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Users Manual

Powder Flame Spray Gun 5PII

205.000 II

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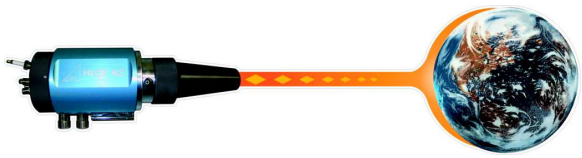

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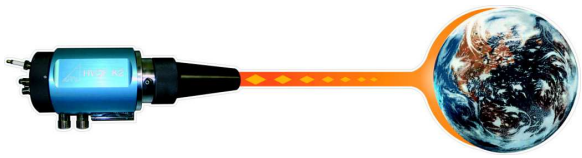

DECLARATION OF INCORPORATION

According to EG- Machine Guideline 2006/42/EG, Annex II B
EG-Guideline Electrical Magnetically Amicability 2004/108/EG

Machine:

PLANT:	Powder Flame Spraying Equipment
TYPE:	5PII
PRODUCTION DATE:	2012
GTV NO.:	205.000 II

IS DEVELOPED AND DESIGNED ACCORDING THE ABOVE MENTIONED NORMS IN FULL RESPONSIBILITY OF

Incorporation:

GTV Impex GmbH,
Vor der Neuwiese, D - 57629 Luckenbach, Germany

FOLLOWING STANDARDS:

- DIN ISO 12100 Safety of equipment, components and machine units
- DIN ISO 14121 Guidance for risk assessment
- DIN ISO 13849 Performance Level
- DIN ISO 60204-1 Electrical setup for equipment and machines
- BGR 500 Gases in machine systems

THIS DECLARATION LOSES VALIDITY, IF CHANGES TO THE EQUIPMENT WILL BE DONE WITHOUT GTV AGREEMENT.

Luckenbach, 16.11.2012

S. Kill, Directory Manager

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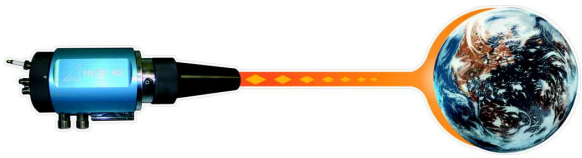
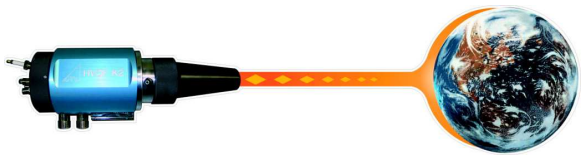


1. INTRODUCTION

5PII is a thermal spraying gun to deposit metals, ceramics or cermets, available in powder form, on to solid work surfaces. The powder to be sprayed is carried in a hopper mounted on the gun. The powder is fed by gravity through a metering valve and is drawn at a reduced pressure into an aspirator chamber. The powder is then propelled through an oxy-acetylene flame. The flame melts the powder and propels the fine molten metal particles towards the work surface to be deposited there in. As only a minute amount off the powder is lost by being blown away or consumed in the flame, the deposit efficiencies are very high, nearly 100% in some cases. Sprayed coatings are dense and uniform. The gun can be operated both manually as well as held in a tool post for large volume automatic production. The design of the gun is such that it can spray a wide variety of powders without change of nozzle. The gun will perform simple instructions regarding the operation and maintenance, as given in this manual, if followed carefully.



2. SAFETY MEASURES

Flame spraying can be hazardous because it requires the use of combustible gases, containers and hoses under high pressure, and potentially irritating or toxic spray materials. It may involve air contaminated by dusts and mists, etc. however, it can be a completely safe process when performed by a capable operator with proper understanding of flame spraying practices, knowledge of the equipment, care in operation, and one who follows the recommended precautionary measures.

2.1 USE OF EQUIPMENT

GTV 5PII has been expressly designed for flame spraying. Never use it for any other purpose such as welding, soldering, brazing and their like.

2.2 REDUCTION OF FIRE & EXPLOSION HAZARDS

Remember that the stream of sprayed metal is hot. Point the lighted gun away from yourselves & away from materials, which will burn. Carelessness in pointing the gun at paper, wood or oily rags can result in fire. Be especially careful not to spray on hoses, when lighting the gun, hoses will burn. Keep them out of the way.

