



**ECO-SNOW
SYSTEMS, INC.**

***ECO-SNOW*TM VARIABLE ORIFICE JET SPRAY GUN MANUAL**

MODEL W-2

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***ECO-SNOW* W2 VARIABLE ORIFICE JET SPRAY SYSTEM COMPONENTS**

The *Eco-Snow* Variable Orifice Jet Spray Gun System, Model W-2 has been assembled to your specifications. To meet your requirements, the system may contain a standard CGA 320 tank connector, as established by the Compressed Gas Association. This connector consists of a nut, a flat gland, and a washer.

A field-replaceable T-type pre-filter is supplied to trap suspended rust particles present in most steel cylinders. The sintered 316 stainless steel filter element is available from Nupro in nominal micron sizes from 0.5 to 90 (P/N SS-4TF-K4-0.5).

A check valve is included to prevent damage to the ultra purifying filter element contained in the handle of the *Eco-Snow*[™] Jet Spray System. This check valve must not be removed or tampered with.

Depending on your application, a suitable length of Teflon hose over-braided with stainless steel connects the check valve to the gun.

The CO₂ Jet Spray device consists of an ergonomically designed handle, a filter element, and the variable orifice valve. The handle should only be disassembled using specialized tools and instructions. The precision-machined valve should NEVER be disassembled because disassembly will alter the alignment of the variable orifice system and may permanently damage it.

A set of up to four electro-polished Jet Spray nozzles is supplied with a nut. All nozzles in the set have been fit checked to your *Eco-Snow* Jet Spray Gun System (Figure 1). The nozzles are not interchangeable with other Jet Spray System Guns.

