WALL COLMONOY

Spraywelder™ System Operating Manual Models J-3 and J-3 HO

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SPRAYWELDER™ SYSTEM OPERATING MANUAL

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SECTION I
INTRODUCTION AND GENERAL INFORMATION

BACKGROUND

1-A. Hard-surfacing is the process of protecting metal parts from deterioration by metallurgically bonding a layer of wear-resistant material to the base metal. The use of hard-surfacing provides protection against abrasion, corrosion, high heat, and the like.

1-B. The Wall Colmonoy Sprayweld™ Process is a method of applying hard-surfaced overlays. Originated by Wall Colmonoy engineers, it was a giant pioneering step in the practice of hard-surfacing. It has the advantages of a smooth application because the alloy is sprayed in powder form, plus the advantages of a solid welded overlay because it is subsequently fused to the base metal by the proper application of heat. Practically all metals having a melting point above 1065°C (1950°F) can be hard-surfaced with Wall Colmonoy's Spraywelder™ System and Spraywelder™ powder alloys.

APPLICATIONS

1-C. Hard-surfacing is utilized both to protect new parts and to restore worn ones. It is useful in any application where metal parts are subjected to corrosive media, high temperatures, or metal-to-metal wear. In most cases, a hard-surface overlay can sharply reduce the incidence of damaging wear.

1-D. Protective overlays can be applied on all types of high-wear metal parts. Some examples are: aircraft engine valves, ball joints, brick dies, cams, form and draw dies, mixer paddles, pistons, shafts, sleeves, valve plugs, etc.

SPRAYWELDER™ SYSTEM

1-E. The main components of Wall Colmonoy's Spraywelder™ system:

a. Spraywelder™ pistol.
b. Control panel.
c. Hoses.
d. Gas supplies (oxygen, fuel gas, and air).

1-F. The Sprayweld™ overlay can be fused in any one of several ways. An oxyacetylene torch is the most common method.

OPERATION

1-G. At the control panel, the pressures and flow rates of fuel gas, oxygen, and the compressed air carrying the powder alloy are precisely controlled and measured before being sent through the hoses to the major component of the system, the Spraywelder™ pistol. The pistol combines the gases into a combustible mixture which is ignited at its nozzle. This causes the powdered alloy being propelled through the pistol to become semi-molten as it is directed onto the part to be overlayed. The pistol has an on-off electric switch to start and stop the flow of powdered alloy, as well as a 3-position lever-operated valve that controls the flows of all three gases. The positions are for ignition, spraying and to extinguish the flame.

ADVANTAGES OF SPRAYWELD™ PROCESS

1-H. The Wall Colmonoy Sprayweld™ Process features easy operation, economical performance, and simplicity of design. The following are the specific advantages provided by this system:

a. A smooth porosity-free overlay is easily and quickly made, within 0.254 mm (0.010") of desired finished size.

b. Wall Colmonoy's hard-surfacing alloys are used to provide unmatched wear resistance to abrasion, corrosion, galling and high heat.

c. While cylindrical parts permit near automatic overlaying operations, almost any part contour can be sprayed.

d. Warpage of the work piece is held to a minimum - far less than that experienced in hand welding.

e. Sprayweld™ operations are much faster than overlaying and oxyacetylene rod, and cheaper for that same reason.

f. Of tremendous importance is the reduced finishing time made possible by smooth, even overlays.

g. The Model J-3 Spraywelder™ will spray Wall Colmonoy's powders at either 7.7-8.6 kg or 4.5-5.4 kg (17-19 or 10-12 lbs) per hour, depending on which replaceable nozzle is installed in the pistol. Deposit efficiencies are as high as 95%. There are several easily-installed nozzles available. Refer to page 4-3, "Model J-3 Spraywelder™ Operating Table" for help in nozzle selection.

h. HO Unit has been developed that will spray in the 11.3-13.6 kg (25-30 lbs) per hour range for some alloys.

LIMITATIONS OF SPRAYWELD™ PROCESS

1-I. The Sprayweld™ Process has only a couple of limitations. They are as follows:

a. Thickness of overlay. A finished overlay of up to 1.524 mm (0.060"). can be easily accomplished. When more than this is required, hand welding with a gas rod should be considered as a more economical method.

b. Large parts with heavy cross sections require a great deal of heat; however, if sufficient heating equipment is available, these parts can be hard-surfaced with the Spraywelder™.

METALLIZING WITH THE SPRAYWELDER™

1-J. Besides being used for hard-surfacing, the Wall Colmonoy Spraywelder™ can also be used to apply a wide variety of powdered metals in forming metallized overlays. Metallizing with the Spraywelder™ is described in Section 7 and in Technical Data Sheet "Powder Metallizing Process"

SECTION 2
SAFETY PRECAUTIONS

It is the desire of every employer and employee to finish the day's work and to go home safe. We urge you to read and understand all of the safety related material and the references that follow. Safety is everyone's responsibility.

Primary Safety Hazards Associated with Combustion Thermal Spray Equipment and Consumables used in the Thermal Spray Process.

	Danger: Powder alloys designed for use with the Spraywelder™ System may contain nickel and/or chromium and/or tungsten carbide/cobalt. These are suspected carcinogens. Nickel alloy powders can, upon repeated exposure to dusts and fumes, cause respiratory and kidney toxicity/damage and respiratory or skin sensitization (allergic reaction). Read and understand the suppliers Safety Data Sheets and your employer's safety practices before use or handling.
	Danger: Flammable fuel gases can form explosive mixtures with air. Proper ventilation and safe handling practices are required. Read and understand the suppliers Safety Data Sheets and your employer's safety practices before use or handling.
	Warning: Fumes and Gases can be dangerous to your health. Medical studies suggest that Lung Damage and/or CNS effects can result from exposure to welding fumes and gases. Thermal spraying may have similar effects. Heat rays (infra-red radiation) from the flame or hot metal can injure the eyes and burn skin. Read and understand the thermal spray equipment manual and your employer's safety practices before use or handling.
	Warning: Cylinders containing compressed gases present hazards during handling. Read and understand the suppliers Safety Data Sheets and your employer's safety practices before use or handling.
	Warning: Fuel gases such as Acetylene, Propylene, Propane and HPG are flammable. Read and understand the suppliers Safety Data Sheets and your employer's safety practices before use or handling.

GENERAL

a. Operation of the Wall Colmonoy Spraywelder™ System presents all the normal hazards associated with handling high pressure cylinders and flammable gases and oxy-acetylene welding. Additional hazards relating to the handling of powder metal alloys, dust, fume, noise and hot metal are also present. Read and understand the Safety Data Sheets (SDS's) for the thermal spray materials you will be using, follow ANSI Z49.1 and the contents of this section on Safety Precautions before using the equipment.

b. Never operate the Spraywelder™ System in a closed, unventilated area.

c. Never look at a spraying operation with the naked eye.

d. Never block the torch nozzle while gases are flowing. This can force mixed gases into the powder hopper and can create an explosion hazard.

e. Always make sure the nozzle O-rings are in place and in good condition upon assembly.

f. Operators must exercise caution when handling and igniting the torch (gun) and handling hot parts to prevent being burned.

EYE PROTECTION

a. Thermal spraying produces infrared and ultraviolet light. The intensity of this light presents a hazard to the eyes (and skin) of the operator and observers.

b. Protective eyewear is required when using the Spraywelder™ System and when fusing the applied coatings. Use goggles or face shield which comply with ANSI Z87 providing infrared and ultraviolet filtering with a rating of 4 to 6. For most thermal spray and fusing applications use of Shade 5 lens is recommended.

VENTILATION

a. Fumes and Gases can be dangerous to your health. Medical studies suggest that lung damage and/or CNS effects can result from exposure to welding fumes and gases. Brazing, soldering, and thermal spraying may have similar effects.

b. There are many factors which determine the amount of exposure a worker has to hazardous materials in the workplace. It is recommended that the user consult technical publications such as "Industrial Ventilation" published by ACGIH; or other recognized authority prior to use of the Spraywelder™ System.

c. Local ventilation for the Sprayweld™ Process should consist of either:

1. A small (ie. 2 sq. ft. hood) portable fume extractor with filter which mounts so that the Spraywelder™ sprays into the hood with the part in between. This hood should have a minimum capture velocity of 61 m/min (200 ft/min).

2. A spray area enclosure in which the part and Spraywelder™ operate which has sufficient exhaust to produce an air velocity of 300 ft/min (91 m/min) at the entrance of the enclosure.

3. If sufficient local exhaust is not available to keep fumes and gases from the operators breathing zone it is recommended that the operator wear respiratory protection. The minimum recommended protection in this case (when spraying Colmonoy® products) is a disposable dust mask (filtering face-piece) with an N-95 rating.

HEARING PROTECTION

a. The Spraywelder™ System utilizes a combination of oxygen, fuel gas, and compressed air to produce high quality thermal spray coatings. Expansion of compressed gases creates noise. Hearing protection should be required when operating the Spraywelder™ System.

b. Spray booth design/geometry and acoustics of the room can minimize the effect of noise generated by the process. Noise from several pieces of equipment in an area will be additive to a degree. Sound levels of 95 to 100 dB can be expected at the operator's hearing zone during manual spray operation.

c. Hearing protection that provides >20 dB noise reduction is recommended when operating the Spraywelder™ System.

TOXIC GASES, DUSTS, AND CHEMICALS

a. During the heating or spraying process reactions may take place which liberate compounds in the form of gases, dusts or chemical compounds which are formed from the ingredients in the powder alloy or ancillary cleaning chemicals in the presence of heat.

b. Use of non-toxic solvents is recommended for cleaning purposes. Chlorinated cleaning solvents such as trichloroethylene, trichloroethane, or perchlorethylene can react with heat to form phosgene gas upon decomposition.

c. The normal combustion of oxygen and a fuel gas can produce carbon dioxide and carbon monoxide. Additionally, oxides of the alloyed elements contained in the powder being used can be formed. The threshold limit values (TLV's) for these oxides may be exceeded without exceeding the TLV for general welding fume or nuisance dusts. Chromium oxide may contain hexavalent chromium.

d. Zinc, cadmium, beryllium, lead, and their compounds are toxic. The Sprayweld™ process is NOT recommended for spraying these materials or alloys.

HANDLING HIGH PRESSURE CYLINDERS

a. The containers used to store gases under pressure are known as cylinders (or tanks). Cylinders contain materials under various pressures and forms depending on the material. Typical cylinder pressures vary from relatively low (6.8 - 17.0 bars (100 – 250 psi)) for fuel gases to very high (>136 (>2000 psi)) for gases such as oxygen, argon and nitrogen. If the cylinder itself or the valves are damaged the entire contents of the cylinder can escape with explosive force. This sudden release of pressure can cause physical injury, frostbite, hearing damage, or death, in addition to propelling the cylinder itself away at high velocity.

b. Always follow your employers' safety practices when handling high pressure cylinders.

c. Always secure cylinders before use and use proper two stage pressure reducing regulators which are in good condition.

d. Monitor regulator pressures and change out cylinders before they run out.

OXYGEN SAFETY PRECAUTIONS

a. Oxygen by itself is nonflammable. However, oxygen both supports and accelerates combustion.

b. Make sure oxygen cylinders are secured during use and that the valve cap is on whenever the regulator is removed.

c. Never permit oil or grease to come into contact with oxygen cylinders, valves, regulators, hoses, fittings or torch parts. Do not handle oxygen cylinders with oily hands or gloves.

d. Never use oxygen near flammable materials, especially grease, oil, or any substance likely to support combustion.

e. Do not store oxygen and acetylene cylinders in close proximity. Follow OSHA and NFPA regulations.

f. Always refer to oxygen by its correct name; "oxygen" not "air".

g. Never use oxygen from cylinders without a suitable pressure reducing regulator attached to the cylinder valve.

h. Never tamper with or attempt to repair oxygen cylinder valves. Regulators may be repaired by qualified individuals or returned to Wall Colmonoy for repair.

i. Never use oxygen regulators, hoses or other pieces of apparatus with any other compressed gas.

j. Never attempt to mix any other gases into an oxygen cylinder.

k. Never use oxygen to clean or blow off debris from clothing.

l. Oxygen cylinder valves are "double seating". Open the valve fully to seat in the open position and close completely to seat in the closed position.

m. Always open the cylinder valve slowly to prevent recompression(heating) in the regulator.

n. Be certain that the cylinder valve is closed and the cap is secure before transporting the cylinder.

FUEL GAS SAFETY PRECAUTIONS

a. The Spraywelder™ System is designed to be used with acetylene as its fuel gas. With specially designed nozzles, it can also be operated with propylene or propane as the fuel gas. Take care to use the correct nozzle for the fuel gas being used to avoid a backfire or flashback.

b. Primary Dangers

1. Flammability
   - All fuel gases are flammable they will burn when mixed with air or oxygen and ignited.

2. Explosion
   - Fuel gas when mixed with air or oxygen in a confined or semi-confined space can ignite with explosive force if exposed to heat, spark, or open flame.

3. Asphyxiation
   - Fuel gases and "inert" gases do not contain enough oxygen to support life. These gases such as Acetylene, Propane, Propylene, Natural gas (methane), Argon, Carbon dioxide (CO2), Nitrogen and etc. can displace the air present in a work space causing workers to lose consciousness and suffocate if not rescued. Always maintain adequate ventilation in the workspace when using these gases. It should also be noted that oxygen levels below 19% or above 23% are dangerous, asphyxiation or oxygen poisoning can occur.

4. Reactivity
   - Reactivity is a change of state of matter which can generate dangerous amounts of heat, pressure or toxic compounds. Acetylene is a meta-stable compound and is subject to reactivity hazards when not properly handled, stored, and used. The reaction can occur with such force as to be defined as a detonation.

c. It is strongly advised that work place procedures be established after consulting regulations such as OSHA, ANSI Z49.1, CGA G-1, CGA SB-4, NFPA 51, NFPA 51B, any other relevant standards, and the suppliers Safety Data Sheets for each type of gas and fuel gas being used.

d. For Reference: Immediately Dangerous to Life or Health (IDLH) concentrations are shown below. Local ventilation should be designed to maintain exposures below PEL/TLV limits for any exposure.

Acetone	25,000 ppm
Acetylene	25,000 ppm
Argon	Maintain >19.5% oxygen in local atmosphere
Carbon dioxide	40,000 ppm
Methane	50,000 ppm
Nitrogen	Maintain >19.5% oxygen in local atmosphere
Oxygen	Maintain <23.5% oxygen in local atmosphere
Propane	21,000 ppm
Propylene	20,000 ppm

GENERAL PRECAUTIONS FOR ALL FUEL GASES

a. Use regulators and twin gas hoses which are rated for the appropriate gases which are being used.

b. Keep sparks, flames and heat away from all fuel gas cylinders.

c. Should a leak occur in a fuel gas cylinder:

1. Move the cylinder outside in an open area away from ignition sources.

2. Notify the manufacturer/distributor at once.

3. Follow instructions given by the manufacturer/ distributor.

d. Position fuel gas cylinders so that the valve outlet will point away from the oxygen cylinder(s).

e. Make sure the fuel gas valves are easily accessible and can be quickly shut off in an emergency.

f. Make sure that empty cylinder valves are tightly closed and that the cylinder is marked "Empty" or "MT".

g. Never attempt to transfer fuel gases from one cylinder to another, nor to refill, nor attempt to mix any other gases into a cylinder.

ACETYLENE (C_2H_2)

a. Acetylene is a colorless gas with the UN Number of 1001. In its pure form it is odorless, but the garlic like smell that we are all familiar with comes from impurities in the commercially available product from such things as phosphine.

b. It is a very unstable gas and does not require the presence of Oxygen to burn or explode. Approximately 2.5% - 100% acetylene in air is flammable. It burns at a very fast rate and this makes its explosions (2.5% - 80% acetylene) much more violent than that of other fuels. If not properly stored, it can violently decompose and explode all by itself above 2 bars (29 psi). This is the reason that acetylene regulators will not work beyond an operating pressure of 1 bar (15 psig) or if using a general fuel regulator, the working pressure gauge is red lined after 1 bar (15 psig).

c. Acetylene is the fuel desired for use in all of Wall Colmonoy's thermal spray equipment because it is the hottest burning fuel available. It is also fairly clean burning and it does not react negatively with our alloys. When burned with a stoichiometric ratio with Oxygen the temperatures obtainable range between 3150°C and 3482°C (5700°F and 6300°F) with 54,771 MJ/m^3 (1470 BTUs/cu ft) of heat. This provides outstanding heat transfer characteristics.

d. In the tank, acetylene is stored at 17 bars (250 psi). Acetone (or dimethylformamide, another liquid used) has the ability to absorb or dissolve more than 25 times its own weight of acetylene. In the acetylene tank there is a porous material (such as Agamassan, a sponge-like cementitious material) that holds the Acetone. Do not lay an acetylene tank on its side. The Acetone can leak out of the porous filler and Acetone will draw out when you open the tank. If an Acetylene tank has been laid on its side, it should be allowed to stabilize for 24 hours once it has been set upright. Never store an Acetylene Tank in a horizontal position.

e. If an Acetylene tank is improperly filled or too much Acetone is added, Acetone can be drawn immediately upon opening of the Acetylene tank valve. With the Spraywelder™ System, Acetone draw is never noticed until it reaches the Acetylene flow meter. At this point, it is too late and the system needs to be shut down immediately.

f. Acetone is a solvent and will dissolve most plastics, rubbers and latex. If Acetone is drawn through a J-3 Spraywelder™ System, all hoses, seals, O-rings and the flow meter must be replaced. The Acetylene regulator should also be sent out to a qualified repair shop.

g. The Model J-3 Spraywelder™ uses between 1.3 m^3/hr (44 scfh (standard cubic feet per hour)) and 1.9 m^3/hr (66.5 scfh) of acetylene when spraying Colmonoy® and Wallex™ alloys. The lowest flow is for Colmonoy® 6 and a 'D' Nozzle at 4.5 to 5.5 kg (10 to 12 pounds) per hour. The highest flow is for

the high output system spray Colmonoy® 62SA at 13.6 kg (30 pounds) per hour.

h. It is generally accepted in everyday practice that Acetone can safely release Acetylene at the rate of 1/7 its storage capacity. Per CGA G-1 2009, when the use is "more sensitive to solvent carry over (Acetone)," 1/15 of the tank's capacity should be considered for safe draw of Acetylene.

i. For the Model J-3 Spraywelder™ System, we recommend a minimum of two #5 commercial tanks manifold together. Each tank holds approximately 10 cubic meters (360 cubic feet) of Acetylene. When manifolding Acetylene tanks together, all tank valves must be opened This will keep all of the tanks at a similar level and you will not run the risk of filling another tank at too great a draw. Many companies use as many as 12 to 16, #5 Acetylene tanks manifolded together. This allows for the safest draw down of this fuel. There is no safety reason for the Oxygen to be manifolded together. They are manifolded so that a similar volume of Oxygen is available to match the volume of Acetylene.

