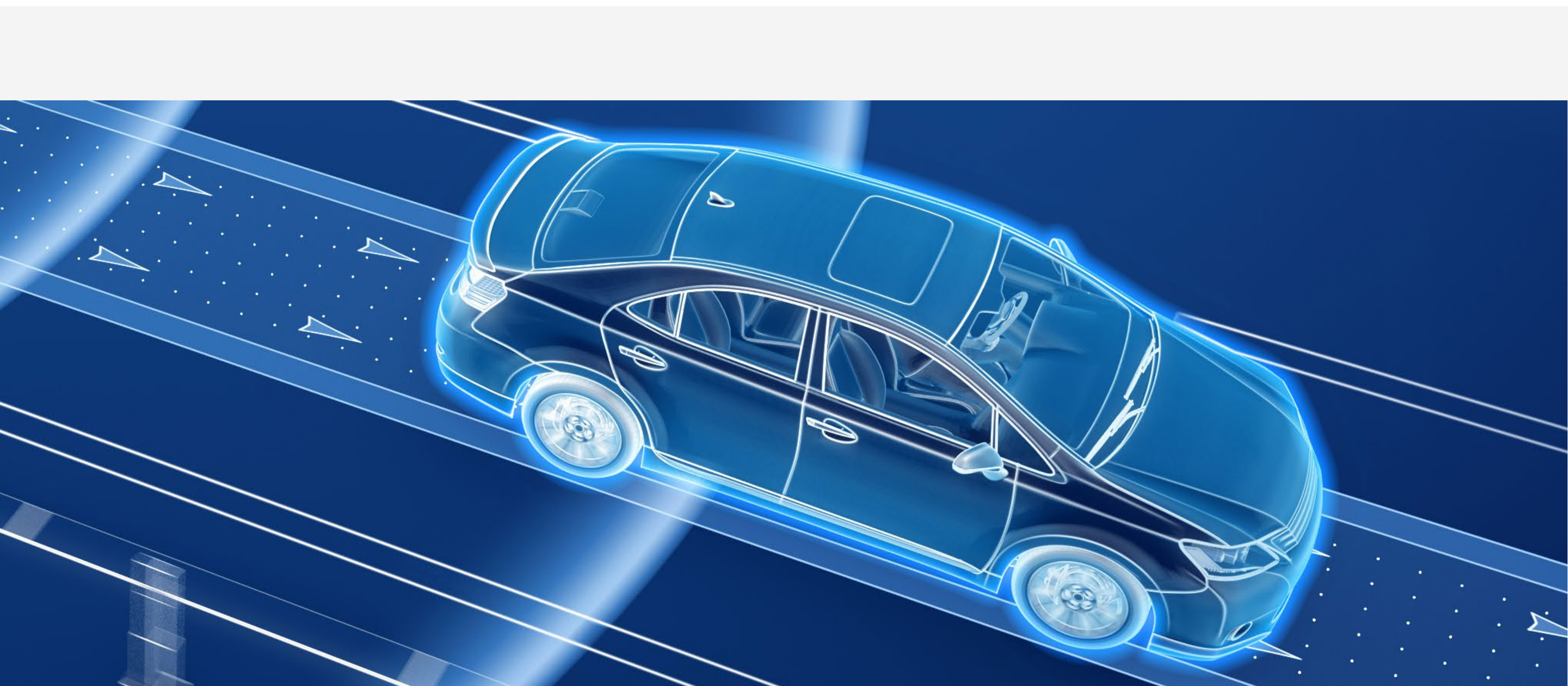
Thermal Interface Material Applications	Popular Configurations
One-Component Material	Helios SD-960 Series FS-EP1 One-Gallon Pail Pump – High-Pressure Bulk Feed 245 No-Drip Valve – Ball-in-Seat Design
Two-Component Material	Helios SD-960 Series Pail Pumps – High-Pressure Bulk Feed Vortik VPg Progressive Cavity Metering Pump – with Static Mixer

Contact us when you're ready to talk about your specific application needs. From there, we'll identify the ideal equipment and setup for your application.

