Operation Manual & Quick Start Guide

P/N PSVP USTS OM

PowerSno Vector Pro™

Universal CO_2 Spray Treatment System

Precision Cleaning ● Dry Machining ● Spot Thermal Cycling

clean imagineering™

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OPERATING INSTRUCTIONS

NOTICES TO USER

POWERSNO VECTOR PRO SYSTEM CHASSIS MAY APPEAR COSMETICALLY DIFFERENT FROM PICTURES DEPICTED HEREIN. HOWEVER, INTERNAL SYSTEM DESIGN, COMPONENTS, AND FUNCTIONALITY ARE EQUIVALENT.

IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS AND NON-COMPLIANCE WITH OPERATIONAL AND MAINTENANCE PROCEDURES DESCRIBED HEREIN MAY CAUSE PERSONAL INJURY AND/OR POOR CLEANING PERFORMANCE AND/OR EQUIPMENT DAMAGE.

This document and other information from CleanLogix LLC, its subsidiaries and authorized distributors and representatives provide product and/or system options for use in gross and precision cleaning applications by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in this instruction manual. Due to the variety of operating conditions and applications for these products and systems, the user, through his/her own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety, and warning requirements of the application are met. This product or system has been designed, constructed, and tested to perform satisfactorily under conditions represented by the user to the seller and is warranted by the seller as described herein.

The products described herein, including without limitation, product features, specifications, designs, replacement parts, pricing, and availability are subject to change by CleanLogix LLC and its affiliates at any time without notice.

PRODUCT DESCRIPTION

The PowerSno™ All-in-One Universal CO_2 Spray Treatment System is an economical yet extremely versatile and powerful precision cleaning or machining fluid tool. Using the latest CO_2 Composite Spray™ technology, the PowerSno™ generates an energetic cleaning spray or cooling-lubricating vapor comprising pressure-regulated compressed air or nitrogen gas, containing micronized CO_2 particles to efficiently remove contaminants from any manufactured surface or cutting tool. The PowerSno™ provides a 100% dry spray or vapor treatment - *On-the-Bench*, *On-the-Line*, *On-the-Robot*, or *In-the-Tool*.

The PowerSno™ provides CO_2 spray treatment for a variety of manufacturing processes such as mechanical assembly, machining, grinding, sanding, polishing, adhesive bonding, welding, coating, and inspection, among many others. Manufacturing contamination such as hydrocarbon films, fine particles, ionic residues, nonvolatile residue (NVR), and machining heat are efficiently removed from surfaces.

The PowerSno™ system comprises a high-performance spray generator with a choice of a coaxial, split, or high-productivity CO_2 composite spray applicator. The PowerSno™ system is fully expandable with several equipment options and accessories including CO_2 purification, cartesian or collaborative benchtop robots, treatment cabinet, atmospheric plasma surface treatment system, and LightSPEC™ Spray Quality Monitoring (SQM) system. The PowerSno™ spray is simply actuated using a footswitch, spray trigger, or by remote machine (or robot) relay closure.

- *All-In-One CO_2 Spray Treatment for Precision Cleaning and Machining Applications*
- *Use Anywhere – On-the-Bench, On-the-Line, On-the-Robot, or In-the-Tool*
- *Simple Adjustment and Instant On/Off Operation, Adaptable and Customizable, and 100% Dry*
- *Quickly and Consistently Remove Surface Particles, Ionics, Thin Films, Nonvolatile Residues (NVR), and Cutting Tool Heat*
- *Superior Cost-of-Operation (CoO) and Performance as Compared to Conventional CO_2 Spray Systems*
- *Footswitch, Spray Trigger, and Remote Machine-Robot Actuation*
- *Standard and Custom Spray Applicators*
- *Expandable – Supports Multiple Plug-and Spray MicroSno™ Cleaning Modules*

PICTORIAL REFERENCES

Figure 1 – PowerSno Vector Pro Universal Spray Treatment System™ Front Panel

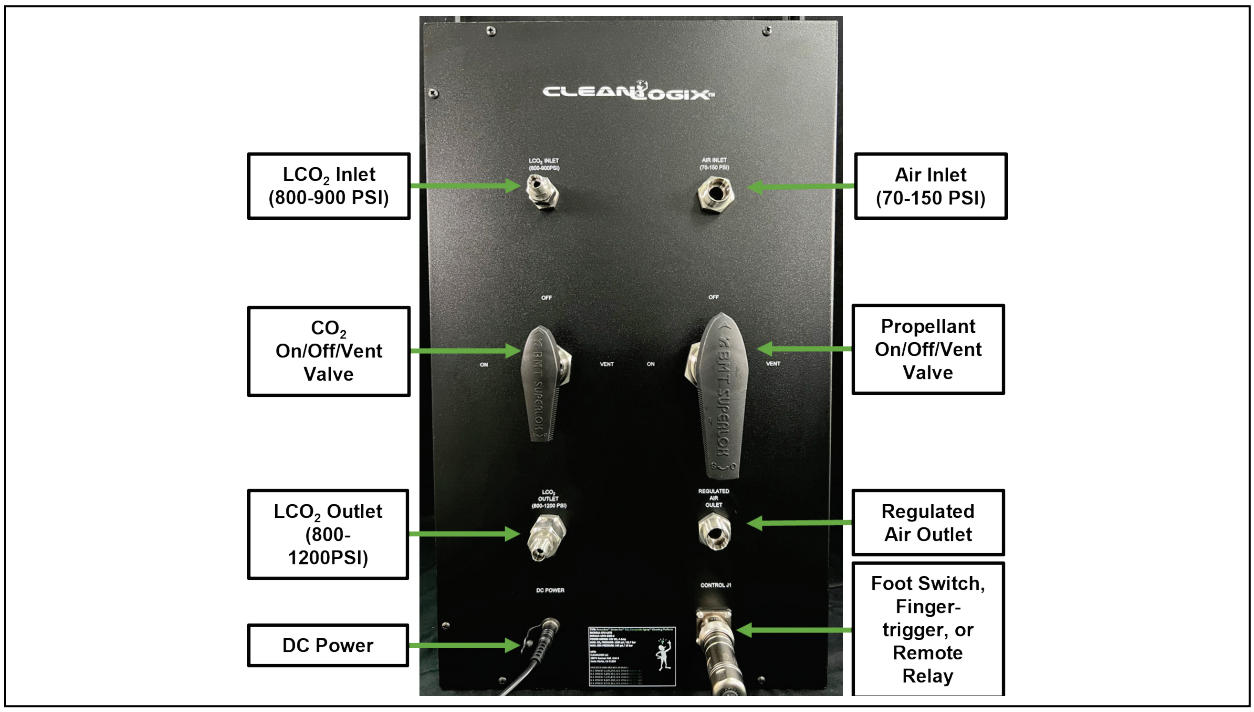

Figure 2 – PowerSno Vector Pro Universal Spray Treatment System™ Back Panel

PICTORIAL DESCRIPTIONS (continued)