Torch / Tip	Acetylene Draw (SCFH)	Number of Acetylene Cylinders Required When in a Manifold Based on Capacity and Torch the 1/7th Withdraw Limit is Suitable for Thermal Spray and Heating Torches							
		200		250		300		400	
		1/7	1/15	1/7	1/15	1/7	1/15	1/7	1/15
J-3 (min)	44	2	4	2	3	2	3	1	2
J-3 (ave)	55	2	5	2	4	2	3	1	3
J-3 (max)	64	3	5	2	4	2	4	2	3
MFA 8 (min)	30	2	3	1	2	1	2	1	2
MFA 8 (max)	80	3	6	3	5	2	4	2	3
MFA 12 (min)	60	3	5	2	4	2	3	2	3
MFA 12(max)	150	6	12	5	9	4	8	3	6
MFA 15 (min)	90	4	7	3	6	3	5	2	4
MFA 15 (max)	220	8	17	7	14	6	11	4	9

j. If acetone is accidentally withdrawn during use the first sign you may see is a change in brightness or color of the flame to more yellow or orange, acetone will also be seen in the flow meter which it may discolor. The final indication is bulging of the acetylene hose. When any of these signs is seen the operator must initiate an emergency shut-down procedure immediately (see section m. Emergency Shut Down). If acetone is withdrawn in any significant amount there may not be enough left in the cylinder to keep the acetylene dissolved. This will allow the presence of undissolved acetylene in the cylinder which may be at a dangerous pressure with the very real possibility of a reaction and subsequent explosion.

k. Acetylene tanks should be stored in well ventilated areas. When storing near Oxygen they should be at a minimum of 6 meters (20 feet) apart. Another option would be to have a fire resistant barrier 1.5 meters (5 feet) minimum in height and with a fire resistance rating of at least one hour.

l. An additional safety situation which can occur when using acetylene and oxygen is a backfire or flashback. This occurs when the total flow of oxygen plus acetylene is too low to generate an exit velocity from the nozzle orifice which is greater than the burning velocity of the mixed gas. This can also happen if the gas jet orifice diameter becomes enlarged or bell mouthed due to cleaning, normal wear or improper cleaning. When the mixed gas velocity is too low, it can begin burning inside the nozzle instead of outside. This is usually indicated by a loud popping sound and/or a hissing noise from the nozzle. The flame jet may or may not be extinguished. The results of a backfire can include:

1. Melting of the nozzle and/or damage to the nozzle O-Rings.

2. Melting of the gas mixer and/or damage to the mixer O-Rings.

3. Melt down of the torch body if system is not shut down.

Flash arrestors in the oxygen and fuel lines are provided to prevent burning in the hoses or propagation of a flame to the cylinder. It is for this reason an acetylene cylinder valve should be opened the minimum amount required to deliver acceptable flow so that it can be closed as quickly as possible in an emergency situation. Half- to one-turn is usually sufficient to provide adequate flow.

m. Emergency Shut Down; After a backfire/flashback or drawing acetone:

1. Immediately close the gas flow valve on the torch.

2. Immediately shut off acetylene at the cylinder valve.

3. Shut off the oxygen at the cylinder valve.

4. Shut off powder, air and unplug electricity at the outlet.

5. After the torch has cooled check nozzle, all O-rings and gas mixer for any damage.

6. Replace any damaged parts.

7. Verify proper regulator pressures and flows before reigniting torch.

PROPANE (C_3H_8)

a. Propane can be compressed into a liquid that flashes to a vapor at atmospheric pressure. It is heavier than air and for this reason a leak can be a problem since it may collect in low lying areas. The maximum flame temperature with Oxygen is 1979°C (3595°F). Propane requires four times the amount of Oxygen as a torch operating with Acetylene. Some parameters have been established for using Propane with the J-3 Spraywelder™ System. It does not produce as clean

a coating as does Acetylene, but it often produces acceptable coatings. Many shops will use Propane for preheating and fusing, since extremely large torches are available for use with this liquid fuel.

PROPYLENE (C_3H_6)

Propylene can also be compressed into a liquid. It also becomes a gas at ambient or room temperature. It offers more heat in its primary flame than does Propane and is generally hotter and more efficient overall. MAPP Gas is trade name for a stabilized mix of methylacetylene and propadiene. It is no longer commercially available. Today suppliers are selling stabilized LPG with high levels of propylene as MAPP. This gas is safer than Acetylene and has a flame temperature of 2927°C (5300°F) when used with Oxygen.

SECTION 3
ASSEMBLY

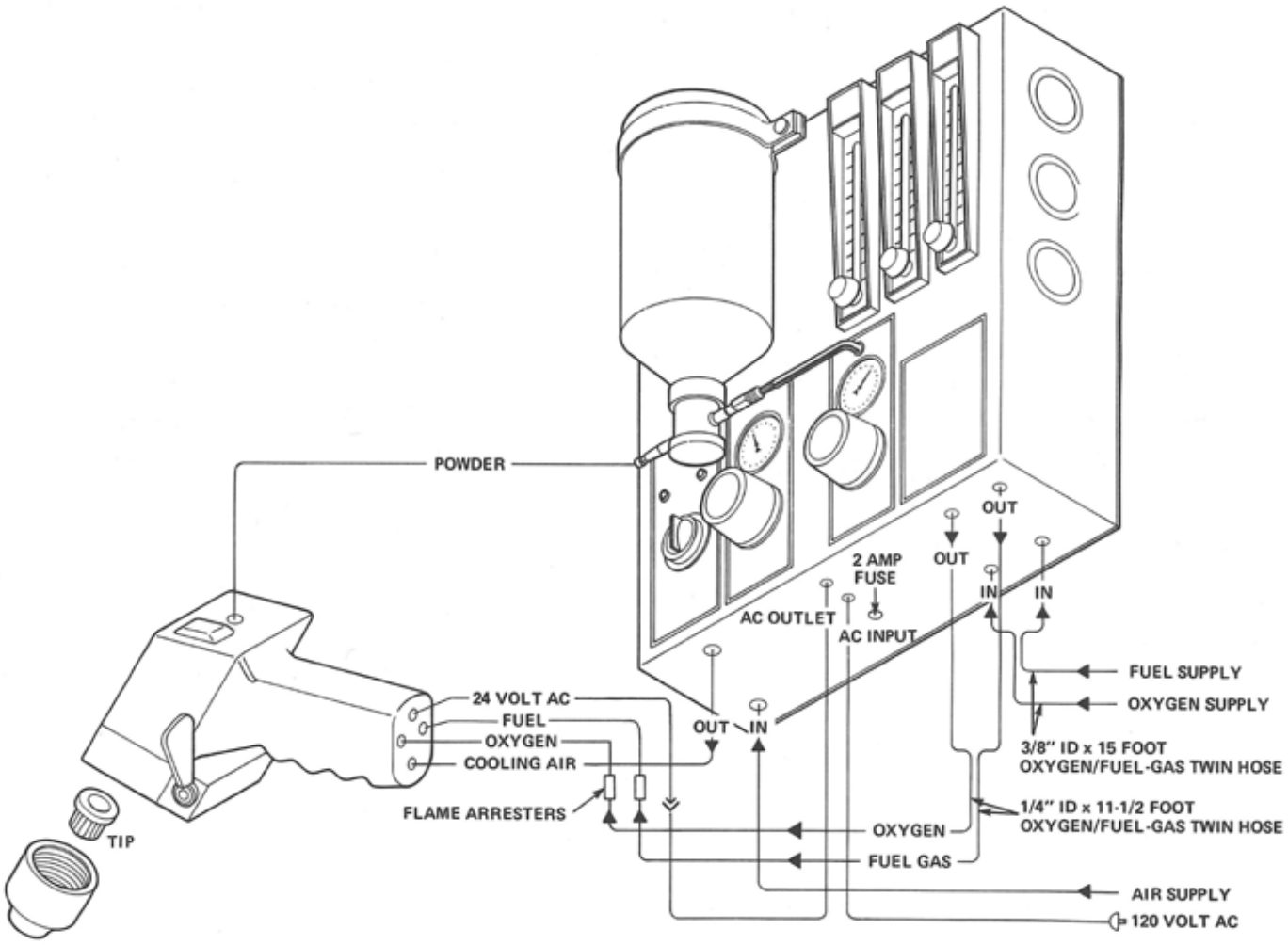

Figure 3-1. Spraywelder™ unit.

GENERAL

3-A. This section lists the components of the Wall Colmonoy Model J-3 Spraywelder™ unit and gives assembly instructions.

COMPONENTS

3-B. The Model J-3 Spraywelder™ unit (figure 3-1) consists of:

a. Pistol and selected nozzles. For nozzle selection refer to page 4-3, "Model J-3 Spraywelder™ Operating Tables".

b. Panel, containing:

1. Adjustable oxygen and fuel gas flowmeters.
2. Air regulator (lock-in type) and gauge, for air cooling the pistol.
3. Air regulator (lock-in type) with gauge, and adjustable flowmeter, for varying powder flow rates.
4. Hopper bracket, powder hopper and carburetor.
5. Selector switch for selecting either remote powder feed at the gun, or powder feed control at the panel.
6. Fuseholder with 2 amp. fuse.
7. 120-Volt AC primary input cable and a 24-Volt AC output cable to connect to pistol.*
8. Step-down transformer, 120-VAC to 24-VAC.*
9. 24-Vac Solenoid Valve (powder On-Off).
10. Pistol holder bracket (vinyl coated).

c. Air filter/regulator, with gauge, to clean and regulate plant air supply, and indicate is pressure.

d. Hose kit consisting of:

1. Air hose, 3/8" ID x 15 ft. for air supply to panel. Marked 21311011.

2. Oxygen/fuel gas twinhose 3/8" ID x 15 ft. for gas supply to panel. Marked 21311010.

3. Air hose, 1/4" ID x 12-1/2 ft. for cooling air from panel to pistol. Marked 21311009.

4. Dual check valves assembly for fuel gas and oxygen hose lines. Installs between the 1/4-in. ID twinhose and the pistol. Marked 21311008.

5. Oxygen/fuel gas twinhose, 1/4 in. ID x 12-1/2 ft., for carrying from panel to check valve assembly. Marked 21311007.

6. Powder hose 3/16: ID x 10 ft. Marked 21311006

ASSEMBLING THE SPRAYWELDER™ UNIT

3-C. To assemble the Spraywelder™ unit, proceed as follows:

a. Install panel on wall or vertical upright (it must be perpendicular to the floor). Panel should be at least as high as the gun working height.

b. Blow out all hoses with clean dry air before making the following connections.

c. Connect your air supply (60 PSI min.) to the panel by connecting cone end of the 15 ft. hose to the port marked "AIR IN" on the bottom of the panel. Connect the other end to your plant air supply. The use of the air filter is mandatory, and it should be placed as close to the panel as possible. An air dryer is highly recommended, as any moisture in the air will cause powder-flow problems. Include dedicated grit blast cabinet air consumption in determining air dryer capacity.

d. Connect the 3/8" I.D. twinhose as follows:

1. Connect one end of green hose to "OXYGEN IN" on bottom of panel. Connect other end to your oxygen regulator outlet.

2. Connect on end of red hose to "FUEL IN" on the bottom of panel, connect other end to your fuel gas regulator outlet. These are left-hand threaded fittings.

e. Connect one end (9/16-18 thread, R.H.) of the cooling air hose to "COOLING AIR OUT" on bottom of panel. Connect the other end (3/8-24 thread, R.H.) to front fitting marked "CA" on bottom of pistol handle.

f. Connect reverse flow dual check valve assembly as follows:

1. Connect 3/8-24 thread R.H. nut on green hose to fitting on bottom of gun handle marked "O".

2. Connect 3/8-24 thread L.H. nut on red hose fitting on bottom of gun handle marked "A".

g. Connect the 1/4" I.D. twinhose as follows:

1. Connect the small end of the 3/8-24 thread R.H. nut of the green hose to the check valve connection marked"O". Connect the large end of the 9/16-18 thread nut to the "OXYGEN OUT" port on bottom of panel.

2. Connect the small end of the 3/8-24 thread L.H. nut of the red hose to the check valve connection marked "A". Connect the large end of 9/16-18 thread L.H. nut to the "FUEL OUT" port on bottom of panel.

h. Connect one end of powder hose to outlet marked "P" on powder carburetor. Connect other end to powder inlet on pistol marked "P"

i. Check all connections with a light pressure on the wrench for tightness.

j. Connect the powder switch control cable marked "24AC" from the bottom of the panel to pigtail connector hanging from bottom of the pistol. Hand tighten connection.

k. Plug the electrical supply cable marked 120 VAC from the bottom of the panel into any 120 VAC outlet or 220 VAC as the situation applies.

THE UNIT IS NOW READY FOR OPERATION.

*240-VAC primary input power is available for non-North American sales.

SECTION 4
OPERATING PROCEDURES

GENERAL

4-A. This section lists the operating procedures that should be followed for the safe and efficient operation of the Spraywelder™ unit.

PRELIMINARY CHECKS

4-B. Preliminary checks.

a. Check oxygen and acetylene regulators. Be sure these are two-stage regulators and are in good operating condition. Tighten fittings and check for leaks.

b. Leak checking the Spraywelder™ System

1. After complete assembly of the system and hook up to oxygen and fuel gas are made; keeping the torch valve closed the oxygen and fuel cylinder valves should be opened.

2. The regulators should then be set to the correct recommended pressures.

3. Make note of the pressure reading on the high pressure stages.

4. The oxygen and fuel cylinder valves should then be closed.

5. Monitor for any drop in pressure reading on the high pressure stages.

6. If there is no pressure drop within 30 minutes the system is leak free.

7. If there is any noticeable pressure drop within 30 minutes there is at least one leak which requires fixing before igniting the torch.
   i. Using commercially available leak check solution (or a soap solution) systematically check all fittings in the gas path external to the console. Start at the regulator and work toward the console and then from the console to the torch.

   ii. With the oxygen and fuel gas valves open spray a small amount of leak check solution onto each fitting.

   iii. If any bubbles are seen the fitting should be tightened, or cleaned, inspected for damage and replaced or retightened until it is verified that no further leak exists.

   iv. If no leaks are found external to the console the internal console fittings must be checked.

   v. Carefully open the console by removing the rear panel.

   vi. According to the schematic diagram figure 8-1, the fittings at the following indicated locations should be checked with leak check solution.
   - 44 and 48 and adjacent fittings for fuel gas leak.
   - 43 and 47 and adjacent fittings for oxygen leak.
   - If an air leak is being checked for; check appropriate fittings in the air circuit.

   vii. Be sure to wipe dry all fittings after the leak check.

   viii. Once all leaks have been identified and corrected repeat the procedure from the beginning.

c. If the leak cannot be identified and corrected the system should NOT be used. It should be returned to Wall Colmonoy for repair.

GAS PRESSURE AND FLOW SETTINGS

4-C. Preliminary steps. All work to be done with proper ventilation for flammable gases.

a. Close 3-way valve on pistol by moving lever forward to "7 o'clock" position.

b. Close valves on three flowmeters (on panel), by turning the knobs clockwise.

c. Shut off pressure regulators (cooling air and powder rate) by turning knob counter-clockwise.

d. Move powder switch, on pistol, to "off" position.

4-D. Gas Pressure and flow settings should be established as follows:

a. Open valves on acetylene gas tanks.

b. Turn on main air supply (4 bars (60 psi) min.).

c. Open 3-way valve on pistol by moving lever back to "2 o'clock" position (full open).

d. Turn cooling air regulator knob (on panel) clockwise until cooling air gauge reaches suggested psi setting (outer band of numbers) shown in table on page 4-3.

e. Turn selector switch (on panel) to "Panel Control On" position.

f. Turn powder rate air regulator (on panel) clockwise until gauge reaches suggested psi setting (outer band of numbers) shown in table on page 4-3.

g. Open valve on powder rate air flowmeter by turning knob counter-clockwise until the center of the ball float is at suggested setting (see table).

h. Turn selector switch (on panel) to "off" position.

i. Open tank-mounted oxygen and fuel gas regulators and adjust pressure settings to suggested levels (see table).

j. Open the valve on the oxygen flowmeter by turning the knob counter-clockwise, until the center of the ball float is at the suggested setting (see table).

k. Repeat above procedure with the fuel gas flowmeter.

l. Close 3-way valve on pistol by moving lever forward to "7 o'clock" position.

m. If percent-of-flow figures in the table can't be achieved, check gauge calibration and regulator operation.

4E. Table shown on page 4-3 was developed using Wall Colmonoy's Spraywelder™ powders. The settings should be considered approximate as there are inherent variations in any given set-up. Flowmeter scales are read from the center of the ball float.

LIGHTING FLAME

4-F. Light flame as follows:

a. Place choice of powder in hopper.

b. Turn on selector switch (on panel) to "Remote Control On" position.

c. Open 3-way valve on pistol to pilot setting by moving lever back to "5 o'clock" position.

d. Ignite gas at pistol nozzle with approved friction lighter. Avoid using igniters with cups; they can cause backfires.

e. Open 3-way valve on pistol by moving lever up to "2 o'clock position (full open) slowly and evenly.

f. If necessary, re-adjust regulators and flowmeters to suggested settings. In any case you must obtain a neutral flame (a flame with no "feather" beyond the bright inner cone). This is best done by varying the oxygen settings; try to maintain the suggested acetylene flow rates.

g. Move powder switch, on pistol, to "on" position.

EXTINGUISHING FLAME

4-G. Shut off powder and extinguish flames as follows:

a. Move powder switch, on pistol, to "off" position.

b. Close 3-way valve on pistol by moving lever down and forward to "7 o'clock" position rapidly and smoothly.
To shut down the whole system, proceed with the following additional steps.

c. Shut off oxygen and fuel gas with tank-mounted valves.

d. Open 3-way valve on pistol by moving lever to "2 o'clock" position (full open) to allow gases to bleed out of the system. Lever should be left in this position when system is idle to relieve pressure on valve diaphragms. They will last longer if you leave them open.

e. Turn off main air supply.

f. Turn off all 3 flowmeters by turning knobs clockwise.

g. Turn off cooling air and powder rate regulators by turning knobs counter-clockwise.