Getting Started

Challenges and Solutions

Challenge	Nordson ASYMTEK Product Solution
The viscosity of some materials can be inconsistent within a pail, and that variability can gradually change the flow rate. How can this be addressed?	Include Mass Flow Calibration (MFC) and the large capacity weight scale in your configuration to adjust the dispense to the variable flow rate.
Is the dispensed thickness or volume enough to fully contact the opposing surfaces after compressing the material to the required bond line thickness?	Include height sensing in your configuration. Height sensing will detect the substrate height before dispense, and you can use it to perform post-dispense checks for sufficient material thickness in a specific location.
Do you have a continuous inline production process or a batch process that requires manual steps between different dispensing applications?	Consider the Helios SD-960 Series dual-drawer system. The Helios dual-drawer system lets you unload, load, and dispense simultaneously without stopping your process, increasing overall UPH.
Does your process demand high accuracy, repeatability, and traceability, such as in the automotive or medical device industry?	The Vortik progressive cavity pump delivers repeatable volumetric accuracy without interruption – and it's all traceable. When combined with the optional weight scale on the Helios SD-960 Series, you will also have access to ARC Technology for two-component material dispensing to control metering and mix ratios.



Large-Volume Thermal Interface Material Dispensing

Helios SD-960 Series

Designed for medium and large-volume dispensing applications, the Helios SD-960 Series supports a broad range of single and two-component applications, including highly abrasive thermal interface materials.

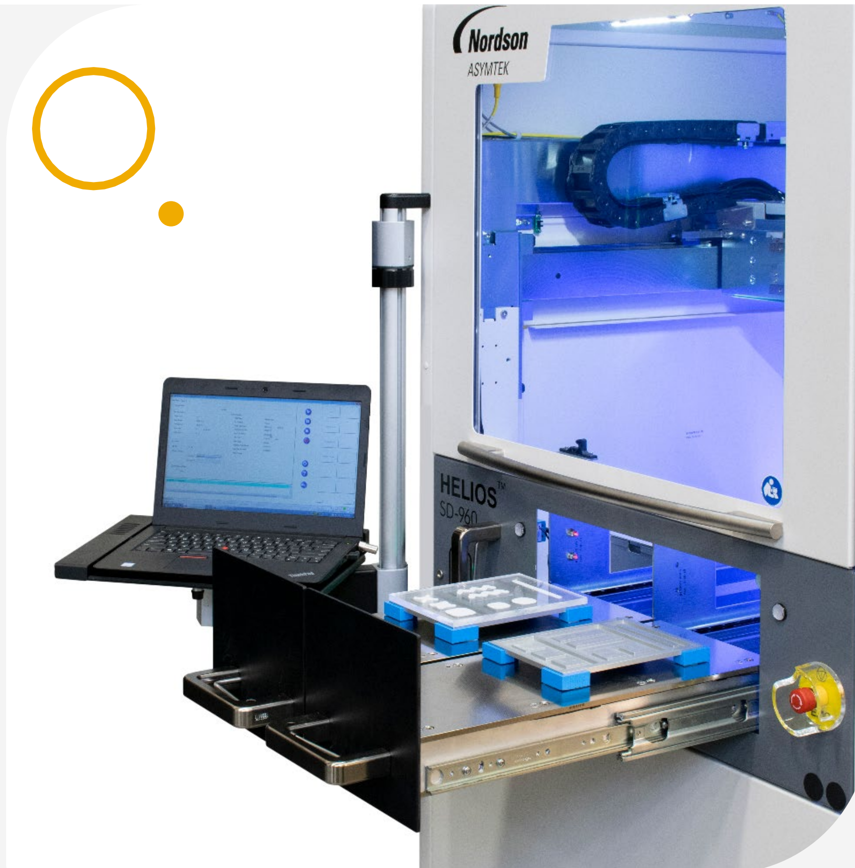
Features

- Fluidmove® Software, with user-programmable dispense geometries
- Camera system for programming and fiducial recognition
- Stainless steel surface design for easy cleaning
- Efficient routing of bulk fluid supply hoses

Options

- Two-component metering system with integrated controls
- Patent pending Mass Flow Calibration (MFC) with large capacity weight scale for closed-loop process control
- Height sensing for automatic XYZ needle position compensation

