CryoTechnics

cleaning solutions

Operations Manual for the

CryoMax Plus! V3P

pneumatic dry-ice blasting machine

Content:

GENERAL INFORMATION

The CryoMax Plus! V3P and its accessories have been developed with the aim of supplying cleaning equipment which minimizes consequential cleaning costs.

Dry ice blasting provides a dry cleaning process. The blasting media itself (dry ice pellets) sublimates: this means that in most cases the process can be used for cleaning components, machinery and plant equipment without dismantling and often without having to cover adjacent plant equipment.

Dry ice blasting provides a dry and gentle, but extremely efficient, cleaning process that leaves no residual blasting media to be disposed of, and no undesired substances that might penetrate into or be deposited on machines and plant components. This means that cleaning by dry ice blasting becomes an excellent alternative to cleaning with traditional methods.

DRY ICE BLASTING – How does it work

Dry Ice Pellets

The CryoMax Plus! V3P uses small CO_2 ”particles” as blasting medium, called dry ice pellets (CO_2 – the chemical symbol for carbon dioxide). For producing dry ice pellets a machine commonly known as a pelletizer is being used. In this pelletizer, liquid CO_2 is used to produce hard and uniform dry ice pellets. The pellets are approx. 3 mm (0.1 inch) in diameter and approx. 10 mm (0.4 inch) in length – or rice-sized. These dry ice pellets have a temperature of -79°C/-110°F. When used for dry ice blasting, the pellets are blasted onto the object to be cleaned at a very high velocity. On contact with the surface of the object, they immediately change from a solid to a gaseous form as they heat up on impact.

Method

The CryoMax Plus! V3P contains a dry ice reservoir and a feeder system, which feeds the dry ice pellets into the compressed air stream. The compressed air transports the dry ice pellets through a special blasting hose to the blasting gun and nozzle. In the nozzle, the air stream is accelerated, and the dry ice pellets leave the nozzle at very high velocity.

From the hopper, dry-ice pellets enter a rotating feeder-disc. This is a disc with holes which during rotation are filled with dry ice pellets. From another point these dry ice pellets by means of compressed air are fed into the blasting hose. During operation the blasting air pressure and the dry-ice consumption can easily be controlled.

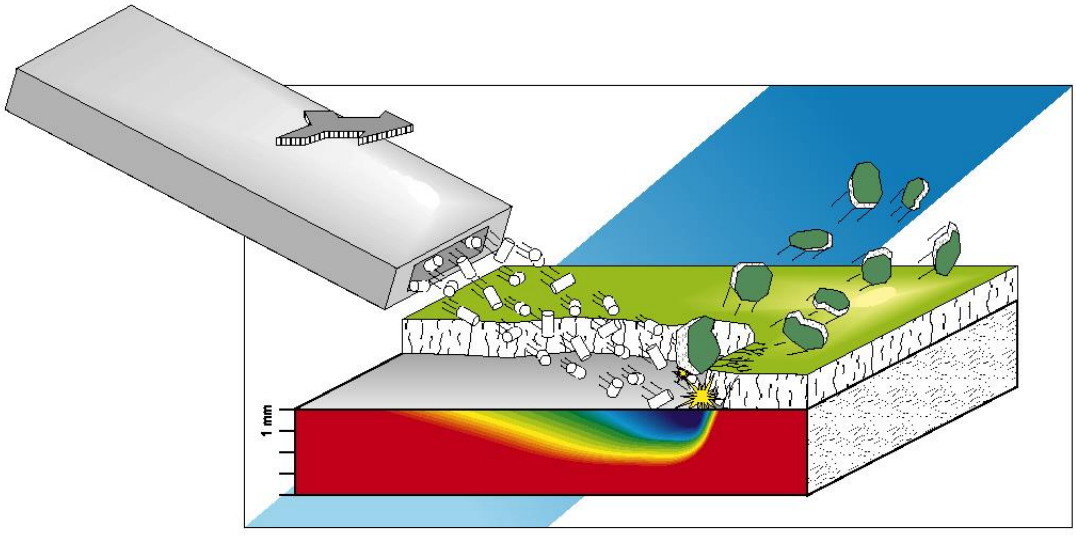
Cleaning Effect

The cleaning effect of dry ice blasting is based on three principles:

***Thermal Effect*:** The dry ice pellets have a temperature of -79°C/-110°F, and impurities are therefore cooled down drastically: the impurities shrink and loosen due to different thermal expansion coefficients.

Kinetic Effect: When the dry ice pellets leave the nozzle they have high kinetic energy and hit the impurities at a speed almost equivalent to the velocity of sound.

Sublimation Effect / Volume Expansion: The dry ice pellets are being pressed into the brittle impurities and sublimate immediately on contact. This results in a volume increase by a factor of approximately 700 witch blows away the impurity like a mini explosion.



Depending on the kind of impurity, the thermal effect will be the most significant factor, in other cases the kinetic effect will be the most significant factor.

SAFETY REGULATIONS

General

This manual contains instructions and safety regulations which must be followed while starting, operating and maintaining the CryoMax Plus! V3P. It is important that the manual is kept, so the operator always knows its exact location. It is also important the owner makes certain that the operator reads, understands and follows the contents of the manual.

Personnel Qualifications

Personnel responsible for operation, servicing and maintenance must be suitably qualified to perform these functions. Special training in machine handling, dry ice handling as well as repair and maintenance is offered by CryoTechnics or its local representative.

The owner of the machine must ensure that the person appointed to operate the CryoMax Plus! V3P fully understands and is able to follow the SAFETY REGULATIONS defined in the following pages, and the WARNING SYMBOLS located on the machine.

Safety and Risk

The machine is constructed to comply with the standards and clauses contained in the declaration of conformity and the terms of sale. Therefore, provided the manufacturer's instructions are followed, the machine will not pose any risk to the operator.

Precautions during Blasting

Air, CO_2 gas and dry ice pellets leave the gun nozzle at a very high velocity (up to 300 m/s – 984 ft/s).

Therefore:
- **do** not aim the nozzle at a person(s) or in the direction of a place(s) where other people work,
- **dry** ice pellets can be deflected back from the object being cleaned
- **do** not aim the nozzle in directions where damage might result.

Only use dry ice pellets as blasting agent. Do not use the machine "for fun" and under no circumstances should you aim the gun nozzle at persons or other living creatures.

POTENTIAL HAZARDS

Static Electricity
Serious discharge of static electricity can occur. Always make sure that objects to be cleaned are adequately earthed/grounded and that this earthing/grounding remains stable throughout the whole cleaning process. The CryoMax Plus! V3P is earthed/grounded, from machine cabinet to blasting gun.

Pacemaker precautions
Do NOT use the CryoMax Plus! V3P, if you are wearing a pacemaker. The CryoMax Plus! V3P may cause pacemaker malfunction.

Explosive Hazard
The machine must never be used in surroundings where there is a danger of explosion. Despite optimum earthing/grounding of both machine and cleaning object, static electricity can be generated and create a spark.

Danger of Frostbite
At atmospheric pressure, CO_2 in a solid form has a temperature of -79°C/-110°F or lower and can give cryogenic burns when the dry ice or cold parts comes in contact with unprotected skin.

Important!
Therefore, always read the safety data sheet provided by the dry ice supplier, and follow the instructions given.