SPECIAL NOTES AND PRECAUTIONS

4-H. The notes and precautions below should be carefully observed:

a. Do not use the Spraywelder™ System strike pistol for fusing, or alloy it to remain lighted without cooling air flowing, as this will overheat and damage the unit.

b. If a deposit forms on the nozzle while spraying, extinguish the flame (see paragraph 4-G), and wipe the nozzle with a piece of wire or with the small brass wire brush found in the cleaner kit. Be careful not to bellmouth the nozzle jets. Never use a large wire brush to clean the nozzle.

c. If the 3-way valve on the pistol is open, with the system not operating, the nozzle should never be blocked (with the hand or other object) as this could drive explosive gases back through the system.

d. O-rings must be in place when assembling gas mixer, nozzle, and air cap to pistol. They must be in perfect condition; replace them if in doubt. Refer to label on pistol.

e. The air cap should be hand tightened only. Do not use a wrench.

f. After sustaining a backfire, inspection of nozzle O-rings is mandatory! Replace if damaged.

g. After operating the Spraywelder™ continuously for 30 minutes or more, periodically check to see that the air cap is snug. It has a tendency to loosen as the pistol heats up.

TABLE 4-3
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
Spraywelder™ Powders

ACETYLENE PARAMETERS

ALLOY	Nozzle No.	Spray Rate lb/hr	Cooling Air psi	Powder Rate		Oxygen		Acetylene		Spray Dist. inches
				psi	% flow	psi	% flow	psi	% flow	
Colmonoy® 4, 5, 6, 56	J-3C	17-19	20-25	26	56	17	43	15	34	9
	J-3D*	10-12	20-25	14	44	16	41	13	30	8
Colmonoy® 42SA, 52SA	J-3B	17-19	20-25	22	52	18	48	15	38	10
	J-3C	10-12	20-25	12	40	17	43	15	34	9
Colmonoy® 62SA	J-3B	17-19	25	27	57	18	48	15	38	10
	J-3C	10-12	25	14	43	17	43	15	34	9
Colmonoy® 69SC, 72 Wallex™ 40, 50	J-3B	17-19	15-20	24	54	18	48	15	38	10
	J-3C	10-12	20-25	13	42	17	43	15	34	9
Colmonoy® 84	J-3C	17-19	20-25	25	55	17	43	15	34	9
	J-3D	10-12	25	14	43	16	41	13	30	8
Colmonoy® 75, 750, Wallex™ 55	J-3A	17-19	25	24	54	22	52	15	42	10
Colmonoy® 730	J-3C	17-19	25	30	60	17	43	15	38	9
Colmonoy® 635	J-3B	15	25	22	52	18	48	15	38	10
Colmonoy® 88	J-3B	18-20	20	24	54	18	48	15	38	10
	J-3C	10-12	25	14	43	17	43	15	34	9
	J-3D*	10-12	25	14	42	17	43	15	34	9

*The J-3D nozzle, with its extremely narrow spray pattern, is recommended for glass industry application

PROPYLENE PARAMETERS**

ALLOY	Nozzle No.	Spray Rate lb/hr	Cooling Air psi	Powder Rate		Oxygen		Propylene		Spray Dist. inches
				psi	% flow	psi	% flow	psi	% flow	
Colmonoy® 42SA, 52SA	J-3BLF	10-12	25	18	48	40	60	20	25	10
Colmonoy® 62SA	J-3BLF	25-26	20	40	45	50	60	34	25	10
	J-3BLF	10-12	25	18	48	40	65	20	30	10
Colmonoy® 69SC	J-3BLF	10-12	25	18	48	40	60	20	25	10
Colmonoy® 88	J-3BLF	10-12	25	18	48	40	60	20	25	10
Colmonoy® 88 (High Output)	J-3ALF	17	25	32	42	40	60	20	25	17

**Use of propylene requires liquid fuel (LF) nozzle

TABLE 4-4
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
SoloCoat™ Powders

ALLOY	Nozzle No.	Spray Rate lb/hr	Cooling Air psi	Powder Rate		Oxygen		Acetylene		Spray Dist. inches	Rockwell Macro Hardness
				psi	% flow	psi	% flow	psi	% flow		
SoloCoat™ 840	J-3A	11	25	16	49	20	50	15	35	8	Rb 95
SoloCoat™ 850	J-3D	13	30	14	44	16	41	13	30	9	Rb 60
SoloCoat™ 870	J-3A	12	25	16	49	22	54	15	41	9	Rb 85

Updated February 2018

Safety Precautions

1. **Never operate the Spraywelder™ nozzle without all five O-rings in place!** See page 8-1 of the Colmonoy® Spraywelder™ Operating Manual for O-ring locations. Always inspect O-rings for wear and damage when replacing or servicing nozzles. Missing or damaged O-rings **will** cause backfire.

2. Inspect O-rings regularly for wear, burn damage, or degradation. Replace with only original Spraywelder™ replacement parts. See parts list on page 8-1 of the operating manual.

3. If the Spraywelder™ is in use for extended time periods (30 minutes or more), ensure the air cap is tightly secured by hand-turning it with just enough torque to secure seating of the O-rings.

4. Never impede the proper flow of gases exiting the nozzle. This can cause combustible gases to back-up in the system, setting the stage for a backfire.

5. If a backfire or other unusual incident occurs, inspect mixer, nozzle, and all O-rings and diaphragms for damage, and clean or replace as necessary.

TABLE 4-5
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
Spraywelder™ Powders
METRIC

ACETYLENE PARAMETERS										
ALLOY	**Nozzle No.**	**Spray Rate kg/hr**	**Cooling Air kPa**	**Powder Rate**		**Oxygen**		**Acetylene**		**Spray Dist. cm**
				kPa	**% flow**	**kPa**	**% flow**	**kPa**	**% flow**	
Colmonoy® 4, 5, 6, 56	J-3C	7.7-8.6	138-172	179	56	117	43	103	34	23
	J-3D*	4.5-5.4	138-172	97	44	110	41	90	30	20
Colmonoy® 42SA 52SA	J-3B	7.7-8.6	138-172	152	52	124	48	103	38	25
	J-3C	4.5-5.4	138-172	83	40	117	43	103	34	23
Colmonoy® 62SA	J-3B	7.7-8.6	172	186	57	124	48	103	38	25
	J-3C	4.5-5.4	172	97	43	117	43	103	34	23
Colmonoy® 69SC, 72 Wallex™ 40, 50	J-3B	7.7-8.6	103-138	165	54	124	48	103	38	25
	J-3C	4.5-5.4	138-172	90	42	117	43	103	34	23
Colmonoy® 84	J-3C	7.7-8.6	138-172	172	55	117	43	103	34	23
	J-3D	4.5-5.4	172	97	43	110	41	90	30	20
Colmonoy® 75, 750, Wallex™ 55	J-3A	7.7-8.6	172	165	54	152	52	103	42	25
Colmonoy® 730	J-3C	7.7-8.6	172	207	60	117	43	103	38	25
Colmonoy® 635	J-3B	6.8	172	152	52	124	48	103	38	25
Colmonoy® 88	J-3B	8.2-9.1	138	165	54	124	48	103	38	25
	J-3C	4.5-5.4	172	97	43	117	43	103	34	23
	J-3D*	4.5-5.4	172	97	42	117	43	103	34	23

*The J-3D nozzle, with its extremely narrow spray pattern, is recommended for glass industry application

PROPYLENE PARAMETERS**										
ALLOY	**Nozzle No.**	**Spray Rate kg/hr**	**Cooling Air kPa**	**Powder Rate**		**Oxygen**		**Propylene**		**Spray Dist. cm**
				kPa	**% flow**	**kPa**	**% flow**	**kPa**	**% flow**	
Colmonoy® 42SA, 52SA	J-3BLF	4.5-5.4	172	124	48	276	60	138	25	25
Colmonoy® 62SA	J-3BLF	11.4-11.8	138	276	45	345	60	234	25	25
	J-3BLF	4.5-5.4	172	124	48	276	65	138	30	25
Colmonoy® 69SC	J-3BLF	4.5-5.4	172	124	48	276	60	138	25	25
Colmonoy® 88	J-3BLF	4.5-5.4	172	124	48	276	60	138	25	25
Colmonoy® 88 (High Output)	J-3BLF	7.7	172	221	42	276	60	138	25	17

TABLE 4-6
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
SoloCoat™ Powders
METRIC

ALLOY	Nozzle No.	Spray Rate kg/hr	Cooling Air kPa	Powder Rate		Oxygen		Acetylene		Spray Dist. cm	Rockwell Macro Hardness
				kPa	% flow	kPa	% flow	kPa	% flow		
SoloCoat™ 840	J-3A	5	172	110	49	138	50	103	35	20	Rb 95
SoloCoat™ 850	J-3D	6	207	97	44	110	41	90	30	23	Rb 60
SoloCoat™ 870	J-3A	5	172	110	49	152	54	103	41	23	Rb 85

Updated February 2018

Safety Precautions

1. **Never operate the Spraywelder™ nozzle without all <u>five</u> O-rings in place!** See page 8-1 of the Colmonoy® Spraywelder™ Operating Manual for O-ring locations. Always inspect O-rings for wear and damage when replacing or servicing nozzles. Missing or damaged O-rings **will** cause backfire.

2. Inspect O-rings regularly for wear, burn damage, or degradation. Replace with only original Spraywelder™ replacement parts. See parts list on page 8-1 of the operating manual.

3. If the Spraywelder™ is in use for extended time periods (30 minutes or more), ensure the air cap is tightly secured by hand-turning it with just enough torque to secure seating of the O-rings.

4. Never impede the proper flow of gases exiting the nozzle. This can cause combustible gases to back-up in the system, setting the stage for a backfire.

5. If a backfire or other unusual incident occurs, inspect mixer, nozzle, and all O-rings and diaphragms for damage, and clean or replace as necessary.

TABLE 4-7
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
18-inch I.D. Water-Cooled Extension
(Currently No Longer Available for Purchase)

ALLOY*	Nozzle No.	Cooling Air	Powder Rate		Oxygen		Acetylene	
		psi	psi	% flow	psi	% flow	psi	% flow
Colmonoy® 4, 5, 6, 56	J-3B	15-20	26	56	18	34	15	28
Colmonoy® 42SA, 52SA	J-3A	10-15	22	52	19	34	15	30
Colmonoy® 62SA	J-3A	10-15	27	57	19	34	15	30
SoloCoat™ 840	J-3B	25	16	44	20	39	15	24

*Qualified alloys – Additional alloys can be qualified by the Wall Colmonoy Corporate Laboratory

Updated February 2018

Parameters based on 18” extension.
Longer extensions may require minor adjustments to powder rate

Safety Precautions

1. **Never operate the Spraywelder™ nozzle without all <u>five</u> O-rings in place!** See page 8-1 of the Colmonoy® Spraywelder™ Operating Manual for O-ring locations. Always inspect O-rings for wear and damage when replacing or servicing nozzles. Missing or damaged O-rings **will** cause backfire.

2. Inspect O-rings regularly for wear, burn damage, or degradation. Replace with only original Spraywelder™ replacement parts. See parts list on page 8-1 of the operating manual.

3. If the Spraywelder™ is in use for extended time periods (30 minutes or more), ensure the air cap is tightly secured by hand-turning it with just enough torque to secure seating of the O-rings.

4. Never impede the proper flow of gases exiting the nozzle. This can cause combustible gases to back-up in the system, setting the stage for a backfire.

5. If a backfire or other unusual incident occurs, inspect mixer, nozzle, and all O-rings and diaphragms for damage, and clean or replace as necessary.

TABLE 4-8
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
18-inch (457-mm) I.D. Water-Cooled Extension
METRIC
(Currently No Longer Available for Purchase)

ALLOY*	Nozzle No.	Cooling Air kPa	Powder Rate		Oxygen		Acetylene	
			kPa	% flow	kPa	% flow	kPa	% flow
Colmonoy® 4, 5, 6, 56	J-3B	103-138	179	56	124	34	103	28
Colmonoy® 42SA, 52SA	J-3A	69-103	152	52	131	34	103	30
Colmonoy® 62SA	J-3A	69-103	186	57	131	34	103	30
SoloCoat™ 840	J-3B	172	110	44	138	39	103	24

*Qualified alloys – Additional alloys can be qualified by the Wall Colmonoy Corporate Laboratory

Parameters based on 18'' extension.
Longer extensions may require minor adjustments to powder rate

Safety Precautions

1. **Never operate the Spraywelder™ nozzle without all <u>five</u> O-rings in place!** See page 8-1 of the Colmonoy® Spraywelder™ Operating Manual for O-ring locations. Always inspect O-rings for wear and damage when replacing or servicing nozzles. Missing or damaged O-rings **will** cause backfire.

2. Inspect O-rings regularly for wear, burn damage, or degradation. Replace with only original Spraywelder™ replacement parts. See parts list on page 8-1 of the operating manual.

3. If the Spraywelder™ is in use for extended time periods (30 minutes or more), ensure the air cap is tightly secured by hand-turning it with just enough torque to secure seating of the O-rings.

4. Never impede the proper flow of gases exiting the nozzle. This can cause combustible gases to back-up in the system, setting the stage for a backfire.

5. If a backfire or other unusual incident occurs, inspect mixer, nozzle, and all O-rings and diaphragms for damage, and clean or replace as necessary.

TABLE 4-9
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
Spraywelder™ Powders
Starting J-3 HO Parameters

ACETYLENE PARAMETERS										
ALLOY	**Nozzle No.**	**Spray Rate lb/hr**	**Cooling Air psi**	**Powder Rate**		**Oxygen**		**Acetylene**		**Spray Dist. inches**
				psi	**% flow**	**psi**	**% flow**	**psi**	**% flow**	
Colmonoy® 62SA	J-3A	26-29	15-20	50	50	26	54	15	44	12
Colmonoy® 69SC	J-3A	26-29	15-20	40	45	26	54	15	44	12
Colmonoy® 88M	J-3A	25-28	15-20	50	50	26	54	15	44	12
Colmonoy® 730	J-3A	25-28	15-20	50	50	26	54	15	44	12
Colmonoy® 62SA	J-3D*	21	20-25	40	45	17	43	15	34	9

*The J-3D nozzle, with its extremely narrow spray pattern, is recommended for glass industry application

PROPANE PARAMETERS										
ALLOY	**Nozzle No.**	**Spray Rate lb/hr**	**Cooling Air psi**	**Powder Rate**		**Oxygen**		**Propane**		**Spray Dist. inches**
				psi	**% flow**	**psi**	**% flow**	**psi**	**% flow**	
Colmonoy® 62SA	J-3ALF	25-28	15-25	40	45	50	60	26	25	10
Colmonoy® 88	J-3ALF	19	15-25	40	45	50	60	26	25	10
Colmonoy® 730	J-3ALF	15	15-25	40	45	50	60	26	25	10

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TABLE 4-10
MODEL J-3 SPRAYWELDER™ OPERATING TABLE
Spraywelder™ Powders
Starting J-3 HO Parameters
METRIC

ACETYLENE PARAMETERS										
ALLOY	**Nozzle No.**	**Spray Rate lb/hr**	**Cooling Air kPa**	**Powder Rate**		**Oxygen**		**Acetylene**		**Spray Dist. inches**
				kPa	**% flow**	**kPa**	**% flow**	**kPa**	**% flow**	
Colmonoy® 62SA	J-3A	26-29	103-138	345	50	179	54	103	44	12
Colmonoy® 69SC	J-3A	26-29	103-138	276	45	179	54	103	44	12
Colmonoy® 88M	J-3A	25-28	103-138	345	50	179	54	103	44	12
Colmonoy® 730	J-3A	25-28	103-138	345	50	179	54	103	44	12
Colmonoy® 62SA	J-3D*	21	138-172	276	45	117	43	103	34	9

*The J-3D nozzle, with its extremely narrow spray pattern, is recommended for glass industry application

PROPANE PARAMETERS										
ALLOY	**Nozzle No.**	**Spray Rate lb/hr**	**Cooling Air kPa**	**Powder Rate**		**Oxygen**		**Propane**		**Spray Dist. inches**
				kPa	**% flow**	**kPa**	**% flow**	**kPa**	**% flow**	
Colmonoy® 62SA	J-3ALF	25-28	103-138	276	45	345	60	179	25	10
Colmonoy® 88	J-3ALF	19	103-138	276	45	345	60	179	25	10
Colmonoy® 730	J-3ALF	15	103-138	276	45	345	60	179	25	10

Updated February 2018

WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET

The Model J-3 Spraywelder™ System

The 5-Step Sprayweld™ Process:

Surface Preparation, Preheating, Spraying, Fusing, and Finishing

General:

In the Wall Colmonoy Sprayweld™ process, a powdered alloy is flame sprayed on a part, and then the sprayed overlay is fused to the base metal by torch or furnace heat. This creates a smooth, non-porous, welded hard surface within 0.25 mm (0.01") of finished dimensions.

1. Surface Preparation:

UNDERCUTTING is frequently necessary to produce an even depth of overlay, as on an unevenly worn surface, or to provide room for a sufficiently thick overlay to take the expected wear, as on parts not originally built to include a hard-surface overlay.

1. The depth of the undercut should be determined by the amount of wear permitted in service. To this it is advisable to add 0.13 mm (.005") (per side, in the case of cylindrical shapes). This is because 0.13 mm (.005") is considered the minimum for a sound overlay. The recommended maximum overlay depth that may be fused at one time is 1.91 mm (.075") (as fused). This would finish to about 1.52 mm (.060").

2. When undercutting to a shoulder, be sure to feather up to the shoulder at a 30° angle (from the surface) (figure 5-1). If an external corner is going to be sprayed, it should have a radius of at least 0.8 mm (1/32").

If rough threading is to be used in preparing the surface instead of grit blasting, the shoulder angle should be reduced to 15°.

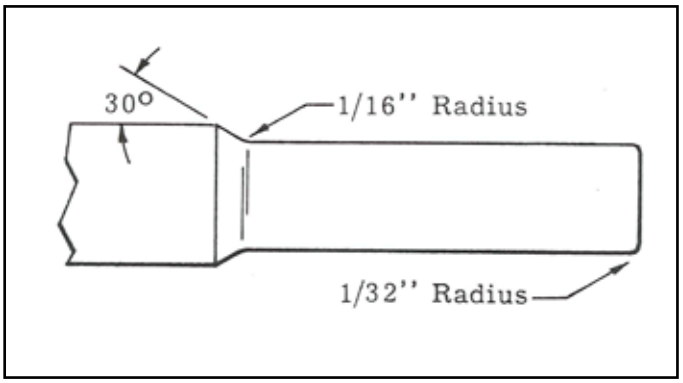


Figure 5-1. Undercutting to a shoulder

GRIT BLASTING is the preferred method of preparing a surface for the sprayed overlay.