2.2.1 GASES

All gas equipment such as fuel gas, oxygen and airlines, compressors, regulators etc., should be inspected regularly for leaks and loose connections.

2.2.2 EQUIPMENT MAINTENANCE

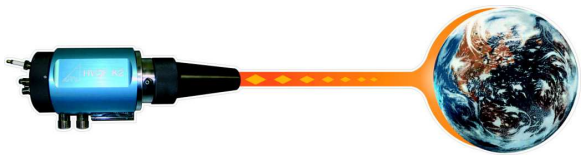
Maintain the flame spray equipment in first class condition. Follow the maintenance recommendations given.

2.2.3 BACKFIRE

Spray gun backfire can be prevented by proper maintenance. A gun will not backfire unless something is wrong. See section 6.5 on backfire.

2.2.4 METAL DUSTS

All dust having considerable calorific value can be explosive. This dust includes: flour, starch, hard rubber dust, wood flour, aluminium dust, and the dust of other metals. Aluminium and magnesium dusts are particularly hazardous. The greatest care should be used in handling them.
To minimize the danger of dust explosion resulting from flame spraying, adequate ventilation must be provided for spray booths, and other confined spaces, to prevent the accumulation off fumes and dust. Good housekeeping in the work area is essential. Inspect and clean regularly to ensure that there is not potentially dangerous accumulation of dust.



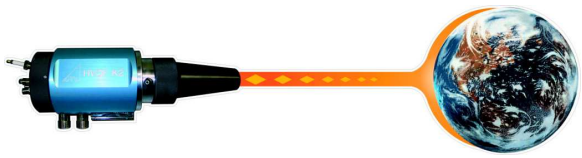
Gas or filter type collectors are not suitable for metal spray dust. A water wash wet collector should be used. All of the dust must be wetted down and remain immersed in water. No accumulation of dry or partially wet dust should be permitted. A wet spray booth is recommended.

2.3 GAS CYLINDER PRECAUTIONS

Charged gas cylinders are potentially dangerous. The following points should be kept in mind in this regard.
Never put a gas cylinder in a hazardous position. Keep cylinders away from heat. Always chain them to keep them from toppling. Put the valve caps on the cylinders when they are not connected for use.
Do not hang a flame spray gun or its hoses on regulators or cylinder valves as a fire or explosion may result.
Before moving any cylinder, shut the valve, discharge and remove the regulator and put on the valve cap.
Never use oil or grease on oxygen equipment.

2.4 REDUCTION OF RESPIRATORY HAZARDS

A suitable spray booth and an adequate exhaust system are required to avoid the toxic or noxious effects of dust, fumes and mists which may be generated by flame spraying.
Any finely divided material may damage the respiratory system in varying degree. Whenever fume concentration is high enough to cause operator discomfort, (dizziness, nausea, etc.) stop spraying. Check the ventilating and exhaust systems and related equipment. If this equipment is adequate and operating properly, respiratory equipment must be provided regardless of the material being sprayed. If operator discomfort continues even with the added protection, stop spraying and recheck all equipment. Do not resume spraying until all possibility of discomfort has been eliminated.
Dusts and fumes of lead, lead alloys, cadmium, chromium and beryllium are highly hazardous. When spraying these metals, completely sealed mask type pressurized respiratory protection and protective clothing must be provided for the operator and other workers in the fume area.
Fumes of zinc and its alloys (brasses and bronzes) are toxic. Hood type pressurized respiratory protection should be provided when fume concentration is high enough to need it.
Fumes of nickel and its alloys are potentially hazardous needing pressurized respiratory devices while spraying these, if fume concentration is high.



2.5 PERSONAL PROTECTION

Possible allergic reaction to dusts, fumes and the like or other unknown causes of health impairment due to contact with the body cannot, in most cases, be predicted. To avoid such reaction, never permit spray dust to enter the eyes, mouth, cuts scratches, or open wounds. After spraying and especially before eating or handling food, wash hands thoroughly.