CO_2 Concentrations

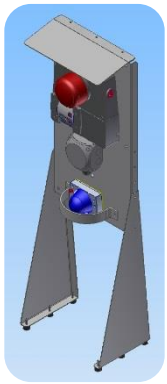
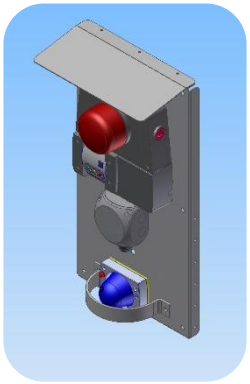
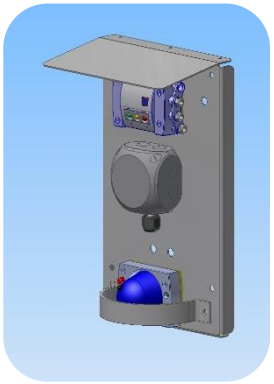
Always sufficiently ventilate the space where dry-ice is used. Both the concentration of the carbon dioxide as well as the concentration of the removed materials have to be taken into consideration regarding the personal safety!
Risks, if present, can be lowered by removing the air at the blasted object (for instance Vacublast). The removed air has to be ventilated, if necessary after filtering, to a place where both the carbon dioxide and the removed material cannot cause a danger. The MAC-value (the Maximum Allowable Concentration in which a person during 8 hours is allowed to work) of CO_2-gas is 5.000 ppm, i.e. a maximum concentration of 0,5 %. The MAC-value of the removed material has to be taken into consideration separately.

The following table is based on the Eiga Code Of Practice Dry Ice.

Volume in percent	**Likely effects**
0,04 %	Natural concentration.
0,5 %	TLV concentration (approx. 8 hours of operation).
1 – 1,5 %	Slight effect on chemical metabolism after exposures of several hours.
3 %	The gas is weakly narcotic at this level, giving rise to deeper breathing, reduced hearing ability, coupled with headache, an increase in blood pressure and pulse rate.
4 – 5 %	Stimulation of the respiratory center occurs resulting in deeper and more rapid breathing. Signs of intoxication will become more evident after 30 minutes of exposure.
5 – 10 %	Breathing becomes more laborious with headache and loss of judgement.
Above 10 %	When the CO_2 concentration increases above 10%, unconsciousness will occur in less than one minute and unless prompt action is taken. Further exposure to these high levels will eventually result in death.

Gas monitoring

As stated above, high CO_2 concentrations can displace oxygen and result in unconsciousness. Therefore, it is strongly advised to use a gas monitoring system with alarm function. The following systems can be placed in the space where dry-ice is used:

The above gas monitoring systems are plug-and-play: install in area where you use dry ice blasting, connect the power-cord into the power supply and the system is operational. This way you have a proper alarm system where you will be alarmed, in time, in case of too high CO_2 level.

Required ventilation

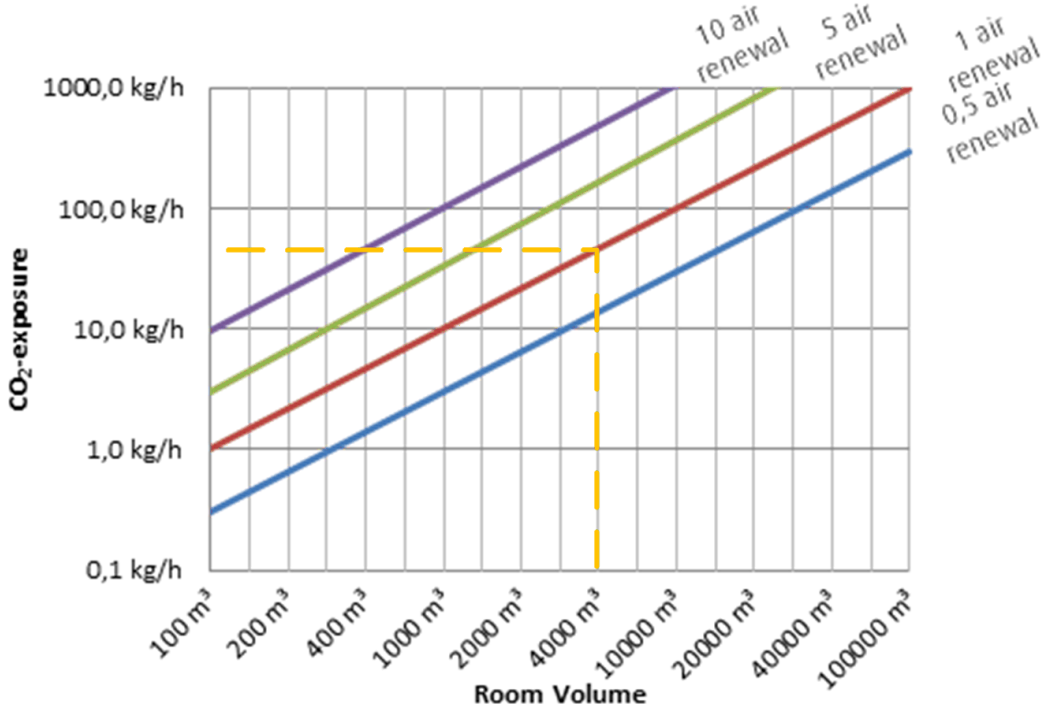
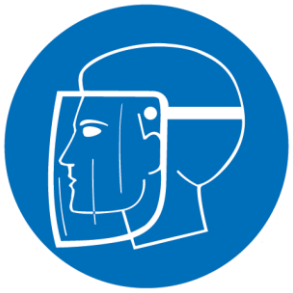


Chart for necessary ventilation

Required exchange of room's volume to achieve Threshold Limit Value below 0,5 vol %. The following chart is based on VDMA 24389, "Blasting Technology".
An example: If the blaster is emitting 60 kg/h CO_2 into a room of 400 m^3, you need to exchange the room's volume once per hour (4000 m^3/h) to ensure a CO_2 level lower than 0,5%.

REQUIRED PERSONAL PROTECTION EQUIPMENT (PPE)



Danger of Thrown Loose Objects

There is a risk of dry ice pellets and small objects being deflected back during blasting. Therefore small objects must be firmly secured before blasting. Loose objects must not be left in the area where the cleaning process is taking place!! The operator must always wear approved protective goggles or a protective shield when working with the dry ice blasting machine. This also applies to anybody near the workspace.

Noise

Noise protection must be worn because of the high air velocities in the gun nozzle during dry ice blasting. During the dry-ice blasting process the volume can be higher than 100 db (A).

Dust

Certain types of impurities will completely pulverize during the dry ice blasting process. Therefore we recommend that the operator wears a dust mask or if necessary a breathing mask and industrial protective clothing.

Gloves

Wear protective gloves because some parts of the CryoMax Plus! V3P can get very cold. Flying objects might enter your skin during blasting. Make sure the gloves have closed cuffs so no dry ice can enter the glove and cause frost bite. CryoTechnics recommends the protective clothing to comply with ISO 14877:2002, "Protective clothing for abrasive blasting operations using granular abrasives" comparable standards.