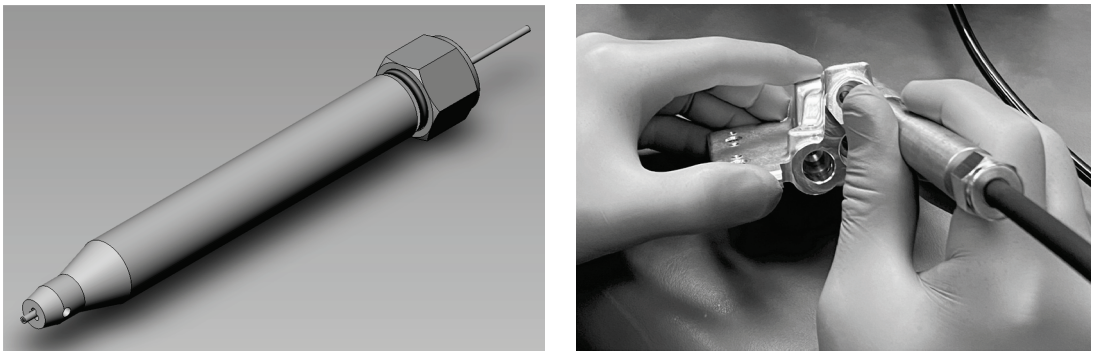

Figure 3 – Single Nozzle Spray Applicator

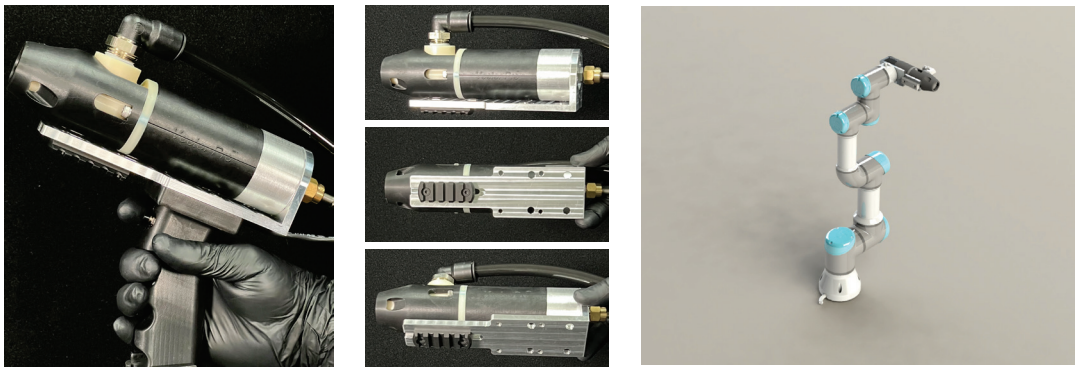

Figure 4 – Triad Cluster Spray Applicator (Handheld or Robot Mounted)

Figure 5 – Penta & Deca Cluster Spray Applicators (Handheld or Robot Mounted)

PICTORIAL DESCRIPTIONS (continued)

Figure 6 – Deca Wide Spray Nozzle (Fixed or Robot Mounted)

Figure 7 – Optional accessories include LightSPEC Module
Spray Quality Monitoring System, M-LOK Flashlight/Laser, and M-LOK Foregrip, and more!

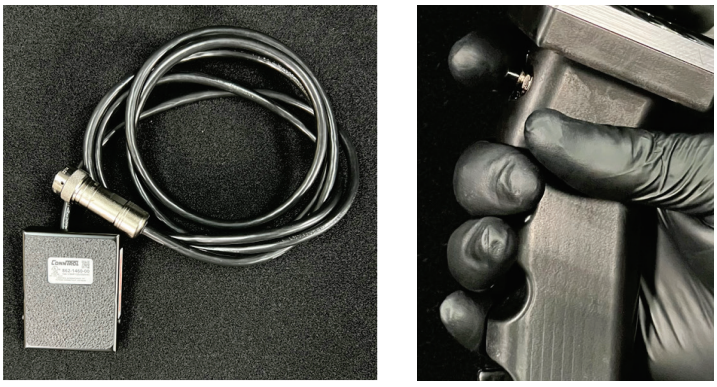

Figure 8 – Footswitch & Finger-Trigger Actuator (Triad & Cluster Deca Spray Applicators Only)

PICTORIAL DESCRIPTIONS (continued)

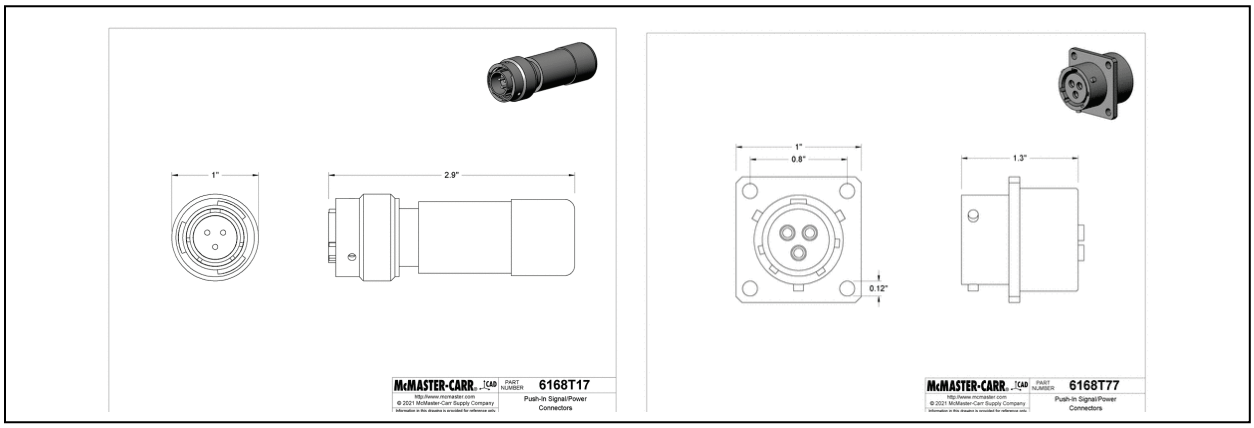

Figure 9 – Remote Relay Contact Closure Push-In Signal/Power Male & Female Connectors