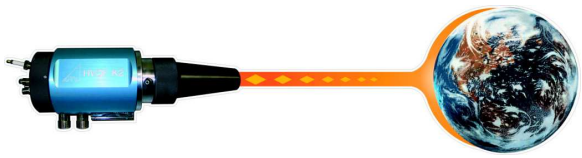
2.6 REDUCTION OF NOISE HAZARD

The noise from GTV 5PII is quite high. Except for short periods of operation, the operator and other personnel close to the flame spray operation must be protected from excessive noise. If possible, the flame spray operation should be isolated. If this is not possible, personnel should be rotated. Hearing protection should be used. Do not rely on wads of cotton for hearing protection. They are ineffective against high intensity noise.

FAQ: The noise level of 5PII Gun ranges from 90 – 110 dBA.

2.7 EYE PROTECTION

Always wear eye protectors while operating or watching the flame spray operating, inspect the eye protectors frequently. Lenses and cover plates, which are scratched, pitted or damaged, can impair vision and seriously reduce protection.



3. OPERATION

Each 5PII gun is given an operation test before it leaves the factory and is ready to be hooked up for operation on receiving. If, however, several months have escaped between the time the gun is received and first put into service, it may be necessary to relubricate the valve.

3.1 PREPARING FOR OPERATION

3.1.1 CHECK UP

When putting a gun into operation

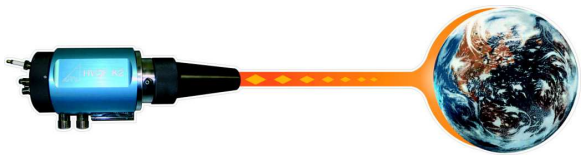
1. Use the nozzle & metering valve shown in the spraying table for powder to be sprayed.
2. Make sure that the nozzle nut (205.575) is tight.
3. Seal the siphon plug flange firmly in the gun body. The mating surfaces must be clean and free of chips.
4. Tighten the air cap body (205.501)

3.1.2 HOOK UP & INITIAL ADJUSTMENTS

Hook up the gas regulator, gas flow meter and air control unit, if air is to be used. Blow out the gas lines progressively to clean each section of foreign material. Never blow out the oxygen or fuel gas hoses with compressed air.
The gun hose fittings are at the back of the gun. The fuel gas and oxygen fittings are side by side. The air fitting is centered below the other two. When air is used the cap on the air fitting is removed before connecting the air hose.
When connecting the hoses to the gun, it should be noted that the acetylene hose is red and the oxygen hose is blue. The air hose is reinforced and transparent. The air and oxygen hoses have right hand nuts. Acetylene hose nut is left hand. The hose nuts must be drawn up tight enough to prevent any leakage but should not be over tightened, as this will collapse the hose stem.

3.1.3 LOADING POWDER

GTV powders are a blend of many different sizes of particles. Powders, which stand for a length of time, tend to separate, with the finer particles drifting to the bottom of the container. To obtain good coatings and consistent results, it is essential that the powders be thoroughly mixed. Each container of GTV powders is partially filled to make it convenient to mix the powder thoroughly before using it. Check to see that the cap is screwed on tight, then lay the container on a bench and roll it back and forth for several revolutions. Turn it end over end a few times. This way the powder will get thoroughly mixed and give consistent results.



NOTE:

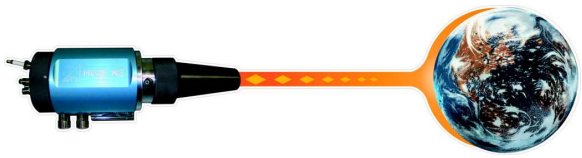
Make sure that the gun trigger is in the off position (unlatched) before pouring powder into the hopper.
Always replace the hopper cover after loading.
Keep the powder dry and clean. Moisture of foreign particles in the powder will cause erratic feed and may spoil the sprayed coating. Keep the powder hopper tightly capped. Do not sweep spilled powder and return it to the container.

3.2 LIGHTING

The gas valve handle points up when the valve is closed and forward when the valve is full open. At intermediate positions the valve is partially open. The following sequence should be followed to light the gun.
Set the oxygen and fuel gas pressure to figures shown in the spraying table under “lighting pressure”
Take up the spark lighter and open up the gas valve, until you feel it click into the “lighting position” (about half way to full open).
Spark the lighter in front of the nozzle to ignite the gases.
Open the gas valve all the way.
After lighting up, adjust the fuel gas and oxygen regulators until the readings on the gas flow meter correspond to the figures in the spraying tables.