Learn More



Nordson
ELECTRONICS SOLUTIONS

One-Component (1K) Thermal Interface Material Dispensing

Comprehensive Solution

The comprehensive Helios SD-960 Series 1K TIM dispensing solution includes three main elements:

- Helios SD-960 Series
- FS-EP1 One-Gallon Pail Pump
- 245 No-Drip Series Valve

Get the Solution Data Sheet

Helios SD-960 Series

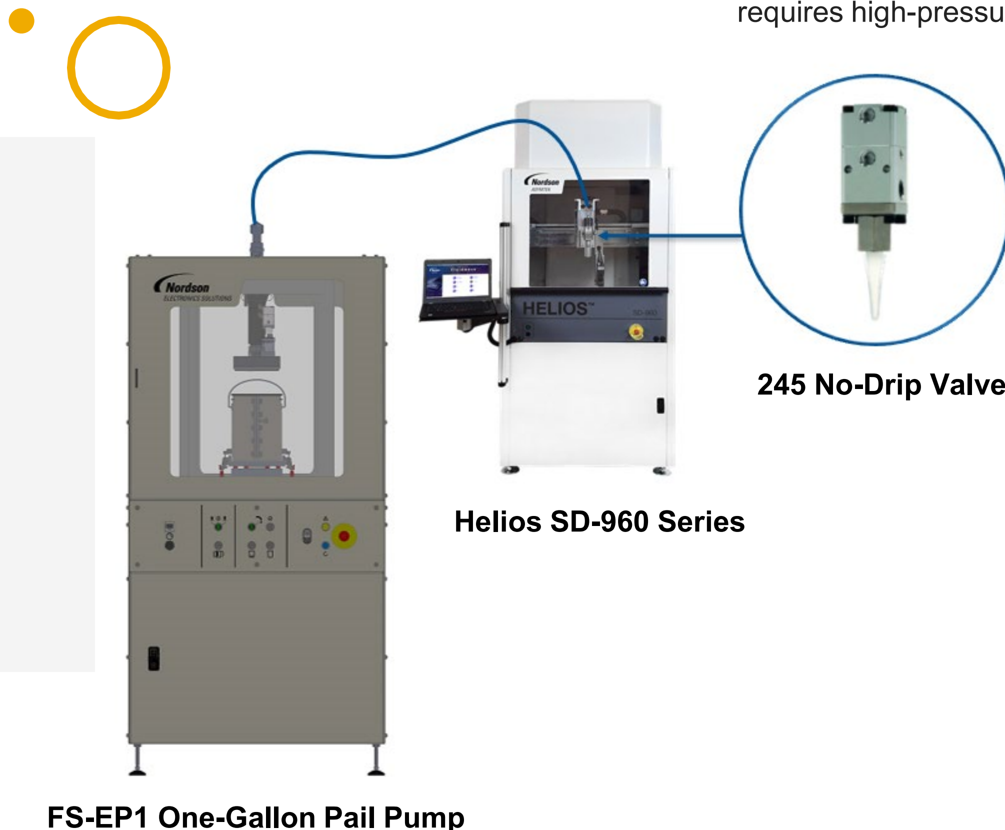
- Conveyorized in-line, single-drawer features a 420 x 440 mm dispense area (maximum)
- Dual-drawer for batch processes offers a 210 x 380 mm (left drawer) and 200 x 380 mm (right drawer) maximum

FS-EP1 One-Gallon Pail Pump

- Efficiently transfers dispensable materials from one-gallon metal pails, minimizing downtime with a unique pail change and loading system

245 No-Drip Series Valve

- Designed for highly-viscous, abrasive material such as thermal gap filler that requires high-pressure dispensing