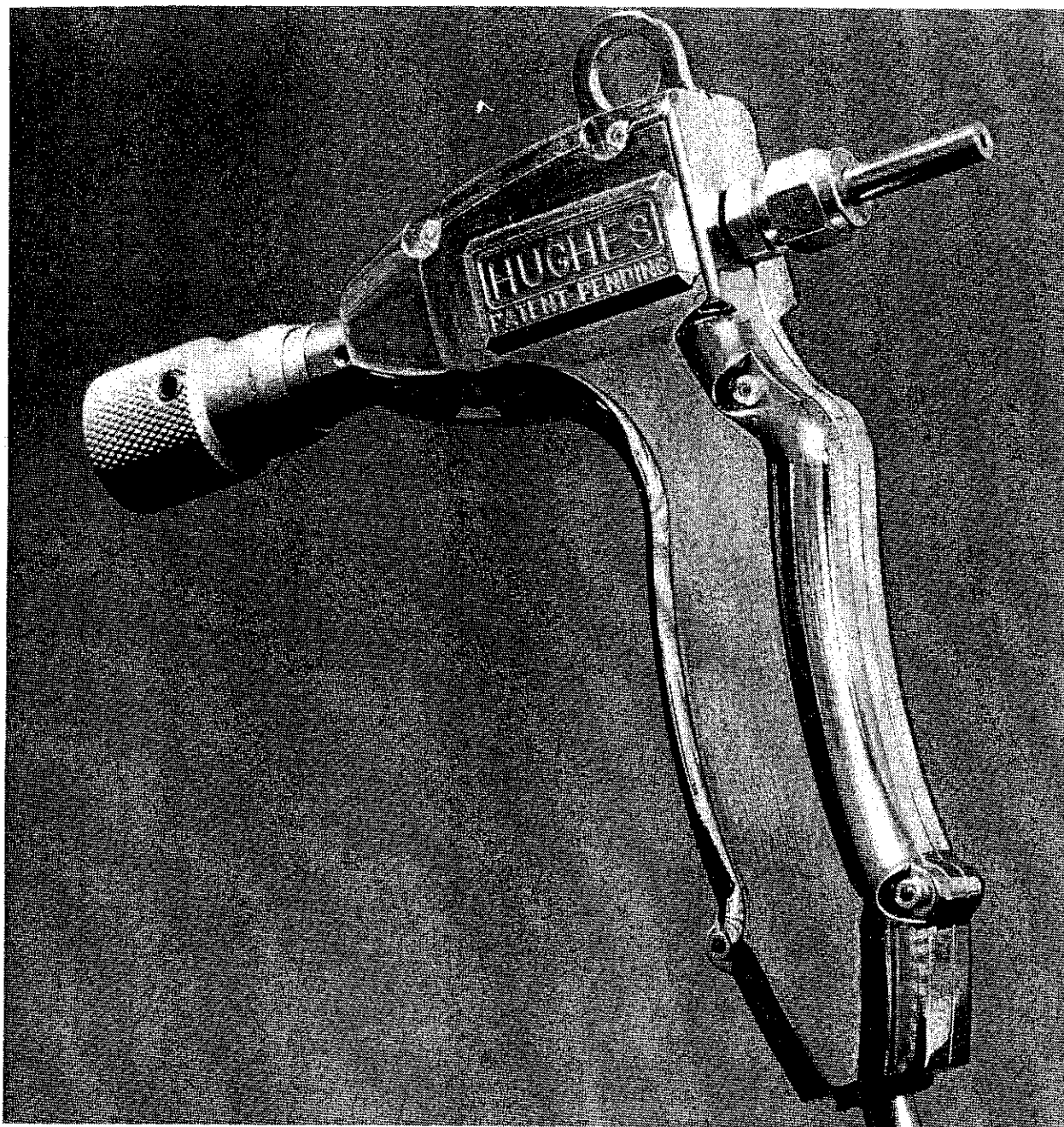


Figure 1. Variable Orifice Jet Spray Gun

SETUP/SHUTDOWN PROCEDURES

Always Wear Safety Glasses When Operating the *Eco-Snow*TM Jet Spray System.

TANK REQUIREMENTS

Use only Grade 5 (99.999%) or higher purity liquid CO₂. A lower grade may result in high molecular contamination, will contribute to particulate contamination of the filters, and may plug the jet spray system. Higher purity CO₂ is available in Grade 6 (99.9999%). This grade is more costly, however, and may not be required for your application. Call us if you are unsure or need help.

The CO₂ tank must be equipped with a dip tube or siphon tube for withdrawing liquid CO₂. Do not use the contents of a tank that is tipped on its side. Large quantities of particulates may be liberated from the inside surfaces of the tank when the tank is tipped. Furthermore, tipping the CO₂ tank on its side imposes unacceptable safety risks.

A typical cylinder is a size 200, which holds 55 pounds of liquid CO₂. Liquid CO₂ is expended at the rate of ~20 lb/hr of continuous spraying, depending on the valve opening and nozzle selected. The nominal pressure is 838 psig at 70°F. Consult your gas vendor for available sizes and purities.

ATTACHING A NOZZLE

Four CO₂ Jet Spray nozzles providing various CO₂ snow spray patterns are supplied with the *Eco-Snow*TM Jet Spray System. Depending on the type of cleaning desired, additional nozzles can be supplied after an engineering assessment has been made. Insert the nozzle into the valve body until it is seated and then attach the knurled nut. Tightening the nut until “finger tight” will provide a sufficient seal. The nut may be further tightened an additional 1/16 of a turn. Tightening beyond this point will damage the valve throat.

INITIAL SETUP

Connect the hose connector, with the Teflon[®]1 washer in place, to the CO₂ tank. Attach one of the nozzles (Figure 2). Open the micrometer valve two full turns, and then slowly open



G400249F-2a

a) Insert nozzle straight



G400249F-2b

b) Tighten 1/16 turn

Figure 2. Attaching a Nozzle

then slowly open the tank valve. Within a few seconds to half a minute, the CO₂ Jet Spray will be strong and stable. Close the micrometer valve. The CO₂ Jet Spray System is now ready for use.

MICROMETER SETTING RECOMMENDATIONS

Set the micrometer valve between 0 (zero) and 2.000 inches (eight turns open, 0.025 inch/turn) only. Tightening the valve past zero will damage the needle.