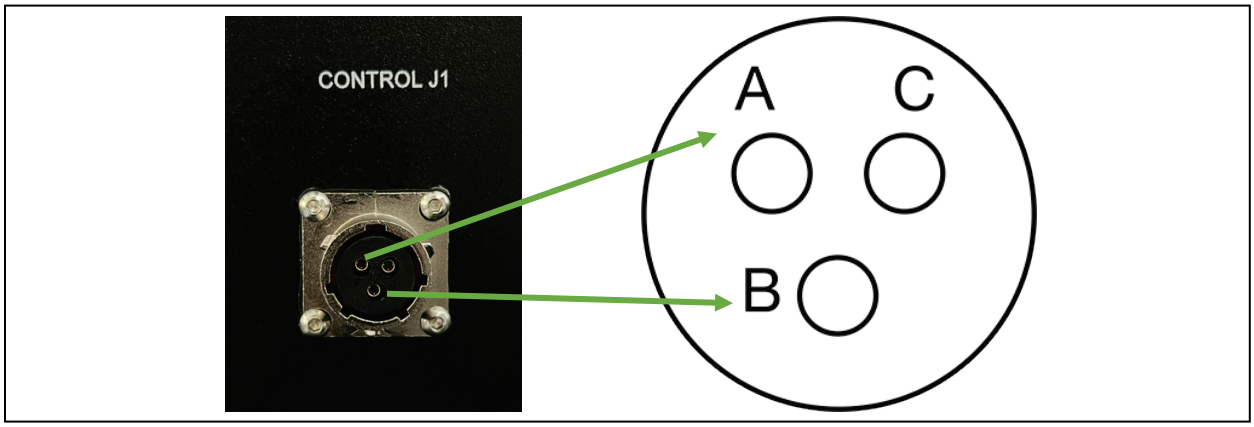

Figure 10 -- PowerSno Vector Pro Universal Spray Treatment System™ Remote Relay Contact Closure PIN A & B

WARRANTY

CleanLogix LLC warranties the PowerSno Vector Pro Universal Spray Treatment System™ (and all accessories) system to be free from all defects in material and workmanship for a period of twelve (12) months from the date of original purchase.

This warranty shall apply to the original purchaser only. CleanLogix LLC shall not be liable for damages from any cause or use of such equipment of and above the cost of repairing any defective parts.

In the event of any defect covered by this warranty, any replacement parts shall be furnished by CleanLogix LLC without cost, F.O.B. CleanLogix LLC factory, Valencia, California, provided however, notification by purchaser of such defect is received by CleanLogix LLC within the period of the warranty, and further provided that such defective part is received by CleanLogix LLC for inspection within thirty (30) days following receipt by CleanLogix LLC of the notification of defect.

This warranty shall be void if the purchaser shall fail to follow the operating instructions or to use any supplies or parts (which include, but not be limited to, snow tubes, coaxial propellant lines, nozzles, accessories, and attachments) in such equipment not manufactured or supplied by CleanLogix LLC.

This is only warranty by CleanLogix LLC and is provided in lieu of all other warranties of merchantability and fitness for any application or purpose. No representations or warranties are authorized except as herein stated.

PowerSno Vector Pro Universal Spray Treatment System™ Quick-Start-Guide

1. This PowerSno Vector Pro Universal Spray Treatment System™ Operation Manual, P/N PSVP USTS OM, provides operating and troubleshooting information for the PSVP-USTS™, common to both PowerSno™ Standard and PowerSno™ Elite Spray Treatment Systems.

2. The PSVP-USTS™ is shipped complete in one Pelican case and should be handled with care and packaged properly when transporting.

2.1 The PSVP-USTS™ includes a coaxial spray applicator(s), foot pedal spray actuator, propellant pressure regulator, and CO_2 pressure regulator. This system also includes all needed power, propellant gas, and liquid CO_2 cylinder connection kits.

2.2 The PSVP-USTS™ may be shipped with optional accessories:

- Custom Cleaning Cell or Workstation
- Custom CO_2 spray applicator(s).
- CO_2 purifier upgrade for PSVP-USTS module.
- Clean Dry Air (CDA) filter trains.
- LightSPEC™ CO_2 treatment spray monitor (for machine installations).
- Tantec atmospheric plasma treatment module.
- UR3 tabletop collaborative robot system.
- 3D printed spray applicator mounts for machine integration and UR3 robot EOAT.
- Remote PowerSno™ spray actuation cable (replaces footswitch).
- M-LOK Universal Mounting Rail and Accessories (Only applies to Triad & Deca Spray Applicators)
- Wall-mounted propellant heater (recommended only for optical cleaning applications)

Set-up and operating instructions are provided separately with each accessory item.

3. Locate the PSVP-USTS™ on top of a level work bench and secure to bench or surface or place the module on the floor under the work surface (recommended). If supplied or applicable, place the spray applicator into the workstation, mount to UR3 robot, or mount into machining tool.

Note: The internal compressor generates periodic noise and vibration during operation. It is highly recommended that the PSVP-USTS™ be located under a work bench on the floor or secured to a work surface using a strap or other suitable restraint.

4. When tightening any of compression fittings on the supply lines for Air and CO_2, it is recommended the operator uses two wrenches to provide a resistance to the direction in which you are tightening so that the stainless-steel bulkhead does not loosen with the direction of tightening over time.

5. Connect the PSVP-USTS™ to a regulated supply of clean dry air or nitrogen gas with a maximum pressure of 150 PSI using the supplied compressed air connection hose (1/2" OD Polyurethane). Dirty gas will contaminate the cleaning system and create surface contamination problems. Cylinder supplied and regulated nitrogen gas may be used as clean dry propellant gas. If the propellant gas pressure cannot be adjusted to at least 40 psi when the PSVP-USTS™ is operated, the gas supply pressure is too low and must be increased. Attach the air connection hose to the air inlet port on the back panel of the PSVP-USTS and adequately tighten the nut onto the bulkhead.