Danger of Congelation

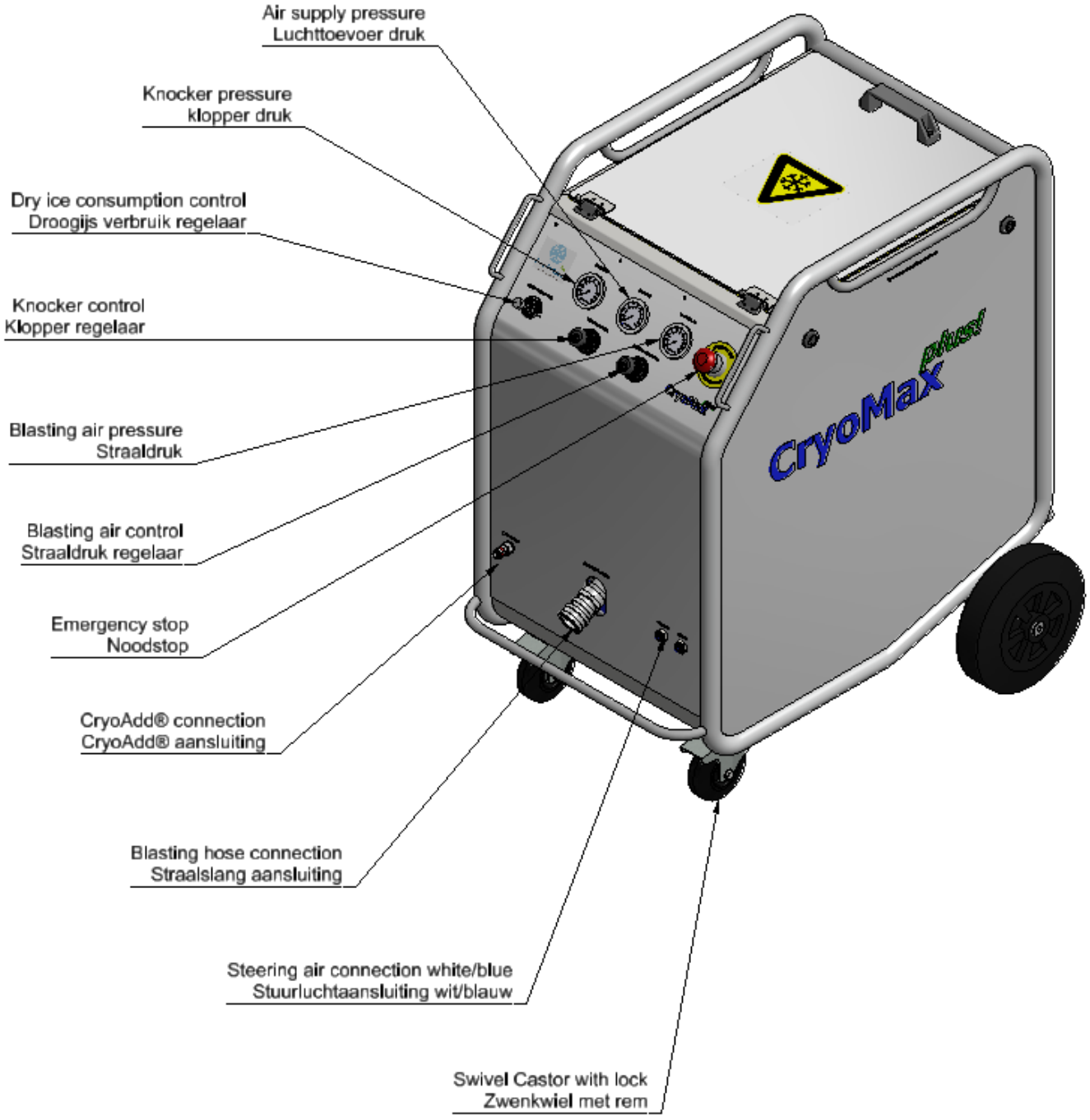
Operators must wear tight protective clothes to secure the skin against dust and any flying objects released during blasting. CryoTechnics recommends the protective clothing to comply with ISO 14877:2002, "Protective clothing for abrasive blasting operations using granular abrasives" or comparable standards.

Footwear

Safety footwear must be worn to ensure stable standing. In addition, to prevent injuries if the blasting gun accidentally falls.

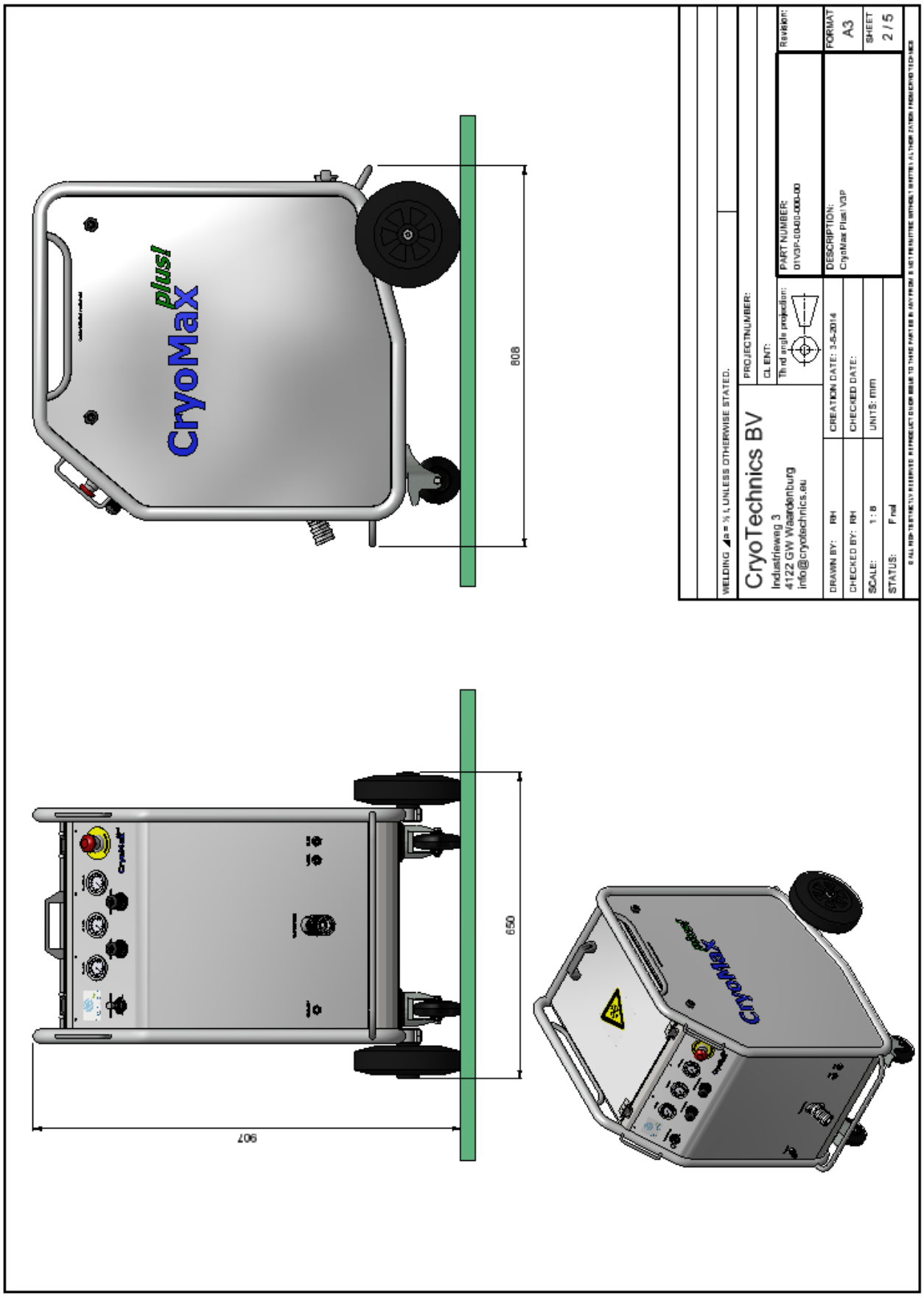
TECHNICAL INFORMATION CRYOMAX PLUS!