It is important that satisfactory surface preparation be obtained to provide a good mechanical bond between the sprayed overlay and base metal during the spraying operation. This prevents the lifting or peeling of the overlay during the fusing operation.

The recommended minimum blasting pressure is 3.5 bars (50 psi) for a pressure blaster and 5.5 bars (80 psi) for a suction blaster.

1. The surface to be sprayed must have all plating, carburizing, nitriding, and all other surface treatment removed. Parts should be degreased, if necessary (this is necessary to prevent contamination of grit).

2. If the hardness of the surface is over 30 Rockwell C, anneal the part before blasting. With the surface hardness less than 30 Rockwell C, it is blasted with crushed angular chilled iron grit. Grit size can range from SAE No. 12 to No. 16. Use grit on the smaller end of this range in preparing for thin overlays, and the larger grit for heavier ones. Always blast more area than you expect to spray: blast surfaces around external corners, and beyond the shoulder of undercut areas.

The grit blast cabinet must be kept clean – use clean air and an adequate exhaust system to remove all fine grit and dust. Do not blast rusty or scaled parts in cabinet. If such parts are blasted therein, clean cabinet prior to use for surface preparation.

3. If grit blasting cannot be done, it is possible to prepare the surface by rough threading. It is the 'second-best' method, and can't be used at all on stainless steel base metals.

Threading should be done with a standard (U.S.) thread tool, cutting 32 to 40 threads per 25.4 mm (1"), not over 0.2 mm (.008") deep. Work must be turned slowly, and tool should be below center of the work. Allow tool to drag, in order to tear the surface. Metal slivers should be removed by running a clean file lightly over the surface. Threading should be done on the undercut shoulder areas, and a little beyond, to ensure good adherence at the overlay edges.

SPECIAL PRECAUTIONS should be taken to have a clean, oil-free surface for spraying.
Parts should be wrapped after grit blasting or rough threading to keep them free of grease or finger marks. It is best to spray as soon after blasting as possible to prevent rust or oxide from forming. If there's any doubt about the cleanliness of the surface, it should be washed by flooding and brushing it with an approved non-toxic solvent.

If there are holes, keyways, or slots in the work piece that are to remain "as is", they should be plugged during grit blasting with wood. To prevent their being sprayed, they should be plugged again, with carbon. The top surface of the carbon plug should be level with the desired height of the finished overlay.

Often there are surface areas, adjacent to where metal spraying is to be done, that must be kept free of any sprayed deposit. Nicrobraz® Green Stop-Off™ may be applied to these areas by brushing or dipping. This is a surface active material that prevents bonding. It is a lacquer-base liquid and the residue may be removed by grit blasting, wire brushing, polishing or pickling. A similar water-based material is also available.

2. Pre-heat:

Pre-heating is a function of the base metal. Please see SW-2.

3. Spraying:

The spraying operation (figure 5-2) should proceed as follows (refer to section 4 for operating instructions):

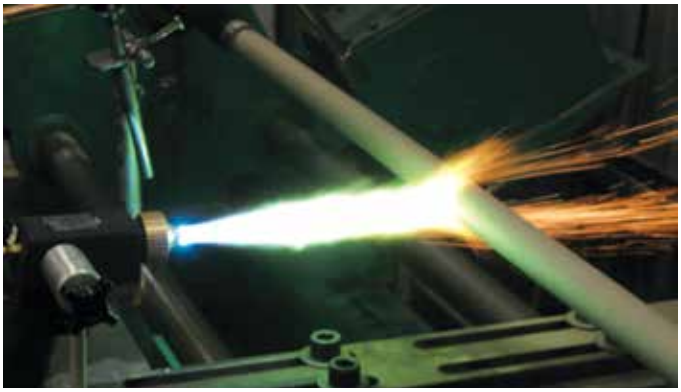


Figure 5-2. Spraying the overlay.

In standard operation, the tip of the outer flame envelope is usually held about 25.4 mm (1") from the work surface. However, the base metal, diameter, or geometry of the part might require that this distance be modified. The distance from work surface to gun tip falls in the range of 200 - 280 mm (8 - 11"). Users of earlier Spraywelder™ models should follow directions on the hopper panel. The gun may be mechanically or hand-held. The essential thing is to produce a uniform overlay which will require a minimum of finishing. The part should be rotated at about 30 - 37 M/min (100 to 120 SFM). Multiple passes are best; apply thin layers 0.05 to 0.25 mm (0.002" to 0.010") for best results.

In figuring the thickness of the sprayed overlay, allowance should be made for 20% shrinkage upon fusing. The part sprayed will tend to expand from the heat of the gun flame and allowance must be made for this expansion. It is best to check a wall thickness for reference rather than the diameter whenever a

tubular part is being processed.

An allowance of at least 0.25 mm (.010") per side for finishing should be made.

Example 0.9 mm (0.10") radial undercut requiring:

+ .025 mm (0.10") allowance for finish
  1.55 mm (.045")
  .018 mm (.009") allowance for 20% shrinkage on fusing
  1.33 mm (.054")
+ 0.13 mm (.005") safety factor
  1.46 mm (.059") Total before fusing

The part should be pre-heated to about 205-260°C (400 to 500°F) when working under the following conditions: when spraying internal diameters, when spraying heavy sections, and when spraying heavy deposits. This precaution will prevent cracking of the sprayed mechanical bond. Fuse immediately after spraying.

4. Fusing the Colmonoy® Overlay:

Fusing (figure 5-3) can be accomplished in one of several ways. Regardless of the method used, the principle involved is to bring the Colmonoy® overlay and base surface under it to a temperature range of 1010 - 1120°C (1850°F - 2050°F) at which point it will wet and bond to the base metal without losing its shape or running. Cylindrical parts should be turned at approximately 6 - 15 M/min (20 - 50 SFM), depending on part diameter and thickness of overlay. The various equipment and methods which can be used are:

OXYACETYLENE TORCH is the preferred method. Use a multi-flame tip which produces a soft bushy flame.Adjust to neutral flame. If the part is cylindrical, and its entire surface is overlaid, start at the end farthest from the chuck that holds the part. Hold the torch flame 45° to axis of the work during the entire fusing process so that the heat is "driven' toward the secured end. Preheat slowly until the overlay reaches a dull red color (minimum of 705°C (1300°F)). Then move the torch closer to the surface and heat to the fusing temperature. The overlay will assume a shiny, glassy appearance: the torch should be moved just ahead of the shiny surface until the whole overlay is fused.

Torch movement should be constant; slowly enough to heat the overlay to its bonding temperature but fast enough to prevent too much heat being applied in one place, which would cause the overlay to sag.

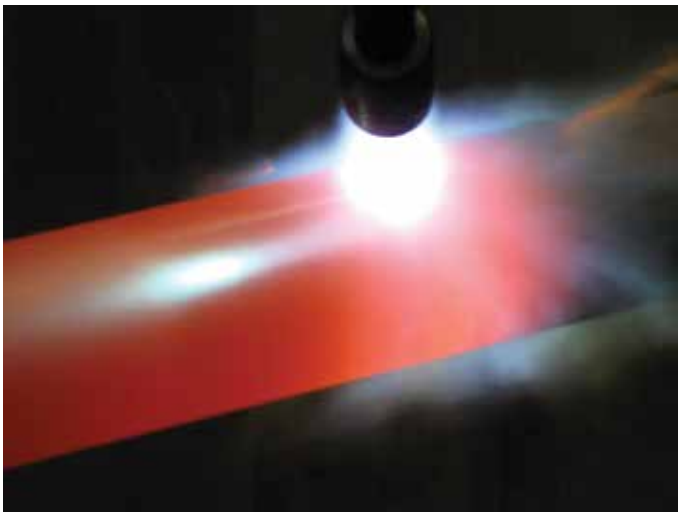


Figure 5-3. Fusing the overlay.

If the overlay does not extend to the end of the workpiece, start heating about 50 mm (2") away from the overlay, to insure full heat penetration of the base metal and prevent the overlay from rolling back as it is heated. Then, concentrate the heat on the beginning of the overlay. This fusion method is very easy to learn and one or two practice parts will be sufficient to insure proficiency.

CONTROLLED ATMOSPHERE FURNACE In this method the sprayed part is put in a furnace having a neutral or reducing atmosphere, at a temperature of approximately 1025 to 1095°C (1875 to 2000°F). The exact temperature and degree of control required depends on the atmosphere being used and the position of the sprayed surface. Only pure, dry hydrogen is recommended as the furnace atmosphere. It is advisable to watch the part (if possible) through the furnace peep hole and when the overlay assumes a glassy appearance, the part should be carefully removed. This method is used on parts with irregular cross section where the torch method is not practical.

It is best to work out a temperature and time cycle using a simulated work piece, prior to furnace fusing the production work. This is advisable because different types and purity of atmosphere will require slightly different time and temperature combinations. Also the fusing temperature of an alloy may vary slightly from one lot to the next.

INDUCTION if equipment is available and a number of the same parts are to be fused, this method can be used.

SPECIAL FUSING PROCEDURES To eliminate porosity in the center areas of overlays on cast iron or steel parts of heavy cross section, the fusing should be done in one of the following ways:

1. On large, flat parts, start at an outside edge and fuse approximately 13 mm (0.5") from edge, and all around the perimeter. The fusing flame should then be transferred to the center of the sprayed area, and fusion started there. Fusion should proceed outwards until it blends into the area first fused.

2. Large, irregular surfaced parts should be pre-heated in a furnace. Heat as quickly as possible, bringing the part to between 1000 to 1200°F (540 to 650°C). Fuse immediately upon removing with a multi-flame oxyacetylene torch. Use extra torches to maintain the amount of preheat and to speed fusing.

3. Sprayweld™ powders containing particles of tungsten carbide do not clearly show, by the typical "glassy look", when they are actually fusing to the base metal. The danger is that, in missing that visual signal, too much heat is applied causing the overlay to sag. One way to provide that signal is to spray a light coat of Spraywelder™ powder containing no tungsten carbide over the sprayed overlay. Use Colmonoy® 6 over Colmonoy® 75. Use Wallex™ 50 over Wallex™ 55.

Inspection by Heat Checking

To assure that the overlay has been properly bonded, it is advisable to "heat check" all parts. This test is used to determine whether or not the operator has fused the Spraywelder™ powder sufficiently to effect a complete bond with the base metal. Protective glasses must be worn. The heat checking method is as follows:

1. The part to be checked should be at room temperature.

2. Set it up in turning fixture if surface to be checked is cylindrical.

3. The oxyacetylene torch flame is momentarily passed over the surface of the rotating part. Use the same size multi-flame tip required for the fusion operation and have the cone of the flame almost touching the Spraywelder™ powder overlay. The torch should be moved along at the rate of about 1 inch per second. The "heat checking," in effect, sets up a momentary thermal stress in the Spraywelder™ powder overlay and if it is not bonded, it will break loose from the base metal. If no cracking occurs in the overlay, the bond is satisfactory.

5. Finishing

The Spraywelder™ powder overlay should be finished as follows:

MACHINING Colmonoy® 6 and 72 can be machined using cubic boron nitride tools, such as GE's BZN compacts (BRNG-43T) or Kennametal's CNMA 433KC-210. Use a negative rake tool with 15° lead angle. Should have a 19.05 mm (0.75") radius and T-land edge. Set tool at centerline of work. Feed at 0.0127 - 0.254 mm per revolution (0.0005 – 0.010 inches per revolution), depth of cut up to 0.762 mm (0.030"), at least 61 - 91 M/min (200 - 300 SFM).

All other alloy grades (except those containing tungsten carbide) can be machined with Carboloy 883 or Kennametal K6 tools. Tool should have slight lead and rake angles, and a radius of 0.8 mm (1/32"). Feed about 0.076 mm per revolution (0.003 inches per revolution), depth of cut about 0.38 mm (0.015"), at 4.5 to 13.7 M/min (15 to 45 SFM). Machining can produce a 0.3 to 0.4 µm (12 to 16-microinch) finish. The last 0.13 mm (0.005") can be ground, to produce a 0.1 to 0.3 µm (4 to 12-microinch) finish.

GRINDING All Spraywelder™ powder deposits can be ground. Use green silicon carbide grinding wheels of H, I or J hardness. Wet grinding is recommended. For roughing use 24-grit wheels. For finishing use 60-grit or finer. Refer to Technical Data Sheet Tech-2 for wheel recommendations.

LAPPING The nickel-based and cobalt-based alloys can be given a 0.05 µm (2-microinch) finish by dry lapping. Silicon carbide, boron carbide, and diamond dust will do the cutting job. They must be imbedded in a cast iron or steel wheel. Used loose, they will cut the nickel matrix before the chromium borides and carbides, giving the surface an etched appearance. Apply with a steady pressure and avoid overheating.

Updated August 2018

SECTION 6
NOTES ON BASE METALS

GENERAL

6-A. Many metals can be hard surfaced by the Sprayweld™ Process without special precautions. Others require special preheating or special cooling procedures to prevent cracking of the Spraywelder™ powder overlay.

METALS AND PRECAUTIONS

6-B. The following are partial lists of metals that can be overlaid without special precautions:

S.A.E. Steels below 0.25% Carbon Content:

1000 Series	5000 Series
1200 Series	5100 Series
1300 Series	6100 Series
4000 Series	8600 Series
4100 Series	8700 Series

405 Stainless Series
430 Stainless Series (Carbon .10% max.)

Irons and Non-ferrous Metals:

Gray Cast Iron	Nickel
Meehanite Iron	Monel Alloy 400
Malleable Iron	Inconel Alloy 600
Ingot Iron	Nichrome
Wrought Iron	Chromel
Copper	Most high-temp. alloys

6-C. The Austenitic 300-series stainless steels may be overlaid, but they have a high coefficient of expansion. Thus, it is advisable to preheat these steels to about 315-370°C (600-700°F) prior to spraying. This will expand the part sufficiently to prevent subsequent expansion or contraction from breaking the mechanical bond prior to fusing. The fusing of these steels is best done immediately after spraying. As they require more heat, it is important to be certain enough heat is applied to the part adjacent to the sprayed overlay before commencing to fuse it.

NOTE: 303 stainless steel and other "free machining" metals (sulphur, manganese, phosphorus, lead, or selenium-bearing) are not sprayable. 321 stainless steel and other titanium or aluminum-bearing alloys are not sprayable.

6-D. When the carbon content is above 0.25%, as in the following list of steels, the part will require a 260-370°C (500-700°F) preheat prior to fusing the Spraywelder™ powder deposit, and slow cooling after fusion:

S.A.E. Steels above 0.25% carbon content:

1000 Series	5100 Series
1200 Series	5200 Series
1300 Series	6100 Series
4000 Series	8600 Series
4100 Series	8700 Series
5000 Series	9200 Series

6-E. Air-hardening tool steels and the S.A.E. 400 Series martensitic stainless steels (except 414, 421 & 431) can be hard surfaced easily by the Sprayweld™ Process. However, these metals require preheating prior to fusing the overlay, and an isothermal cooling cycle after fusion to prevent the overlay from cracking. Read more about these requirements in Technical Data Sheet SW-3.

6-F. Our Metallurgical Department will be happy to give specific recommendations on your particular applications.

HARD SURFACING OVER SPRAYWELDER™ POWDER DEPOSITS

6-G. In many cases, it will be necessary to apply a Spraywelder™ alloy over an existing Spraywelder™ powder deposit, especially on hard-surfaced parts that have been in service. The steps are:

a. Be certain the part is clean, and all oxide is removed. Machining or grinding should accomplish this.

b. Heat the deposit, or a workable section of it, to about 815°C (1500°F) (a medium red heat, under average interior light conditions).

c. Immediately spray the heated area with a light coat. Repeat heating and spraying as necessary to accomplish a first coat.

d. Proceed with building up the sprayed overlay in the normal way.

e. Fuse immediately, using normal procedures.

6-H. Should it be necessary to remove a Spraywelder™ powder deposit, it can be done by grinding or machining it off. An overlay can be heated to the melting point and scrubbed off with a wire brush, but grinding would still be necessary to produce a clean base metal surface.

HARD SURFACING OF AGE HARDENABLE BASE METALS WITH COLMONOY® NICKEL-BASED ALLOYS

6-I. Much effort has been done over the years at Wall Colmonoy to develop specific overlay procedures on these alloys. This guide is compiled to gather all of this information and provide you with a reference source for future use.

6-J. Some general facts and rules for consideration:

1. All age hardenable alloys cannot be lumped into a group as such.

2. They all contain copper, aluminium and titanium either alone or in combination and in varying amounts (less than 0.1% presents no problems).

3. When aluminium is the predominating element, we can overlay if the grit blasted surface is treated in one of two ways. Either a hot acid pickling solution (66°C (150°F), 20% HCL & 5% HNO) or an electrolytic plating of 0.025 mm (.001") nickel will allow a spray and fuse coating to be applied. Oxy-acet rod welding with the addition of 6-20 flux is also possible.

4, When titanium is the predominating element, we can overlay if the grit blasted surface is Electrolytically plated with 0.025 mm (.001") of nickel. Also, oxy-acet rod welding with 6-20 flux is feasible.

5. When copper is the predominating element, spraying is accomplished in the same manner used on austenitic stainless steels. Again, oxy-acet rod welding with 6-20 flux is recommended.

6. Age hardened steels harden over a wider hardness range, usually 10 points Rockwell C as compared with 4 points Rockwell C for quench hardening steels. The reason the hardness range is so wide is that the harness obtained after hardening is not predictable to any closer limits.

6-K. As a general rule, the austenitic grades of age hardenable alloys should be treated the same as the 300 series of stainless steels because of the high expansion on heating and contraction on cooling. Diameters less than 1" cannot normally be hardfaced without bond problems. Most martensitic types expand very much during cooling, after fusion of the overlay, with resultant cracking of the overlay material. Two examples of the latter are 17-4PH and 17-7PH. When heated above 760°C (1400°F) and allowed to cool, they expand 0.13 mm per mm (.005" per inch) during cooling from 120 to 20°C (250°F to 70°F). Overlays on these two alloys will always crack during cooling. Please refer to SW-3 for additional information and familiarize yourself with the Isothermal Transformation diagrams and how to use them.