6. Connect the PSVP-USTS™ to an unregulated and clean high-pressure (800-850 psi) siphon tube cylinder supply of LIQUID CO_2, 800-850 PSI, 65-70°F using the supplied high-pressure liquid CO_2 cylinder supply connection assembly (cylinder adaptor/gasket, filter, and flexible ¼" OD stainless steel braided hose). Dirty CO_2 will contaminate the spray system and create surface contamination problems. Cylinder supplied liquid CO_2 (with a siphon tube) industrial grade or better is recommended. Connect the high pressure LCO_2 hose to the LCO_2 inlet port located on the back panel of the PSVP-USTS™ adequately tighten the nut onto the bulkhead.

7. Liquid CO_2 and the propellant gas supplies must be clean and dry for precision cleaning applications. Moisture and other contaminants will adversely affect the quality of surface cleanliness. If compressed air is used, it must be filtered using activated carbon, dried using a molecular sieve, and filtered using a microfilter (0.5 micron minimum). CleanLogix LLC offers compressed air and liquid CO_2 treatment trains for this purpose.

8. Plug in the 110V AC/ 24V DC Adapter along with the footswitch or trigger-finger (Triad & Deca Applicators) Push-In Signal/Power Connector shown in Figure 2.

9. If using a Triad or Deca Spray Applicator, attach the applicator's ¼" OD LCO_2 hose to the LCO_2 outlet port of the PSVP-USTS™ located on the back panel shown above in Figure 2. You must also attach the applicator's ½" OD polyurethane propellant tube to the air outlet port while adequately tightening both nuts onto the bulkheads.

10. After a thorough review that all fittings are tightened adequately, you can begin to charge your system with LCO_2. Slowly open your bottle or house supply of LCO_2 with an unregulated incoming pressure of 800-900 PSI. Slowly turn the air and CO_2 valves located on the back panel of the PSVP-USTS™ to the on position. If the LCO_2 pressure regulator located on the front of the PSVP-USTS™ is already set to a pressure around 1150-1250 PSI, your pump will begin boosting pressure within the unit. If the LCO_2 pressure regulator is not set, you can begin to slowly turn the knob clockwise until a pressure range of 1150-1250 PSI is achieved. Be careful not to over pressurize above this limit and it is advised that once you set the pressure regulator, you press the knob in to lock it and leave it at the optimal pressure range indefinitely. Please note that if your pressure regulator is pre-set, you must turn on the LCO_2 valve first before the air valve otherwise the pump will begin to dry-cycle.

In terms of safety, the Haskel AAD-5 pump is designed to stall at 1250 PSI but can still reach a cycle pressure of up to 1350 PSI depending on CO_2 temperature. The CO_2 pressure vastly drops off after it exceeds the stall pressure limit and will not cycle again until it drops below the set pressure. A pressure relief valve set at 1500 PSI is located inside of the unit as a backup to the stall limit of the pump.

Warmer supplies of LCO_2 can produce a large amount of high-pressure gas thus producing less dense liquid and less dry ice particles. The supply should be brought down to room temperature or cooler before operation to prevent spray cleaning quality from being affected.

11. The spray cleaning power varies with the distance from surface and spray angle. The optimum cleaning action is usually obtained when the CO_2 spray nozzle is approximately one-half inch (½") to one inch (3") from and at an angle to the surface (see Section 3.5 for more detail). A higher LCO_2 pressure above 1250 PSI does not increase particle velocity or cleaning effectiveness and may damage the spray applicator. However, a higher propellant pressure (max 150 PSI) does increase particle velocity and cleaning effectiveness and is warranted on some applications. Note that a higher propellant pressure may damage the part being cleaned but it should be tested and verified before proceeding.

12. After completing all the steps above, the operator can then press the ON/OFF button located on the front panel of the PSVP-USTS™ shown in Figure 1 to the ON position (pressed in). After verifying the spray applicator is mounted securely or held firmly, the operator can then begin spraying by actuating the solenoid valves within the PSVP-USTS™ using a footswitch, finger-trigger, or remote relay contact closure shown in Figures 8, 9, & 10.

While spraying, adjust the LCO_2 and air pressure as needed and verify the LCO_2 pressure is within the optimal range of 1150-1250PSI. Air pressure should be within 40-150 PSI. A higher air pressure typically yields a faster cleaning result but at the cost of potentially damaging the substrate.

13. A single nozzle consumes 4 lbs. of LCO_2 per hour & requires a propellant flow rate and pressure of at least 2.75 SCFM @ 80 PSI. A single nozzle scales linearly with various spray applicator configurations.

14. Care should be taken to maintain a minimum 4-5" diameter loop in the coaxial delivery tubing from the fitting on the rear panel of the PSVP-USTS™ generator. Sharp bends and kinks may cause the internal PEEK capillary to rupture or result in premature failure of the propellant delivery hose.

15. Depressurize supply lines for overnight shutdown. Close propellant gas and liquid CO_2 cylinder supply valves. It is OK to leave regulators set to the desired pressures if the inlet valves have all been shut off before leaving the unit unattended for an extended period. The pump will not cycle or boost pressure without air. Depress the ON/OFF button and disconnect the power cord.
When disconnecting supply lines, slowly loosen the compression nuts and bleed out any residual CO_2 or air.

OPERATING INSTRUCTIONS

1. GENERAL SPECIFICATIONS

1.1 DESCRIPTION

1.1.1 The PowerSno Vector Pro Universal Spray Treatment System™ delivers a precisely controlled stream of solid carbon dioxide particles entrained in a propellant gas at high velocity. By adjusting the propellant pressure and liquid CO_2 injection rate via CO_2 pressure (i.e., CO_2 particle size and mass flow adjustments), it will clean surfaces to a variety of surface cleanliness levels.

Shown in Figures 1-6, the PSVP-USTS™ system comprises a LCO_2 pressure booster with a variety of spray applicators that serve different functions in the precision cleaning industry.

Moreover, shown in Figure 8 & 10, the PSVP-USTS™ employs a durable single footswitch, trigger actuator (Triad & Deca Applicators), and or remote relay contact closure allowing for CO_2 Composite Spray precision cleaning with operator friendly adaptability in the workplace.

1.1.2 The PSVP-USTS™ provides complete CO_2 Composite Spray control. All the necessary controls to operate the system reside on the front and rear panel.