Overview front side

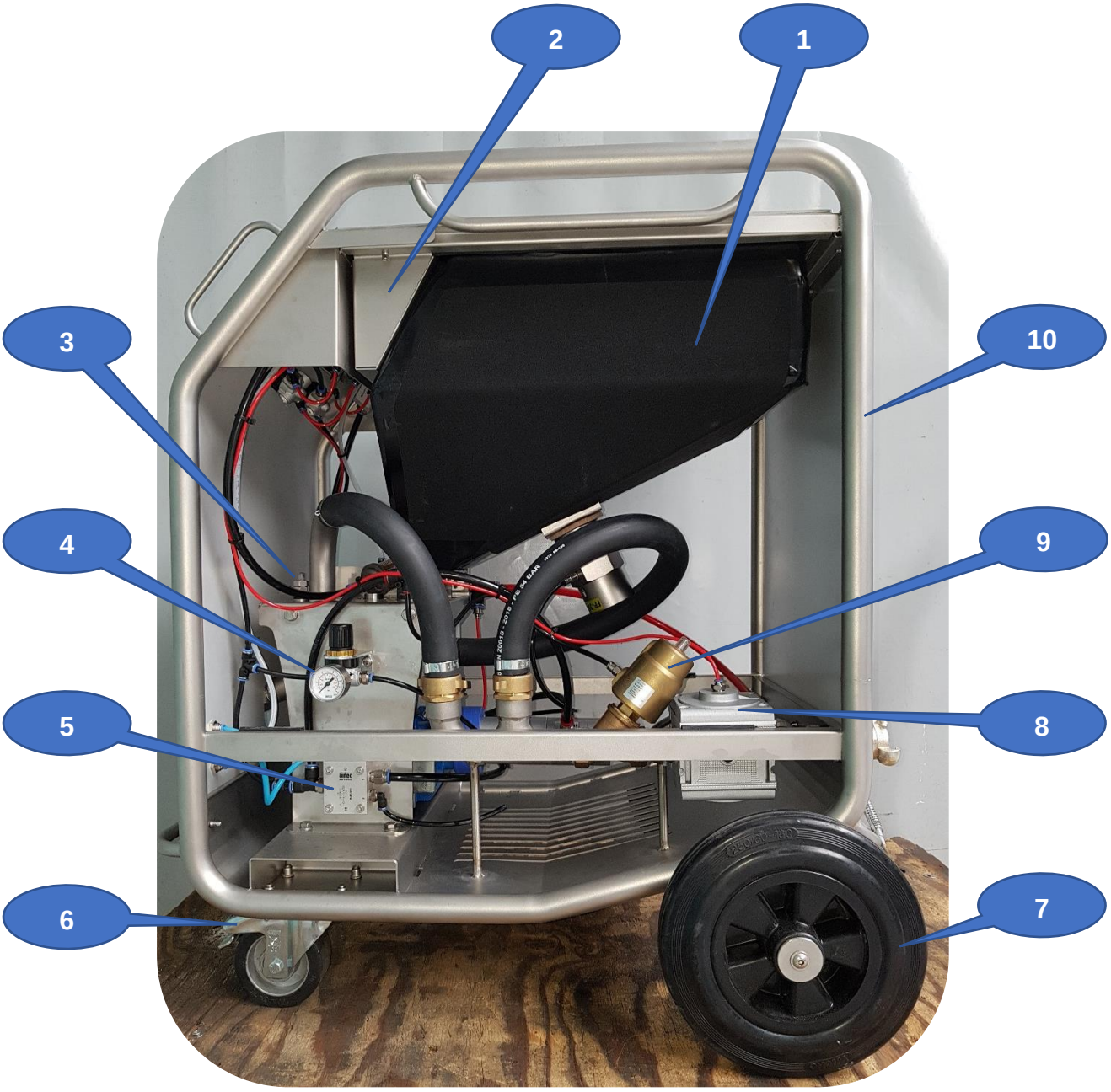


Overview back side

Dimensions

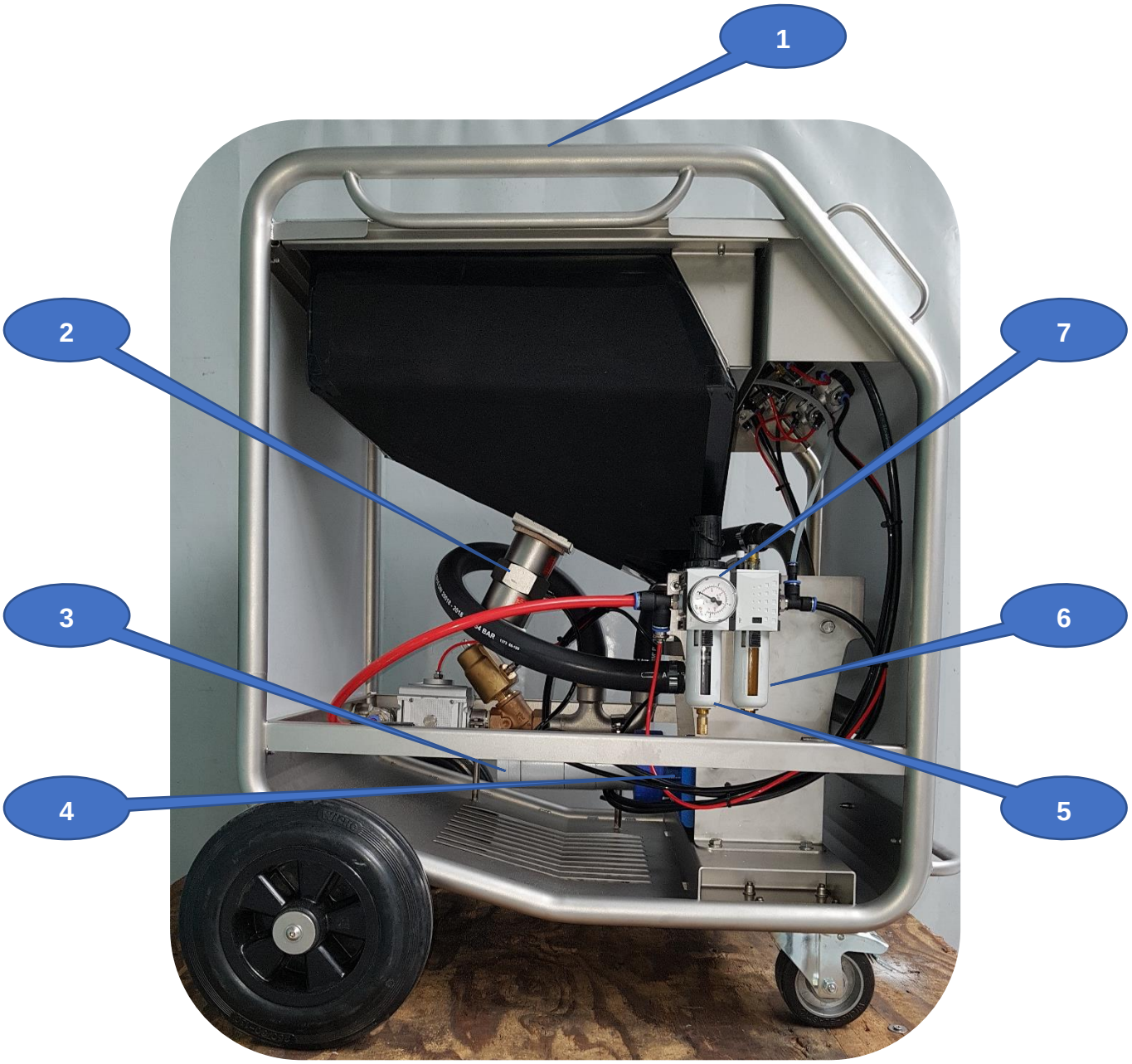

CryoMax plus!
808
907
650
CryoTechnics BV
Industrieweg 3
4122 GW Waardenburg
info@cryotechnics.eu
PROJECTNUMBER:
CLIENT:
PART NUMBER:
DTV3P-00400-000-00
DESCRIPTION:
CryoMax Plus! V3P
CREATION DATE: 3-5-2014
FORMAT
A3
SHEET
2 / 5

