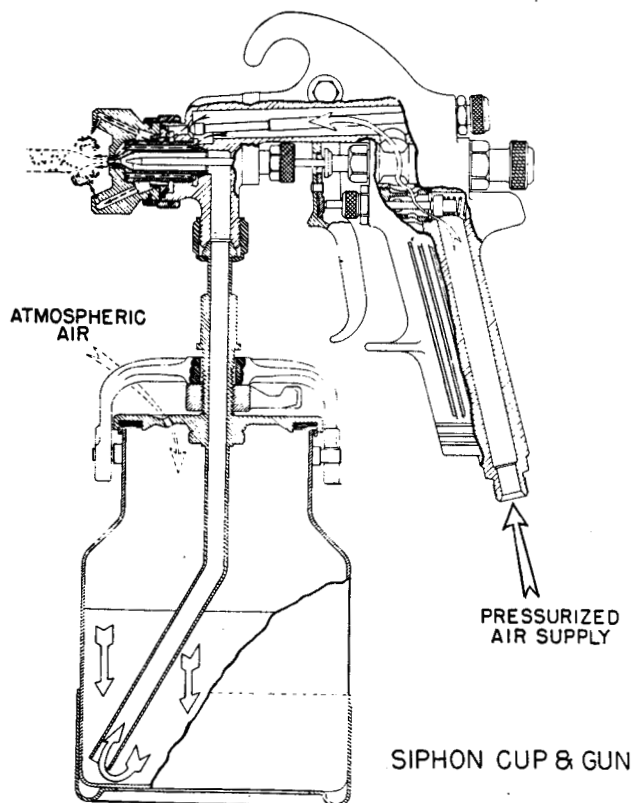


I. GENERAL DESCRIPTION OF AN AIR ATOMIZING SPRAY GUN

The basic function of an air atomizing spray gun is to use compressed air to break up material into small droplets and give these droplets direction. The spray gun itself provides two convenient valves to start and stop the flow of compressed air and fluid. The mixing of air and material can take place outside the spray gun between the "horns" of the air nozzle. This is described as "external mix atomization". If the mixing of air and material takes place inside the air nozzle of the spray gun, we use the term, "internal mix nozzle".

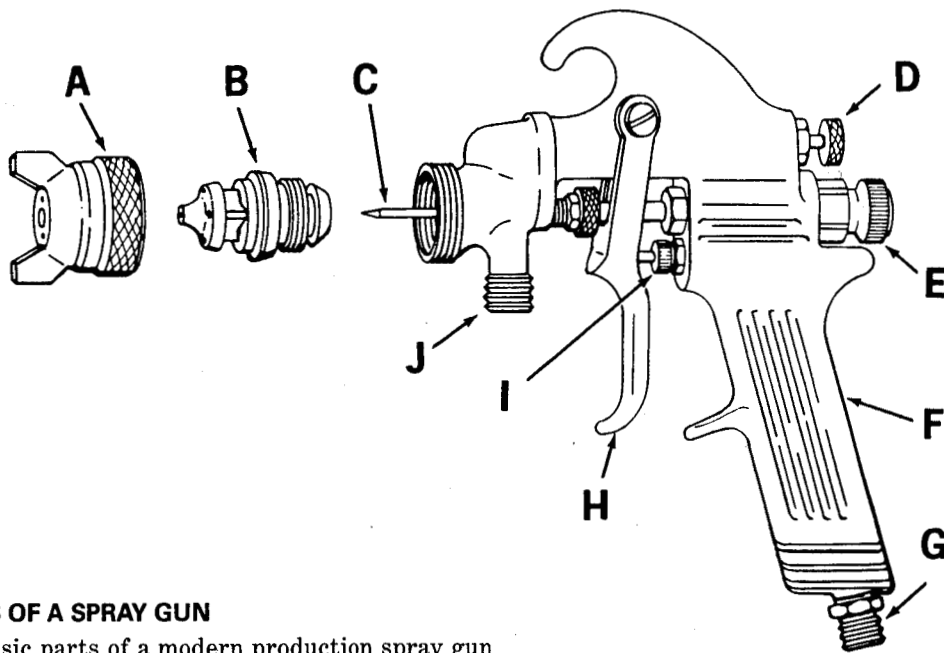
Material can be brought to the spray gun by creating a vacuum at the face of a *siphon* type external mix nozzle. This vacuum draws the material through a tube coming from an open top material container to the air nozzle of the spray gun for atomization. This method of atomization and material delivery is called "siphon spraying". See Fig. #1. When heavier fluids or higher production rates are required, the material can be pressurized and forced up to the air nozzle for atomization. This method is then called "pressure feed spraying".



II. SPRAY GUN SELECTION

The selection of a spray gun is determined by its function or end use. The most common types of air atomizing spray guns and their features are listed below:

- A. Heavy Duty Production Spray Guns:
 - 1. High volume of material output,
 - 2. Rugged construction,
 - 3. Must be able to handle a wide range of materials,
 - 4. Provide the widest range of controls,
 - 5. Ease of operation,
 - 6. Modular design of components.
- B. Standard Production Spray Guns:
 - 1. Performs the same as heavy production spray guns; normally takes the same air and fluid nozzles,
 - 2. Lighter construction.
- C. Touch-up Spray Guns:
 - 1. Light weight,
 - 2. Light construction,
 - 3. Handle only light materials,
 - 4. Small physical size.
- D. Heavy Fluid Spray Guns:
 - 1. Rugged construction,
 - 2. High capacity nozzles,
 - 3. Handle heavy materials.
- E. Automatic Spray Guns:
 - 1. Same requirements and nozzles as for production type spray guns listed previously,
 - 2. Spray gun is operated by remote control.
- F. Special Purpose Spray Guns:
 - 1. Air blow guns,
 - 2. Car washing guns,
 - 3. Engine cleaning guns,
 - 4. Road marking,
 - 5. Extension pole guns,
 - 6. Flow guns,
 - 7. Flock spray guns,
 - 8. Plural component spray guns.
- G. Special Spray Gun Attachments:
 - 1. Fluid strainers,
 - 2. Circulating connections,
 - 3. Nozzle extensions,
 - 4. Extension arms.



III. PARTS OF A SPRAY GUN

The basic parts of a modern production spray gun are outlined as follows:

Item Description

- A The *air nozzle* of a spray gun is the most important part of the entire spray gun. The air nozzle directs air jets to atomize the fluid and to give the particles velocity to reach the product surface.
- B The *fluid nozzle* is the second most important part of a spray gun, for this part provides a control for metering material delivery.
- C *Needle assembly* acts as a stop-start valve for the material flow through the spray gun in conjunction with the fluid nozzle.
- D *Side port control* or fan control regulates the spray pattern width by controlling the air supply to the "horns" of the air nozzle.
- E *Fluid control assembly* provides mechanical pressure on the needle valve so that it will close when the trigger is released.
- F The *spray gun body handle* is designed to hold all the parts and give the operator a balanced and comfortable handle for spraying.
- G *Air inlet* to provide a connecting point for the air hose, normally 1/4 in. N.P.S.
- H *Trigger* activates and controls the air and material movement to the nozzles.
- I The *air valve* controls the air movement through the spray gun.
- J *Fluid inlet* connecting point for siphon cup or material hose, normally 3/8 in. N.P.S.

The versatility of using compressed air to atomize material has made this type of spray gun the main means of applying a coating in the finishing industry today. These spray guns can handle all types of sprayable liquid materials and can be controlled to such a degree as to produce the finest possible finish on a product, with lowest possible equipment cost. This type of spray gun is a precision tool. The spray operating efficiency is dependent upon a knowledge of proper spray gun selection, spraying techniques and maintenance.

