

Using Airless Spray Equipment



The basic principles of airless spraying are covered in this month's column, which was originally published by JPCL in October 1989 and recently revised for use in PCE by the technical department of WIWA Wilhelm Wagner GmbH & Co. KG, Lahnau, Germany.

Airless spray equipment works by pressurising paint so it travels through a supply hose to an airless spray gun nozzle and atomises, or disperses in fine droplets, as it exits the nozzle. A very small orifice or opening in the nozzle and high pressure in the range of 130–400 bar cause the paint to atomise.

Airless spray derives its name from the fact that air is not used to atomise the paint, as it is with conventional air-atomising spraying, which was covered in two recent installments of the Applicator Training Bulletin (August and December 1998). Other types of systems, such as plural-component, electrostatic, and thermal spraying, will be covered in future months.

The focus this month is on the use of airless spray equipment with conventional coating materials. Topics covered include system components, set-up, operation, safety, and maintenance.

System Components

The main components of an airless spray system are a power source, pressure pump, paint container, high-pressure fluid hose, spray gun, and gun tip.

The power source may be a gasoline engine, an electric motor, or compressed air. With each of these power sources, the purpose is to operate the hydraulic pump that pressurises the paint fluid.

The pump may be either a submersible type with a fluid section that is placed into a paint container (wet feed), or it may be outside the paint container and fed by suction with a siphon (siphon feed).

Once the paint is pressurised by the pump, it is forced through a high-pressure hose to the airless spray gun and directed to the gun tip, which is sized and shaped to create atomisation and a specific fan pattern.

Very high pressures (from 200 to about 400 bar) can only be achieved with pneumatically driven airless pumps having pressure ratios between 60:1 and 73:1. These high-ratio pumps are needed to atomise solvent-free or low-solvent materials. Especially when using very long hoses (e.g., 80 m or more) or multiple spray guns, such high ratios are necessary for spraying

high-viscosity materials.

Set-up of an Airless Spray System

Once the components of the equipment are in place, setting up an airless spray system requires only a few adjustments, such as system pressure, fluid viscosity, and spray distance. It is also necessary to select the proper tip orifice size and spray angle.

There are no adjustments on the airless spray gun itself except to change the tip. The size and shape of the orifice in the tip determine the size and shape of the spray pattern.

The size of the orifice must be matched with the viscosity of the paint. In general, high-viscosity materials require larger orifices to assure adequate flow; low-viscosity materials require smaller orifices so flow is not too great. Zinc-rich primers require a large orifice because of the size of zinc particles. Since zinc-rich primers are generally known to be quite abrasive, it is recommended that pneumatically driven pumps with relatively low pressure ratios (e.g., between 32:1 and 42:1) but with high volumes be used to ensure that the pumps operate at a low speed.

Always consult the paint manufacturer's application data sheet for guidance on tip size, fluid pressure, pot life, and viscosity.

System pressure on the material to be applied can be



adjusted with either a pressure regulator on gasoline- or electric-driven pumps or an air pressure control valve on air-driven pumps. Adjustments to system pressure should be made before spraying work begins. Simply point the spray gun at a target and pull the trigger. Start with the valve completely shut. Then increase the pressure until the proper spray pattern is achieved. Too much or too little pressure will distort the spray pattern. You will know the pressure is correct when the desired spray pattern appears.

The viscosity of the material can be lowered by adding solvents or by heating. However, changing viscosity by either of these methods must conform with the requirements of the paint manufacturer as expressed in the application data sheet. Overthinning must be avoided because you may not be able to achieve proper film build. Besides, excessive use of thinners or solvents should be avoided because of pollution and environmental regulations.

Normally, stand-off distance from the gun to the substrate should be about 30–40 cm. Minor adjustments in

stand-off distance can be made to increase or decrease the size of the spray pattern, but you must be careful that proper film coverage is achieved. If the spray gun is too close to the substrate, you can lose your efficiency and possibly apply excessive paint. If you are too far away, you can get uneven film coverage and excessive overspray, resulting in unnecessary pollution.

Airless Spray Gun Operation

In operating an airless spray gun, you should remember a few basic things about keeping the system clean, positioning the gun correctly, controlling the speed of the gun's movement, overlapping the spray pattern, and triggering to assure even coverage.