Overview inside right



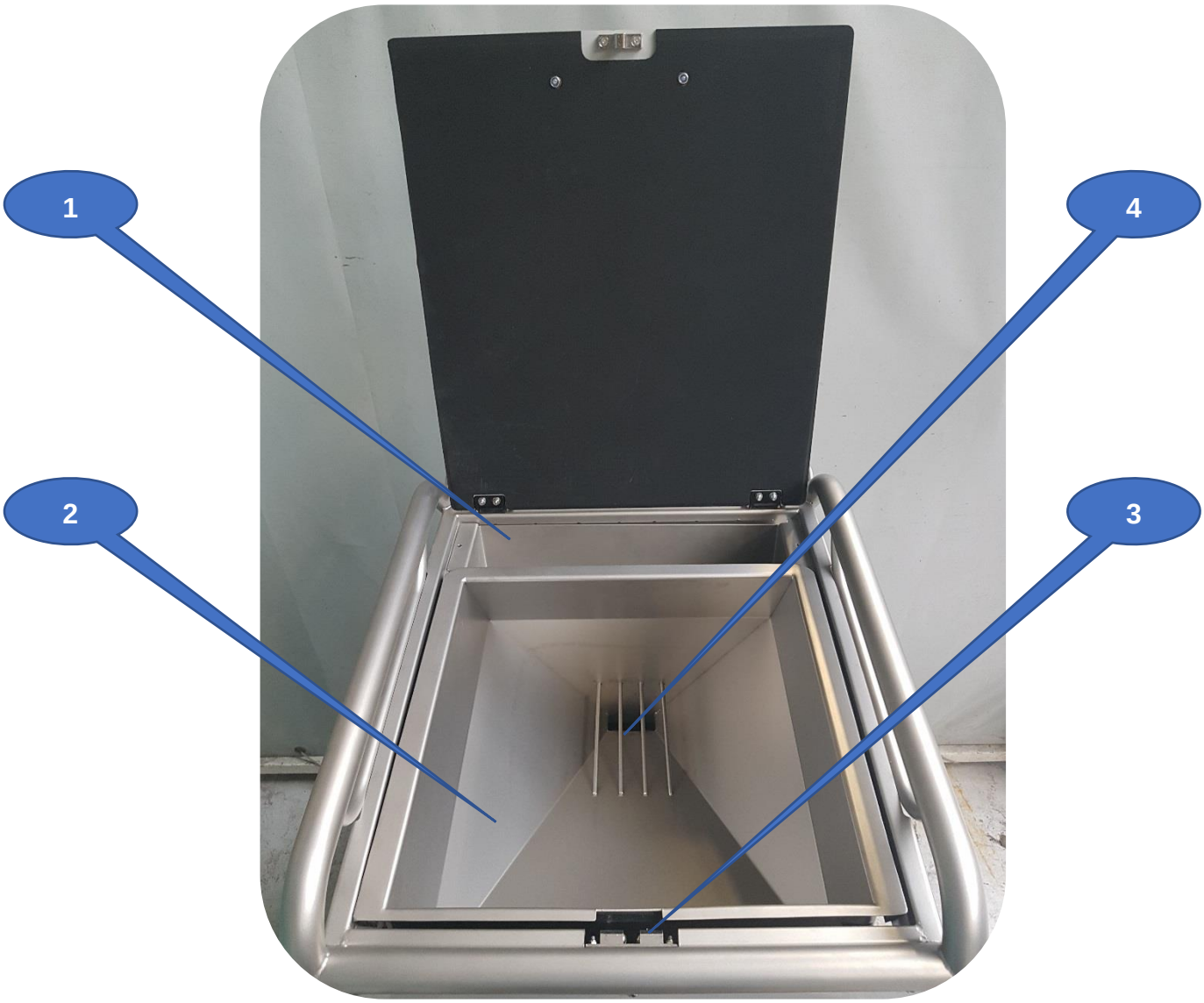
1: Hopper (dry ice reservoir) insulated
2: Toolbox
3: Feeder system
4: Regulator CryoAdd® (set 1 bar)
5: Pneumatic 3/2 valve
6: Swiveling front wheel with brake
7: Back wheel
8: Dome valve for pressure control
9: Main air valve NC
10: Stainless frame

Overview inside left



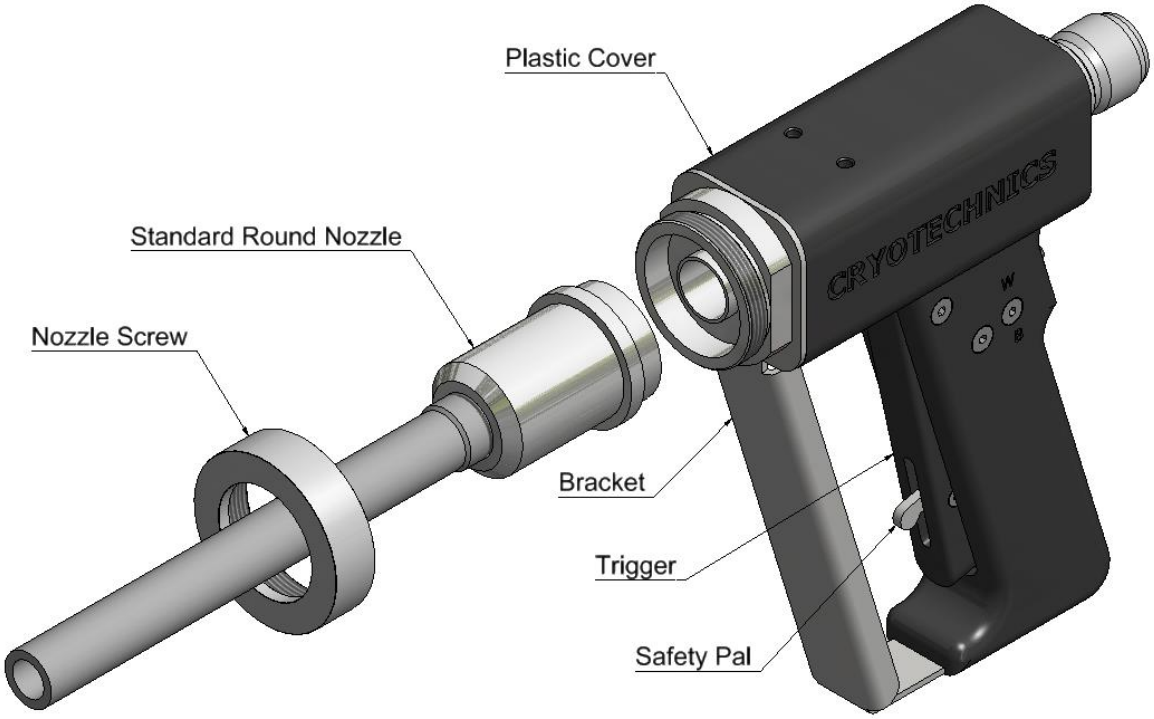
1: Grip for maneuvering or lifting
2: Knocker
3: Air motor
4: Gearbox
5: Filter
6: Oiler
7: Regulator internal air supply (set at 7 bar)