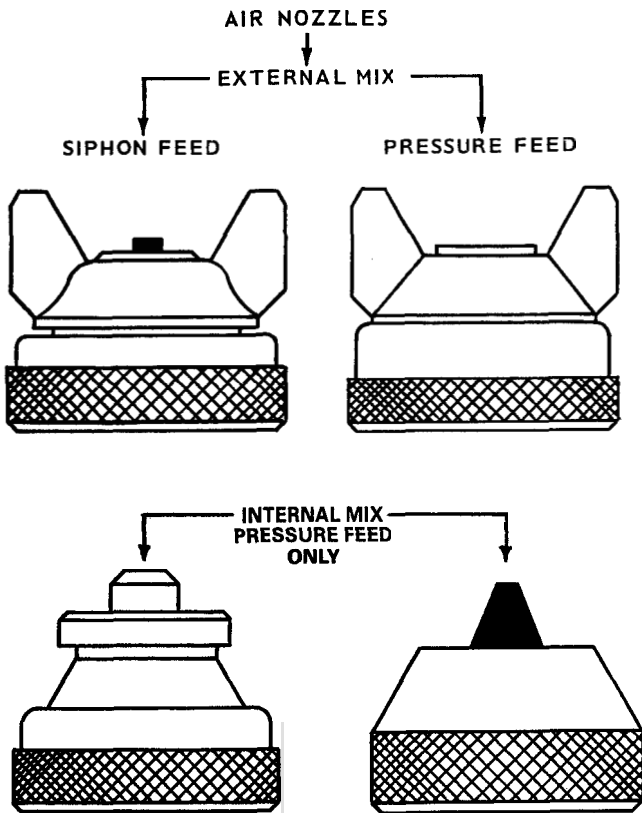
IV. SPRAY GUN DESIGN

- A. Bleeder or non-bleeder type spray gun. Most production spray guns are non-bleeder type. Air flow through spray gun only by the action of the trigger. Bleeder type spray guns are normally used with small portable air compressor to maintain constant pressure, and prevent the possibility of starting up the compressor against a load. Air discharges from the air nozzle continuously.
- B. Construction Features:
 1. Removable head,
 2. Cartridge type valve assemblies,
 3. Adjustable needle assembly,
 4. Trigger bearings and a wear plate.
- C. Material Used In The Construction Of The Spray Gun:
 1. Aluminum,
 2. Brass,
 3. Stainless steel.
- D. Method of Construction:
 1. Drop forging,
 2. Die casting,
 3. Rough casting.
- E. Spray Operators Features:
 1. Weight,
 2. Location of controls (front or rear of spray gun),
 3. Handling characteristics,
 4. Balance.
- F. Design Features:
 1. Number of parts,
 2. Ease of air flow through spray gun (pressure drop),
 3. Air nozzle and fluid nozzle design,
 4. Protective finish,
 5. Type of material used in construction of fluid passageway.

Compare these points to the expected service one may receive as compared to the initial cost of the spray gun selected.

V. AIR NOZZLES

A. Air spray gun nozzles fall into the following categories:



B. The control and operation of these air nozzles depend on many factors such as:

1. Proper type of air nozzle,
2. The size selected,
3. Spray gun used,
4. Method of feeding material to the nozzles,
5. Material to be sprayed,
6. Setting of pressures air and fluid,
7. Adjustment of spray gun controls.

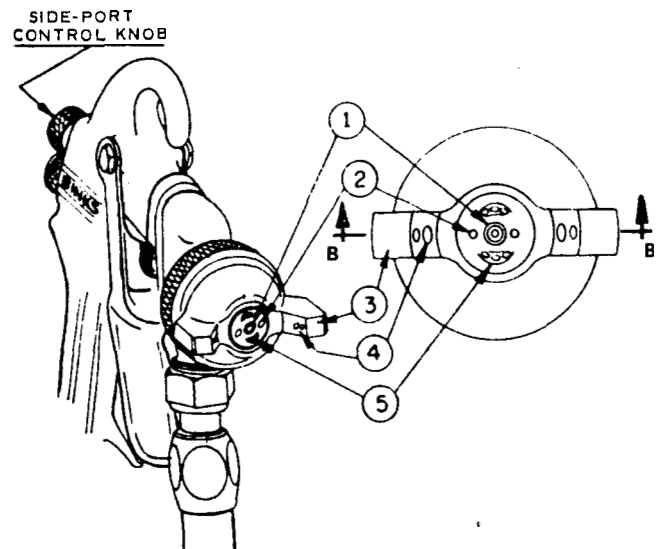
C. External Mix Air Nozzle.

The most common type of air nozzle used today is the external mix nozzle. The reason for its wide acceptance is that it will produce the finest atomization which, if controlled properly, will give you the best possible finish. These air nozzles are designed to put compressed air to work in the following manner:

1. The annular ring, the space between the fluid nozzle and the air nozzle, provides a column of air to surround the fluid stream. (See Fig. A-1).
2. The fluid stream expands and mixes with the air coming from the annular ring of the air nozzle. This is called *first stage* atomization.
3. The holes which are in a straight line with the "wings", "ears" or "horns" of the air nozzle are containment holes. (See Fig. A-2).
 - a. To keep the spray pattern from expanding too fast.
 - b. To keep the "horns" clean.

4. On pressure feed air nozzles, a second set of holes may be indexed 90° from the containment holes. These holes are called angular converging holes. This is called second stage atomization. (See Fig. A-5), these air passages add additional force to help atomize the fluid stream since in a pressure system, the fluid comes out of the nozzle at a higher velocity than a siphon system. The air movement at this point, creates an air cushion at the face of the nozzle; this helps to keep the face of the air nozzle clean.
5. The air passageways in the "horns" (sometime called "wings" or "ears"), are called side port jets. (See Fig. A-3).
6. The side port jets of air, strikes the fluid stream just ahead of the second stage atomization point. The primary purpose of these side port air jets is to form or shape the air and fluid stream into a "fan" shape. Some additional atomization may also result.
7. The size of the "fan" width can be controlled by regulating the amount of air diverted to the side-port jets (See Fig. B, Side Port Control Stem).

FIGURE A – EXTERNAL MIX ATOMIZING HOLES



- ① ANNULAR RING AROUND THE FLUID NOZZLE TIP.
- ② "CONTAINMENT HOLES"
- ③ "WINGS", "HORNS" OR "EARS"
- ④ SIDE-PORT HOLES
- ⑤ ANGULAR CONVERGING HOLES