WELDABILITY CHART*
COLMONOY® NICKEL-BASED ALLOYS

Trade Name or Specification No.	Sprayweld™/Rod	Application
NICKEL-BASED ALLOYS		
Inconel "M"	Yes[2]	Yes
Inconel "X"	Yes[3]	Yes
Inconel "W"	Yes[3]	Yes[1]
Duranickel ("Z" Nickel)	Yes[3]	Yes
Duranickel "R"	Yes[3]	Yes
Inco 550	Yes[3]	Yes
Nimonic "90"	Yes[3]	Yes
Refractaloy	Yes[3]	Yes
Rene 95	Yes[3]	Yes
Nimonic "80" & "80A"	Yes[3]	Yes
K-42-B	Yes[2]	Yes
"K" Monel	Yes[3]	Yes
"KR" Monel	Yes[3]	Yes
Permanickel	Yes[2]	Yes
Hastelloy "C"	Yes[2]	Yes
Udimet 500	Yes[3]	Yes
M 252	Yes[3]	Yes
Inconel 700, 718	Yes[3]	Yes
IRON-BASED ALLOYS		
USS Stainless-W	Yes[2]	Yes
17-7 PH	Yes[2]	Yes[1]
17-4 PH	Yes	Yes[1]
A-286-Tinidur-AMS 5735	Yes[2]	Yes
Donegal DC-50	Yes	Yes
Allegheny Metal 350	Yes	Yes
Allegheny Ludlum S-590	Yes	Yes
Armco 22-4-9	Yes[3]	Yes
Discaloy	Yes[2]	Yes
COBALT-BASED ALLOYS		
Stellite No. 21	Yes[2]	Yes
Refractaloy 70	Yes[2]	Yes
Allegheny S-816	Yes[2]	Yes
Refractaloy 80	Yes[2]	Yes
Cobenium	Yes[2]	Yes
Alloy X-40	Yes[2]	Yes
G.E. Alloy J-1570	Yes[2]	Yes

* Oxy-Acet with flux or GTAW with appropriate pre-heat.

* This chart is not complete. When in doubt, obtain complete chemical analysis from customer.

* This chart indicates weldability only and does not indicate whether the harder trades of Colmonoy® will crack when the part is cooled to room temperature after surfacing.

1. Avoid heating base metal over 926°C (1700°F) for a prolonged period of time or bubbling and porous deposits will result.

2. Spray a light coating over entire surface to be sprayed to prevent oxidation of base metal during subsequent spraying for build-up.

3. Plate 0.03 mm (0.001") of nickel on grit blasted surface prior to spraying.

Powder Metallizing Process

Applying SoloCoat™ (1-step) Powders

Preparation

Cleaning and masking

The worn section to be coated must be free of grease and oil. If necessary, sand lightly to remove dust and oxides. Adjacent areas not to be coated should be protected by masking Nicrobraz® Green Stop-Off™ Type II or other effective material.

The Nicrobraz® Green Stop-Off™ is applied with a small brush, while the workpiece is turning (as in a lathe). Dip the brush into the Nicrobraz® Green Stop-Off™ and hold it to the underside of the rotating part. Start about three inches from the area to be metallized and work inward. Remove the brush when it is within 0.5 in (12.7 mm). of the area to be metallized (figure 1). If any of the Nicrobraz® Green Stop-Off™ smears or runs into the area to be sprayed the contaminated area will have to be wire brushed to fresh metal.

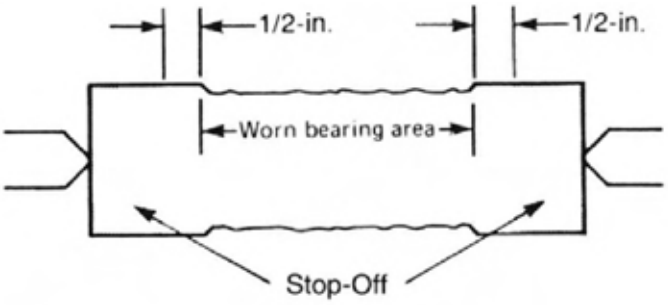


Figure 1. Placement of Nicrobraz® Green Stop-Off™

Another way to protect selected ares from the metal spray is a technique called shadow masking. A mechanical barrier, such as a piece of steel, is positioned vertically in front of the rotating part so that it shields a chosen area from the sprayed metal (figure 2). There are also commercially available masking tapes designed for thermal spraying.

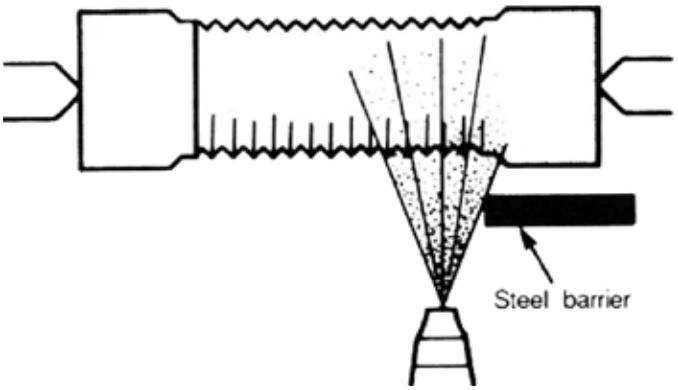


Figure 2. Shadow Masking

Undercutting

It is frequently necessary to produce an even depth of overlay. Use only a sharp 90° tungsten carbide cutting tool so that the shoulders produced will be 45°. DO NOT USE CUTTING COMPOUNDS OR COOLANTS. Undercut to a depth necessary to expose a clean, even surface of unflawed base material. To ensure a sufficient thickness of overlay the minimum undercut depth (per side) is 0.25 mm (0.010").

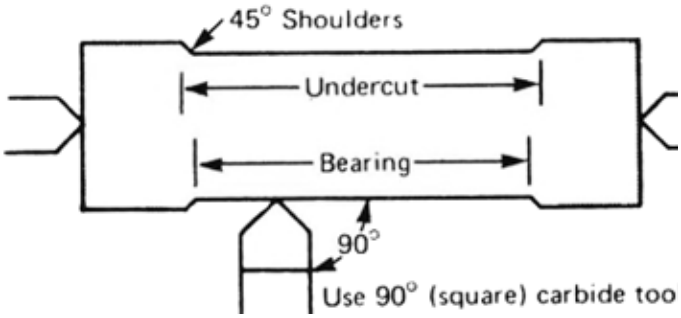


Figure 3. Undercutting worn area

The surface to be coated must be roughened to create an anchor pattern so that the coating will have sufficient bond strength to be usable in service.

Grit blasting is the preferable method to achieve this. A variety of grits can be used to accomplish this (chilled iron, alumina, ilmenite or others so long as they are free of water or oil base contaminants). Alternatively rough-thread the undercut section with the same 90° tool (figure 3), in accordance with the following:

Undercut (Radius)	Threads per mm (inch)
0.381 mm (0.015")	50-70
0.635 mm (0.250")	30-50
1.016 mm (0.040")	20-40
1.270 mm (0.050")	15-30
1.524 mm (0.060")	10-25

Leave a shoulder on each side if possible. Remove any burrs with a stainless steel wire brush. If work must be handled prior to spraying it should be wrapped with clean paper first to keep it free of grease or finger marks. Spray as soon as possible after threading to avoid development of oxides. Prepared parts should be coated within 4 to 8 hours. If parts cannot be coated within this time frame the final surface preparation should be delayed until such is feasible.

If there's any doubt about the cleanliness of the surface, it should be washed by flooding with an approved non-toxic, non-residue, non-petroleum-base solvent and brushing with a stiff bristle or stainless wire brush.

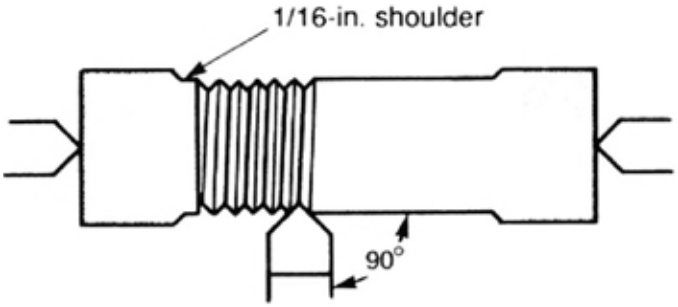
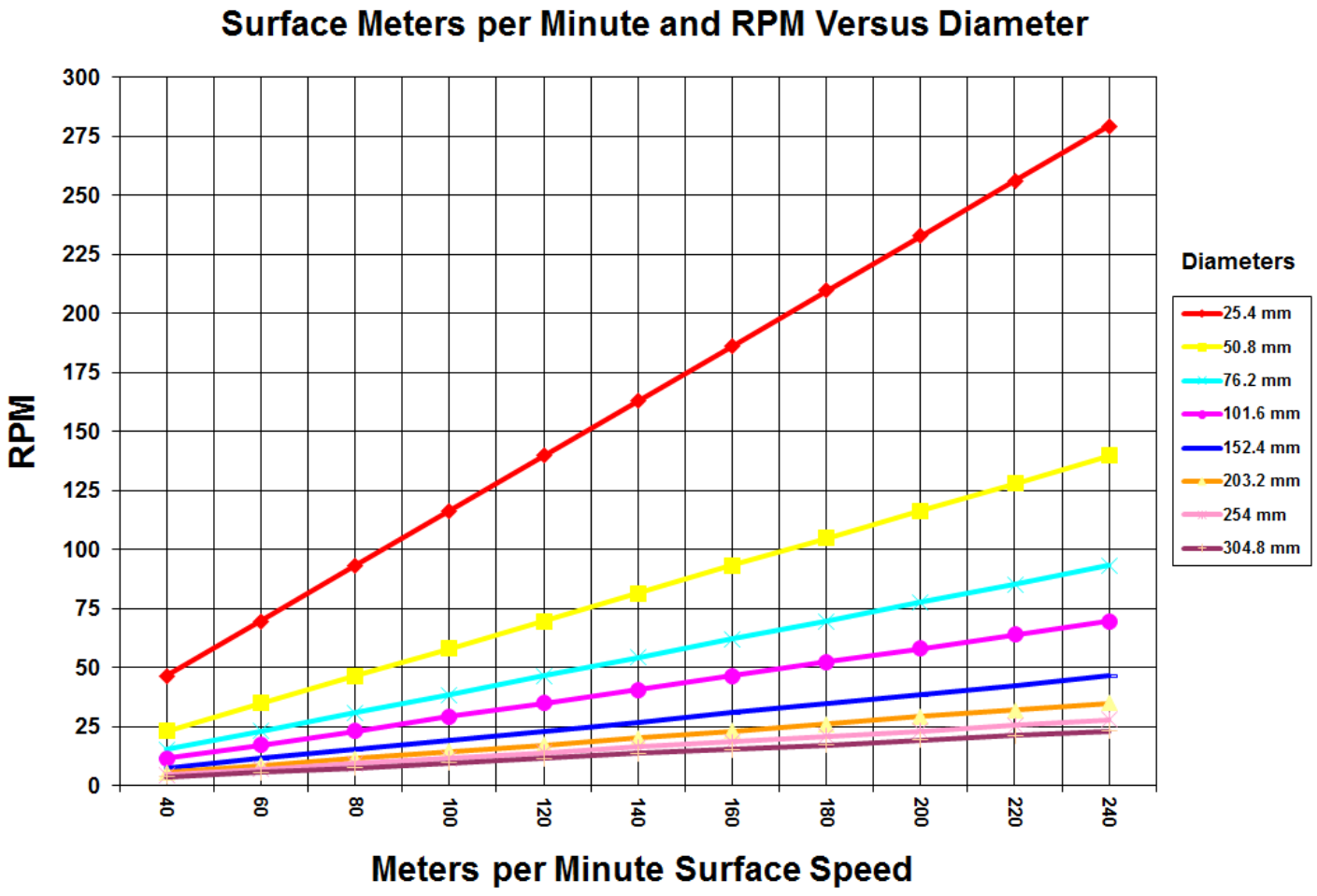


Figure 4. Rough threading

Turning rates

Parts should be turned at a rate that achieves a surface speed greater than 30 meters per minute (100 surface feet per minute). For very small diameter parts slower speeds can be used but exceptional care must be taken not to over heat the part during coating. The following table can be used as a guide:



The traverse rate should be adjusted to give you approximately 0.050 to 0.152 mm (0.002 to 0.006 inch) of deposit per pass (per side). This is generally achieved at 3.18 to 6.35 mm (0.125 to 0.25 inches) per revolution.

Preheating
The area to be coated should be preheated to at least 90°C (200°F) but not more than 175°C (350°F), with the workpiece turning at the suggested speed. Monitoring preheat and maximum temperature during coating is critical to success. An appropriate contact or infrared pyrometer is recommended.

Spraying
Apply SoloCoat alloys using the spray parameters shown in the Spraywelder™ System operating manual.

Applying SoloCoat™ one-step metallizing powders:
Adjust the Spraywelder™ to the appropriate parameter settings according to the operating manual. Begin at one end of the prepared area and work toward the other, moving in on direction only (to reduce heat input). Spray beyond the threaded area at both ends, by 12.7 to 25.4 mm (1/2 to 1 inch). SoloCoat alloys should be applied to a thickness of 0.25 mm (0.010") per side beyond the final dimensions, to allow for finish machining.

Preventing cracks
Workpieces having heavy sections and not requiring more than 1.27 mm (0.05") thick overlay generally absorb and dissipate heat fast enough from the overlay to avoid oxidizing, cracking, or even melting of the deposit. While these dangers can of course be avoided on any work by waiting long enough between passes, dry, compressed air can be used to cool the deposit sufficiently to allow continuous spraying. Overheating must be avoided. Do not exceed 260°C (500°F).

On round pieces a stream of dry, compressed air can be directed on the deposit, directly opposite the spray stream. On flat pieces an air stream can be directed on the opposite side of the piece. Cooling air can be blown through tubular work. When several pieces, or different areas on the same large piece are to be built up, spray a pass on each area in turn, allowing each to cool before returning to it again.

Finish Machining
The machining of SoloCoat coatings must be done with carbide tools. On plain surfaces, that is, those with no flats, keyways, or holes, etc., a suitable turning speed cross feed so as to minimize tool wear (slower is generally better) and provides the desired surface finish depending on the SoloCoat alloy being used. Properly applied coatings do not have flash (a heavier build-up at the coating edge.) If there is flash present, chamfer it by infeeding the tool at 45°, while transferring cut by hand, back and forth, until the flashing breaks away. Repeat this procedure at the opposite end, if necessary (figure 5).

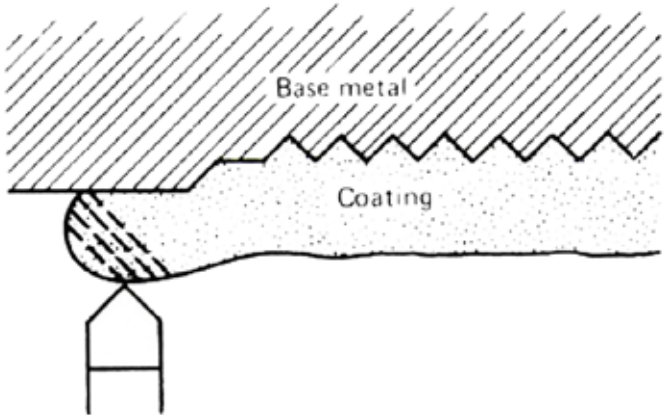


Figure 5. Remove any flash first

With flashing removed at both ends, machine off any remaining high spots. Work from the midpoint of the coated area, toward the ends (figure 6)

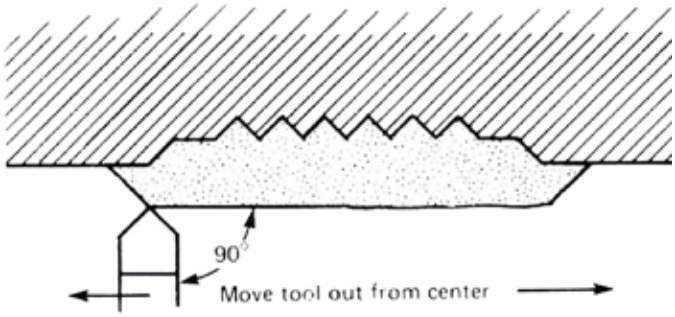


Figure 6. Rough Machining

when the overlay thickness is fairly uniform, (but still not flush with the base metal) perform a full longitudal traverse cut with a light infeed (<0.127 mm (0.005") on radius) (figure 7).

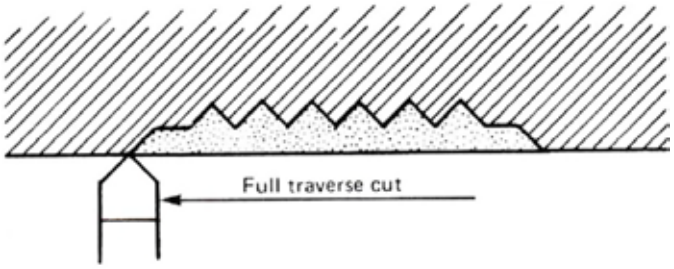


Figure 7. Final finishing

When there are flats, keyways, or holes in the surface, more care is required in finishing by turning. The movement of the file or grinding wheel should always be "into" the work; avoid creating any lifting action that might pull the coating away. (The chamfering is done to make such action less likely when finishing on the lathe.) Chamfering should go down to the base metal (figure 8).

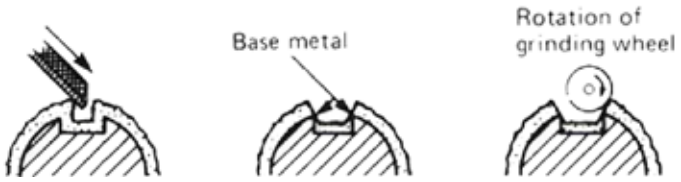
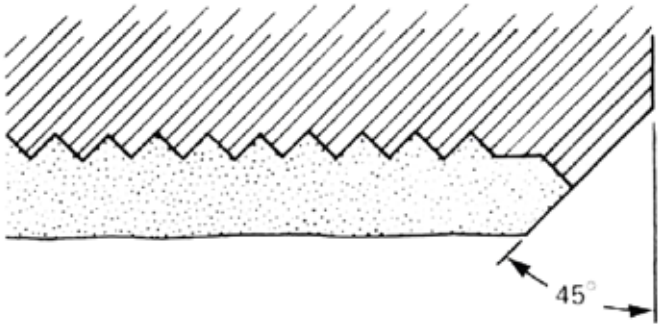


Figure 8. Chamfering keyway edges

To keep keyways and holes free of sprayed metal you can protect them with Nicrobraz® Green Stop-Off™ (being very careful about misplacement). Or you can plug them with a graphite or other "dummy plug" before spraying (the dummy key or plug should not stand much above the final sprayed surface). Remove any plugs used, before chamfering the edges, as described above.