The most efficient CO₂ Jet spray cleaning is achieved at settings between 0.010 and 1.500 inches on the micrometer dial (Figure 3). A general description of the nozzle types and micrometer settings that should be used for various cleaning applications is given in Table 1. Before beginning any cleaning, ensure that the snow stream has reached a strong and stable state. The micrometer valve may be closed to stop the flow of CO₂ snow between cleaning cycles. Figure 4 shows spray pressure 1 inch from the nozzle at 20 different settings.

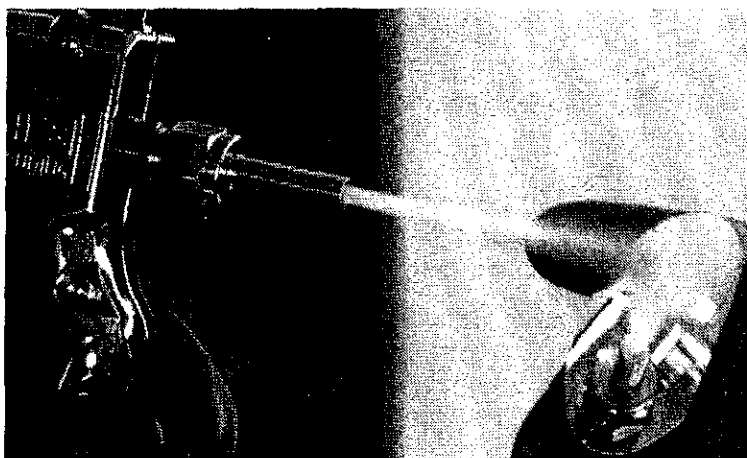


Figure 3. Example of a Good Jet Spray Plume

Table 1. *Eco-Snow*TM CO₂ Jet Spray System Nozzle Types and Micrometer Settings

Nozzle	Micrometer Range	Comments
88200	14 to 55	Most aggressive; thin film organics
88300	15 to 75	Stubborn contamination
88400	10 to 100	Particles/delicate components
88500	50 to 150	Final dust-off

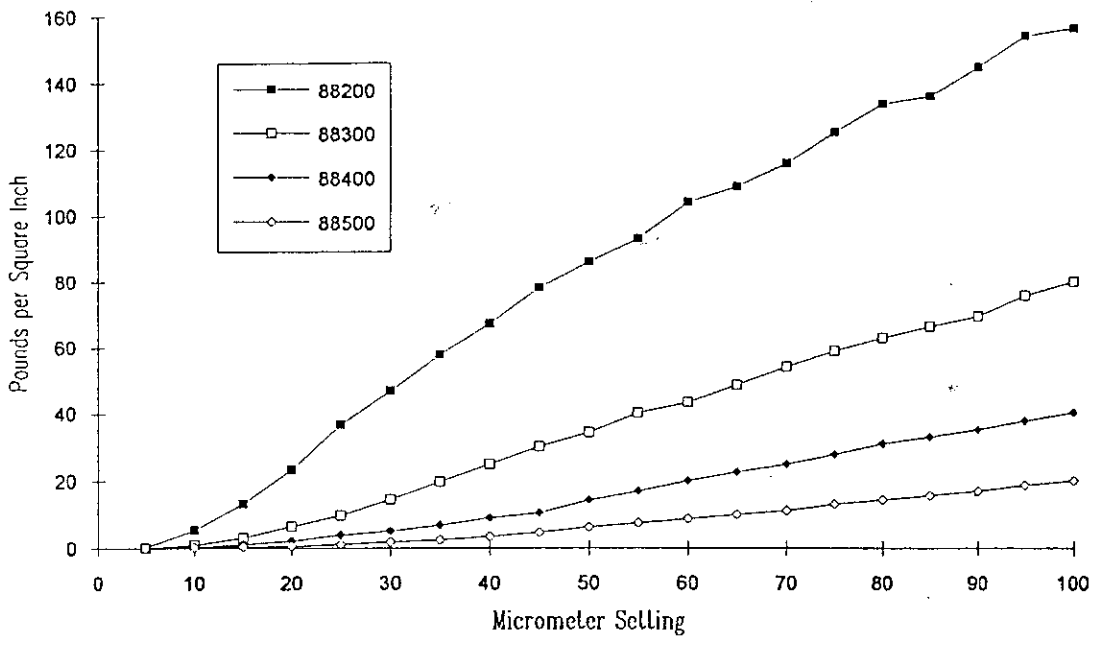


Figure 4. Spray Pressure 1 Inch From Nozzle at 20 Different Settings

SHUTDOWN PROCEDURE

To shut down the *Eco-Snow™* Jet Spray System, close off the tank valve and then open the micrometer valve to bleed out all the pressure. Set the micrometer valve between 0.01 and 0.05. Overtightening will permanently damage the valve.