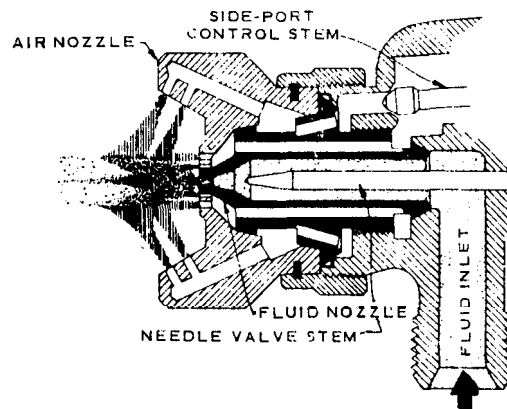
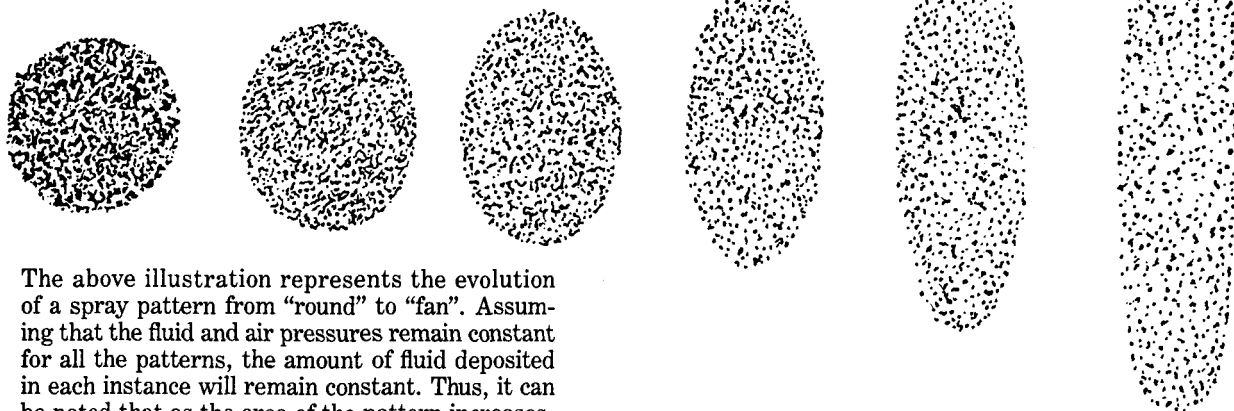


FIGURE B – AIR and MATERIAL FLOW

D. The Evolution Of An External Mix Air Nozzle Spray Pattern.

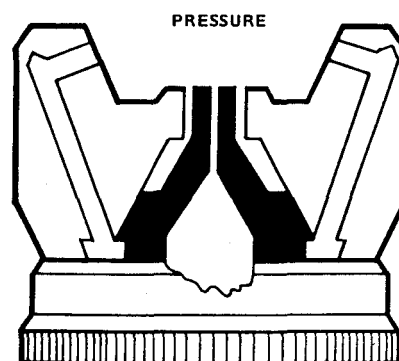
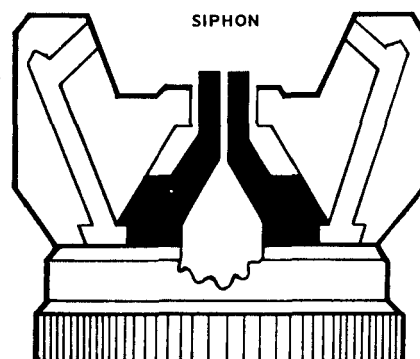


The above illustration represents the evolution of a spray pattern from "round" to "fan". Assuming that the fluid and air pressures remain constant for all the patterns, the amount of fluid deposited in each instance will remain constant. Thus, it can be noted that as the area of the pattern increases, the fluid film coating thickness must decrease. The fluid film coating (or fluid deposit) is measured as mil thickness (1 mil equals .001 inches). For example, if the pattern on the extreme left has an area of .800 square inches and a thickness coating of 4 mils, the pattern on the extreme right with an area of 1,600 square inches will have a thickness coating of 2 mils. Generally, proper atomization can be achieved in any pattern, although with some nozzles and fluids, minute adjustments of fluid and air pressure may be necessary since more overspray and solvent flash-off will occur with the fan pattern than with the round pattern. Since this fluid is "lost" and not deposited on the surface being sprayed, actual film thickness in all cases should be determined by measurement. Also a dry film will measure less than a wet film because only the "solids" remain after the solvents have evaporated in drying.

E. Determining Siphon And Pressure Feed External Mix Air Nozzles.

External mix air nozzles break down into two types. They are either siphon or pressure feed. The siphon feed nozzle can be determined by the fluid nozzle protruding beyond the face of the air nozzle. The angle at which the side port jet holes are drilled in a siphon nozzle is different from that in a pressure nozzle because a vacuum must be created at the face of the siphon air nozzle. (See illustrations at right)

Pressure nozzles can and should be used with lower atomizing air pressure since the vacuum condition is not required as in the case of the siphon nozzle. Pressure spraying is more efficient, faster and cleaner. Siphon spraying is best suited when small quantities of material are being used such as in an automotive body shop. Pressure feed nozzle horns are shorter and the face has additional air holes to help keep the face of the nozzle clean. The side port jet angles can be drilled at a closer angle because no vacuum must be created at the face of the pressure feed nozzle. The numbering designation will indicate whether or not they are siphon or pressure nozzles by the letters "S" or "P" stamped on the nozzle.



F. Requirements, Advantages And Limitations For External Mix Nozzles.

1. Equipment requirements.
 - a. An air supply capable of meeting the requirements of the air nozzle. There are many different types of external mix air nozzles available. These nozzles differ by the amount of air they consume, spray pattern size and materials they will atomize. Sales literature and engineering data must be checked for

this information.

- b. The air nozzle must be designed for siphon or for pressure spraying.
- c. Pressure feed nozzles require that the material be supplied under pressure to the spray gun.
- d. Pressure feed nozzles cannot be used for siphon feed spraying.
- e. Siphon feed nozzles can be used for pressure spraying but the spray pattern size will be smaller. Siphon feed nozzles are often used for pressure feed spraying of adhesives.

2. Advantages.

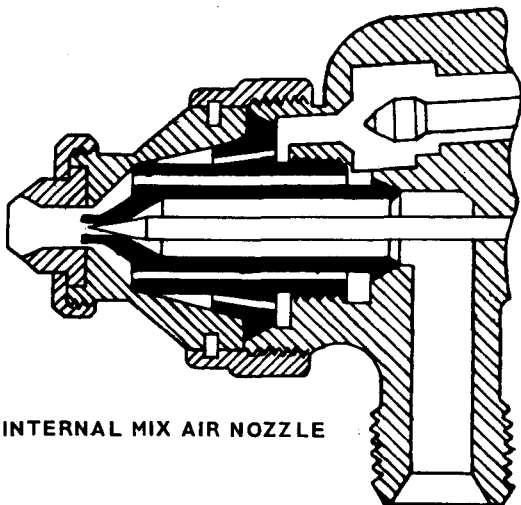
- a. External mix nozzles can produce the finest possible finish, making it ideal for furniture and car finishing.
- b. This air nozzle has great flexibility in controlling the spray pattern size and the degree of paint atomization.
- c. A siphon nozzle can be used for drawing material from a container and atomizing it.

3. Limitations.

- a. They require larger quantities of air.
- b. They operate at relatively high air pressures.
- c. They may create large amounts of overspray and rebound if air and fluid pressure are not properly established.

VI. INTERNAL MIX AIR NOZZLES

In an internal mix air nozzle or low pressure nozzle, air and fluid are mixed in a cavity inside the air nozzle before being released to the atmosphere. These air nozzles have either a round hole or a slot from which the material sprays. When the material leaves the air nozzle it will "fan out" and conform to a shape as determined by the air nozzle opening.



INTERNAL MIX AIR NOZZLE

These air nozzles find wide acceptance in the maintenance painting market for applying coating to large areas very rapidly. These internal mix air

nozzles do not produce very fine atomization but have high production capabilities and are suitable for most maintenance painting work. Not all materials can be sprayed with this type of nozzle. They are limited to slower drying materials because fast drying materials tend to plug the exit hole.

A. The equipment requirements, advantages and limitations for internal mix air nozzles are:

1. Equipment Requirements:

- a. This type of air nozzle can only be used with a pressure feed system.
- b. The nozzle requires the use of low air and fluid pressures.
- c. The air and fluid pressures must be closely regulated.
- d. The air and fluid pressure must be approximately equal at the nozzle.
- e. Internal mix nozzles are available in many sizes and constructed of many types of material; the choice is dependent upon the kind of material you wish to spray and the rate at which you wish to apply it. (Refer to sales and engineering bulletins for selection data).