When doing shaft ends it is best to leave a shoulder at the shaft end when undercutting prior to spraying, especially if there is bearing pressure all the way to the end, in service. In finishing such an application follow the instructions above. After step-chamfering, the shaft should look like the drawing (figure 9).



Safety:

When handling powders do so in such a way to avoid creating a dust cloud; avoid inhalation or contact with skin or eyes. Conduct coating operations in a properly ventilated area. For more information, consult 11.8 (Ventilation), AWS Thermal Spraying: Practice, Theory, and Application available from American Welding Society, OSHA Safety and Health Standards available from U.S. Government Printing Office, and the manufacturer's Material Safety Data Sheet (MSDS).

Warning: Thermal spray torches and heating torches used for application of this product utilize compressed gases including oxygen and a flammable fuel gas. Follow your employers safety procedures when using and handling these gases and equipment. Infrared and ultraviolet radiation (light) emitted from flame and hot metal can injure eyes and burn skin. Use appropriate personal protective equipment.

Storage Requirements:

Keep thermal spray powders in a closed container and protect against moisture pick-up. The containers should be tumbled before using the powder. If moisture is absorbed from the atmosphere, it can be removed and flowability can be restored by drying the powder, with the seal removed and lid loosened, at 66-93°C (150-200°F)for two hours prior to use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s).
Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

updated August 2018

SECTION 8
CARE AND MAINTENANCE

GENERAL
8-A. This section outlines care and maintenance procedures for the Spraywelder™ system.

CLEANING OR CHANGING TIPS
8-B. To clean or change nozzles on the pistol, proceed as follows:

a. Position the pistol so it is pointing straight up. This can be done right at the spraying location, while it's mounted on the tool post holder, or in a vise. If a vise is used, position pistol so that the vice grips the flat area of the gas head, not the pistol body.

b. Unscrew air cap from the gas head. It should only be hand tight.

c. Remove air cap, nozzle, and gas mixer, clean out the air holes, gas holes and powder holes with a piece of wire or with the small brass wire brush found in the tip cleaner kit. Never use a large wire brush to clean the nozzle.

d. Replace used O-rings with new ones. Reassemble O-rings and the cleaned (or new) gas mixer. Place the nozzle onto the gas mixer, and the assembly into the gas head.

e. Place air cap over gas head and tighten, by hand, until slight resistance is felt against the O-rings. Do not use a wrench.

AVOID MOISTURE IN POWDER HOSE
8-C. Clogging can be minimized by avoiding moisture in the powder hose.

a. If at some time the powder does not flow freely, remove the powder hose and blow it out with clean, dry air.

b. A filter-regulator unit should be installed in the air supply line. If the Spraywelder™ is used daily the filter drain should be opened once a day to remove water. When it is observed that the filter element requires changing, remove and clean bowl, and install a replacement cartridge.

CARE OF POWDER
8-D. Always keep lids on powder cams and store in warm dry place. When finished spraying for the day, the powder should be removed from the hopper and placed in proper can. Also blow out powder hose on unit.

REPAIRING THE SPRAYWELDER™
8-E. The Spraywelder™ is designed so that the user can make most necessary repairs. If the unit requires repair beyond the users capability, it may be returned to the factory. Charges are nominal.

The user is cautioned to use only Model J-3 nozzles with the Model J-3 pistol. Use of nozzles from earlier models will cause internal powder blockage.

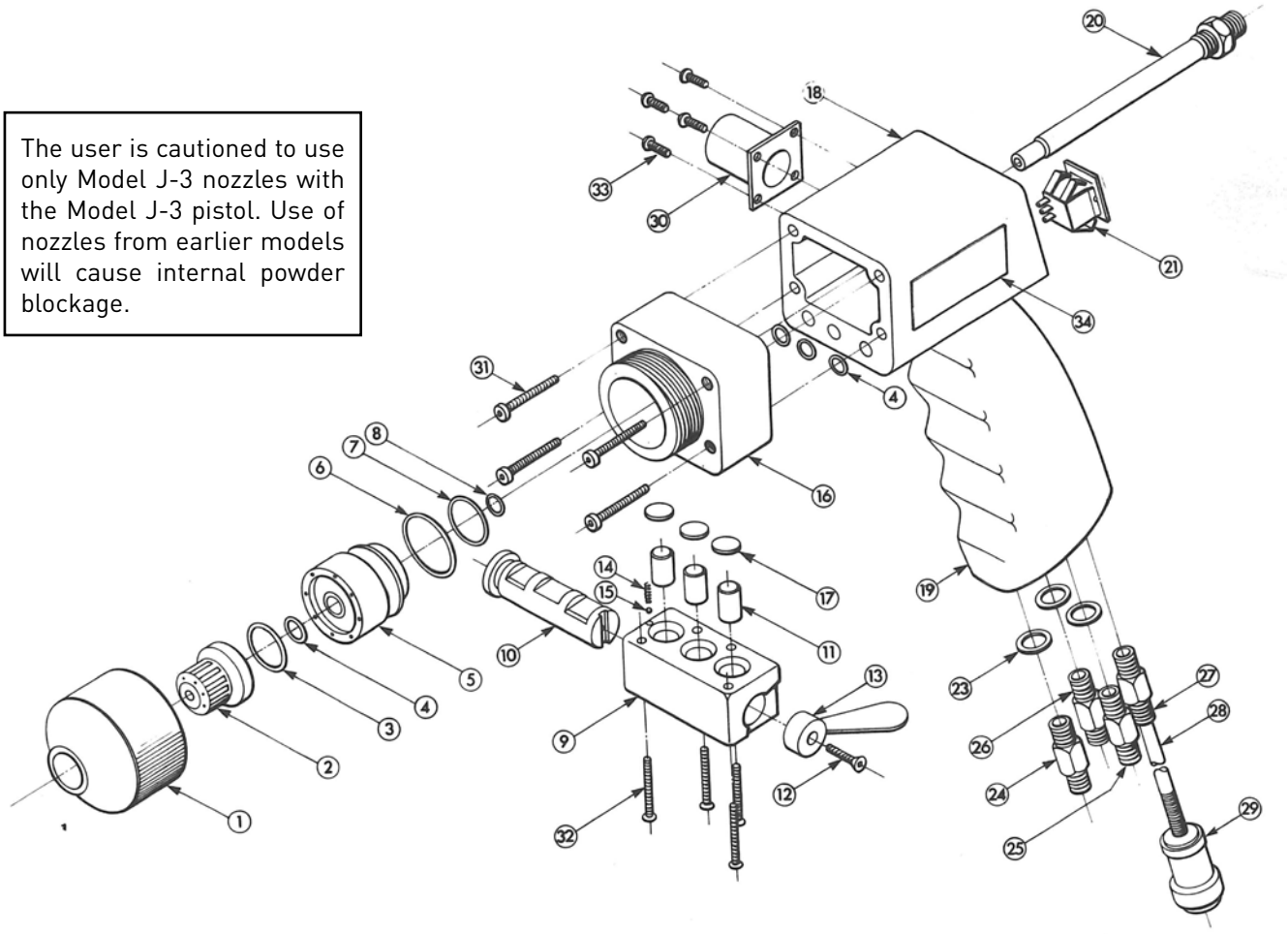
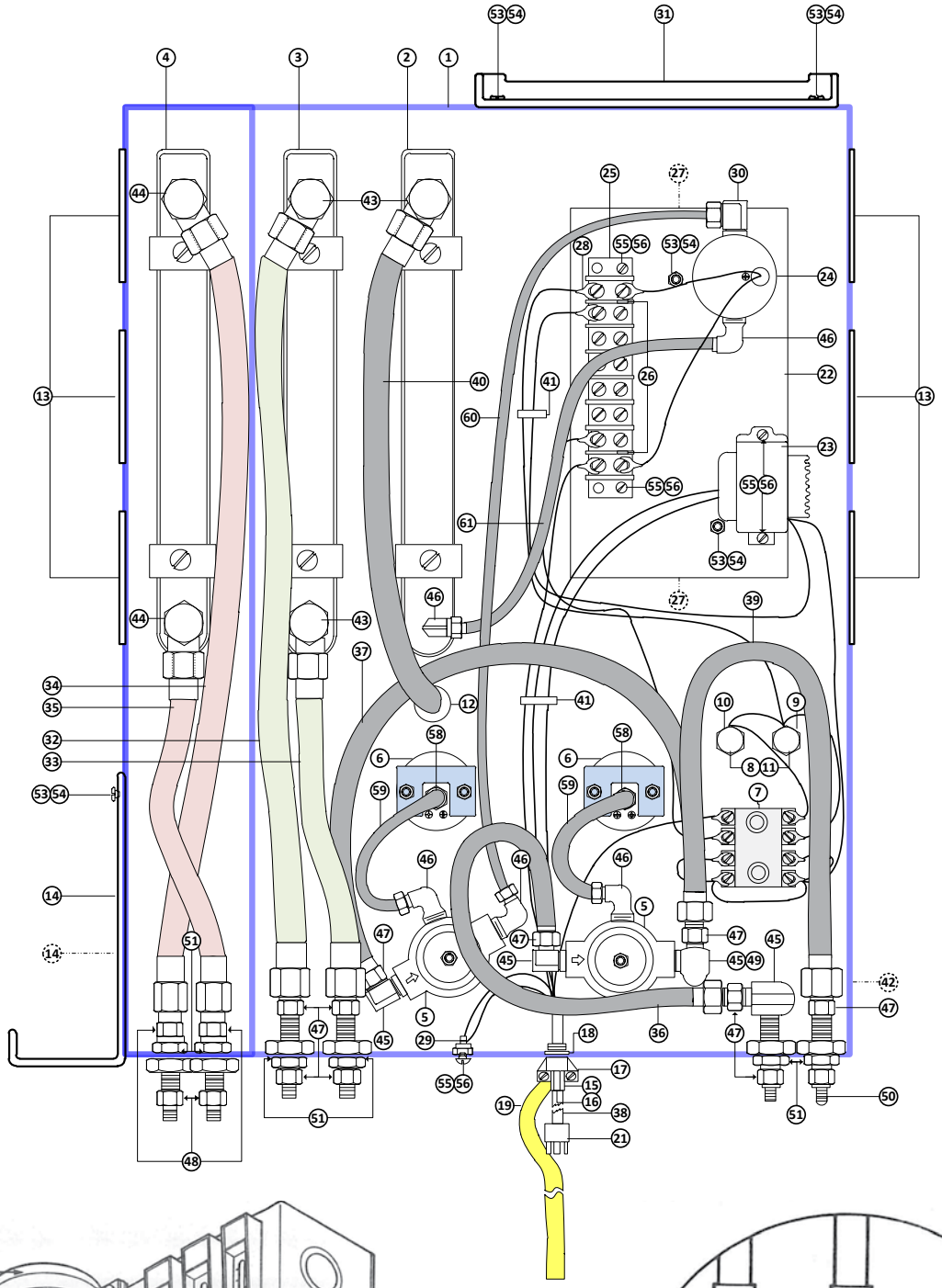
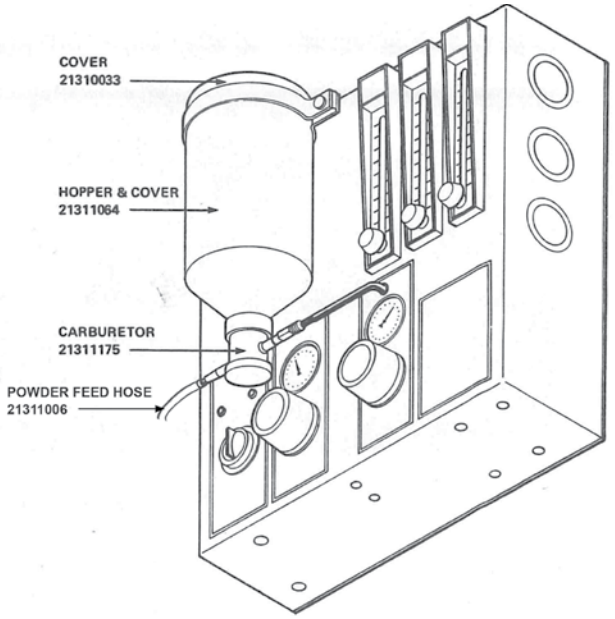


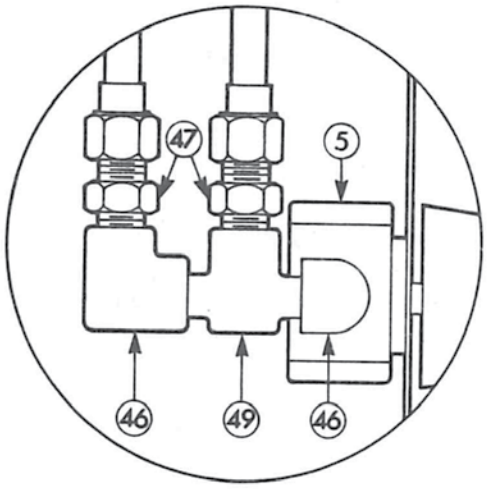
Figure 8-1
PISTOL PARTS LIST

Item	Part No.	No. Req.	Description
1	21311183	1	Air cap
2	21311184	1	Nozzle No. J-3A
2	21311185	1	Nozzle No. J-3B
2	21311186	1	Nozzle No. J-3C
2	21311187	1	Nozzle No. J-3D
2	21311197	1	Nozzle No. J-3BLF
3	21311019	1	O-Ring 2-018*
4	21311018	4	O-Ring 2-009*
5	21311182	1	Mixer, Gas
6	21311022	1	O-Ring 2-022*
7	21311021	1	O-Ring 2-017*
8	21311020	1	O-Ring 2-010*
9	21311026	1	Housing, Gas Valve
10	21311028	1	Camshaft, Valve
11	21311035	3	Tappet; Air, Oxygen, Fuel Gas
12	21311030	1	Cap Screw, Flat Head M3 x 10
13	21311029	1	Handle, Valve
14	21311031	1	Spring, Detent
15	21311032	1	Ball, Detent
16	21311181	1	Gas Head
17	21311024	3	Diaphragm
18	21311039	1	Main Body Assembly
19	21311052	1	Handle Grip, Tubing
20	21311040	1	Powder Tube, Complete
21	21311041	1	Switch, Powder Control
23	21311049	3	Washer, Nylon
24	21311048	1	Air Fitting
25	21311046	1	Oxygen Fitting
26	21311047	1	Fuel Gas Fitting
27	21311045	1	Cable Fitting
28	21311043 01	1	Cable, Powder Control
29	21311042	1	OBSOLETE
30	21311050	1	Support, Tool Post Holder
31	21311025	4	Cap Screw Socket Head M5 x30
32	21311027	4	Cap Screw Socket Head M3 x25
33	21311051	4	Cap Screw Socket Head 8-32 x5
34	21311053	1	Name Tag "Model J-3"

*Available as O-Ring Kit 21311023







VIEW A-A

Figure 8-1

Figure 8-1
PANEL PARTS LIST

Item	Part No.	No. Req.	Description
1	21311176	1	Panel
2	21311060	1	Flowmeter, Air
3	21311061	1	Flowmeter, Oxygen
4	21311062	1	Flowmeter, Fuel Gas
5	21311065	2	Air Regulator
6	21311066	2	Air Gauge 0-60 psi
7	21311067	1	Selector Switch
8	21311068	2	Lamp Holder
9	21311069	1	Lens, Green
10	21311070	1	Lens, Amber
11	21311071	2	Lamp Bulbs
12	21311072	1	Grommet
13	21311073	6	Plug Button
14	21311074	1	Bracket, Pistol Holder (Not Shown)
15	21311075	1	Fuseholder (2- if 220V)
16	21311076	1	Fuse, 2 AMP
17	21311077	1	Cable Clamp
18	21311078	1	Strain Relief Bushing
19	21311080 01	1	Cord, 3 Conductor, 24 VAC
20	21311080	1	OBSOLETE
21	21311081	1	Plug, 3 Prong, 120 VAC
22	21311082	1	Mounting Plate (6" x 4")
23	21311083	1	Transformer and Mtg. Bracket
24	21311084	1	Solenoid Valve
25	21311085	1	Terminal Board (8)
26	21311086	2	Jumper, Terminal Board
27	21311087	2	Spacer, Nylon 1/2" x 1/2" (Not Shown)
28	21311088	19	Spade Terminal Lug
29	21311089	1	Ring Terminal Lug
30	21311113	1	Reducing Elbow 1/4" x 1/8"
31	21311090	1	Hopper Bracket Clamp Assembly
32	21311091	1	Oxygen Hose 1/4" x 12-1/2"
33	21311092	1	Oxygen Hose 1/4" x 7-1/2"
34	21311093	1	Liquid Fuel Hose 1/4" x 12-1/2"
35	21311094	1	Liquid Fuel Hose 1/4" x 7-1/2"
36	21311095	1	Air Hose 1/4" x 19-1/4"
37	21311096	1	Air Hose 1/4" x 17"
38	21311097	1	Cable, 3 Conductor (120 VAC) 15'
39	21311098	1	Air Hose 1/4" x 14"
40	21311099	1	Air Hose 3/16" x 12"
41	21311100	12	Cable Tie
42	21311101	2	Rubber Bumper (Not Shown)
43	21311104	3	#254 Adaptor, L.H.
44	21311105	2	#253 Adaptor, R.H.
45	21311106	6	#269 x 44 x 4 Elbow
46	21311107	5	#3400 x 4 Elbow
47	21311108	11	#32 Bushing, R.H.
48	21311109	4	#33 Bushing, L.H.
49	21311110	1	#3750 x 4 Tee
50	21311111	1	#5205 x 6 Male Connector
51	21311112	6	#W21204 Bulkhead Adaptor
52	21311115	3	OBSOLETE
53	21311116	5	Machine Screw, Pan Head 1/4-20 x 1"
54	21311117	5	Nut 1/4-20
55	21311118	5	Machine Screw, Round Head, 8-32 x 3/4"
56	21311119	5	Nut 8-32
57	21311121	1	#3150 x 2 Plug 1/8"
58	21311122	2	#269 x 44 Elbow 1/8"
59	21311124	2	Poly-Flo Tubing 1/4" O.D. x 6-1/2"
60	21311125	1	Poly-Flo Tubing 1/4" O.D. x 17"
61	21311126	1	Poly-Flo Tubing 1/4" O.D. x 8"

