WHITE PAPER

Reducing Coatings Costs with Advanced Airflow Technology

How Laminar Airflow Principles Are Changing the Coatings Industry

Manufacturers are constantly challenged to reduce costs and increase productivity to remain viable in today's hyper-competitive marketplace. This is especially true for those that need to apply paint or other finishes to their products.

Despite their widespread use, traditional High Volume Low Pressure (HVLP) spray gun designs hinder the coatings operations manager from achieving optimum levels of efficiency and productivity. Even the best HVLP products may produce booth fog and overspray, resulting in wasted materials and added clean up time. In addition, HVLP guns are more likely to provide poor finish quality and are not ergonomically friendly.

Fortunately a new spray gun technology enables manufacturers to achieve higher quality finishes while reducing costs and improving employee productivity. This white paper will examine the challenges of HVLP guns and introduce the many advantages of solutions that leverage Laminar Airflow Technology.

Problems with Traditional HVLP Guns

Despite an improvement over older Conventional Air Spray (CAS) guns, HVLP systems still waste materials, often reduce finish quality, and may be putting workers at risk

The internal design and construction of a spray gun largely determines its performance. Most HVLP gun bodies are based on Conventional Air Spray (CAS) designs that were optimized for high inlet pressures. To avoid massive design and retooling costs, many spray gun manufacturers simply adapted these designs to meet HVLP regulatory requirements, despite the potential drawbacks.

Unfortunately today's HVLP guns still suffer from these original design limitations. In particular, incoming compressed air is forced through a series of sharp twists, turns, and junctions as it makes its way through the gun. These turns create turbulent airflow. Since turbulent air is more difficult to move, higher pressures are required at the base of the gun. It is not uncommon for an HVLP gun to require 30psi or more at the base of the gun to produce 10 psi at the air cap.

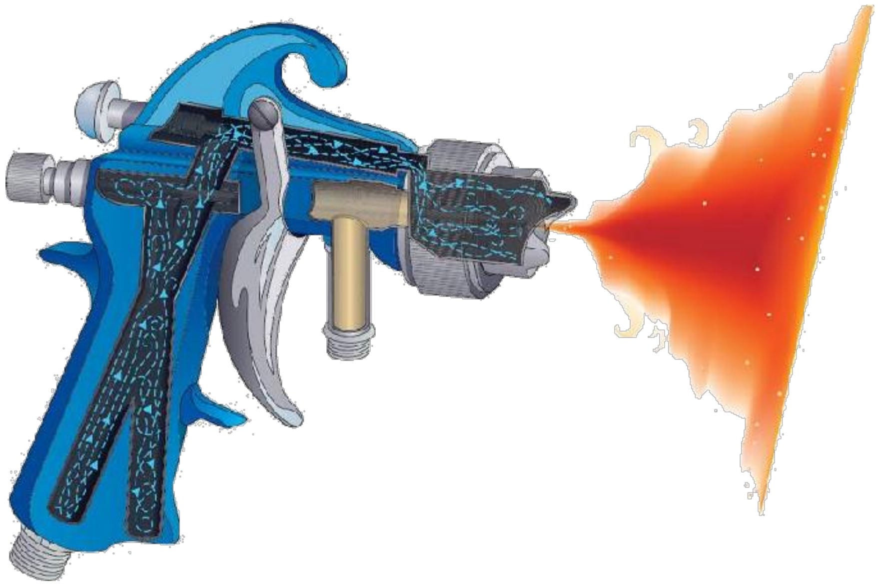
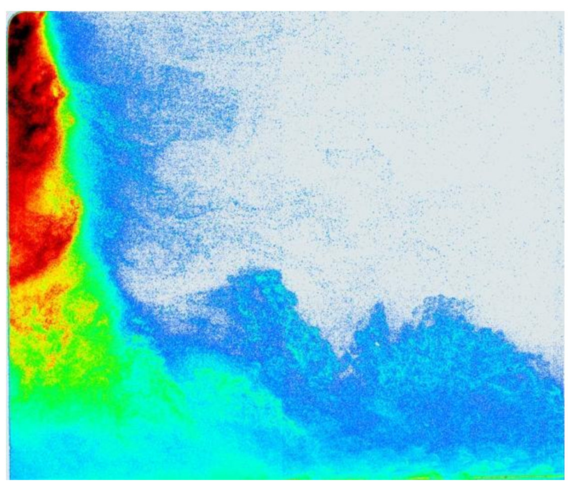


Figure 1: Sharp-cornered gun chambers in HVLP guns create turbulent air that reduces finish quality.