2. Advantages.

- a. Low volume air consumption (cubic feet per minute),
- b. Low air pressure (pounds per square inch),
- c. By using low air pressure and fluid pressure the overspray or rebound will be minimal,
- d. Capability of high rate of fluid output,
- e. Can produce large spray patterns,
- f. Has the ability to break up heavy, filled materials,
- g. Nozzle tips can be replaced at low cost.

3. Limitations:

- a. This air nozzle produces coarse atomization and is not recommended for extra fine finishes,
- b. Some fast drying fluids have a tendency to clog the exit slot or hole,
- c. There is no control except by nozzle selection for the spray pattern size or shape,
- d. Nozzle wears due to abrasion. Tips must be replaced.

B. Start-up procedure for internal mix air nozzle.

For maximum efficiency, both the fluid pressure and the air pressure should be the same at the nozzle. To initially adjust, always start with the air pressure. Then slowly raise the fluid pressure, gradually lowering the air pressure until the desired flow rate and spray is reached. NEVER open the fluid valve first, since without air atomization pressure, the fluid will tend to back up into the air passages of the gun.

VII. SPECIAL EFFECT AIR NOZZLES

Special effect air nozzles are generally pressure fed. These nozzles are used to create special effects with certain types of materials by using extremely low air and fluid pressures which have been accurately controlled. These special effects are normally sprayed to create exotic type random spray patterns such as veiling, spatter and distressing (sometimes called "fly specking"). These nozzles are available and interchangeable with standard production spray guns. No special spray gun is required.

A. Equipment Requirements:

1. A special mix nozzle kit for the type of effect you want to achieve, mounted in your spray gun,
2. Two air regulators for precise control of both air and fluid pressures is required,
3. A one or two quart pressure cup, or pressure tank, depending on the amount of material that is required to be sprayed.

B. Advantages:

1. The ability to mass produce a special effect,
2. Added sales appeal to a product,
3. Hiding ability to cover defects.

C. Limitations:

The spray operator must be more highly skilled when applying these effects, in order to maintain some uniformity.

VIII. PROPER AIR NOZZLE SELECTION

A. The following points must be taken into consideration when selecting an air nozzle:

1. The type of material you are going to spray will determine the spray pattern size as well as how it atomizes. Because different materials will shear or tear apart according to their cohesive nature.
2. The volume of air you have available in C.F.M.—not pressure. Do not choose an air nozzle with a cubic foot per minute rating which is larger than that which your compressor can supply. A rule of thumb you can follow is that a one horse power electric motor driven compressor will provide four cubic feet of air per minute at a hundred pounds per square inch.
3. All air nozzles will not physically fit over all fluid nozzles so it is necessary to select these items as a matched set. Proper matching of air and fluid nozzles must be checked out on a chart provided by the equipment manufacturer which shows all available combinations.
4. The higher the C.F.M. rating of an air nozzle, the greater the volume of material that the air nozzle is capable of atomizing.

- a. Therefore an air nozzle with a larger C.F.M. rating will provide a faster rate of application of the material on the substrate.
- b. The higher the air pressure at which the air nozzle must operate, the greater the air pressure increases, air volume (C.F.M.) required also increases.

EXTERNAL MIX AIR NOZZLE	vs	INTERNAL MIX AIR NOZZLE
ADVANTAGES		LIMITATIONS
Fine Atomization Control of spray pattern size No wear on air nozzle Siphon and pressure nozzles available		Coarse atomization Fixed spray pattern size Air nozzle tips will wear Pressure feed only
LIMITATIONS		ADVANTAGES
Require more C.F.M. of air Works with high air pressure only Maximum overspray Minimum film build per pass Minimum size spray pattern		Require less C.F.M. of air Requires lower air pressure Minimum overspray Maximum film build per pass Maximum size spray pattern

IX. FLUID NOZZLES

A. The function of the fluid nozzle is to meter and direct the fluid into the air stream. The fluid nozzle also forms a seat for the fluid needle which shuts off the fluid flow.

B. Fluid nozzle selection.

1. The required fluid nozzle orifice size is determined by:
 - a. The viscosity of the material.
 - b. The amount of material required.
 - c. The maximum fluid flow rate.
2. There are many variables for each type of material being sprayed, but the following general table may be of some help.

Fluid Nozzle Orifice Range (diameter)	Viscosity Range	Like
.022-.028	Very Thin	Acetone
.040-.052	Thin	Water
.059-.070	Medium	SAE No. 10 oil
.086-.110	Heavy	SAE No. 50 oil
.125-.500	Very Heavy	Vaseline

3. Heavy (high viscosity) materials flow slowly and require larger orifices and higher fluid pressures to obtain the necessary fluid flow. Conversely, lighter fluids flow more easily with less pressure and will require smaller fluid orifices for control.

4. To determine fluid flow rate for pressure feed spraying, shut off the atomizing air and pull the spray gun trigger to bleed the fluid into a graduated container for one minute. The following flow rate chart for a 20 second material using a number 4 Ford cup, at a temperature of 75°F, may be of some help in predicting flow rates.

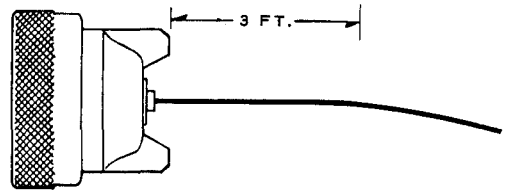
Delivery in Ounces Per Minute			
Orifice Size	At 8 P.S.I.	At 12 P.S.I.	At 18 P.S.I.
.040	12.5	15.0	19.0
.046	17.0	21.0	27.0
.052	20.5	25.5	33.0
.059	24.0	30.0	40.0
.070	28.0	36.0	48.0

5. For a more accurate reading of fluid delivery and pressure at the inlet of a spray gun for a particular size fluid nozzle orifice at a certain material viscosity, the following four charts showing the most common size fluid nozzle orifices used will be of assistance. To use these graphs one must measure the fluid delivery and viscosity to find out the pressure at the inlet of the spray gun. When the required delivery is known for a particular viscosity material, the fluid pressure and fluid nozzle orifice size in a spray gun can be determined by drawing straight lines connecting the known values to find the unknown values. Example, what size fluid nozzle will give a 28 fluid oz. per min. delivery at 12 P.S.I. fluid pressure with a 15 second material? Answer—.052 orifice.
6. Material from which the fluid nozzle is made will vary depending on the characteristics of the fluid to be sprayed:
 - a. Standard paints use hardened steel nozzles.
 - b. Corrosive materials (water based, acids, etc.) use stainless steel nozzles.
 - c. Abrasive materials (ceramics, etc.) use tungsten carbide equipped nozzles.

C. Control of fluid flow:

1. Siphon spraying.
 - a. The fluid nozzle orifice.
 - b. The adjustment of the fluid control on the spray gun,
2. Pressure spraying.
 - a. The fluid nozzle orifice.
 - b. The fluid pressure setting. Note: Not to exceed 18 P.S.I. at the spray gun inlet for standard type of materials, excessive fluid pressure causes high fluid velocities which prevent the air nozzle from atomizing the material properly. Always use the largest possible fluid nozzle orifice and the lowest possible fluid pressure to give you the material delivery you require.
 - c. The adjustment of the fluid control knob on the spray gun should be in the maximum open position on a pressure feed systems. This is just about that point where the screw threads appear on the fluid control knob. The fluid control knob is the last item that is adjusted for fluid delivery.