SAFETY INSTRUCTIONS FOR USING CARBON DIOXIDE

Obtain a Material Safety Data Sheet (MSDS) from your gas supplier. Read and understand it completely before operating the *Eco-Snow*[™] Jet Spray System. The following information is provided in addition but not a replacement for the MSDS. Consult with your company's Safety Representative for additional precautions beyond those given in the MSDS.

Carbon dioxide (CO₂) is a minor but important constituent of the atmosphere, averaging about 300 ppm by volume. At higher concentrations, it may affect the respiratory rate. **Use the *Eco-Snow*[™] Jet Spray System only in a well-ventilated area.**

Do not use CO₂ in a confined space. Do not enter a confined space where the gas may be present unless the area has been well ventilated or has been tested for adequate oxygen. Oxygen and CO₂ monitors are commercially available. CO₂ is heavier than air and may collect in low areas.

Prevent skin from contacting liquid CO₂, cold vapors, CO₂ snow, or cold surfaces. Solid CO₂ is extremely cold (-109°F, -78°C) and may cause severe burns or frostbite.

Do not aim the CO₂ Jet Spray System at a person's unprotected body parts, and never at a person's face. **Always wear safety glasses.** CO₂ snow may cause serious eye damage.

The CO₂ cylinder must be secured in an approved cylinder rack or be chained to a stable workbench. The cylinder and preferably the surface to be cleaned should be electrically grounded to prevent static charge from building up during use.

Check the tank connection for a tight seal. Open the tank valve slowly. The *Eco-Snow*[™] Jet Spray System contains several sealing interfaces (connectors) and a valve mechanism that are sensitive to damage from pressure surges.

Do not operate the valve without a nozzle attached. The cold CO₂ snow will cool the orifice and needle, possibly resulting in permanent damage. Always bleed all CO₂ lines through the nozzle before breaking any connections. Never break a connection downstream of the check valve.

Persons working with compressed gases need to be familiar with the general and specific practices relating to the safe storage and use of compressed gases. Facilities should have established procedures for container storage and handling, gas use, and emergency practices. It is the responsibility of every user to become familiar with these procedures before operating the *Eco-Snow* Jet Spray System. Proper use and maintenance of the *Eco-Snow* Jet Spray System is the responsibility of the user.

The *Eco-Snow* Jet Spray System operates at standard CO₂ pressures. **Do not operate the system at higher pressures.** Do not use tanks that have pressures above 900 psi.

Caution: Do not spray static-sensitive hardware, such as live circuit boards, without the appropriate ESD control device made for the *Eco-Snow* Jet Spray System.

Repair and Maintenance

No repair or maintenance to the *Eco-Snow* Jet Spray System should be required when using the system properly and when using Grade 4 or higher purity CO₂. Heavily contaminated CO₂ tanks that contain a substantial amount of rust will clog the pre-filter. A spare pre-filter element has been included with this gun. Replace the pre-filter element per the enclosed instructions.

The Teflon washer in the CGA 320 tank attachment assembly will gradually degrade with use. Periodically inspect the washer to determine when replacement is required. A loss of performance may indicate a clogged pre-filter. The appearance of frost on the pre-filter most likely indicates that the pre-filter is clogged.

Should the *Eco-Snow* Jet Spray System become contaminated with molecular impurities, contact the appropriate Eco-Snow Systems, Inc. representative for decontamination procedures.

For further information, contact Ramesh Borade at Eco-Snow Systems, Inc., 925-605-1923.