Many current HVLP guns also incorporate air chambers that change in diameter throughout the gun. These changes, coupled with unnecessary obstructions from fluid needles and fan pattern valves, combine to create even more turbulence inside the gun. When a large volume of turbulent air is ejected through the air cap, it combines with the coating material in an explosive decompression that carries atomized coating material in all directions. This is the primary cause of paint booth "fog" (see figure 1).



All traditional HVLP guns are designed to use high volumes of air to sufficiently atomize coating materials. Unfortunately, with nowhere else to go, this air has a tendency to bounce back at the operator or swirl off to the sides of the target – carrying even more material with it into the surrounding air. The Particle Image Velocimetry (PIV) image to the right illustrates an actual HVLP spray pattern after it has hit a flat target, demonstrating this “blowback” effect.

In addition, if the excess air is unable to escape to the sides, it may become trapped in the paint, leading to sagging or dripping when a thick paint film is applied. This causes many operators to slow down, recoating the same area multiple times to achieve the desired paint thickness without impacting finish quality.

Relying on HVLP guns using these older technologies causes many problems for manufacturing businesses, including:

Significant costs. For any manufacturer, cost containment is an important part of the production process. Unfortunately in the coatings business few operators understand that paint booth fog and overspray are the number one cause of material waste. Traditional HVLP guns clearly achieve greater transfer efficiencies than older high pressure CAS guns. However, as much as 40-60 percent of material can still be wasted due to overspray and excessive paint fogging. The fog created by HVLP guns also results in more frequent spray booth air filter exchanges, which can cost manufacturers several hundreds or thousands of dollars each year.

Poor finish quality. Due to federal environmental laws established in the 1990s, operators are often required to use coatings with lower Volatile Organic Compound (VOC) content. These materials have high solids content and are generally thicker and more difficult to spray. Since air turbulence inside typical HVLP guns is very high, controlling atomization of these materials is very difficult. The result is a spray column with uneven droplet sizes and inconsistent material densities. These factors ultimately impact the operator's ability to apply a consistent film thickness across the entire substrate, making sagging, dripping, and orange-peel more likely.

Unhealthy work environment. In any work environment where toxic fumes are present, workers with even the best protective masks and suits will still be at an elevated health risk. Because HVLP guns disperse excessive amounts of material into the air, health-related risks increase. Workers' health organizations have also found that unbalanced or front-heavy spray gun designs increase the likelihood of worker fatigue as well as a host of hand- and arm-related injuries. Most HLVP guns have relatively long barrels with heavy air caps and fluid tips. This leads to a tendency to drop the tip of the gun, especially toward the end of a long workday when fatigue is setting in.

Production limitations due to permit constraints. In certain regions with poor air quality, regulatory agencies limit the amount of toxic material that manufacturers can release into the atmosphere. Since HVLP designs produce excessive amounts of overspray and fogging, manufacturers that use these guns may find their ability to increase production hampered by the air quality limitations of their existing operating permits. Petitioning for an increase in emissions can be a very long and costly process if it is allowed at all.

Advancements in Spray Gun Technology

HVLP guns resulted from EPA regulations in the 1970s and 80s and have changed little over the last 20 years

The first mechanical spray gun was invented more than 100 years ago. Atomization designs in use today were originally developed in the 1930s, when the most significant achievement was the development of the industrial air compressor that allowed spray guns to vaporize paint into a consistent mist, an essential process for a high-quality paint finish.

Beginning in the 1970s, the Environmental Protection Agency (EPA) established limits on the amount of toxins that could be expelled into the atmosphere from atomized paint mixtures, forcing manufacturers to modify their gun designs to accommodate lower air pressures. This established the current HVLP standard. However, this new standard created finish quality problems that were especially prevalent with high-solid material formulas.

Unfortunately for some manufacturers, their only recourse to maintain high quality finishes was to ignore the regulations and increase the amount of air pressure through the spray gun. While this effectively handled the thicker paint, it exacerbated the amount of overspray, resulting in greater amounts of material waste, more environmental damage, greater health risks and higher operating costs.

To overcome these challenges, today's manufacturers need a new design standard that adheres to existing regulatory requirements, but allows them to use high-solid paint formulas in combination with lower amounts of air pressure to produce a high quality finished paint surface. The ideal solution will provide manufacturers the quality they need, create little material waste, lower operating costs and keep emissions low.