Shown in Figure 1 & 2, controls include a main power switch, propellant pressure regulator and gauge, liquid carbon dioxide pressure regulator and gauge, and a coaxial spray applicator. The PSVP-USTS™ liquid CO_2 injection is controlled using a coaxial 0.008-0.030 inch capillary condenser tube fed by a proprietary high pressure hose. A proprietary low-pressure hose is brought in unison up to the spray applicator to mix both air and CO_2 particles that are propelled at a surface.

1.1.3 All the component parts are manufactured to the highest commercial standards and are selected or designed for maximum life consistent with reasonable cost.

1.2 PRINCIPLES OF OPERATION

1.2.1 Clean dry air or nitrogen gas flows through a pressure regulator and particle filter to form a variably controlled pressurized and filtered propellant (Propellant Gas). Propellant gas flows through a coaxial or split coaxial delivery assembly comprising an outer propellant delivery tube (propellant tube) and around an inner liquid CO_2 cleaning agent delivery tube (capillary condenser tube). Liquid CO_2 injection into the capillary condenser tube is pneumatically controlled using a booster pump (Vector Pro System). These two delivery tubes and fluids are split and delivered using separate tubes in a Vector Pro configuration. The propellant tube and capillary condenser tube are integrated within a mixing nozzle. The propellant gas passes into the mixing nozzle that contains the capillary condenser tube, which is centrally positioned within the mixing nozzle using a positioning insert(s). Through momentum transfer, a significant transfer of energy is exchanged between the near-sonic propellant gas stream and the subsonic CO_2 particle stream forming the CO_2 Composite Spray stream.

1.2.2 Depressing the footswitch, trigger actuator, or activating a remote relay contact generates a CO_2 Composite Spray cleaning stream at the spray nozzle (Note: Securely hold or mechanically fixture the spray nozzle applicator before actuating the spray to prevent potential injury from a whipping spray applicator assembly!). The treatment spray can be adjusted from a very fine to very dense CO_2 particle spray and from low particle impingement velocities to very high impingement velocities. The spray form factor is controlled by user-adjustable propellant pressure and liquid carbon dioxide injection rate.

1.3 DETAILED SPECIFICATIONS

1.3.1 CO_2 Particle (Liquid CO_2) Supply

Chemical Name	Liquid Carbon Dioxide
Temperature, °C	10 (min) - 25 (max)
Pressure, PSI	650 (min) - 1250 (max)
Usage, Pounds/Hour	4 – 40 (depends on capillary condenser tube diameter, number of capillary tubes (nozzles) and metering valve adjustment) Examples: Single, Penta, & Deca nozzles
Moisture, PPM Max.	10
Oil, PPM Max.	1
Particles, Micron	5 (max)

1.3.2 Propellant Supply

Type	Clean Gas – CDA or Nitrogen
Supply Pressure, PSI	40 (min) to 150 (max)
Usage, SCFM	2.75-30 @ 80 PSI (depends on pressure regulator adjustment and number of nozzles) Examples: Single, Penta, & Deca nozzles
Working Pressure, PSI	80 (Recommended Operating Pressure)
Min. Spray Pressure, PSI	40
Moisture, PPM Max.	10
Oil, PPM Max.	1
Particles, Micron	5 (max)

1.3.3 Coaxial Mixing Nozzle

Material	Stainless Steel, Aluminum or Delrin (High Purity Available)
Mixing Body Size, I.D.	.5”-.75”

1.3.4 CO_2 Condenser Tube

Material	PEEK
Capillary Size, I.D, O.D.	0.008 - 0.034 ID X .0625 OD
Configuration	Coaxial

1.3.5 Electrical

Voltage, VAC, 1 PH	110 (Operating voltage, phase, and frequency specified on rear-mounted nameplate)
Frequency, Hz	50/60
Power	24V DC

1.3.6 Physical Dimensions

Width, in.	12
Depth, in.	24
Height, in.	22

1.3.7 Fluid Connections:

Liquid CO_2 Supply	0.250 in., tube connection 1200 psi (max)/ 650 psi (min)
Gas Propellant Supply	0.250-0.5 in., Compression Straight Thread or Push-to-connect tube, 150 PSI (max), 80 psi (min)

2. INSTALLATION AND TEST

2.1 UNPACKING

2.1.1 Open the Pelican case carefully.

2.1.2 The typical items accompanying a PSVP-USTS™ system include a Vector Pro spray generator with attached coaxial or split coaxial spray treatment applicator, fluids connection kits, and foot pedal actuator. Additional accessories may have been ordered which can include custom spray applicators and fixtures, spare nozzle, workstation, among others. These are provided in one or more separate shipping containers.

2.2 WORK AREA

2.2.1 Work Environment

A suitable environment is required which provides a means of working with the spray system without contaminating the atmosphere of the room, displacing breathing air, or re-contaminating the substrate. It must also protect the operator's face from potential flying objects during spray operations, provide adequate lighting conditions, and suitable ESD control means. CleanLogix LLC offers an ionized workstation which can be supplied with the PowerSno™ and connected to suitable ventilation system for this purpose. Moreover, the spray system may be used safely on a portable cleaning cart or installed in an assembly tool to provide cleaning or cooling in place.

2.2.2 Propellant Supply

A *regulated* clean gas supply is required with an inlet pressure of between 80 PSI (minimum) and 150 PSI (preferred). The propellant gas supply may be clean dry air (CDA) or nitrogen gas. The gas must be clean and dry, having a maximum of 10 PPM moisture vapor, 1 PPM oil vapor, and 5 micron maximum particulate matter. Since most plant compressed air systems cannot supply air to these specs, compressed air treatment trains (coalescer, dryer, particle filter, etc.) must be employed. CleanLogix LLC offers application-specific treatment trains employing multi-stage coalescers, refrigerated dryers, mineral desiccants, particle filters complete with pressure regulators, change-over circuits, and safety pressure relief devices.

2.2.3 Liquid CO_2 (CO_2 Particle) Supply

An *unregulated* liquid CO_2 supply is required with a pressure of between 650 and 950 PSI and a temperature of between 50°F and 75°F. The liquid CO_2 supply must be clean and dry, having a maximum of 10 PPM moisture content, 1 PPM oil content and 5 micron maximum particulate matter. Most commercial supplies meet these specifications. CleanLogix LLC offers purification systems to meet more stringent snow supply specifications. One or more (manifolded) 50 lb. steel cylinders of liquid CO_2 equipped with siphon tubes may be used. No regulator should ever be used. A high-pressure interconnection kit is required and is supplied with the system. CleanLogix LLC offers liquid CO_2 interconnection kits with a variety of filtration system options.