Cleanliness is very important with airless spray, because any dirt or lumps in the system can clog the equipment. Paints must be thoroughly mixed and then poured into the feed container or siphoned directly from the original paint pail. Generally, most airless spray rigs have two filtering systems (at the siphon end and at the pump outlet) to remove any lumps or foreign material that ac-

Safety Tips for Airless Spraying

- Never point the spray gun at any part of your body or at another person.
- Do not make adjustments to the equipment set-up, such as changing nozzles or fittings, without first shutting off the pump and releasing the system pressure.
- Do not remove the tip guard during operation.
- Always engage the trigger lock when the spray gun is not being used.
- Always make sure the fluid hose is in good condition before spraying. Kinks or abrasion can develop into a rupture.
- Do not use standard hardware on an airless spray system. Only high-pressure fittings can be used.
- High-pressure hose is required for fluid flow. The hose must never be bent or kinked in less than a 10-cm radius. Ensure that the hose is properly earthed.
- Other airless spray equipment also must be properly earthed to prevent static sparking. Make sure that any extension cords used are properly earthed as well.
- High-pressure hoses must conform with maximum

working pressures, including safety factors, set by the country where the work is being done.

- Do not spray solvent through the nozzle tip. This can build up static electricity and cause an explosion or fire. Take the tip off before spraying solvent through the system.
- Do not spray solvents or materials containing solvents into a narrow-neck can or a barrel with bung holes because of the danger of explosion.
- With water-borne or acidic materials, ensure that all wetted parts of the spray gun are made of stainless steel in order to prevent corrosion. This is also necessary in closed or pressurised systems where aluminium or galvanised parts could come into contact with solvents such as trichloroethylene, methylene chloride, or other solvents containing chlorinated hydrocarbons because of the danger of chemical reaction.
- Ensure that airless spray equipment with an integrated fluid heater is cold before flushing the system with solvent.



cidentially get into the system.

If a clog should occur while using a standard tip (with a tip filter recommended), you would have to shut down the spray unit, bleed the pressure off the system, remove the tip from the gun, clean and reassemble the tip or exchange it for a new one, and repressurise the system before going back to work. The alternative is to use a reversible tip. This is especially useful when spraying heavily loaded paints like zinc-rich primers. The reversible tip has a key on top. If the tip should clog, all you have to do is turn the key 180 degrees, pull the trigger to blow out the clog, turn the key back to the spraying position, and continue working.

If you position the spray gun properly in relation to the substrate, you can achieve even coverage. The gun should be held perpendicular to the substrate, and it should remain perpendicular throughout the stroke. In other words, at every point in the spray pass along the substrate, the gun should be in the same position with respect to the substrate. The travel of the gun should be parallel to the substrate.

If you tilt the gun up or down, you will get excessive paint at the top or bottom of the spray pattern. If you arc the gun instead of keeping it parallel to the substrate, you will get thin coverage and overspray at the right and left of the spray pattern. In addition, arcing or tilting the gun can cause some of the paint to bounce off rather than stick to the substrate.

You want to spray at a comfortable speed, while at the same time assuring the proper coverage of the substrate. Airless spray delivers a lot of paint quickly. There are only two settings possible with this equipment—on and off. You do not have the same control as with a conventional air-atomising spray gun where you can adjust the amount of paint with the trigger. Therefore, you must move faster with an airless gun.

Airless spray equipment is best suited for large, flat surfaces. It is difficult to use where there are a lot of details to paint. (For this purpose, it may be better to use an airless unit with a lower pressure ratio equipped with an air-assisted spray gun. Some of these spray guns are capable of providing a dual spray function—i.e., using one gun for airless or air-assisted applications.)

If the specified film thickness cannot be achieved in one pass without sagging, then two or more passes—with a flash-off period between each one—may be required.

When Spraying Two-Component Materials . . .

Here are several things to keep in mind when two-component coating materials are being applied by airless spray.

If the work is interrupted for any reason, it is essential to ensure that the components of the entire spray system (pump, hose, gun tip) are thoroughly flushed within the pot life of the paint to avoid clogging.

It is advisable to use plural-component airless equipment for two-component materials with a pot life of 15 minutes or less or when applying two-component materials in bulk quantities.