3.3 SPRAYING

The work surface, which has to be sprayed, must be properly “prepared”. Preparation of the work surface requires its cleaning and roughening with some undercutting to get proper bonding of the sprayed coating with the base material. A variety of techniques are available for this purpose. Surface roughening may be done by threading, grooving, knurling or grit blasting. The following procedure should be followed for spraying:
Prepare the work and preheat it, if required.
Open the flow control valve to the setting recommended in the spraying table.
With the gun lighted and the flow control valve open, pull the trigger until it latches back. The gun will start to spray.
Direct the spray at the work. Refer to the spraying table for the recommended nozzle to work spray distance.
Traverse the work as evenly as possible. On stationary work the traverse rate should be 300mm in 2 to 4 seconds, laying down “strips” 10 to 20mm wide at each pass. On rotating cylindrical work, surface speed should be 6 to 30 m/min. with a traverse of 6 to 12mm per revolution.



On undercut sections direct the spray into corners of the undercut from a 45 angle at the end of each pass. This tends to fill in the section somewhat faster than the center, and prevents excess oxides from being trapped in the corners.

3.4 SHUTTING DOWN

3.4.1 TO SHUT THE GUN DOWN, FOR A BRIEF PERIOD

Unlatch the trigger & turn off the gas valve

Always follow this sequence to keep powder from accumulating in the passages. Never snap the valve when opening or closing it. Turn it gradually.

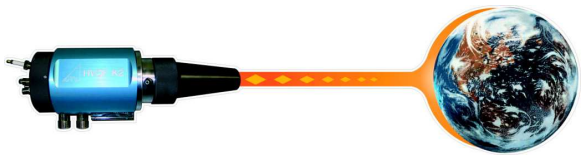
3.4.2 TO SHUT DOWN FOR AN EXTENDED PERIOD (I.E. WHEN THE GUN IS NOT GOING TO BE USED FOR A LONGER PERIOD)

Shut the gun down as stated above.
Shut off the oxygen and fuel gas at the cylinders
Shut off the air at the air control regulator. It is also good practice to back out the pressure regulating screws on the gas regulators and bleed off pressure in the hoses by opening the gas valve momentarily.
Empty the powder hopper since powder left off in the gun may pick up moisture.
When putting the gun away, latch the trigger back to avoid forming a crimp in the metering valve tube.
Clean the gun thoroughly. Do not blow the gun clean with compressed air unless the air is free of oil and moisture.

3.5 REQUISITES FOR SPRAYING

3.5.1 FUEL GAS

Acetylene is the fuel gas used for spraying. It may be obtained in standard cylinders, or an acetylene generator may be used. Use of acetylene at pressure greater than 1.03 bar (15 psi) is not approved. Do not open the valve on an acetylene cylinder more than 1 1/2 turns. (1.4 bar)
Manifolding cylinders of acetylene together will provide greater efficiency and economy than using on cylinder at a time. A high withdrawal rate from a single cylinder may result in too much acetone vapor in the acetylene, which lowers flame temperature and slows down flame propagation. This may result in low deposit efficiency and poor coating quality. In addition, excessive flow rates have a refrigerating effect, which makes it impossible to get all of the acetylene out of a cylinder. Cylinder pressure should not be run below 1.4 bar (20 psi), to avoid the discharge of acetone vapor. In very hot weather the minimum pressure should be a little higher say, 1.7 bar (25 psi).



Acetone vapour is a source of trouble and higher the melting points of the powder being sprayed, greater the trouble. If an acetylene generator is used, the safety precautions prescribed by the manufacturer should be observed.

3.5.2 OXYGEN

It is available in standard cylinders and used as such for spraying

3.5.3 AIR

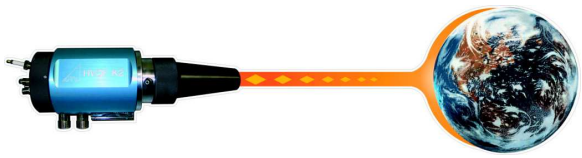
Air is used:

- To cool the work.
- To cool the equipment when spraying inside cylinders with an extension.
- For brighter, cleaner coatings with the self-fluxing alloys.
- For greater carbide deposit efficiency when spraying powders with high concentration of tungsten carbide.
- To reduce “smoking” of some metal powders.
- To narrow the spray pattern for high target efficiency when spraying small parts.