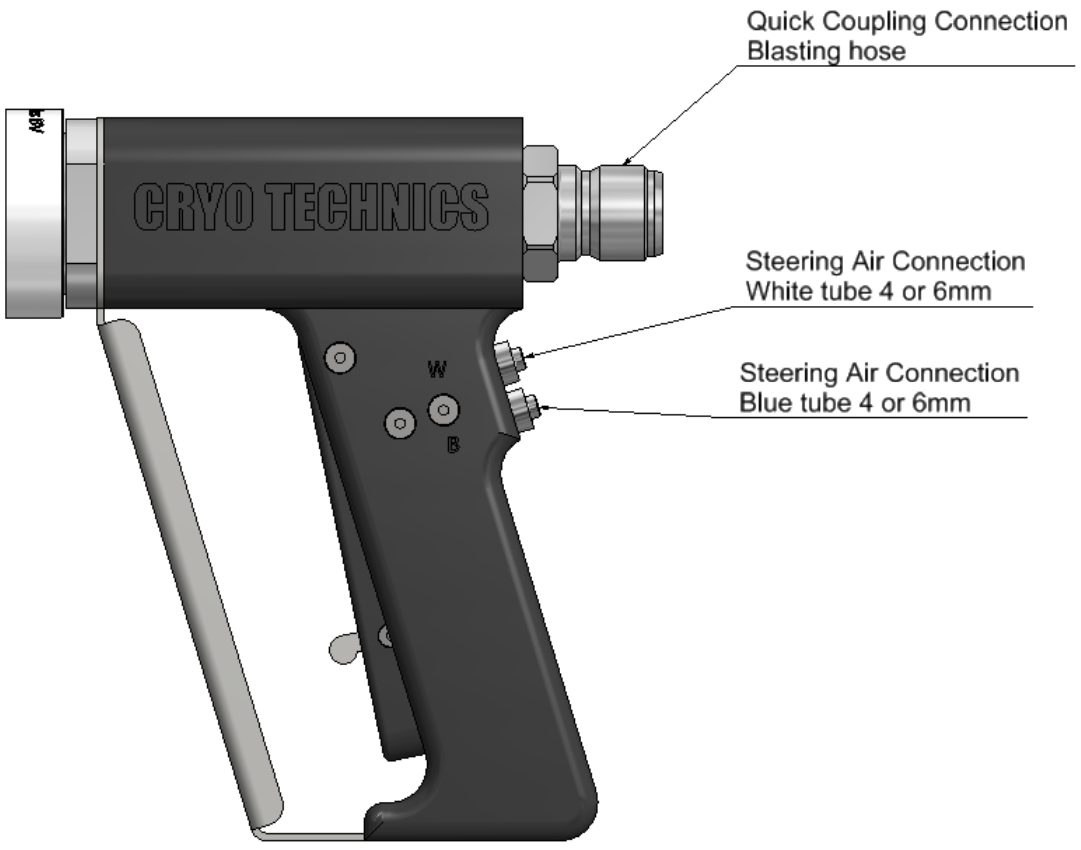
Overview top side



1: Toolbox
2: Hopper
3: Lock for cover
4: Hopper grit

Blasting gun



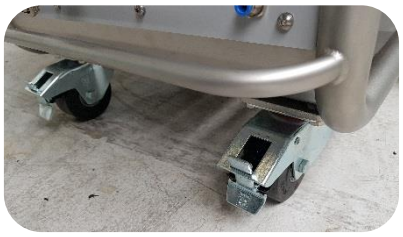


SET UP THE CRYOMAX PLUS!

Safe Set-up

1: For maximum safety we advise that one operator alone takes care of the complete set-up including all connections.

2: Give the CryoMax Plus! V3P, nozzles, tools, blasting hose and air supply hose an visual inspection on damage every time you do an set-up. In case of visual damage: stop with set-up and first repair or interchange the damaged part.



2: The CryoMax Plus! V3P is on wheels and can (after unlocking the 2 front-wheels) be positioned manually by means of two grips on the top. The CryoMax Plus! V3P must be placed on a flat surface. Do not place the machine in a hot or extremely dusty space and do not expose the machine to frost, excessive rain or moisture to prevent freezing. Once in position the front-wheels must be locked. In the bottom plate of the CryoMax Plus! V3P are openings where condensation water can come out. Make preparation to avoid the underground get slippery and/or damage. In certain cases dry ice can come out of the machine. Make preparation to avoid the underground get slippery and/or damage and/or dry ice can fall on people and/or objects on lower levels. Make sure the blasting and air supply lines and the white and blue control lines are out of the way from any traffic. The blasting- and air hose should not make sharp curves. Avoid stepping on the hoses.

3: Before connecting the compressed air hose to the machine, the work area must be secured. This can be achieved by placing caution tape around the blasting area. The standard delivered high quality air supply hose has claw-couplings. The air hose is easy to couple on the back side of the CryoMidi Eco V3E and can be secured against accidental opening with the screw ring behind the coupling. After comparing and checking the available air pressure, air capacity and air quality*, connect the delivered air supply hose from the main air supply (i.e. compressor) to the "Air supply" connection at the back of the CryoMax Plus! V3P. Tighten all connections and use the whip-check cable to secure the air supply hose to the CryoMax Plus! V3P. To avoid trouble we advise to use as dry as possible compressed air! (Dew point < 15 °C). The use of more moisturized compressed air than specified can cause malfunction.

* is standard medium air with a minimum air supply pressure of 5 bar, required for the correct functioning of the pneumatic parts.
The maximum air supply pressure numbers 16 bar.
The temperature of the air pressure is not allowed colder than + 5 °C. (to avoid damage to the synthetic parts of the pneumatic parts).

4: Connect the blasting hose to the "blasting air" connection at the front of the CryoMax Plus! V3P. Hand-tight is enough. Don't use to much force if using a wrench. Keep the thread clean of dust and dirt, use a little bit of suitable grease.

5: Connect the blue and white steering control lines from the blasting hose at the front panel of the CryoMax Plus! V3P by pushing them into the push-in fittings.

To disconnect them, push back the blue ring and pull out the control line. Mount the required nozzle on the blasting gun and tighten the nozzle screw by hand.

6: Press the Emergency stop button on the control panel to secure the machine.

7: Slowly pressurize the air supply hose (max. 16 bar). Check the "air supply" pressure on the control panel.

WARNING!
While the system is pressurized, never disconnect any lines or loosen any fittings !!

8: While the operator holds the gun in a safe position, unlock the Emergency stop button by turning clockwise, set the blasting pressure at 2-3 bar and start the machine by pressing the blasting gun. Air comes out of the nozzle and the knocker starts to operate. Let the machine run for about 60 second at 2-3 bar to remove any moisture out of the system.