The investment could be justified by savings in labour costs (e.g., manual agitating of the coating material) and material losses (e.g., paint residues in pails or remainders of mixed paint when the job is done).

Overlapping the spray pattern assures complete coverage. The amount of overlap must be consistent from stroke to stroke so coverage is even. Depending on the material viscosity, tip size, and spray angle, an overlapping of 20–40% of the previous spray pattern can be achieved.

Since you cannot control the flow of paint from an airless spray gun with the trigger, except to achieve full flow or shut-off, you have to learn to begin moving the gun before you pull the trigger. Otherwise, you may spray too much paint at the beginning of the stroke.

If you begin moving the gun before triggering, you must start the stroke to the left of the actual target and squeeze the trigger when you reach the target.

The same idea is important for the end of the spray pass. You must stop triggering when you reach the end of the target area, but you need to keep the spray gun moving beyond the target to avoid a paint buildup on the far edge.

Airless Spray Safety

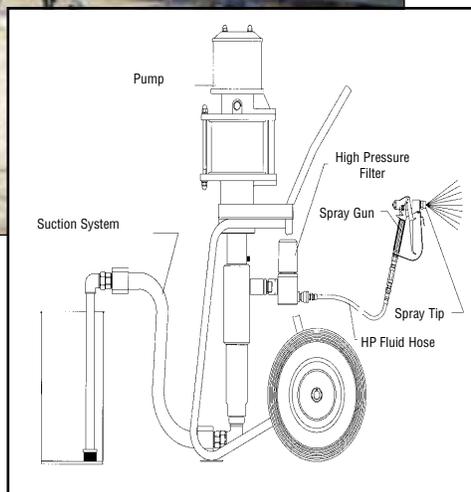
Because airless spray systems operate at high pressure, you need to give special attention to safety during operation of this equipment. Adhere strictly to the instructions in the material or paint data sheet and in the equipment operation manual.

Two safety considerations are paramount:



A typical airless spraying operation (above) and a close-up of an airless spray rig (right)

(Courtesy of WIWA Wilhelm Wagner GmbH & Co. KG)



Maintaining an Airless Spray System

To maintain an airless spray system, you must ensure that all system components are clean and that worn or damaged components that might fail under pressure are replaced. The entire system must be depressurised before maintenance and cleaning work are done.

To clean the system, replace the coating material supply with a supply of the appropriate solvent, and after removing the nozzle tip, flush the system by spraying the solvent into an open container. (Always ensure that the nozzle tip has been removed first.) When the solvent runs clean, the system has been purged of paint material.

With metal containers, take care that the spray gun is constantly in contact with the container wall in order to earth the system and prevent static sparking. Also, since it is possible for solvent vapours to be given off, de-

- fluid sprayed from the gun is propelled with sufficient force to penetrate your skin and cause very serious injury; and
- the entire system is pressurised so that hose ruptures or leaks at fittings can result in dangerous high-pressure spray.

Two important safety features that must be on all spray guns are a tip guard and a trigger lock.

The tip guard is there so you cannot put your finger too close to the tip and accidentally inject paint under your skin. (In the event of injection of fluid through the skin, get immediate medical attention, even if the injury does not appear to be serious. Make sure you tell the doctor what kind of paint and solvent you were spraying and have the material data sheet at hand.)

The trigger lock keeps anyone from accidentally pulling or activating the trigger. Get into the habit of engaging the trigger lock each time you are not using the gun, even if it is only a short break or a stop to talk to your foreman.

Some important safety tips to help you avoid these hazards are highlighted in the box on page 47.

pending on the materials used, the workplace should be sufficiently ventilated in order to avoid damage to health and property. Always observe the processing information from the material manufacturer.

Special attention needs to be given to cleaning the nozzle tip and system filters. The nozzle tip and tip filter screen should be cleaned with solvent and a rag. They can be immersed into a bucket of solvent, if needed. It may be necessary to use a small implement to scrape paint off the tip. The implement can be a small brush or wooden pick but not a metal object or scraper that could damage the tip.

Summary

To benefit from the advantages of airless spraying, you must understand the basic operation of the system, know how to make system adjustments, use proper spraying techniques, and observe the precautions necessary to operate the equipment safely.

Next month: Assessing the quality