LPISM Frequently Asked Questions

9524S & 9524D HVLP Sprayer

The 9524S and 9524D HVLP Spray Units utilize advanced spray technology to apply uniform LPISM coatings to PCBs. This is accomplished by sweeping the heated gun across the PCB at very high speeds as the PCB passes through the spray chamber on a continuously moving edge-contact conveyor. This provides an efficient, reliable system which minimizes over-spray and produces a continuous, conveyorized throughput of LPISM-coated boards. The difference between the 9524S and 9524D is the throughput capability; the double-spray 9524D will process twice as many boards per hour as the single-spray 9524S.

9724 IR Tackdry Oven

The 9724 IR Tackdry Oven is designed to quickly and efficiently tack-dry LPISM-coated PCBs. The unit consists of three individually controlled long-wave infrared heater zones, a forced-air circulation system, and a conveyor to move the boards through the oven. This highly innovative technology, developed by Argus International, provides a breakthrough in significantly reducing the tack-dry time of LPISM-coated PCBs. While convection-only ovens rely on air to transfer heat, the 9724 directly heats the board with IR radiation and provides forced air circulation; this technique lowers the normal tack-dry time from 35-45 minutes to 3-4 minutes.

1. How does the HVLP-heated spray gun work?

HVLP stands for high-volume low-pressure, a type of spray gun that allows LPISM to be atomized into a fine spray through the use of air pressure. Typical HVLP systems require that the spray liquid be diluted with a compatible solvent to a viscosity low enough to allow proper atomization. To spray LPISM in a typical, unheated HVLP gun, approximately 45% additional solvent by weight is usually required.

The 9524, however, does not use a typical spray gun. The heated gun technology developed by Argus International **significantly reduces solvent usage** during spray, providing economic, safety, and environmental benefits. Typical solvent level is approximately 20% - 35%. This technology, which heats both the LPISM and the atomizing air at the point of spray, causes a drop in LPISM viscosity just long enough to allow proper atomization without the use of excessive amounts of solvent.

2. How does IR tack-drying work?

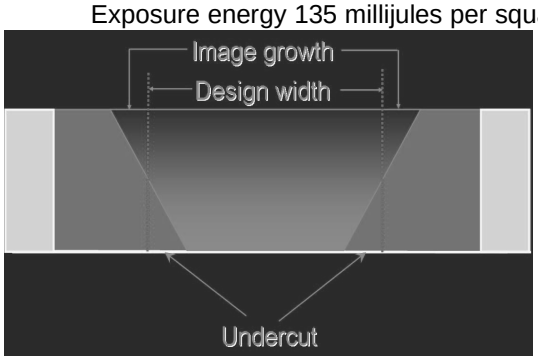
Traditional convection ovens use electric coils to heat the air; the air moves around and heats the coating; eventually the coating heats the substrate. Once the substrate gets hot enough to not heat-sink the coating, the coating dries from the outside.

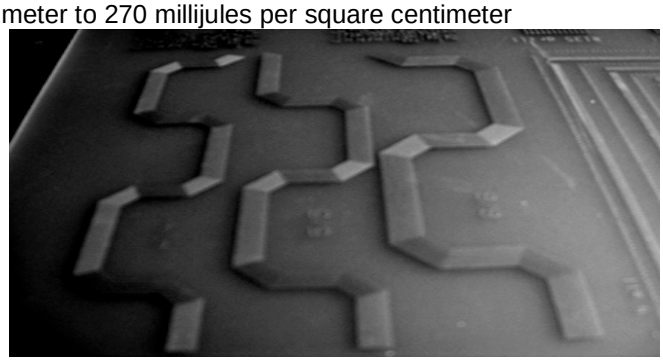
The Argus IR Tackdry Oven employs 5 to 8 micron IR emitters that directly transmit energy to the densest material, in this case the PCB. Because the air and coating are between the emitter and the PCB, some residual heating occurs, but the bulk of the energy is absorbed by the PCB. This means that the coating predominantly dries from the inside; that is, the junction between the PCB and the coating, thus increasing the drying rate while reducing skin formation and solvent retention. Forced air circulation in the 9724 then rapidly removes the evaporated solvent from the PCB surface.