9: Make sure the hopper is dry and clean, fill the hopper with a small amount of CryoPellets® and close the cover.

WARNING!
The CryoMax Plus! V3P is only suitable for dry ice pellets (1-3mm).
Other blasting media can cause great damage !!

Point the nozzle in a safe direction and start the machine by pressing the blasting gun till the hopper is empty.

10: Always close the cover. This avoids that:

- -blasted dirt gets into the hopper where it may cause damage to the feeder mechanism
- -unnecessary loss by sublimation of the dry ice pellets
- -excessive attraction of moisture.

11: The CryoMax Plus! V3P is now ready for operation.

OPERATING WITH THE CRYOMAX PLUS!

Pressing the gun trigger (CryoPellets® blasting)

After pressing the gun trigger the following happens:
the blue steering airline will be pressure rise and switches, with a small delay, the 3/2 valve witch activates:

- the knocker on the hopper (check by ears)
- the main air valve NC
- the flow of pressure air to the feeder system

WARNING!
Before activating the blasting gun, the operator must stand in a working position that prevents loss of balance causes by possible backpressure !!

Adjustment of pressure

After blasting with sufficient pressure and air capacity the blasting air pressure can easily be controlled with the manual controlled valve "blasting air" on the operating panel from 2 to 16 bar.

Adjustment of dry ice pellet consumption

The amount of dry ice pellets can be reduced or increased (up to approximately 40kg/h minimum up to approximately 100kg/h maximum with the manual controlled valve “dry ice consumption” on the operating panel. This valve controls the speed of the feeder disc:

-counter-clockwise is more dry ice (the feeder disc goes faster and gives more ice)
-clockwise give less dry ice (the feeder disc goes slower and dives less ice)

With changing the feeder disc (optional available in different thicknes) the quantity of dry ice pellets can be changed from the standard settings till more or less consumption kg/h.

Changing the nozzle

Close the main valve of the air supply and start blasting to depressurize the system, make sure no air is coming out of nozzle.
Press the emergency button and keep the gun in a safe direction.
Unscrew the nozzle screw by hand (in a safe direction).
Pull the nozzle by hand from the gun.
Change the nozzle.
Tighten the nozzle screw by hand.

Note: Check if the screw thread is clean and pure when connection cannot be turned by hand. If necessary, grease the thread.

Effectiveness

The effectiveness of the cleaning - measured in m^2/h cleaned surface – depends on the to be removed pollution, the surface structure and the temperature of the surface. The operator can change the cleaning effectiveness by adjusting the blasting pressure, the dry ice consumption and type of nozzle.

With higher blasting air pressure more air will flow through the nozzle. In consequence of this the speed of the dry ice pellets will get higher and the impulse increases.

Filling dry ice into the hopper

Best performance will be get with fresh dry ice pellets (1-3mm). Other blasting media cause great damage! Make the hopper dry in case of condensation drops. Always use the delivered dry ice shuffle and make sure it's clean. Always close the cover, this avoids that:

-blasted dirt gets into the hopper where it may cause damage to the feeder system
-unnecessary loss by sublimation of the dry ice pellets
-excessive attraction of moisture.

Run the hopper complete empty every 2-3 fillings to check if there are no bigger dry ice part left. If so, remove first before refilling the hopper.

Emergency stop

Activation of the emergency stop button immediately stops the blasting air stream and dry ice dosing.

WARNING!

Keep in mind the set-up is still under pressure after activating the emergency stop !!

For un-locking the emergency stop button, turn the red button counter-clockwise.

The blasting hose

The blasting hose is subject to high demands. It has to be suitable for a pressure up to 10 bar, a temperature of -78,5ºC and must resist wear from the inside during which all the hose has to stay flexible. Further also the blue and white signal lines and a break/static electricity discharge cable are led along the hose.
Especially in curves the blasting hose is sensible for wearing from the inside by the along scraping dry ice pellets. This wear can be excessive if the blasting hose makes a sharp curve. For example a sharp curve direct at the blasting gun. This effect will become worse because at the same time the blasting hose is cooling down extremely. Also a sharp curve direct from the machine shows this effect. We therefore advise strongly to follow a minimum curve with a radius of 50 cm. By taking the blasting hose over the shoulder during blasting, can avoid a sharp bend behind the blasting gun.

Blasting- and Air Supply Hose Repair

Blasting- and air supply hoses must only be repaired either by an CryoTechnics technician or by the owner's qualified personnel having been trained by CryoTechnics in the repair and maintenance of CryoTechnics dry ice blasting machines and accessories. Beyond the necessary knowledge, the person concerned must have appropriate tools and equipment, as well as the auxiliary materials required, at his disposal. We advise yearly inspection of the blasting- and air supply hose with a pressure test. CryoTechnics has the expertise and tools to do such test. A certificate will made of the test.

SHUT-DOWN THE CRYOMAX PLUS! V3P

Safe Shut-down

1: For maximum safety we also advise that one operator alone takes care of the complete shut-down including all disconnections.

2: Empty the hopper and activate the trigger switch on the blasting gun for a few seconds in order to empty the system of possible dry ice residue.

3: Close the compressed air supply.

4: Activate the trigger switch on the blasting gun for a few seconds in order to depressurize the system. Check on the control panel at the pressure-gauge "air supply".

5: Carefully loosen the coupling of the main supply before complete disconnecting as there may still be pressure in the air supply line.

MAINTENANCE

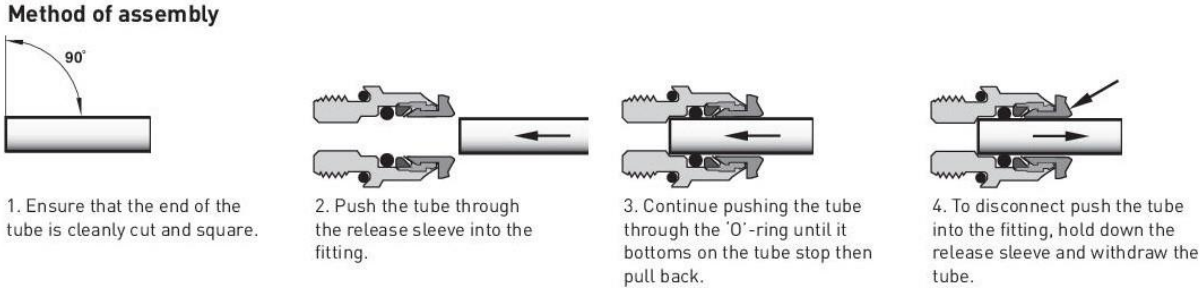
Introduction

The CryoMax Plus! V3P requires only a minimum of maintenance. The daily inspection is however very important, see point 2 by "SET UP THE CRYOMAX PLUS! V3P"

WARNING!
Make sure that the machine is completely depressurized before opening or disconnect any lines or loosen any fittings !!

WARNING!
Make sure make sure only authorized personnel opens the machine !!

All air tube connections are made by push-in fittings. Please follow the next procedure to remove or insert an air tube:



Examine every 100 hours all connections for wear and tear or other damage, repair or interchange the damaged parts if necessary.

Cleaning of the CryoMax Plus! V3P

The construction of the machine is made out of stainless steel. The panels are made out of aluminum with a special coating. The symbols and text on the panels are IN the coating. The machine can be easily cleaned with water.