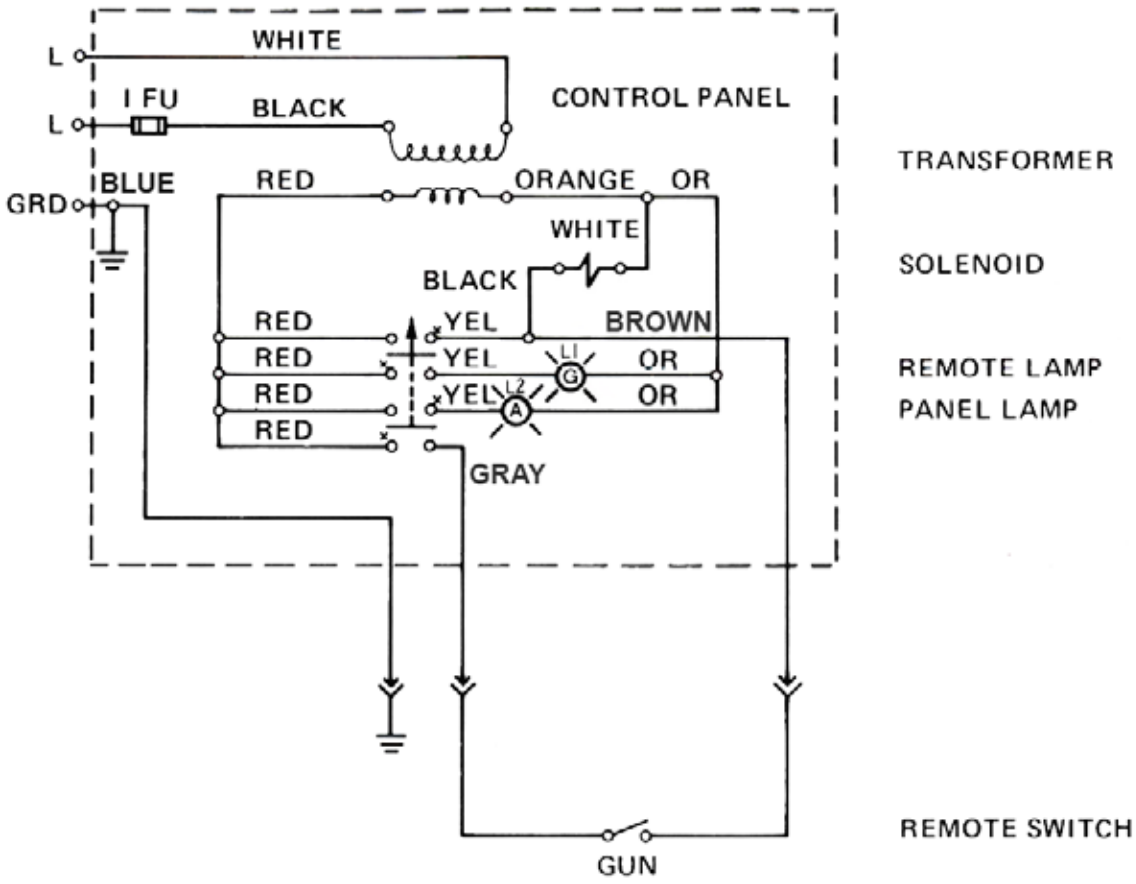


Figure 8-3. Schematic diagram of electrical circuit

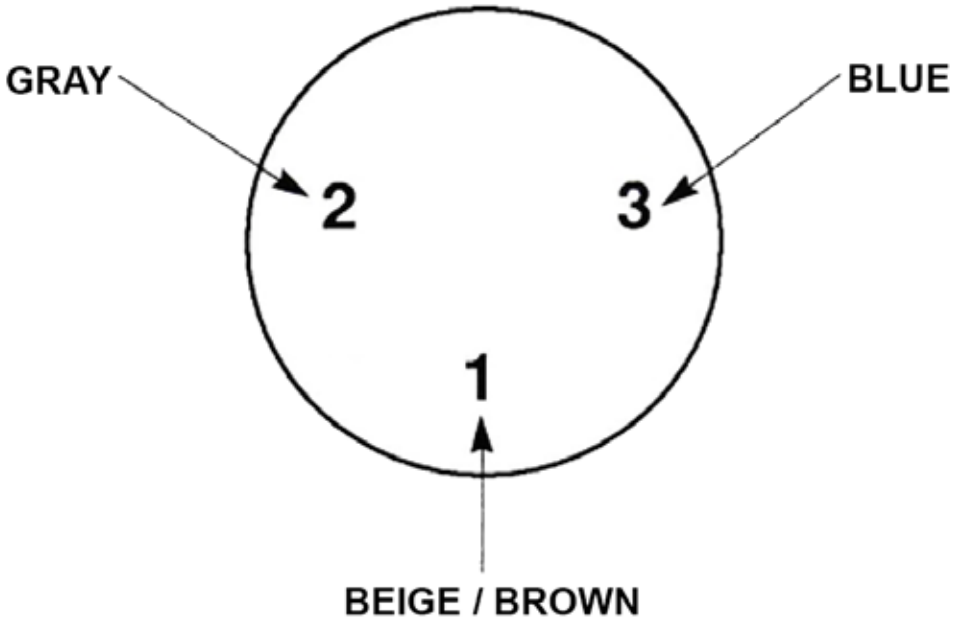


Figure 8-4. Wiring diagram for amphenol connectors (male or female)

TROUBLESHOOTING GUIDE

PROBLEM	PROBABLE CAUSE	REMEDY
No electrical power to unit	1. Power cord not plugged into electrical outlet	1. Plug power cord into 120V outlet (U.S.A. or Canada) or 220V outlet (Great Britain and Europe)
	2. Blown fuse in Spraywelder™ panel	2. Replace 2A Slo-Blo fuse
	3. Power not available at outlet	3. Check plant electrical supply
Erratic flame (fluttering/ crackling)	1. Insufficient cooling air	1. Increase cooling air
	2. Dirty or damaged nozzle	2. Clean or replace nozzle
	3. Dirty mixer, damaged mixer	3. Clean or replace mixer
Popping or blowback	1. Missing or damaged O-rings on mixer	1. Replace O-rings
	2. Carbon build-up in nozzle holes or mixer holes	2. Use tip cleaners - clean out all holes thoroughly
Lack of neutral flame	1. Dirty or damaged nozzle	1. Clean or replace nozzle
	2. Dirty mixer, damaged mixer	2. Clean or replace mixer
	3. Bad oxygen or acetylene regulator	3. Replace oxygen and/or acetylene regulator
	4. Sticking tappets	4. Clean tappets and tappet holes in valve housing
	5. Sticking diaphragms	5. Clean diaphragms and diaphragm pockets in gas head
	6. Diaphragms wrong side up	6. Diaphragms should have green side facing toward the gas head
	7. Oxygen regulator set too low	7. Increase oxygen pressure and readjust oxygen and acetylene flowmeters
	8. Low oxygen and/or acetylene volume	8. Check oxygen and/or acetylene supply
Gas leak or burning between gas head and main body	1. Loose or missing screws in gas head to body	1. Tighten or replace screws
	2. Missing or damaged O-rings between gas head and body	2. Replace O-Rings
No pilot flame	1. Sticking acetylene tappet	1. Clean acetylene tappet and tappet hole in valve housing
	2. Sticking acetylene diaphragm	2. Clean acetylene diaphragm and diaphragm pocket in gas head
	3. Diaphragm wrong side up	3. Diaphragms should have green side facing toward the gas head
	4. No acetylene	4. Check acetylene cylinder volume, check regulator setting, check flowmeter valve is open
Flame extinguishes when 3-way gas valve is moved from "pilot" to "full open"	1. Check acetylene settings on cylinder regulator and/or flow meter (may be too low)	1. Adjust fuel gas settings to operating table recommendations
	2. Sticking acetylene tappet	2. Clean acetylene tappet and tappet hole in valve housing
	3. Sticking acetylene diaphragm	3. Clean or replace acetylene diaphragm
	4. Acetylene diaphragm has taken a set (flattened out)	4. Replace acetylene diaphragm
Gas valve lever difficult to move (or frozen)	1. Dirty or corroded valve shaft and/or valve housing	1. Clean and polish valve shaft and housing
		2. Lubricate with a light film of Silicone grease provided with unit. **Do not use oil on camshaft or tappets!**
No powder flow	1. Empty hopper	1. Place powder in hopper
	2. Damp air	2. Install desiccant dryer in air line
	3. Bad powder switch at pistol	3. Install new powder switch at pistol
	4. Bad amphenol male and/or female connectors in 24V electrical cord from panel to pistol	4. Repair or replace male and/or female amphenol connectors (see figure 8-4)
	5. Bad powder feed switch on panel	5. Replace powder feed switch on panel
	6. Bad solonoid valve - continuous air leak allowing powder to build up in powder hose when powder switch is in "off" position causing blocking of powder hose	6. Replace solonoid valve - send complete panel to factory for re-calibration
	7. Panel set lower than pistol	7. Raise control panel to above pistol level

TROUBLESHOOTING GUIDE (cont'd)

PROBLEM	PROBABLE CAUSE	REMEDY
Low powder flow High Powder flow	1. Plugged carburetor or dirty nozzle 2. Worn or damaged carburetor 3. Low powder rate air settings 4. High powder rate air settings 5. Moisture in air supply	1. Remove blockage and clean carburetor and/or nozzle 2. Replace carburetor 3. Adjust powder rate settings to table 4. Adjust powder rate settings to table 5. Check air filters and/or air dryers
Macro (large) porosity (Powder flow too high for heat available)	1. Using wrong gas settings 2. Using other than recommended nozzle 3. Using powder hose shorter than standard 4. Nozzle powder holes worn too large 5. Worn or damaged carburetor 6. Acetylene cylinder may be low (gauge showing less than 50 psi) causing acetone to form in lines	1. Recheck settings 2. Use only recommended nozzle 3. Use only approved standard length powder hose (unless powder rate settings are adjusted for other than standard length hoses) 4. Replace nozzle 5. To determine this, perform "powder flow rate test" (see below) 6. Change to full acetylene cyclinder. If flowmeter shows discoloration, clean or replace. If pistol nozzle shows lacquer coating around gas holes, clean nozzle.
Micro (small) porosity (powder flow too low for heat available)	1. Using wrong gas settings 2. Using other than recommended nozzle 3. Using powder hose longer than standard 4. Powder hose restriction 5. Damp or wet powder 6. Worn or damaged carburetor 7. Air supply line leakage	1. Recheck settings 2. Use only recommended nozzle 3. Use only approved standard length powder hose (hoses longer than standard length are not recommended) 4. Replace hose and perform "powder flow rate test" (see below) 5. Use only dry powder (check air supply for moisture) 6. To determine this, perform "powder flow rate test" (see below) 7. Check all air line fittings for leaks

HOW TO DETERMINE ACTUAL SPRAY RATE

A key parameter in achieving consistently high-quality sprayed overlays is the powder delivery rate. This variable is a function of the flowability of the powder and the powder air pressure and flowmeter settings. (No mechanical vibration or individual metering orifices are used). The powder air pressure/flowmeter settings for various powder grades are given in the two tables on pages 4-2 and 4-4. These settings are approximate and optimum settings will vary from unit to unit. To determine the optimum settings for a specific unit, it is recommended that actual spray rates be determined upon initial installation to qualify the system. Following is a procedure for doing this:

1. The pistol gas lever will stay in the "off" positions; the test is done without a flame.

2. From the spray tables on pages 4-3 and 4-4 find the correct nozzle and powder spray rate for the powder being used.

3. Use a small empty plastic container to capture the sprayed powder. Weigh it first, using a gram scale (postage scales that measure in ounces are not accurate enough).

4. Put a sufficient amount of the selected powder into the hopper, usually 1.5-3 kg (3-5 lbs).

5. Adjust the powder air regulator and flowmeter to the recommended settings.

6. Turn the pistol powder switch to "on". Allow powder to freeflow momentarily, then capture the spray for exactly five minutes.

7. Weigh the container and contents, subtract container weight, and divide by five. With this grams-per-minute figure, convert to pounds-per-hour, using the table.

8. If actual rate is lower than it should be, increase flowmeter settings one to two gradations. If too high, reduce flow rate.

All materials should be within ±10% of spray rates in the spray tables.

SPRAY RATE CONVERSION TABLE

GRAMS/ MINUTE	POUNDS/ HOUR	OUNCES/ MINUTE	GRAMS/ MINUTE	POUNDS/ HOUR	OUNCES/ MINUTE
15	2.0	.53	61	8	2.1
17	2.2	.59	68	9	2.4
18	2.4	.64	75	10	2.7
20	2.6	.69	83	11	2.9
21	2.8	.75	91	12	3.2
23	3.0	.80	98	13	3.5
24	3.2	.85	106	14	3.7
26	3.4	.91	114	15	4.0
27	3.6	.96	121	16	4.3
29	3.8	1.0	129	17	4.5
30	4.0	1.1	136	18	4.8
34	4.5	1.2	144	19	5.1
38	5.0	1.3	152	20	5.3
42	5.5	1.5	159	21	5.6
46	6.0	1.6	167	22	5.9
49	6.5	1.7	174	23	6.1
53	7.0	1.9	182	24	6.4

SECTION 9
ACCESSORIES

GENERAL

9-A. The following Spraywelder™ accessories are offered:

a. Spraywelder™ pistol extensions
b. Air filter/regulator (supplied as standard)
c. Dual check valve assembly (supplied as standard)
d. Tool post holder
e. Fusing torch handle and tips
f. Gas regulators, Y-connectors, and hoses
g. Grit blast cabinets
h. Spray booths
i. Air dryers

SPRAYWELDER™ PISTOL EXTENSIONS

9-B. Work pieces with internal diameters of 152 mm (6") or more can be effectively sprayed through the use of Spraywelder™ pistol extensions. These are air or water cooled, and are supplied complete with nozzle, air cap, and air cap nut, in standard lengths of 305 and 610 mm (12" and 24"). Special lengths can be furnished to order.

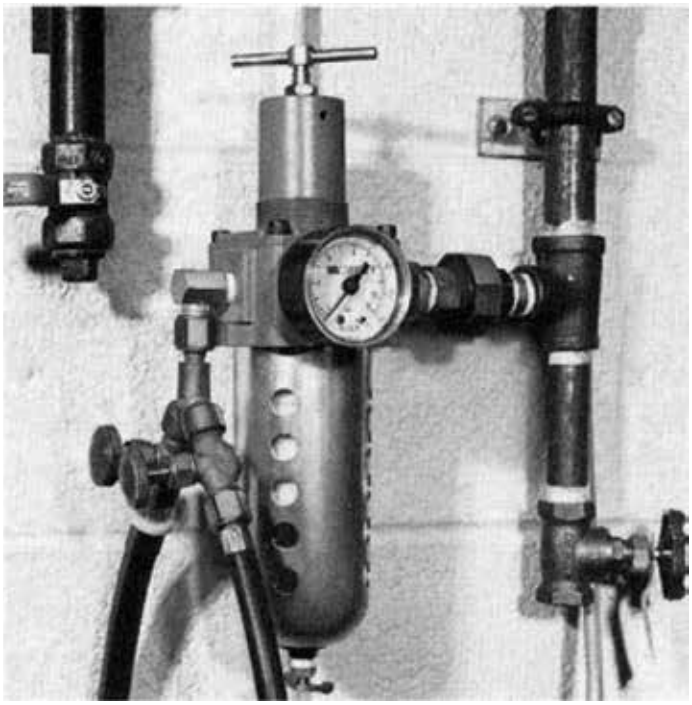


Figure 9-2. Air filter/regulator

AIR FILTER/REGULATOR (suppled as standard)

9-C. The air filter/regulator (figure 9-2) filters, regulates, and indicates the pressure of the plant air supply. An adjustable balanced piston valve maintains selected pressure, including shut-off. The unit offers instant response to supply or demand fluctuations. The rugged filter contains 2-micron filter cartridge made of borosilicate glass microfibers, bondded into a cylinder.

The rugged filter contains a 2-micron filter cartridge made of borosilicate glass microfibers, bonded into a cylinder.

Figure 9-3. Dual flash-back arrestor

DUAL CHECK VALVE ASSEMBLY

9-D. Two flash back arrestor units, joined together, are provided with each Spraywelder™. This assembly is installed in the fuel gas and oxygen lines immediately behind the pistol. Each half has two individual check valves of unique design (one plunger and one ball) mounted in series. This helps prevent any gases moving back into the system, and is an important safety measure

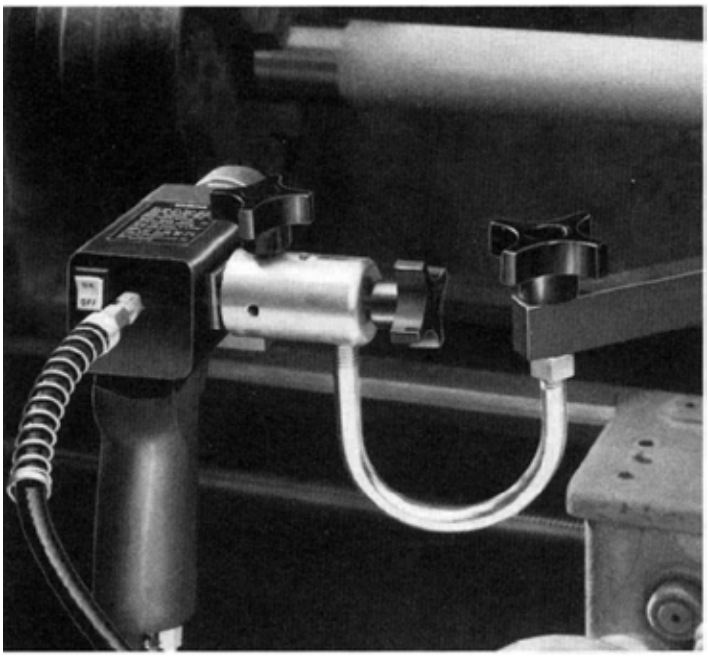


Figure 9-4. Tool post holder

TOOL POST HOLDER

9-E. As shown in figure 9-4, the Spraywelder™ tool post holder is a fixture designed for attachment to a lathe tool post. The holder is adjustable through horizontal and vertical angles of 180°, to hold the pistol in any set relationship to the work. The pistol can be removed from the holder to facilitate lighting and adjusting. This prevents the carbon deposits (from the acetylene) and overheating of the work piece often caused when the pistol is lighted while it is in the working position.