- d. A rule of thumb that can be followed with standard materials when setting pressures is that with the air supply cut off, the paint will flow in a solid stream. This fluid stream should begin to bend down about three feet from the spray gun. Anything in excess of three feet means too high a fluid velocity. (See figure below).

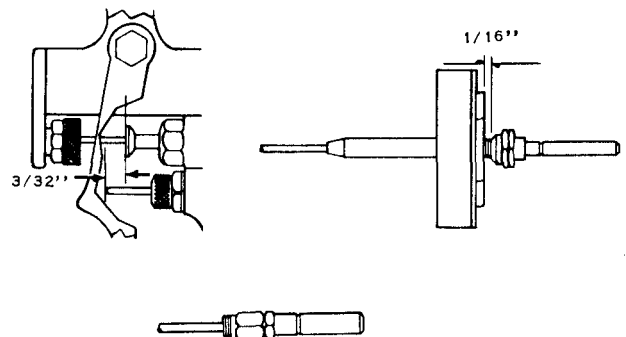


X. NEEDLE ASSEMBLY

The basic function of the needle is to shut off the fluid flow. It also can be used to meter the material passing through the fluid nozzle. (C2-c above)

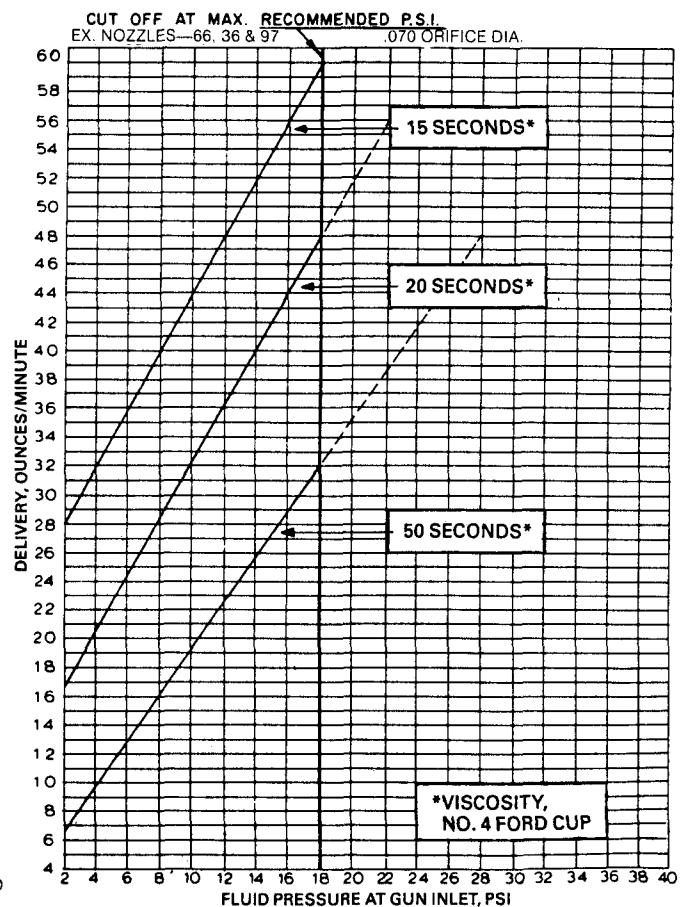
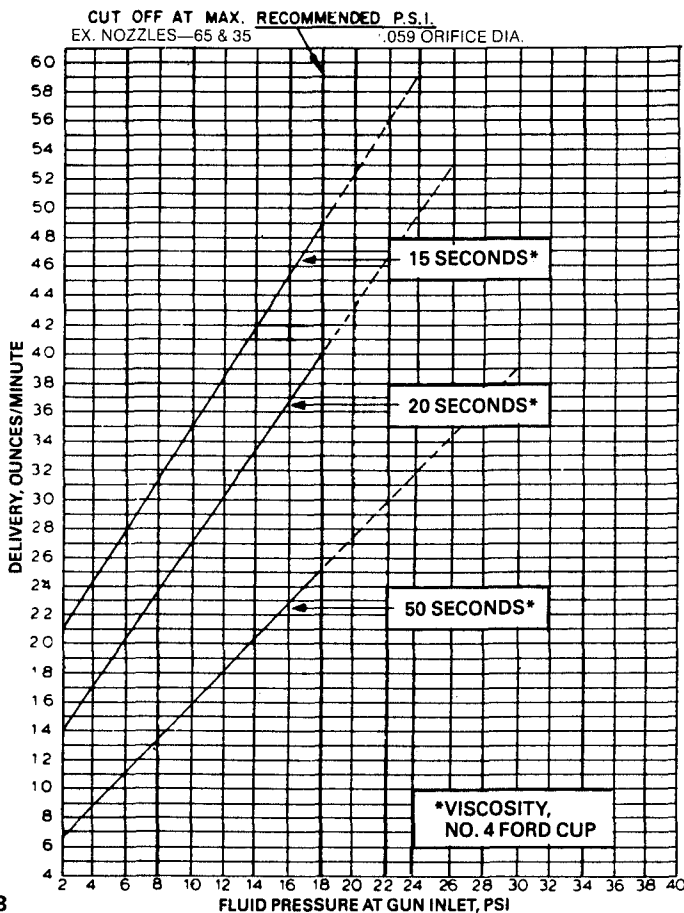
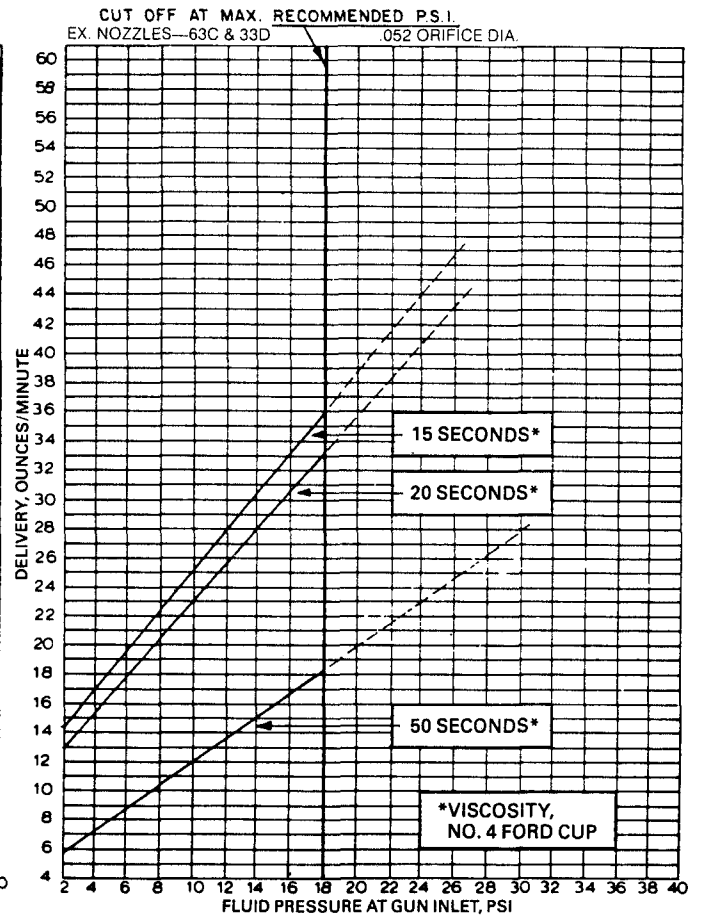
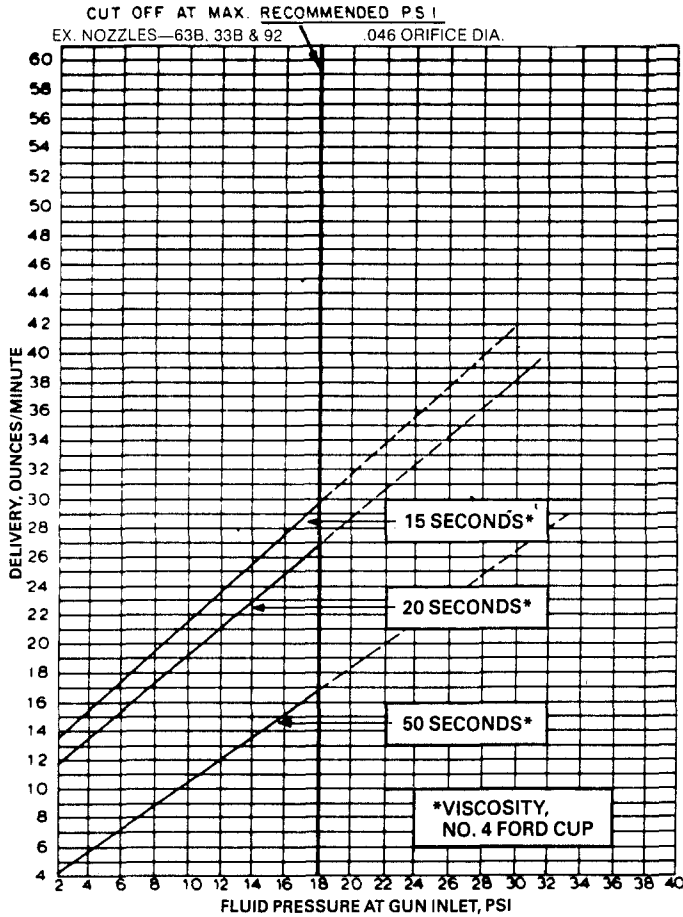
Needle selection is based on:

1. The needle must be made of the proper material and the right size to match the fluid nozzle.
 - a. Standard needles are corrosion resistant, hardened stainless steel.
 - b. Abrasive resistant needles are tungsten carbide tipped.
 - c. Needles which require positive shut off are made of nylon.
2. The needle is part of a matched set and if not the right size it will cause problems:
 - a. Leak at the fluid nozzle,
 - b. Split the end of the fluid nozzle,
 - c. Turn on the fluid before the air,
 - d. Excessive protrusion of the needle tip which will restrict fluid delivery,
 - e. A needle tip which is too large will not clean out the fluid nozzle orifice when seated.
3. Needle adjustment is required on certain spray guns to compensate for wear. The adjustment is accomplished by changing the position of the shoulder and locking nuts. (See right hand figure below.)
 - a. Determine the amount of adjustment required—hand guns should have an air stroke of 3/32 of an inch (approx.) and automatic spray guns about 1/16 of an inch (see figures below).
 - b. Loosen the lock nut and move the shoulder forward to shorten the air stroke or rearward to lengthen the stroke. Try the needle in the spray gun.
 - c. Adjustment is by trial and error—when correct position is found tighten the lock nut to hold the shoulder nut.



FLUID NOZZLE ORIFICE AND FLOW CHARTS

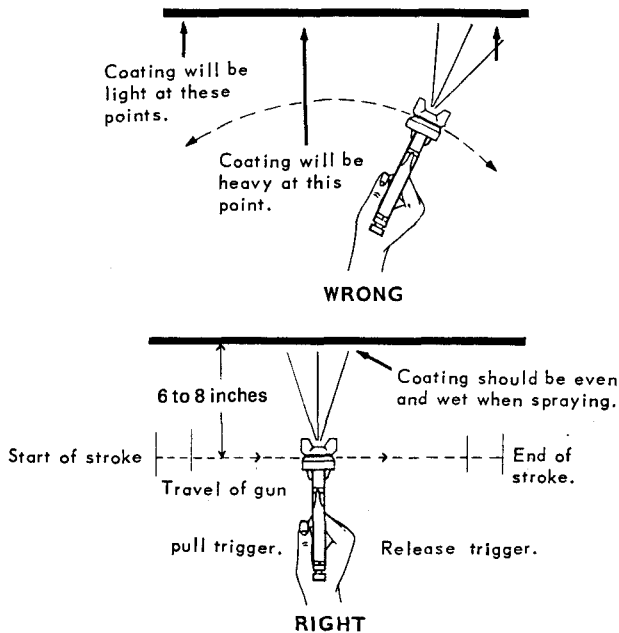
Note: These figures are approximate *only*; variations may be expected depending upon conditions.



XI. SPRAY GUN CONTROLS

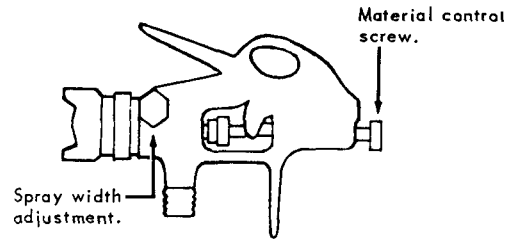
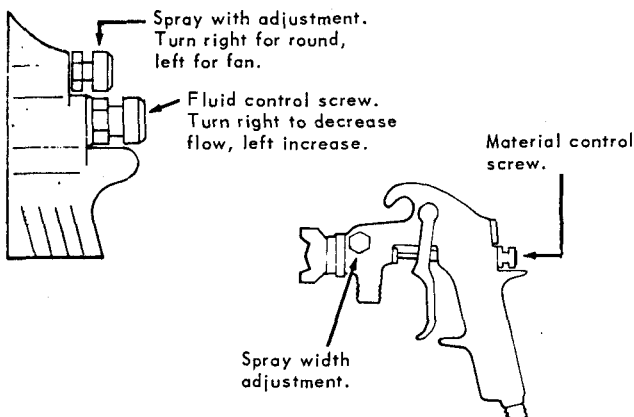
A. Operator Spraying Techniques.

The first requirement if proper handling of the spray gun. The spray gun should be held perpendicular to the surface being covered, and moved in even strokes parallel with the surface. The stroke should be started *before* the trigger is pulled and released *before* the stroke is finished. This is easy and gives accurate control of the spray gun and materials. The distance the spray gun is held from surface is determined by the material and atomization pressure, and may vary from 6 to 12 inches, but the material deposited should always be even and wet. Overlap each stroke by 50 per cent over the preceding stroke to obtain a uniform finish. For additional information on spraying techniques see Training Division Bulletin No. TD-49-1 pertaining to this subject.



B. Adjustment of Spray Gun Controls.

- The proper adjustment of spray gun controls permit a spray operator to control the size of the spray pattern and the amount of material coming out of the spray gun.
- The spray gun controls will be located on most spray guns in one of the three following positions:



C. Siphon Spraying.

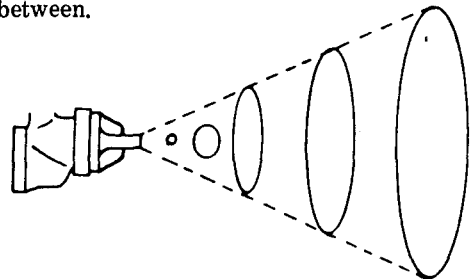
Set atomization pressure at approximately 25 P.S.I. and test spray pattern with fluid control knob opened. If material atomization is too coarse, increase air pressure by 10 P.S.I. and test spray pattern again. Continue this until you have 50 to 60 P.S.I. at the spray gun. If material atomization is still too coarse close (turn clockwise) the fluid control knob on the spray gun slightly. Adjust the spray pattern width and repeat adjustment until a proper spray pattern is achieved using the lowest possible air pressure that will produce the desired finish. Additional thinning of material may also be required.