Typical developing speed for 6-7 ft. chamber is 10 to 12 feet per min. for following requirements:

- Maintain minimum 0.4 mil on track edges
- Wash clean 7 mil via holes
- Maintain 2 mil solder dams

Exposure energy 135 millijules per square centimeter to 270 millijules per square centimeter





From the above results it is evident that benefits attributed to reduce ink deposit in holes and between pads allow significant improvements in capability and turn, productivity with Argus air spray & Tackdry systems.

3. How does the spray unit handle over-spray?

Touch screen input of board dimensions and photocell detection of board position allow the operator to control the spray pattern and coverage of the desired area of the PCB, thus minimizing over-spray.

The exhaust system, which is designed to remove solvent vapors and any over-spray from the low-volume spray chamber, maintains straight-line flow in the direction of spray. This configuration combines efficiency of operation with reduced equipment size and cost.

Any LPISM which adheres to the edge-contact conveyor is continuously removed by an automatic cleaning system.

4. What is the expected LPISM efficiency?

Typical spray operation will provide 140 to 150 square feet of a 1 mil thick dry coating per kilogram of LPISM; this easily equals or exceeds the efficiency and economy of other methods of application. Because of the heated spray gun technology, this 1 mil coating will adequately cover much higher traces than a coating produced by other methods, yielding additional economy of operation. For example, 5-7 mil high traces have been encapsulated with half the dry thickness coating required with silk screen systems.

5. Can the 9524 spray materials other than LPISM?

In addition to LPISM, the 9524 Spray Unit has been tested for use with photoimageable legend inks, primary image resists and photoimageable dielectric coatings. We can offer a system for inner-layer coating of liquid resists for production-volume processing in conjunction with panels frames for thin core material and flexible as well as flex-rigid board. This system should allow major cost reduction in both raw materials and equipment, and will likely cause a shift away from dry film in primary image processing.

6. How does the 9524 deal with LPISM in the barrels?

LPISM in the barrels is a significant problem in silk screen application methods. Because the silk screen squeegee forces LPISM into the holes, higher developer pressure is required to obtain clear holes.

Spray coating with the 9524 does not result in significant amounts of LPISM in the barrels, as the mask is not forced into the holes as it is by the squeegee; therefore, lower developer pressure can be used, and process speed is improved. LPISM dams between fine pitch patterns are more easily held, under-cut during development is reduced and the surface cosmetics are improved because proper developing procedure can be maintained

7. Are there many LPISMs that work well with IR tack-drying?

Most LPISM manufacturers can supply coating materials that function well in the 9724 Tackdry Oven. Sun Chemical, Electra, Enthone, J-Kem International, Lackwerke Peters, Tamura, Technic, and Taiyo all produce LPISMs that have processed well in our laboratory evaluations. Potential customers are welcome to view the IR Tackdry Oven in operation, or to process sample boards in our Technical Service Laboratory.

8. Does the heated spray gun have benefits in addition to reduced solvent usage?

Heated spray gun technology has improved the ability of HVLP systems to encapsulate traces, because the LPISM returns to room temperature and higher viscosity before it strikes the PCB. The heated gun also reduces LPISM usage by allowing thinner coatings to adequately cover higher circuit traces.

Because the **heated gun requires less solvent** in the LPISM, tack dry times are significantly reduced; if the 9724IR Tackdry Oven is used in conjunction with the 9524 Spray Unit, tack-dry time may be reduced to as little as 3 minutes.

9. How does the 9524 apply a uniform coating with just one spray gun?

The 9524 Spray Unit uses a shuttle head that attains speeds of up to 160 feet per minute. This allows the single spray gun to sweep the width of the PCB while the board moves forward as little as half an inch. Because the spray pattern from the heated gun is approximately 2.5-3.0 inches wide, the entire PCB may receive as many as 8 coats of LPISM during the spray process. At typical conveyor speeds, the board will receive 4 coats of LPISM.