The air is turned on or off at the control unit. The gun gas valve does not control the airflow The gun has an air cap, which fits over the gun nozzle and is held in place by the air cap body. The air cap is reversible. One face is flat and the opposite face is grooved. With the flat face outward, the air cap is set up for cooling. A divergent stream of air provides a cooling shield around the flame to keep the work area immediately surrounding the target from overheating. The edge of the cap is stamped “c” at this end. Air pressure for cooling should be set at about 2.4 kg/cm² (35 psi).
With the grooved face outward, the air cap is set up for “pinching”. A convex event stream of air pinches the flame and provides fits listed in points above. The edge of the cap is stamped “p” at this end. to use pinch air when spraying coarse powders, air pressure should be set at about 0.34 kg/cm² (5psi).For spraying fine grade powders with acetylene fuel gas, pinch air must be used. Air pressure and other spray parameters are given in the spraying table.
In all cases, the gun can be lighted with the air on. At the higher air pressure spark the gas lighter close to the nozzle. Do not pinch the flame when spraying ceramic powders.
When operating without air, the air cap must still be in place. However, it makes no difference how the air cap is oriented.

3.5.4 TOOL POST FIXTURE

The tool post fixture is designed for convenience and flexibility when mounting the gun on a machine tool such as a lathe. The fixture body is usually clamped in the tool post of the lathe, extending towards the operator and to the left at about 45°.



4. AVOIDING TROUBLE

4.1 CARE OF POWDER

Following are important points to remember about GTV powders.

1. Keep it dry and clean. Do not let the powder container stand uncovered. Never reclaim spilled powder.
2. All powders have a tendency to separate. Thoroughly remix the powder in its container before pouring it into the gun canister. To do this, tighten the cover on the container; roll the container back and forth several times on the bench top and then turn it ends over end a few times.
3. When pouring powder into the gun canister, carefully avoid picking up particles of foreign matter, which may be on the outside of the container. Clean the outside of the container before pouring powder.

4.2 GENERAL GUN CARE

Keep the gun clean. Do not blow it out with oily air. If the gun does not feed properly, or the trigger latch fails to catch, disassemble it as described in “Construction & Installation” and clean each part.
In the event of the backfire always clean the nozzle face and the siphon plug and check the nozzle, siphon plug “O” rings (replace new “O” rings if old damaged).

4.3 HOSES

Obstructions in the hoses reduce the flow of oxygen and fuel gas and upset the flame balance.
Do not get oil in the hoses. Oil in the oxygen hose is very dangerous. In any hose, oil will soften the rubber. In an old, worn hose the lining may come loose and plug up the hose.
If hose fittings are over tightened, the holes in the fittings may collapse. This reduces the flow of gases and causes the same troubles as obstructions in the hoses. The gun end connections of the two gas hoses are most apt to be damaged.

4.4 LIGHTING

For proper lighting, the nozzle and siphon plug jets must be clean and undamaged.
If the gun has been idle for some time, or after the valve has just been lubricated, it is advisable, before lighting, to work the valve “on” and “off” a few times with gases turned on. This will blow out any excess valve lubricant from the small bleeder holes in the valve. Plugged bleeder holes may cause trouble.
Lighting with the valve opened past the lighting position may cause some gas jets to break away from the nozzle face, particularly if the lighter is held to one side of the nozzle. Throttling back the valve will reset the jets, after which the valve can be fully opened again.

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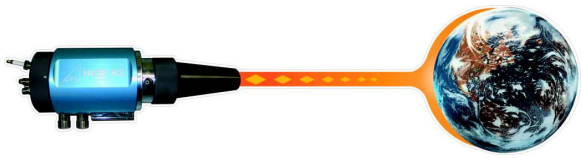


4.5 BACK FIRE

If the gun backfires, it will appear to go out with a “pop” and will burn back in the siphon plug. Shut off the gun immediately and determine the cause of the backfire.
The following may cause backfiring:
If nozzle “o” rings damaged.
Dirt in the nozzle jets
Oversized or ragged nozzle jet holes.
Dirt in the siphon plug jets.

Excessive backfire, or permitting the gas to burn back in the siphon plug too long, makes it necessary to clean the jets in the siphon plug and nozzle. Replace new nozzle, siphon plug “o” rings if old damaged. It may also cause the nozzle nut to loosen.
The cause of the backfire should be found and corrected. The gun will not backfire unless something is out of adjustment.