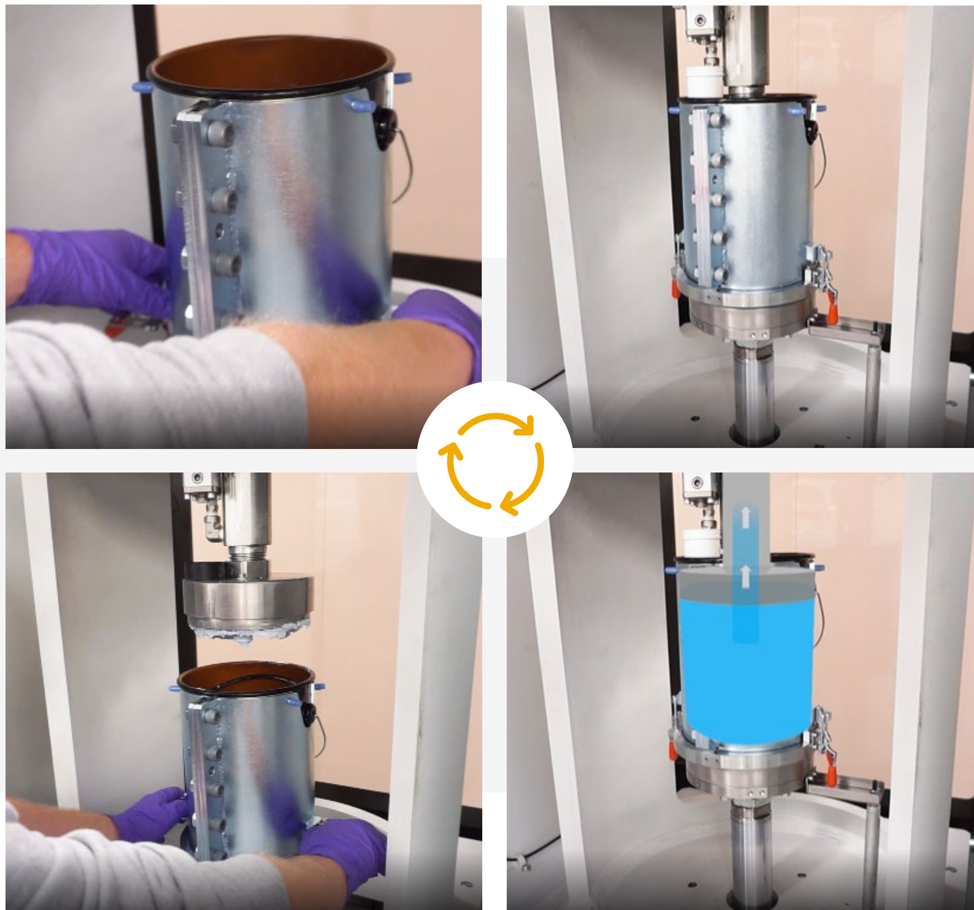
FS-EP1 One-Gallon Pail Pump

One-component thermal gap fillers are often highly viscous and abrasive, making them difficult to transfer from the original packaging to the dispense valve.

Facility air pressure and chunk pumps are standard solutions for transferring these thick materials. Still, these are not robust long-term solutions because the air pressure achieved is usually insufficient, or the pump wears out quickly, leading to premature failure.

The FS-EP1 pail pump combines the Helios SD-960 Series and the 245 No-Drip Valve to provide the ideal long-term solution.

- Simple to use and easy to maintain
- Low COO
- Closed-hydraulic system
- Ideal for highly viscous one-component thermal gap filler (>1 million cps)
- Moving parts do not contact materials during dispensing
- Standard pressure configuration supports 1K TIM dispensing out of the box
- Compatible with the Helios SD-960 Series dispensing system

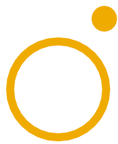


Simple Changeover with the FS-EP1 One-Gallon Pail Pump

245 No-Drip Valve

When selecting a valve to dispense one-component materials, consider:

- Material viscosity
- The required flow rate



245 No-Drip Valve

- One-component dispensing
- Suitable for abrasive TIM materials
- Ball-in-seat
- Free flow of high-viscosity materials
- No-drip feature creates immediate material shut off
- Angled dispensing with tilt and rotate
- Dual-valve dispensing – independent or simultaneous operation

245 No-Drip Valve

Nordson ELECTRONICS SOLUTIONS

Progressive Cavity Pump

Vortik VPg

Equipped with a fully integrated one or two-component Vortik VPg progressive cavity pump, the Helios SD-960 Series is ideal for a range of applications – including abrasive thermal interface materials that require larger-volume dispensing and high volumetric accuracy.