Simplicity of setup, speed of operation and uniformity of performance all favor the use of a single spray gun system. This system is not subject to multiple gun spacing, placement, adjustment and pattern problems that can all lead to inconsistent coating thickness.

The table below shows the mean result of a thickness uniformity test carried out across the surface of 10 panels 24" x 18" spray with 9524S spray system.

Cured thickness, randomly selected, across panel (mil):

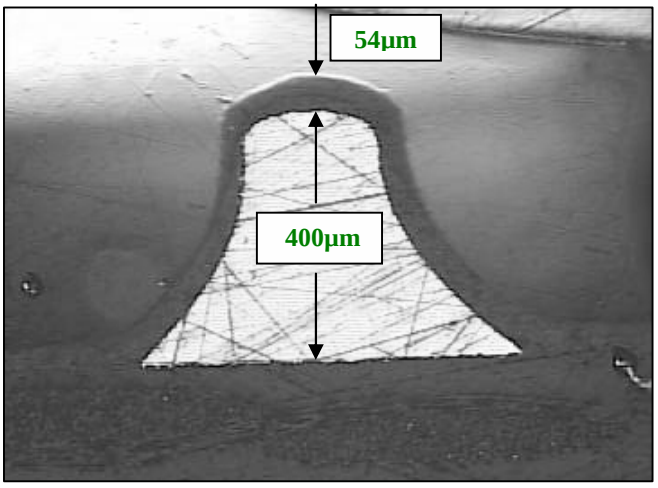
1.16	1.14	1.22	1.19	1.16	1.19	1.14	1.23	1.21	1.14
1.26	1.22	1.19	1.19	1.22	1.23	1.21	1.18	1.18	1.19

Mean: 1.2 mil - Standard Deviation: 0.028 mil - Upper Control Limit: 1.285 mil - Lower Control Limit: 1.11 mil

Solder mask thickness & Track Encapsulation and Coverage

Ink deposit around tracks and pads is a key to process capability. Argus spray unit is able to cover the tracks up to 12-15 mils thick with a single coat. Spray solder masks properties are optimized to prevent slumping from the track-edges. Argus Spray technology allows encapsulation below 4 mil track gap configuration. The spray process permit very high levels of thixotropy resulting in excellent track coverage.

Tracks Size	Solder Mask Thickness	Dry Thickness	Coverage (per kilogram)	Minimum Edge Cover
2.5 mil - 2.75 mil	2mil- 2.5 mil	1mil-1.5mil	172 square feet	0.4 mil



Excellent encapsulation up to 400 micron copper capability

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10. What is Argus International's experience with LPISM systems?

The Argus Technical Service Laboratory is currently testing and evaluating many LPISMs, with the objective of creating a databank of characteristics, operating parameters and peculiarities; when completed, this will be made available to customers. The Laboratory will also demonstrate the 9524 Spray Unit and the 9724 IR Tackdry Oven, as well as Final cure ovens and process sample boards for potential customers.

For installation, our Process Engineering Group will assign a process engineer to assist in physical location of the equipment, conduct initial start-up and train operating personnel at your facility. Continuing technical support, service and parts supply are provided with the same dedication that has existed at Argus International since 1965.

11. What are the benefits of acquiring the complete LPISM Application and Drying System?

The real benefit to acquiring the complete 9000 Series LPISM Application System is that it allows the machines to be linked together so that LPISM application becomes a load-unload operation, without handling of wet boards. By placing the equipment end to end, boards may be loaded at the entrance of the 9524D Spray Unit and removed at the exit of the 9724 Tackdry Oven just minutes later, fully coated and tack-dried.

With the 9000 Series LPISM Application System, conveyor speeds of 4 feet per minute are realistic as are throughputs of up to 120 boards per hour for 24” X 24” samples, giving excellent production rates and genuine economy benefits.