4.6 SIPHON PLUG

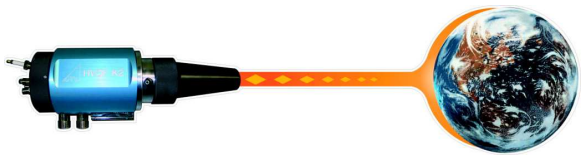
This part should be cleaned occasionally. Instructions for removing and replacing it are given in the chapter on “construction & installation”. When cleaning it, wipe out the grooves. Clean the jets with the proper size wires in the cleaning wire kit. Do not use drills. Do not use over size wires. Do not rotate the wires. Never soak the siphon plug “O” rings in strong solvent. Inspect them for damage & replace as necessary. Do not stretch the “O” ring more than necessary when putting them on the siphon plug. Lubricate the “O” rings with generous coat of GTV powder lube after assembly.

4.7 NOZZLES

The nozzle must be tight on the siphon plug. However, trying to correct a leaky nozzle by over tightening the nozzle nut can cause damage.

4.8 GAS VALVES

The gas valve is designed for long service life with minimum maintenance. It has a cylindrical core and relies upon special elastomeric “O” rings for proper sealing.
Lapping or other precise fitting is not required.
At periods of major overhaul the valve can be disassembled for cleaning and lubrication. Instructions for taking it apart are given in the chapter on “construction & installation”. The hose connection block on the back of the valve must be removed before the rest of the valve can be taken apart. Any valve part that becomes worn or damaged can be replaced in the field.



If the valve develops a leak, examine all “O” rings carefully and replace any which are worn or damaged. The ring materials are specially formulated for proper service in the valve. Use only authorized replacements.
The metal parts of the valve can be washed with cleaning solvent. Make sure the small bleeder holes in the cylindrical valve core are clean and free of any hard residue.
Never sock the “O" rings in solvent. Lubricate all valve “O” rings and sliding metal parts with a thin coat of valve lube.

4.9 GAS ADJUSTMENT

Always use the flow meter to set the flame balance as specified in the spraying tables. An improperly balanced flame will reduce deposit efficiency and may cause faulty coatings and fusing trouble.

4.10 VIBRATOR USE

The fine powders and ceramic powders require vibration to keep them feeding freely. Follow the recommendations in the spraying tables.

4.11 NORMAL LIGHTING FLOWS

Normal gas flow ranges with the gas valve in the lighting position are given below. Flows lower than those shown indicate a possible blockage in a valve core bleeder port. Higher flows may mean a leaky valve seal.

Fuel gas	Lighting pressure bar (psig)		Lighting flow	
	Oxygen	Acetylene	Oxygen	Acetylene
Acetylene	1.4 bar (20)	0.9 bar (13)	3 – 6	16 - 20

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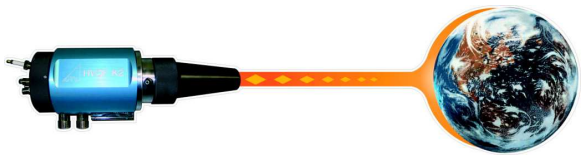

5. CONCENTRATED SPRAY

Centrating nozzle has been developed especially for spraying small surfaces metal powders. The nozzle produces a narrow, concentrated cone of sprayed permitting small areas to be sprayed with minimum over spray loss.

The spray distance of 3 to 6 inches is maintained from nozzle to work.

Spray rates will be about 1/3 of the obtainable with the standard nozzle. Replacing the no. 12 metering valve with the no. 11 valve can increase rates. When doing this, extreme care must be taken to avoid overheating.

Set up chart, concentrating nozzle

Fuel	Metal powder grade	Vibrator	Meter valve	Flow control valve Setting	Lighting pressure (note)		Flow meter readings	
					Oxy.	Fuel	Oxy.	Fuel
Acet.	Coarse	No	12	16 – 18	25 psi	11 psi	30	36
Acet.	Coarse	No	12	16 – 18	1.72 bar	1.03 bar	30	36

When using a type GH-5 flow meter, reduce pressure shown for oxygen 10 psi (0.69 bar), acetylene 5 psi (0.395 bar).