D. Pressure Spraying.

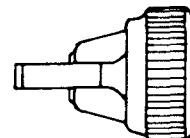
Select correct fluid nozzle orifice size using the previous fluid nozzle selection charts and set fluid pressure for required material delivery. Set atomization air at about 25 P.S.I. and test spray pattern. If spray pattern is too coarse, raise air pressure. Adjust desired spray pattern width, repeat spray gun adjustments and fluid pressure setting if necessary. In some instances material may require additional thinning. Remember keep fluid control screw in "open" position. Use correct fluid nozzle size and proper fluid pressure setting to obtain proper fluid delivery. NOTE: To reduce "over-spray" and obtain maximum efficiency, always spray with the lowest possible atomization air pressure and the lowest possible fluid pressure that will give you the required finish you are seeking.

E. Spray Pattern.

The spray pattern of an external mix nozzle on a spray gun equipped with a fan control is variable from round to fan with all spray patterns in between.



In normal operation, the wings on the nozzle are positioned horizontally as illustrated here. This provides a vertical fan shape spray pattern which gives maximum coverage as the spray gun is moved back and forth parallel to the surface being sprayed.



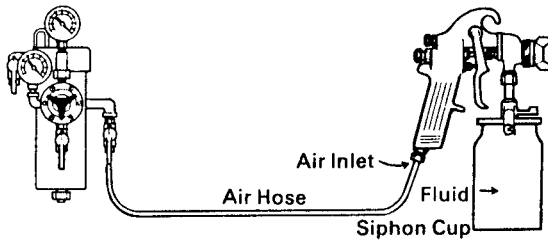
XII. SPRAY GUN INSTALLATIONS

There are many ways in which a spray gun can be installed and used. The system selected will depend on the amount of material you wish to spray, the fluid viscosity and the atomizing air you have available.

SIPHON FEED HOOKUP

For limited spraying and touch-up.

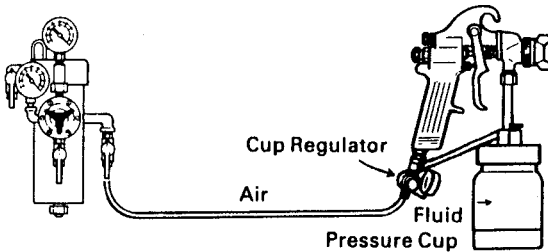
Atomization air is regulated at extractor. Amount of fluid and atomization is adjusted by fluid control screw on gun, consistency of paint and air pressure.



PRESSURE FEED CUP HOOKUP

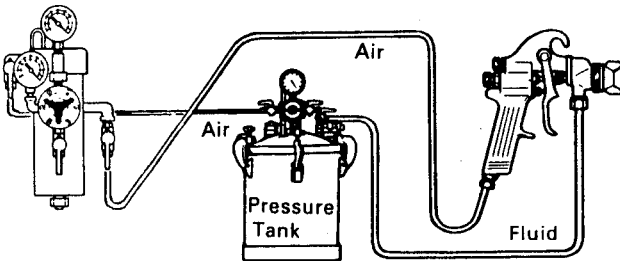
Atomization air is regulated at extractor. Fluid pressure at cup regulator. Atomization air passes through cup regulator. This method is ideal for fine finishing with limited spraying.

Pressure cup also available less cup regulator. Fluid pressure equal to atomization pressure. For heavy fluids and internal mix nozzle spraying, fluid adjusted by control screw on gun.



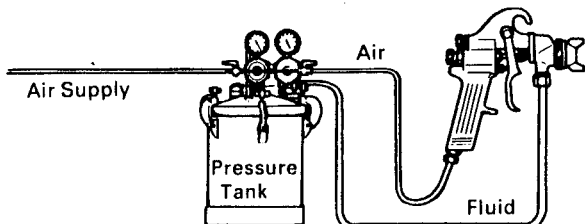
PRESSURE FEED TANK HOOKUP (Single Regulator)

Atomization air is regulated at extractor. Fluid pressure at tank regulator. This system is ideal for medium production spraying.



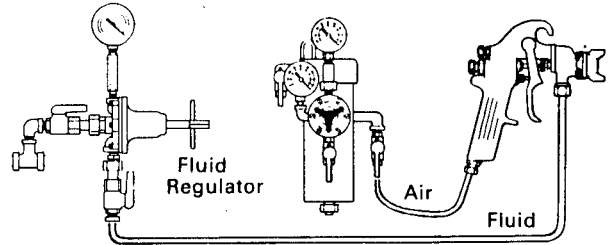
PRESSURE FEED TANK HOOKUP (Double Regulator)

Atomization air and fluid pressure is regulated by two individual air regulators on tank. This is proven highly efficient for portable painting operations.



PRESSURE FEED CIRCULATING SYSTEM HOOKUP
Atomization air regulated at extractor. Fluid pressure regulated at fluid regulator. Recommended for heavy production spraying.

INITIALLY — Always prepare paint to be sprayed in accordance with *Manufacturer's Instructions*. Material should always be strained first.



PRESSURE FEED INTERNAL MIX NOZZLE SET UP

For maximum efficiency, fluid and air pressure should be identical at the nozzle. To set up this condition easily, always introduce air pressure first. Then, slowly introduce fluid pressure while simultaneously lowering air pressure until the desired flow rate and spray pattern are achieved.

NEVER introduce fluid pressure first since, without air pressure, fluid will back up into the air passages of the gun and cause subsequent malfunctioning.





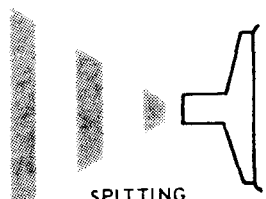
XIII. MAINTENANCE PROCEDURES FOR THE AIR NOZZLE, FLUID NOZZLE AND NEEDLE ASSEMBLY

A. All air nozzles, fluid nozzles and needles, regardless of their cost, are precision made and care must be taken when handling these parts.

1. Do not make any alterations, however slight; these could cause finishing difficulties (with the exception of needle adjustment).
2. To clean air and fluid nozzles, soak the parts in solvent to dissolve the dried material on them and blow clean with air only.
3. Do not probe any of the holes of the nozzles with metal instruments. If you feel probing is necessary, use only a tool that is softer than brass.
4. The needle assembly must be adjusted so that the air turns on before the fluid does.

B. To check out a spray gun properly and be certain that the air and fluid nozzle are functioning correctly, a series of spray pattern checks should be made. Start by opening the side port control to the maximum open position. Turn on the air supply using a low air pressure setting, then turn on the fluid supply if needed. Increase air pressure in 5 P.S.I. increments until the desired spray pattern is created. Increase fluid pressure slowly if needed to help balance out the spray pattern. Trigger the spray gun in short bursts on a clean surface and watch the spray pattern take shape. (See Page 4).

TYPICAL FAULTY AIR NOZZLE SPRAY PATTERNS

Pattern	Cause	Correction
	1. Dried paint in one of the side port holes of air nozzle.	1. Dissolve paint in side port hole with thinner; do not probe in any of the holes with a tool harder than brass.
	1. Fluid build up on side of fluid nozzle. 2. Damaged fluid nozzle because spray gun was dropped.	1. Remove air nozzle and wipe off fluid nozzle. 2. Replace damaged fluid nozzle.
	1. Air pressure too high. 2. Spray pattern too wide. 3. Fluid pressure too low.	1. Reduce air pressure. 2. Reduce fan width. 3. Increase fluid supply.
	1. Air pressure too low 2. Excessive fluid velocity or too much fluid.	1. Increase air pressure. 2. Use smaller fluid nozzle orifice, lower fluid pressure.
 SPITTING	1. Air entering the fluid supply could be caused by: a. Loose fluid nozzle, or not seating properly due to dirt. b. Loose or missing packing nut or dried fluid packing. c. Fluid connection loose.	a. Tighten fluid nozzle, or clean fluid nozzle seat area. b. Tighten packing nut, or replace missing or dried fluid packing. c. Tighten all fluid supply connections leading to spray gun.