Learn More

Features

- True positive displacement of a fixed volume with each rotation regardless of ambient temperature conditions or fluid pressure variation.
- Continuous needle dispensing of one and two-component fluids with a volumetric accuracy of ± 1% – reducing cycle time and increasing reliability and productivity.

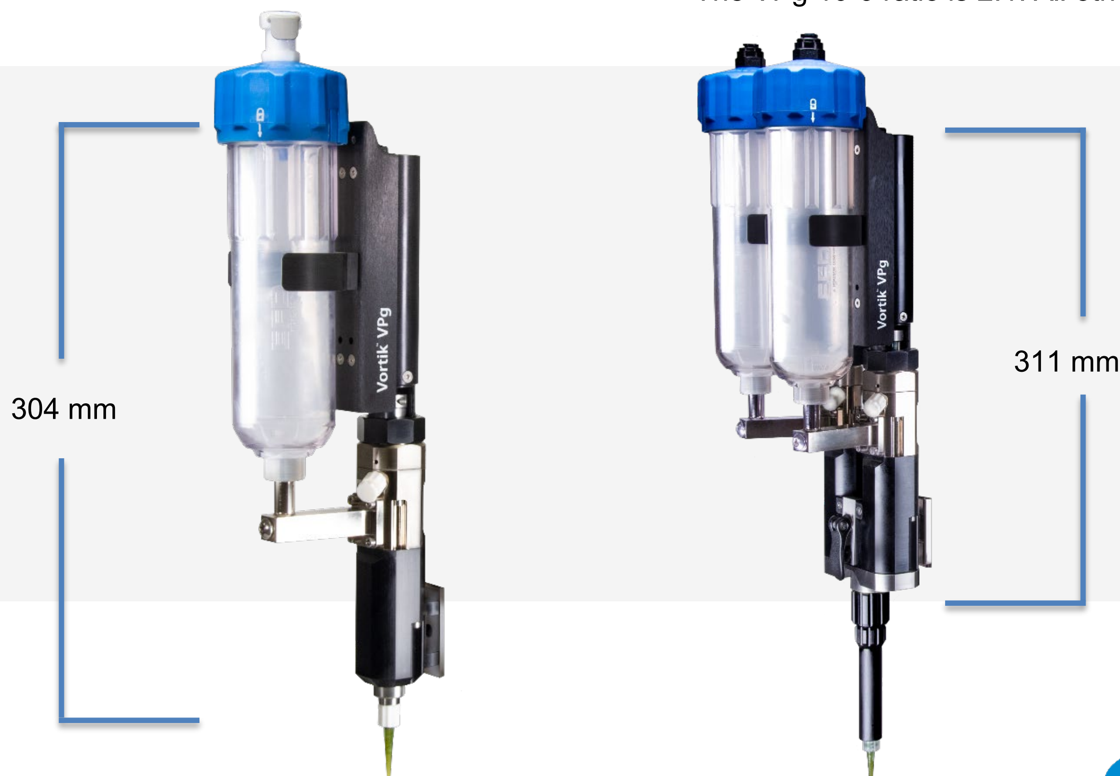
One-Component Dispensing

Flow rate
VPg 9: 28 – 203 µl/s
VPg 10: 45 – 333 µl/s

Two-Component Dispensing

Flow rate*
VPg 9-9: 55 – 405 µl/s
VPg 10-9: 83 – 500 µl/s
VPg 10-10: 91 – 667 µl/s

*The VPg 10-9 ratio is 2:1. All other ratios are 1:1.



Nordson
ELECTRONICS SOLUTIONS

Your Representative Has All the Details

Contact us today. A member of our dedicated applications team will work directly with you to understand your application, assist with equipment selection, and set up and run your application demo. We are recognized for exemplary service and commitment to customer success – winning Circuits Assembly Magazine's Service Excellence Award all 16 years that we've entered.

Discover how our thermal interface material solutions and outstanding application and support teams can optimize your operations.

We've earned the confidence of the world's largest electronics companies to support their high-volume dispensing processes.

We can help you succeed.

Let's Talk

Visit our website or contact us. We have several global locations to serve you.

North America
Asia Pacific
EMEA

nordsonasymtek.com/global-locations
info@nordsonasymtek.com