The Solution: Laminar Airflow Technology

Laminar Airflow Technology results in extremely high transfer efficiencies and superior finish quality across a wide range of materials

Laminar airflow technology is the first major innovation in spray gun technology in over 60 years. The design incorporates a combination of straight and smoothly curved internal chambers that minimize restrictions and improve the flow of air and material through the gun (see figure 2).

This new design results in a precise amount of material coating the targeted surface, producing a superior quality finish and significantly reducing costs by eliminating wasted materials. Because of its efficient design, Laminar Airflow Technology also eliminates excess paint fogging that can result in an unhealthy working environment.

The advanced Laminar Airflow Technology design also allows for an ergonomic, balanced and lighter gun that reduces worker fatigue during long production periods. The flexibility gained by its advanced shape also provides greater control, making it highly suitable for working in tight spaces or on projects requiring substantial hand and arm movement.

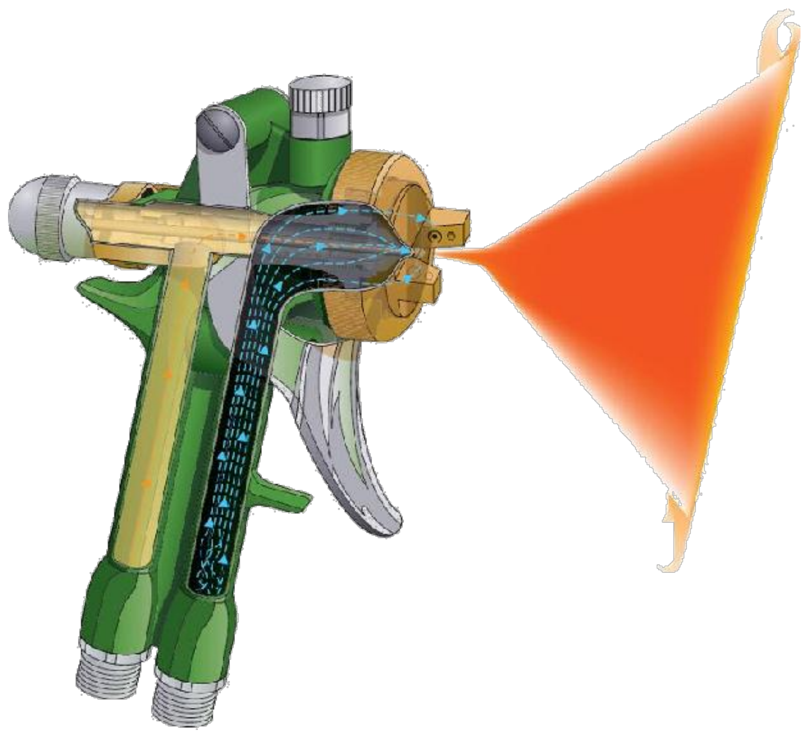


Figure 2: Smoothly curved chambers facilitate efficient air and material flow.

The Benefits of Laminar Airflow Technology

Laminar Airflow guns lower manufacturer operating costs, improve finish quality, and reduce health concerns

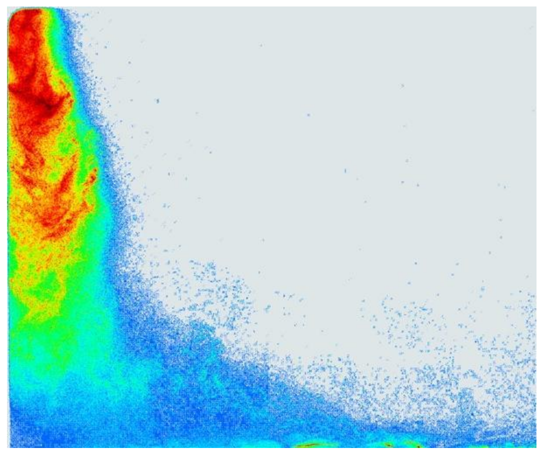
Gun designs based on Laminar Airflow Technology provide significant benefits for manufacturers by:

Lowering operating costs. The Laminar Airflow design creates superior material transfer efficiencies, in some cases producing as much as a 60 percent improvement over HVLP designs. The gun's precise targeting means that a greater amount of material is applied to the target area, resulting in less fluid waste and lower production costs. This also reduces the amount of atomized particles released into the air, resulting in half as many filter replacement cycles. In addition, a spray gun designed with advanced Laminar Airflow Technology can be used for a wide range of materials, such as primers, base coats, clear coats, sealers, epoxies, urethanes, and even latex paints. This eliminates the need for operators to purchase multiple guns for multiple coatings.