XIV. GENERAL MAINTENANCE PROCEDURES FOR SPRAY GUN

A. Pointers on cleaning a spray gun.

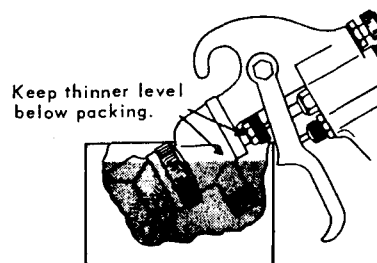
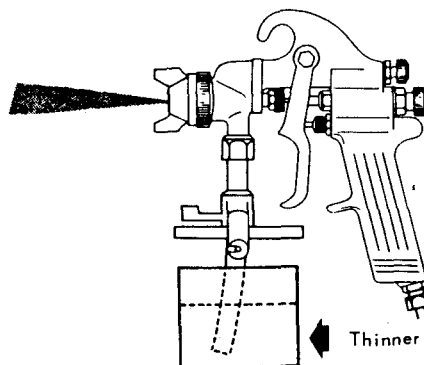
When a spray gun is used with a *siphon cup*, thinner or suitable solvent should be siphoned through the spray gun by inserting the cup tube into an open top container of that solvent. Trigger repeatedly to thoroughly flush the passageway and clean the tip of the needle.

Cleaning spray gun used with a pressure tank—open vent on tank and loosen air nozzle. Hold a piece of cloth wadded in the hand over the air nozzle and pull the trigger. The air will back up through the fluid nozzle and force the fluid in the hose back into the tank (sometimes referred to as “blowing back”). Next, put enough clean thinner or solvent into the tank to wash the interior of the hose and spray gun thoroughly and spray this through the spray gun until it runs clean.

B. NOTE: It is extremely poor practice to immerse the entire spray gun in thinner. When this is done, the solvent removes the oil in the leather packings and causes the spray gun to “spit and leak”.

1. Immerse the spray gun head until the solvent just covers the fluid inlet connection.
2. Use a hair bristle brush with solvent to wash or scrub off any accumulated paint on the spray gun.
3. Do not place the entire spray gun in solvent because:
 - a. It dissolves the oils in the leather packings, causing them to dry out.

- a. Tighten fluid nozzle, or clean fluid nozzle seat area.
 - b. Tighten packing nut, or replace missing or dried fluid packing.
 - c. Tighten all fluid supply connections leading to spray gun.
4. Wash down the outside of the equipment with solvent dampened rags.



5. Lubrication of spray gun should be done daily (preferably before using). Oil parts (a) through (d) with light machine oil. CAUTION: Never use lubricants containing silicone, as silicone cannot satisfactorily be flushed from spray gun or hoses once contaminated.
 - a. Fluid needle packing.
 - b. Air valve packing.
 - c. Side port control packing.
 - d. Trigger pivot points.
 - e. Coat the needle valve assembly spring with petroleum jelly.
- C. All part sheets packed with spray equipment should be retained for future reference for the purpose of ordering spare parts and performing maintenance operations. When corresponding with the equipment manufacture in the event of difficulties, to aide in the solution of your problems please indicate the following points whenever possible.
 1. Spray gun model number _____
 2. Nozzle set up - Air _____ Fluid _____ Needle _____
 3. Pressure feed _____ Siphon feed _____
 4. Bleeder _____ Non bleeder _____
 5. Air Source - CFM _____ PSI _____
 6. Type paint used
 7. Type reducer used
 8. Viscosity or reducing ratio
 9. Type product being painted
 10. Production rate
 11. Any other information felt pertinent, such as pressure settings.

XV. LIST OF COMMON TERMS USED WHEN DESCRIBING SPRAY GUN PRINCIPLES

SPRAY GUN: A precision tool designed to spray apply a material using one of the three basic principles to atomize the material.

AIR NOZZLE: (Air-Cap) The part of the spray gun which utilizes compressed air to atomize and direct the material to the work surface.

FLUID NOZZLE: (Fluid Tip) That part of a spray gun which directs the fluid into the air stream, and also serves to position the air nozzle.

NEEDLE VALVE: That part of a spray gun which regulates the material passing through the fluid nozzle.

TRIGGER: Operates the air valve and fluid needle valve.

FLUID CONTROL: Controls the volume of fluid by restricting the movement of the needle valve.

SIDE-PORT CONTROL: (Fan Control) Controls air flow to the horns or wings to regulate pattern size and shape.

AIR VALVE: Turns the air on and off.

FLUID PACKING NUT: Provides controlled pressure on the packing, preventing air from entering the fluid passage or fluid from leaking out of spray gun along the needle.

LUBRICATION POINTS OF A SPRAY GUN:

- a. Trigger pivot,
- b. Fluid needle packing,

- c. Air valve packing,
- d. Fluid needle spring,
- e. Side-port control packing.

SIPHON SPRAYING: When material is fed into a spray gun by atmospheric pressure due to a partial vacuum created by the design of the air and fluid nozzle.

PRESSURE FEED: Term used to describe the process of force feeding material to the spray gun using a pressure cup, tank or material pump, used for large volume spraying or when the material is too heavy to siphon.

BLEEDER GUN: Provides uniform air pressure at the air nozzle of spray gun; air constantly flows through air nozzle of spray gun. (Recommended when small portable air compressors are to be used.) Has no air valve usually.

NON-BLEEDER SPRAY GUN: Air flows through spray gun only when trigger is actuated.

EXTERNAL MIX AIR NOZZLE: Accomplishes atomization by mixing compressed air and fluid outside the air nozzle by the action of air jets from holes which are drilled into the air nozzle. This method is normally used when fine finishes are required.

SIPHON NOZZLE EXTERNAL MIX: Designed to create a vacuum in front of the fluid nozzle and draw material from a cup by atmospheric pressure. This nozzle can usually be identified by the fluid nozzle protruding beyond the air nozzle. Most Binks siphon nozzles of this type can be identified by the letter "S" in their nomenclature. (Example: 66SF.)

PRESSURE NOZZLE EXTERNAL MIX: Requires pressure to feed the material to the fluid nozzle. May be identified by the letter "P" in the nozzle designation. The fluid nozzle is flush with the air nozzle. (Example: 66PE.)

INTERNAL MIX AIR NOZZLE: Atomization is obtained and spray pattern is formed by the mixing of compressed air and fluid inside the air nozzle. These nozzles usually can be identified by a slot or round hole in the center of the air nozzle. Usually used to spray heavy maintenance paints where a fine finish is not required.

ADJUSTABLE NEEDLE ASSEMBLY: One where the shoulder of the needle is moveable to compensate for wear as in the Binks spray guns.

MUSHROOM NEEDLE: A needle with a flat tip instead of a tapered (point) one used with fluid nozzles with large openings, which are made to spray heavy materials.

FLUID CONNECTION: The point where fluid hose or siphon cup connects to the spray gun, usually 3/8" straight pipe thread.

AIR CONNECTION: The point where the air hose connects to the spray gun normally at the bottom of the spray gun handle. Usually is 1/4" straight pipe thread.

AUTOMATIC SPRAY GUN: Used for automatic spraying applications where the work is carried past the spray gun.