SAFETY NOTE: DO NOT USE A LOW PRESSURE AND TEMPERATURE LIQUID CO_2 SUPPLY. These are

commonly delivered in 300 lb or 400 lb capacity vacuum-insulated Dewar tanks having an internal liquid CO_2 temperature of around 0°F and pressures between 250-350 psi, and typically have both liquid (siphon tube) and gas (no siphon tube) connection manifolds. These types of liquid CO_2 supplies do not work with the PowerSno™ system. Withdrawing low pressure cold liquid CO_2 into a PowerSno™ system will create an internal over-pressure hazard. Cold (0°F) low-pressure (300 psi) liquid CO_2 increases to over 1500 psi at room temperature!

2.2.4 Electric Power

A source of 110 VAC 60 Hz capable of providing 5 amps is required for the PSVP-USTS™. Actual power required for the machine will be found on the nameplate.

2.3 SET-UP AND TEST

2.3.1 Referring to Figure 2, place the PSVP-USTS™ cleaning system with the rear panel connections within reach of the electrical outlet, propellant gas source, and liquid CO_2 source – steel cylinder supply or remote booster supply. All necessary interconnection lines are supplied with the system.

2.3.2 Using the supplied propellant supply hose, connect a supply of clean propellant gas to the propellant gas inlet port. Adjust the source pressure of the propellant gas supply to 150 PSI for best performance but not less than 80 PSI. Turn on supply valve and check for leaks.

2.3.3 Using the supplied high-pressure stainless steel over-braided Teflon line or other proprietary high pressure hose and bottle connection kit, connect a supply of clean high pressure liquid carbon dioxide (i.e., 70 F, 850 PSI supply with siphon tube) to the liquid CO_2 inlet port. Turn on supply valve and check for leaks.

SAFETY NOTE: Do not attempt to repair leaks while the lines are pressurized. Always depressurize a system prior to diagnosing and effecting repairs.

PERFORMANCE NOTE: Most supplies of commercial grade cylinder grade supplies of liquid carbon dioxide contain metallic particles and other residues (i.e., rust residues) which can damage the performance of the PowerSno™ or contaminate the substrate being cleaned. A complete high-pressure liquid CO_2 connection kit, including a high-pressure hose, CO_2 cylinder fitting and seal, standard 10 micron or better filter, and 0.25 inch female compression fitting for PSVP-USTS™ rear-mounted liquid CO_2 supply connection is supplied with the system. Ultra-pure liquid CO_2 and gaseous propellant supplies are highly recommended for precision cleaning applications. We offer purifiers for these applications.

2.3.4 Using the supplied electrical connector, plug the power cord into an electrical outlet with the correct voltage. See the nameplate for the correct voltage.

SAFETY NOTE: Do not provide power to the system if the PowerSno™ spray enclosure or electrical connection line appears physically damaged or if the system cabinet does not have the safety

cover attached. Doing so produces the risk of electrical shock and is a fire hazard.

2.3.5 Place the supplied footswitch assembly in any convenient position for the operator and attach the 3-Pin male connector to Control J1 female connection port on the rear panel. The unit may be shipped with an optional accessory remote actuation cable for assembly machine tool integration. Please refer to instructions provided with this accessory for proper connection and operation or see Figures 9 & 10.

2.3.6 Referring to Figure 1, to power on the unit, depress the "Power" switch to innermost position.

2.3.7 To power off the system, depress the power switch to the outermost position.

2.3.8 If applicable, install a suitable vent line from the vent hole on the rear of the workstation to a suitable vent source (i.e., vacuum source) or to the contamination collection unit, if used.

SAFETY NOTE: The PowerSno™ cleaning system emits oxygen displacing CO_2 gas which if used within a confined space (i.e., a small room or unventilated space) can displace breathing air causing dizziness, headache, or even possible asphyxiation. As such, the PowerSno™ must be used in a properly vented environment (i.e., exhaust or atmosphere turnover rate is equal to or greater than CO_2 emission rate). CleanLogix LLC offers and recommends carbon dioxide and/or oxygen gas monitors to monitor ambient displacing gas or oxygen gas levels wherever doubt exists regarding breathing air displacement concerns. These may include audible alarms, lights or may be integrated with the PSVP-USTS™ (i.e., vis-a-vis Control J1 Switch Circuit) to prevent operation of the system under hazardous conditions.

2.3.9 Referring to Figures 3, 4, 5, & 6 while holding the applicator or mechanically secured in a spray applicator fixture, depress the footswitch. Adjust the propellant pressure with the "Propellant Pressure" regulator knob until the desired pressure (thrust) is reached on the pressure gauge. Turning the knob clockwise raises the pressure (increases thrust). Likewise, turning the knob counterclockwise lowers pressure (lowers thrust). Depressing the right footswitch actuates the CO_2 Composite Spray, comprising both propellant gas pressure and CO_2 particle injection. Adjust the CO_2 pressure with the "CO_2 Pressure Regulator" knob clockwise until the desired pressure of 1150-1250 PSI is reached on the pressure gauge.

PERFORMANCE NOTE: Do not over pressurize the CO_2 above 1450 PSI or failure of the applicator and or relief valve actuation may occur. It is normal for the pressure to move slightly above 1250 PSI and fluctuate down to 1050 PSI while the spray is on during pump cycles.

2.3.10 There should be no obvious gas leaks while the system is charged or while the spray is actuated.

The unit is now ready for operation.

DEPRESSURIZING FOR SHIFT SHUTDOWN OR RELOCATION

2.3.11 Turn off the liquid CO_2 supply at the source (cylinder valve) and the propellant gas supply at the source (regulator/flow control valve). If desired, although not necessary, residual gas and liquid carbon dioxide may be discharged from the delivery lines by securing the applicator and depressing the footswitch or trigger until the system has audibly and visually ceased to produce a CO2 Composite Spray. However, if the system is to be disconnected and relocated, it must be completely discharged to ambient pressure conditions.

NOTE: Both the inlet air supply valve and CO2 supply inlet valve must be turned to the "OFF" position to prevent the internal compressor from cycling rapidly under no load.

3. OPERATION

3.1 PREPARATION FOR CLEANING

3.1.1 Open liquid CO_2 supply valve on cylinder completely.

SAFETY NOTE: Check to see that no leaks are apparent on the cylinder and rear connection ports. If a leak is discovered, follow the stopping procedure in section 3.3 below and repair condition. Also check to see that the ventilation system is operational, if installed.