Since the Laminar Airflow guns use lower volumes of compressed air at lower pressures, the air compressor can run less frequently, lowering electricity usage and costs. Other cost-saving factors include less tape masking and preparation around the target, shorter clean up periods, and longer-lasting parts.

Improving finish quality. The low volume of air used by Laminar Airflow guns means less air is trapped behind the coating material as it hits the target. Because there is very little air entrapped in the coating, sagging and orange peel are virtually eliminated. Because Laminar Airflow is smooth and organized, static build up is greatly reduced, ensuring foreign air particles are not drawn into the spray column.

Reducing health problems. Since Laminar Airflow guns reduce the amount of material used, fewer VOCs and other hazardous air pollutants are released into the workspace. As a result, less material lands on the hair and skin of users, creating a reduced chance that toxins will permeate the body. This ensures a healthier work force and fewer sick days, translating into greater productivity. The PIV image illustrated to the right shows how laminar airflow reduces the material leaving the spray column, lowering the potential for any blowback onto the operator. With lighter weight and ergonomically balanced handle and trigger designs, laminar airflow guns also reduce injuries, such as repetitive stress problems and carpal tunnel syndrome.



Growing operations without re-permitting. The efficient design of Laminar Airflow guns reduces the dispelling of excess particulates and VOCs into the surrounding atmosphere, keeping companies in regulatory compliance and minimizing the possibility of operating fines. These increased efficiencies allow businesses to use existing permits to expand current production lines without petitioning regional air quality authorities to allow increase emissions.

What to Look for in a Laminar Airflow Gun

When comparing spray gun technologies, it is important to evaluate these essential issues before making a decision:

Transfer efficiency. Does the gun offer a significant improvement in transfer efficiency? Many guns claim to increase transfer efficiencies, but true breakthrough technology should offer at least a proven 15-40 percent materials saving. Ask for a trial or demonstration to review transfer efficiency improvement for your specific application.

Range of coatings. Does the solution support the range of coatings needed for your manufacturing operation? Does a single configuration support a range of both low and high viscosity material as well as many different paint formulations, including lacquers, urethanes, epoxies, latex paints, and chemical agent–resistant coatings?

Ergonomic and user-friendly design. Does the gun embody an innovative design that will reduce stress on the operator? Ideally, the gun should weigh 15 ounces or less and should not be "front heavy" in design.

Cost reduction. Does the spray gun technology substantially reduce material usage costs? Look for documentation that can demonstrate clear cost savings of at least 15 percent over your current coating method.

Environmental hazards. Does the spray gun design have a proven track record in reducing total VOC output? Be sure to ask for case studies that substantiate any claims.

Number of moving parts. How does the gun design translate into easier maintenance? How many parts does the gun have, and how often will they wear out under normal use. Be sure to ask how easy it is to service the gun.

Direct and knowledgeable staff. Does the new gun manufacturer have a dedicated team of specialists available in your area? Do the salespeople have knowledge and background in the paint and coatings industry so that they understand your business and your needs?

Compatibility and return on investment. Is the new gun design compatible with your existing air delivery and fluid distribution equipment? Does it require switching standards, configurations or involve investing in new air compression equipment?

Regulatory compliance. Does the gun meet or exceed regulatory standards and can it be used in your industry, without special permission from local air quality officials?

The DUX Advantage

DUX spray guns offer up to 40 percent improvement in transfer efficiencies over today's HVLP guns, dramatically reducing costs while enhancing finish quality

DUX spray guns bring the global coatings application market a technology that exceeds transfer efficiency expectations while providing coating specialists the finish and productivity output they demand. Manufactured by DUX Area Inc., DUX spray guns were first inspired by high-performance Formula racecar engine airflow designs.

DUX spray guns are the first to incorporate true advanced Laminar Airflow Technology and meet all of the requirements outlined in this white paper. Featuring a single investment-cast aluminum body, smoothly curved internal chambers and an ergonomic handle, DUX spray guns will help manufacturers reduce costs, improve finish quality and ensure a healthy work environment. With transfer efficiency improvements of 15-40 percent over the best HVLP guns, and the lightest-weight design available, DUX spray guns will revolutionize your painting process.

For more information, please visit our Web site at www.DUXarea.com, or simply call 888-DUX-AREA (888-389-2732).