Figure 9-5. The Spraywelder™ Equipment Group includes accessories needed in a Sprayweld™ Process Installation: Two-stage oxygen and acetylene regulators, fuel gas supply hose (15-ft), fusing torch handle (310 H.D.), three complete nozzles (type 11, sizes 8, 12, 15), two Y-connectors, friction lighter, temperature crayons (93, 260, 343°C) (200, 500 & 650°F)), and a pint of Green Stop-Off™ Type II Inhibitor (not shown).

FUSING TORCH HANDLE AND TIPS

9-F. The fusing torch handle and the three multi-flame torch tips shown in figure 9-5 are available from Wall Colmonoy. They provide the soft bushy flame required to properly fuse Wall Colmonoy alloys.

GAS REGULATOR, Y-CONNECTORS AND HOSES

9-G. It is important that oxygen and acetylene regulators be in top condition when using the Spraywelder™. Special two-stage Spraywelder™ regulators are available (figure 9-5).

9-H. To allow the use of the same regulators and tanks for both spraying and fusing operations, special Y-connections are sold. Twin hose for the fusing torch in 15 ft. lengths is also available (figure 9-5).

CHEMICAL AIDS

9-I. Often there are surface areas, adjacent to where metal spraying is to be done, that must be kept free of any sprayed deposit. A liquid chemical,, Nicrobraz® Green Stop-Off™ made for this purpose. It is painted over surfaces (threads, holes, etc.) to be protected. Any overspray that hits the surfaces so coated will not adhere. The coating can be removed by wire brushing. (See description of use in Section 7).

9-J. When it is desirable to eliminate the porosity normally present in a metallized overlay (to protect the substrate from chemical attack, for instance) it can be done by sealing the sprayed and finished surface with a sealant, such as an air drying phenolic.

FAN SPRAY ADAPTER
INSTALLATION & OPERATING INSTRUCTIONS

PART NO: EDP# 213112-02-00

COMPONENTS: 1 - Specially modified brass air cap
1 - Fan Spray ring with two air jets
2 - Two 10-ft. black air hoses with 'A' couplings
1 - Valve control and manifold
1 - J-3A nozzle

PROCEDURE:

Remove existing air cap and nozzle. Inspect front two 'O' rings and replace if necessary. Insert 'A' nozzle and install new air cap. Position fan spray ring on new air cap so that air jets are oriented on the horizontal. This will ensure vertical elongation of the spray pattern which is recommended for coating large, flat surfaces.

The ring may be rotated to achieve desired pattern. A 45° position off the vertical will allow both horizontal and vertical movement of the J-3 gun with minimal adjustment to hand rotation. Lock ring in position with cap screws provided.

Disconnect cooling air hose at the panel, and attach needle valve and manifold assembly to panel. Reattach air hose to bottom of valve assembly. Attach the two black air hoses to the remaining fittings on valve assembly.

Set needle valve for approximately 10.6 kg/cm^2 (1.5 psi). This should give the desired spray pattern of approx. 6.35 cm (2.5") long. Avoid excessive air pressure which will have a tendency to split the spray pattern into two separate, distinct paths. Adjust as necessary. Proper care should ensure the long service life of your new Fan Spray Adapter with minimal repairs. If replacement parts are needed, contact Wall Colmonoy.

SECTION 10
POWDERS USED IN THE SPRAYWELDER™ FOR SMOOTH, WELDED HARD SURFACING

ORIGINAL CRUSHED POWDER NICKEL ALLOYS

The original formula Crushed powders have more surface area than spherical atomized powders. They are recommended for the Model J-3 Spraywelder™ System only. Using these powders via other thermal spray equipment will result in excessive amounts of oxide in the coating.

	Hardness Rockwell C	Fusing Temp (°C)	Fusing Temp (°F)
Colmonoy® 4	35-40	1050	1922
Colmonoy® 45S	43-46	1045	1913
Colmonoy® 5	45-50	1030	1886
Colmonoy® 56	50-55	1030	1886
Colmonoy® 6	56-63	1025	1877

HIGH CORROSION-RESISTANT ALLOYS

These nickel-alloy atomized powders contain chromium carbides for abrasion resistance, and high chromium levels for excellent corrosion and oxidation resistance.

Colmonoy® 42SA	35-40	980	1796
Colmonoy® 98	55-60	1015	1859
Colmonoy® 69SC	58-63	1030	1886

ATOMIZED NICKEL ALLOY POWDERS

An equivalent line of general and special purpose alloyed powders for virtually all spray and fuse industrial applications.

Colmonoy® 229SA	27-32	932	1710
Colmonoy® 42SA	35-40	980	1796
Colmonoy® 4A	35-40	1050	1922
Colmonoy® 40M	37-43	1050	1922
Colmonoy® 45A	45-50	1045	1913
Colmonoy® 5A	45-50	1045	1913
Colmonoy® 62SA	57-63	1025	1877
Colmonoy® 6001	58 min.	1020	1868

PREMIER ATOMIZED NICKEL ALLOYS WITH TUNGSTEN

These atomized nickel-based alloy powders contain alloying elements including chromium, tungsten and carbon which, upon fusing, form hard metal precipitates with extraordinary wear resistance and corrosion resistance.

	Hardness Rockwell C	Fusing Temp (°C)	Fusing Temp (°F)
Colmonoy® 84	40-45	1095	2003
Colmonoy® 72	57-62	1060	1940
Colmonoy® 88	59-64	1050	1922

COBALT ALLOYS

Hot hardness and wear resistance is superior to nickel base alloys of the same room temperature hardness.

Wallex™ 40	41-46	1065	1949
Wallex™ 45	45-50	1075	1967
Wallex™ 50	56-61	1095	2003

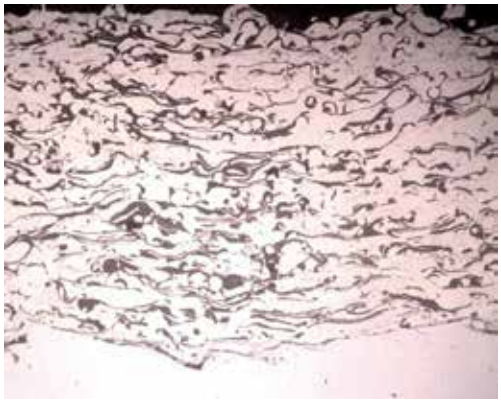
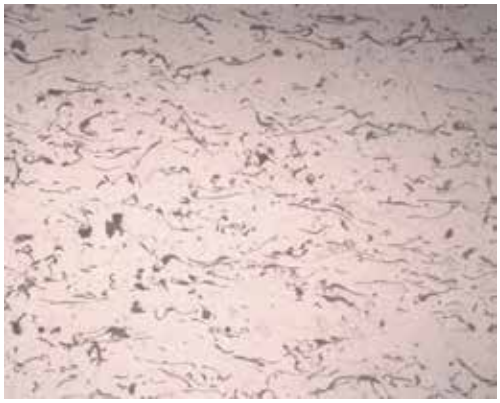
COMPOSITE POWDERS WITH TUNGSTEN CARBIDE

For increased resistance to sliding abrasion, metallurgical composites of Spraywelder™ powders and tungsten carbide (WC) particles are recommended.

Colmonoy® 7602-20M	57 min.	1040	1904
Colmonoy® 635	57-63	1040	1904
Colmonoy® 75	57-63	1050	1922
Colmonoy® 6200	57-63	1060	1940
Colmonoy® 730	57-63	1060	1940
Colmonoy® 750	57-63	1060	1940
Colmonoy® 64	58 min.	1040	1904
Wallex™ 55	58 min.	1095	2003

See TECH 1-K Surfacing Alloys Selector Chart for more complete alloy information.

SECTION 10
METALLIZING POWDERS

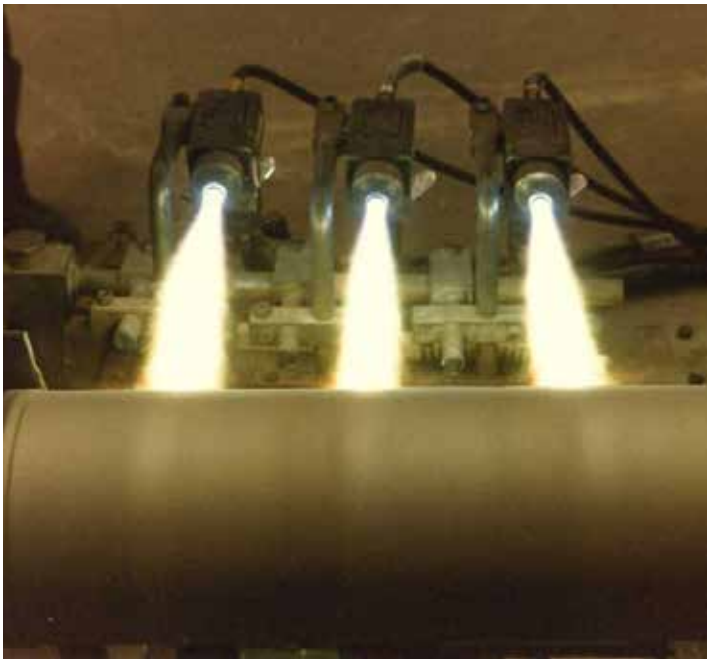
Alloy	Nominal Composition - % by Weight	Typical Properties	Coating Microstructures
SoloCoat™ 840 A general-purpose, stainless-type coating with good wear and corrosion resistance at high temperatures. Excellent for metal-to-metal sliding friction and erosive applications, and build-ups on low-carbon, low-alloy steels, and stainless steels. For pump parts and water turbine blades. Can be machined with carbide tools or ground to a smooth finish.	Al: 9.0 Cr: 9.0 Fe: 7.0 Mo: 5.0 Ni: Bal	Coating hardness: Rb 95 Operating temperature: 871°C (1600°F) Bond Strength: >27.6 MPa (>4,000 psi)	 *Original magnification 200x*
SoloCoat™ 850 An aluminum-bronze alloy, for restoring dimensions to lubricated shaft bearing areas. Can be machined smooth using carbide tools. Excellent for heavy buildup on miss-machined or worn down copper alloy and low- carbon steel components. For pump seals, valve parts, and marine parts.	Al: 10.0 Fe: 1.0 Cu: Bal	Coating hardness: Rb 60 Operating temperature: 371°C (700°F) Bond Strength: >20.7 MPa (>3,000 psi)	 *Original magnification 100x*
SoloCoat™ 870 A nickel-aluminum-molybdenum alloy for general purpose and bond coat use. It yields good wear resistance on hard bearing applications where particle erosion and fretting wear is encountered. Thick buildups without cracks are possible, due to very high interparticle bonding strength. Recommended for rebuilding machine bedways, wear rings, and press-fit parts. Can be carbide-tool machined or ground, and feather-edged.	Al: 5.5 Mo: 5.5 Ni: Bal	Coating hardness: Rb 85 Operating temperature: 649°C (1200°F) Bond Strength: >34.5 MPa (>5,000 psi)	 *Original magnification 200x*

SECTION 11
TYPICAL APPLICATIONS

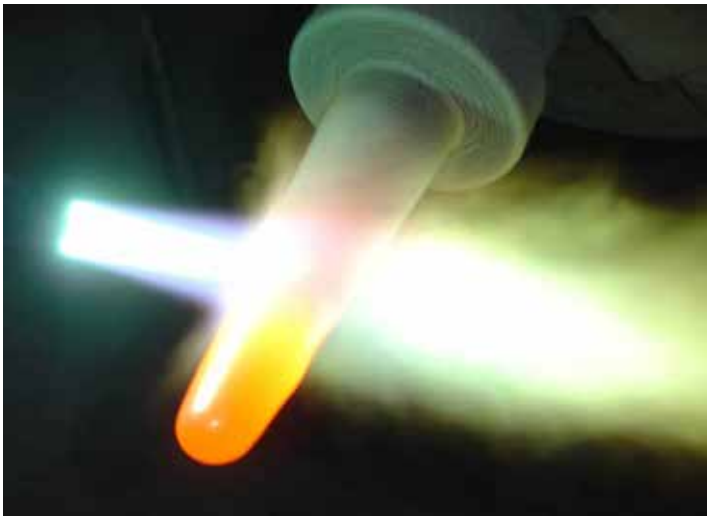
GENERAL

11-A. The following photographs and text illustrate typical Sprayweld™ applications

Oil & Gas Frack Pump Plungers Spray and Fused, then ground with **Colmonoy® 88**.



Three model J-3 Spraywelder™ spraying **Colmonoy® 5** Powder in tandem on a shaft.



A glass mold plunger coated with **Colmonoy® 42**, being torch fused.

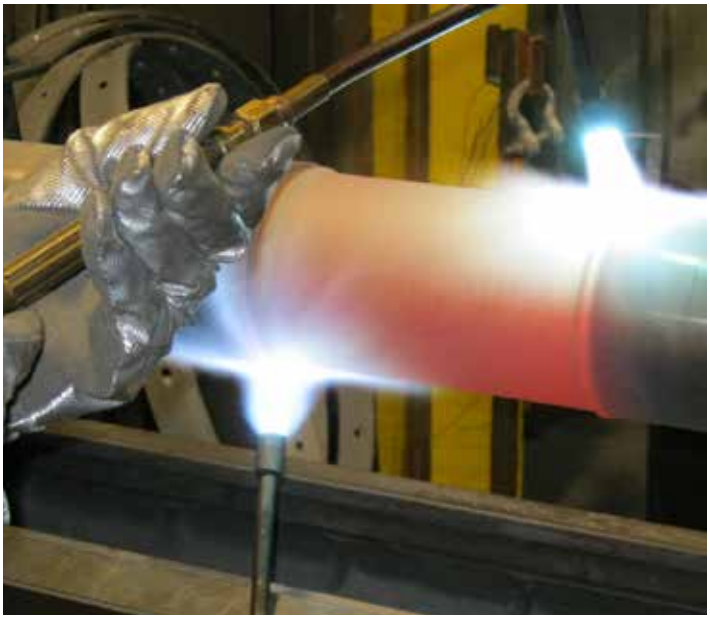
Model J-3 Spraywelder™ mounted on the “Tool Post Holder” spraying **Colmonoy® 6** onto a large 8620 shaft. Notice the metal plates used for shadow masking the edges of the spray area.

SECTION 11
TYPICAL APPLICATIONS (cont'd)

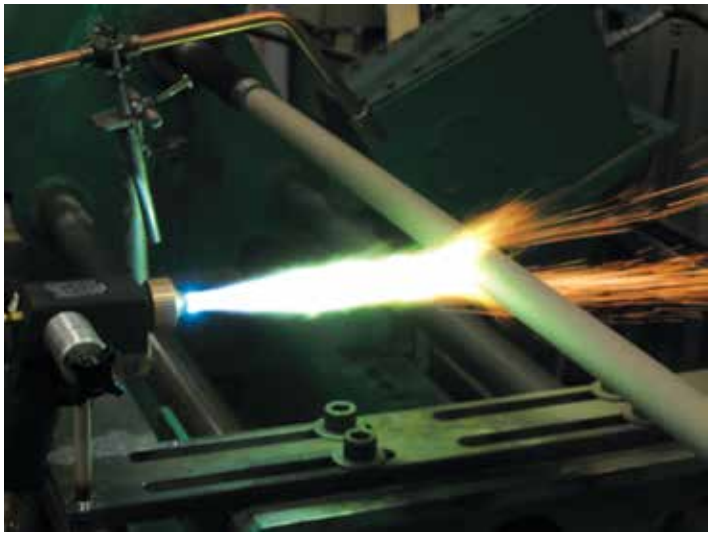
GENERAL

11-A. The following photographs and text illustrate typical Sprayweld™ applications

Brick Die Bridge being sprayed with **Colmonoy® 62M** Powder.



Preparing to fuse **Wallex™ 50** on to a large stem of Inconel X-750.



Down hole pump plunger sprayed by a J-3 Spraywelder™. Alloys such as **Colmonoy® 5, 5A, 6, 62, 6000 or 6001** can be used for this application depending on the coating hardness desired.

WARRANTY

Wall Colmonoy Corporation warrants its thermal spray equipment to be free of defects in materials and workmanship for a period of twelve (12) months after shipment from its plant. This warranty does not cover the Wall Colmonoy product unless it is properly installed, maintained and used under normal environmental conditions in accordance with current instructions and manuals of Wall Colmonoy Corporation, nor does this warranty cover commercial parts purchased by Wall Colmonoy and installed in the equipment, which commercial parts shall carry only the original manufacturer's warranty, if any.

In no event shall Wall Colmonoy be liable for consequential damages for breach of this warranty.

Remedies for breach of this warranty are limited to replacement of repair by Wall Colmonoy of any parts which have been returned to Wall Colmonoy and which, in its opinion, are defective, provided, that transportation charges and any and all sales taxes, duties, imposts or excises for such part or parts shall be paid by the buyer. Wall Colmonoy shall have the sole right to determine whether defective parts shall be replaced or repaired.

Repaired or replacement parts, installed in fulfillment of this warranty, are warranted only for the unexpired portion of the original warranty.

Damages for breach of this warranty shall not include customer labor charges for replacement parts, adjustment or repairs or any other work. Wall Colmonoy service required solely because of defects in materials or workmanship shall be supplied free of charge, provided that all transportation costs incurred during such service shall be paid by the buyer.

This warranty shall not apply to any product which, in the judgement of Wall Colmonoy, shall have been subject to misuse or neglect or shall have been repaired or altered outside of Wall Colmonoy plant in any way which may have impaired its safety, operation or efficiency, nor to any product which has been subject to accident. This warranty shall not apply if any part not manufactured or supplied by Wall Colmonoy for use in the operation thereof shall have been substituted and used in place of the part manufactured or supplied by Wall Colmonoy for such use.

THIS WARRANTY IS A FINAL, COMPLETE AND EXCLUSIVE STATEMENT OF WARRANTY, AND IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESSED OR IMPLIED, AND IN LIEU OF ANY OTHER OBLIGATIONS OR LIABILITIES OF WALL COLMONOY TO THE BUYER ARISING OUT OF THE USE OF THE PRODUCT OR PRODUCTS TO WHICH THIS WARRANTY APPLIES

Wall Colmonoy reserves the right to make changes in design or additions to or improvements in its products at any time without imposing any liability on itself to install the same in any product manufactured prior thereto.

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