3.1.2 Open clean dry air or nitrogen gas supply and adjust supply pressure to between 80-150 PSI.

3.1.3 Turn the system on by pushing the power ON/OFF switch to the innermost position.

3.1.4 With the applicator secured, depress the footswitch or trigger. Continue to operate until CO2 particles are visibly detected within the spray.

3.1.5 Adjust the "Propellant Pressure" knob as necessary, until the pressure gauge is between 40 PSI and 120 PSI. The higher the pressure, the faster the surface will be cleaned. Some substrates may be damaged at higher propellant pressure.

3.1.6 The propellant provides adequate heat capacity for the new Vector Pro spray configuration. As such, the heating system in the PSVP-USTS™ has been removed, however, Cleanlogix LLC can provide external heating solutions if required.

3.1.7 The PSVP-USTS™ is now ready to clean parts.

3.2 CO_2 COMPOSITE SPRAY™ OPERATION

3.2.1 Grasp the applicator, aiming the tip of the nozzle at the workpiece. Step on the footswitch or press the trigger to initiate spray cleaning. The cleaning spray will continue to flow as long as the footswitch or trigger are pressed and will bleed all residual gases after depressing or releasing the trigger. The spray nozzle tip should be positioned between 0.5" and 3" away from and at an angle to the surface for optimum contamination removal.

SAFETY NOTE: Use appropriate personal protective equipment such as safety glasses to prevent flying particles or objects from entering eyes, nose, or mouth. In addition, the operator should wear protective disposable gloves to prevent contamination of cleaned surfaces.

3.2.2 Spray cleaning energy is controlled by distance from substrate surface and propellant pressure. Adjust "Propellant Pressure" knob to raise or lower the spray pressure during application.

3.2.3 CO_2 particle production ceases as soon as the liquid CO_2 supply is exhausted. The system

must be shut down prior to exchanging the liquid CO_2 supply cylinder.

3.3 STOPPING AND DEPRESSURIZATION

3.3.1 To shut down the system, close propellant gas and liquid CO_2 supply valves to the PSVP-USTS™.

3.3.2 To depressurize the system, depress the footswitch or trigger until remaining propellant gas and liquid CO_2 contained in the system is vented.

3.3.3 Turn the main power switch to the off position.

3.3.4 A full cylinder liquid CO_2 may be exchanged with an exhausted cylinder as soon as both fluid supply pressures are relieved.

3.3.5 Liquid CO_2 usage varies based on capillary tube type, number of capillary tubes (nozzles) and duration of cleaning operations.

3.3.6 Standby power loss is small and no damage will result to the equipment with continuous pressure on the system.

SAFETY NOTE: The liquid supply cylinder valve should not be left open when it cannot be monitored for sudden and unexpected leaks.

3.4 LIQUID CO_2 SUPPLY CHANGE-OUT

3.4.1 Shut down and depressurize system as per Section 3.3.

3.4.2 Disconnect CGA tank valve adapter from empty liquid CO_2 cylinder.

3.4.3 Wipe or blow off any visible contamination (particles, films) from connection openings – inside surfaces and threads.

3.4.4 Install a new full cylinder of high-pressure liquid CO_2 (i.e., 850 PSI/70°F cylinder with siphon tube).

3.4.5 Startup system per Section 3.1.

3.5 CLEANING PROCESS OPTIMIZATION

3.5.1 CO_2 Composite Spray Cleaning Process

Key factors that control CO_2 Composite Spray cleaning effectiveness and efficiency include:

- Type and level of surface contamination (as qualified in pre-purchase sample testing)
- Nozzle tip-to-substrate surface distance
- Spray angle with respect to substrate surface
- Propellant pressure
- CO_2 particle size and spray concentration
- Spray raster speed

3.5.2 Spray Distance

As the nozzle is moved closer to the surface, the contamination removal rate increases until a maximum rate is realized. This is typically achieved with a spray distance between the spray nozzle tip to the substrate surface of between .5" and 3".

3.5.3 Spray Pressure

The simplest method of changing cleaning speed or quality is to vary the propellant gas pressure using the "Propellant Regulator" knob. The higher the propellant pressure, the faster the surface will be cleaned. The optimal propellant pressure is between 80-150 PSI.

3.5.4 CO_2 Particle Concentration

The cleaning rate and surface cleanliness level are related to the concentration of the active cleaning agent (CO_2 Particles) contained within the propellant gas and delivered to the surface of a substrate. Adjusting the CO_2 pressure up to 1050-1250 PSI controls this concentration (and use rate) of cleaning agent. This pressure threshold must be met to visibly see CO_2 particles and in order to effectively clean a given surface.

3.5.5 Spray Angle and Raster Pattern

The cleaning action and quality will generally improve at a distance between .5" and 3" from the surface. In most cases, cleaning effectiveness is improved with an angled spray impingement and zig-zag cleaning pattern over the surface, repetitively moving from side-to-side and from top-to-bottom of the surface being treated.

PERFORMANCE NOTE: The quality of liquid CO_2 can also impact cleanliness in some precision cleaning applications. Several quality grades of liquid CO_2 are available. CleanLogix LLC offers a carbon dioxide purification system that converts low-quality liquid carbon dioxide into a high-quality cleaning agent (>99.99% purity).

These aspects are covered in detail in CleanLogix Tech Brief – "Cleaning Action and Chemistry of a CO_2 Composite Spray™.

4. TROUBLE SHOOTING

4.1 NO SPRAY

4.1.1 In the event that no flow of propellant and/or snow occurs when the footswitch or trigger is depressed, verify by attempting to spray at a clean shiny piece of metal, plastic, or glass and look for "frosting" or pressure impact on the surface.

4.1.2 Is "Power" on? Are both air and CO_2 inlet valves on? Is the CO_2 bottle open? Inspect.

4.1.3 Does the propellant pressure gauge indicate gas pressure in system when either footswitch or trigger is depressed?

4.1.4 Is snow tube plugged? De-actuate the footswitch or trigger, turn the unit off and only then examine the end of the nozzle. Make sure eye protection is being used. Check by holding tip to light. Allow snow nozzle to sit several minutes if it remains plugged. If plugging continues, propellant pressure may be too low. Adjust the pressure above a minimum of 40 PSI and inspect.

4.2 NO CO_2 PARTICLES

4.2.1. If CO_2 particle flow ceases but propellant is flowing freely, verify as in 4.1 with a piece of clean shiny material.

4.2.2 Is the liquid CO_2 supply empty or almost empty (siphon tube extends to 2" from bottom of supply cylinder)? Release the system pressure per section 3.3. Depress the "Power" switch to "Off" position. Replace liquid carbon dioxide supply and restart the system.

4.3 WEAR PROBLEMS

4.3.1 Coaxial Hose Failure

With normal use of the PSVP-USTS™ the coaxial delivery line should last for many years. However, if a leak or rupture develops, contact CleanLogix LLC for a replacement kit or send the machine prepaid to CleanLogix LLC for replacement service.

4.3.2 CO_2 Valve Leakage

If for some reason the CO_2 valve "sticks" open or leaks, actuate the prime switch to attempt to "clear" the valve stem seat. If a leakage persists, the Teflon valve seat must be replaced. Contact CleanLogix LLC for a replacement kit or send the machine prepaid to CleanLogix LLC for replacement service.

4.4 EXCESSIVE CO_2 OR PROPELLANT GAS USAGE

4.4.1 Liquid CO_2 and propellant gas may be used at various rates, depending on the number of nozzles per applicator. Also, small leaks can also increase the usage considerably. Normal fluid

usage rates for the PSVP-USTS™ are approximately 4 lbs liquid CO_2 per cleaning hour (machine on time) and 2.75 cubic feet of propellant gas per cleaning hour at 80 psi.

4.4.2 Are there any noticeable or audible leaks? Use a pressure gauge between the supply cylinders and the PSVP-USTS™ system and close the valve on the liquid CO_2 supply. Does it drop rapidly?

4.4.3 Does the CO_2 supply hose leak? Check the tank adaptor to the cylinder supply bottle and the tube fittings into the rear of the PSVP-USTS™ using a small needle dispenser containing soapy water (bubble leak test).

5. MAINTENANCE AND REPAIR

5.1 NORMAL MAINTENANCE

5.1.1 HASKEL AAD-5 Spooler Maintenance: Remove, lubricate, and re-install the air spooler every 6 months. Refer to the online AAD-5 Maintenance Manual for instructions.

5.2 REPLACING PARTS

5.2.1 All electronic components contained within the PSVP-USTS™ system are not user-serviceable and must be repaired or replaced by CleanLogix LLC.

5.2.2 When installing external replacement fittings containing pipe threads, use a small amount of thread sealing Teflon tape (recessed slightly back from fitting front) to insure leak free joints. This does not apply to compression straight thread fittings.

PERFORMANCE NOTE: Be careful not to allow any foreign matter such as pipe tape, sealants, or other substances to enter either the propellant supply or liquid carbon dioxide inlet ports as this will cause flow problems and may damage internal components.

5.2.3 The coaxial delivery system uses specially selected materials suitable for temperature and pressure conditions normally present. Do not replace original components with third party components without first consulting CleanLogix LLC.

SAFETY NOTE: Only coaxial spray applicator kits supplied by CleanLogix LLC should be used if replacement is necessary.

5.2.4 After re-pressurizing, inspect all joints for leaks

5.3 ELECTRONIC AND VALVE REPAIRS

5.3.1 If electronic device or fluid valve repairs become necessary, the machine should be sent prepaid to CleanLogix LLC for factory repair and re-calibration.

6. PARTS LISTS

6.1 REPLACEMENT PARTS

PART NUMBER	DESCRIPTION	QTY
SYSTEM		
PSVP-USTS™- SFS	FOOTSWITCH, SINGLE	1
PSVP-USTS™-ASP	HASKEL AAD-5 AIR SPOOLER	1
PSVP-USTS™-PS	AC/DC POWER SUPPLY	1
PSVP-USTS™-SV	SOLENOID VALVE	2
MANUAL		
PSVP-USTS™ -PSVP-USTS	OPERATION MANUAL, PSVP-USTS™	1

7. SAFETY

7.1 SAFETY DESIGNS

The PSVP-USTS™ Universal CO_2 Spray Treatment System has been designed to be an environmentally safe as well as human-safe cleaning technology. The electronics and pressure components used in the PSVP-USTS™ are of the highest quality and rated for the conditions present in the machine. However, if the machine is misused it can result in personal injury.

7.2 MATERIAL SAFETY DATA

Read and understand the safety precautions given in the Material Safety Data Sheet (MSDS) for handling and using liquid and solid carbon dioxide, provided by your liquid carbon dioxide supplier.

7.3 INSTRUCTION MANUAL

Follow all instructions for using the PSVP-USTS™ given in this instruction manual. The PSVP-USTS™ cleaning system sprays a stream of propellant and snow particles. This means that cold burns and impact and inhalation injuries can result if used improperly.

7.4 APPLICATORS AND SUBSTRATES

Always wear gloves when handling PSVP-USTS™ spray applicators and when cleaning substrates. Handle substrates firmly or fixture them for spray cleaning.

7.5 SKIN AND EYE CONTACT

Never contact or impose the end of the spray applicator directly to the skin (or eyes) and never block the opening of the propellant nozzle with any object, especially your hands and fingers. This can result in a cold injury, impact injury, and/or gas embolism (injecting gas into tissue).

7.6 CO_2 SUPPLY

Use only liquid carbon dioxide stored in a 20 lb. or 50 lb. steel cylinder equipped with a siphon tube and having a pressure between 700 and 850 psi and a temperature of between 50° F and 75° F (high pressure supply). Do not use low pressure-low temperature liquid CO_2 with this machine.

7.7 PROPELLANT GAS SUPPLY

Use only clean inert and regulated gas supply at a maximum inlet pressure of 150 PSI.

7.8 DEPRESSURIZATION

Always turn all valves to the OFF position and depressurize the PSVP-USTS™ gas and liquid supply systems for overnight and extended non-use.

7.9 VENTILATION

If used in small rooms or confined spaces, always ventilate the PSVP-USTS™ work area to prevent the buildup of carbon dioxide gas. Never use the PSVP-USTS™ cleaning system in a confined space or without proper ventilation as a build-up of carbon dioxide will displace breathing air, causing headache, dizziness, or induce unconsciousness. Use a CO_2 gas monitor equipped with an audible alarm when operating within a small room or confined space.

8. DOCUMENT CONTROL

Revision Number	Date	Responsible Engineering Authority (REA)
PSVP-USTS OM 1.3	04-02-2024	Mack Jackson

9. NEED HELP?

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