Moisture and oil from compressed air

An important point to be considered is moisture. The CryoMax Plus! V3P can in principle also operate during some time with wetter compressed air than specified (dew point > 15 °C). The internal water separator removes the remaining water drops for the greater part from the compressed air. Still remaining moisture (vapor) in the compressed air will unavoidably condensate in the pneumatic components and will in there build up a mixture of water and oil. During longer operation this mixture also can become solid (ice).

Check the function of the water filter, clean if necessary by removing the bowl. For removing: unscrew counter-clockwise. Change at least once a year the filter element of the filter.

Storage of equipment

Store the CryoMax Plus! V3P, the blasting hose and air supply hose in a dry and clean area with a minimal temperature of 5ºC and a maximum temperature of 40ºC.
Make sure no dirt like dust and/or sand comes in the air supply hose, this can cause damage to the feeder system.

REPAIR AND WARRANTY

Repair

The repair/replacement of the following parts can be made by the owner's qualified personnel:
- -Blue/White signal lines in the blasting hose
- -Loose/leaking pneumatic tubes
- -Blasting hose couplings on the machine, blasting hose and gun

When making repairs/replacements, use only original CryoTechnics spare parts.

Terms of Warranty

In order to comply with the terms of the warranty, and for safety reasons, repairs other than those stated above require relevant tools and equipment and therefore must always be made either by an CryoTechnics technician or by the owner's qualified personnel who have been trained by CryoTechnics in the repair and maintenance of CryoTechnics dry ice blasting machines and accessories. Beyond the necessary knowledge, the person concerned must have appropriate tools and equipment, as well as the auxiliary materials required, at his disposal.

The liability of the manufacturer under the terms of the CE endorsement as regards safety may become invalid if:
- -If repairs are made using non-CryoTechnics spare parts.
- -If repairs are made by unqualified personnel.
- -If repairs are unsatisfactory due to lack of relevant tools and equipment.

In such cases, the liability of the manufacturer will be solely confined to any manufacturing faults/errors made prior to the machine being delivered and before repairs/replacements have been made.

Technical data CryoMax Plus! V3P

Dimensions	760 L x 650 W x 915 H (mm)
Weight	CryoMax Plus! V3P: 90 kg excluding - air supply hose 10m: 5,5 kg - blasting hose 7 m: 8,5 kg - blasting gun: 1,5 kg - standard round nozzle: 1,5 kg
Material of construction	Stainless steel with aluminum panels
Hopper contents	ca. 40 kg dry ice pellets
Dry ice pellet consumption	standard feeder disc 15mm adjustable from ca. 40-100 kg/h other ranges are available as option
Blasting pressure: Air supply consumption: Air supply pressure input: Air supply quality	adjustable from 2-16 bar ca. 1-11m^3/min depending on used nozzle min. 5 bar, max. 16 bar oil- and dust free (d.p. preferably < 15ºC)
Connections machine: Compressed air: Blasting hose :	 Claw coupling ¾" BSP male
Blasting hose	length 7 or 10m: ¾" BSP (= straight)
Air supply hose Length Maximum surrounding temperature	 10 m: 1" claw coupling + 70ºC
Standard nozzles	1 straight round (high performance) 1 flat nozzle 1 bended round nozzle
Noise level at a distance of ca. 1 m	The noise level of the CryoMidi system ranges from 81 dB (A) at pressures of 5 bar to 110 dB(A) at pressures of 10 bar, dependent on used nozzle and surface
Standard accessories	1 static electric discharge cable 1 safety package 1 dry ice shuffle 3 nozzles

Technical data dry ice pellets

Dimensions	Ø ca. 2,5 - 3 mm x ca. 5 - 10 mm
Carbondioxide (dry ice)	approx. 99,95 % CO_2
Density dry ice	> 1.560 kg/m^3
Density CO_2-gas	1,87 kg/m^3 (15 °C, 1.013 mbar)
Temperature dry ice	- 78,9 °C (1013 mbar)
1 kg dry ice pellets gives	approx. 0,535 m^3 CO_2 gas (15 °C, 1013 mbar)
Dump weight of dry ice pellets	approx. 1.000 kg/m^3

Summary Safety-analysis

Danger source	Protection	Operator
CO_2 general	------	see “potential hazards” see “Safety Data Sheet Dry Ice”
Noise	No protection	Suitable Ear caps
Pressure	1. Protection hose. 2. Break line - Panels.	1. Protective clothes. 2. Distance.
Cold	Isolation	Suitable Gloves.
Propellant	Delay after pressing the gun.	1. Safety eye-glasses. 2. Face shield. 3. Protective clothes. 4. Safety shoes.
Asphyxiation	------	1. Ventilation. 2. Breathing air. 3. Cabin.
Static electricity charge	Static electricity discharge cable.	------
Moving/rotating parts	Panels.	------
Dust	No protection	1. Dust mask 2. Ventilation

Safety data sheet Carbon dioxide, solid (Dry ice)

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY
Product name: Carbon dioxide, solid (Dry ice).
Trade name: Dry Ice Pellets, CryoPellets
Chemical formula: CO_2
Known uses: Not known.
Company identification: Your local dry ice supplier
E-Mail Address: /
Emergency phone numbers (24h): /
Poison center: http://apps.who.int/poisoncentres

2 HAZARDS IDENTIFICATION
Classification: Asphyxiant in high concentrations.

3 COMPOSITION/INFORMATION ON INGREDIENTS
Substance/Preparation: Substance.
Components/Impurities
CAS Nr: 124-38-9
EEC Nr (from EINECS) : 204-696-9
Contains no other components or impurities which will influence the classification of the product.

4 FIRST AID MEASURES
Inhalation: In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation. Low concentrations of CO_2 cause increased respiration and headache. Remove victim to uncontaminated area wearing self-contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
Skin/eye contact: Immediately flush eyes thoroughly with water for at least 15 minutes.
In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Obtain medical assistance.
Ingestion: To swallow must be absolutely avoided, since coldness and developing pressure could be dangerous. Obtain medical assistance.

5 FIRE FIGHTING MEASURES
Specific hazards: Exposure to fire may cause containers to rupture/explode. Non flammable.
Hazardous combustion products: None.
Suitable extinguishing media: All known extinguish ants can be used.
Specific methods: If possible, stop flow of product. Move container away or cool with water from a protected position.
Special protective equipment for fire fighters: In confined space use self-contained breathing apparatus.

6 ACCIDENTAL RELEASE MEASURES
Personal precautions: Evacuate area. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ensure adequate air ventilation.
Environmental precautions: Try to stop release. Prevent from entering sewers, basements and work pits, or any place where its accumulation can be dangerous.
Clean up methods: Ventilate area.

7 HANDLING AND STORAGE
Handling: Suck back of water into the container must be prevented. Do not allow back feed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt. Refer to suppliers container handling instructions.
Storage: Prevent bottles from falling down. Keep container below 50°C in a well ventilated place.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION
Exposure limit value
Value type value Note: MAC 5.000 ppm
Personal protection: Ensure adequate ventilation.

9 PHYSICAL AND CHEMICAL PROPERTIES
General information
Odor: No odor warning properties.
Important information on environment, health and safety
Molecular weight: 44 g/mol
Melting point: -56,6 °C
Sublimation point: -78,5 °C
Critical temperature: 31 °C
Auto ignition temperature: Not applicable.
Flammability range: Not applicable.
Relative density, gas: 1,52
Relative density, liquid: 0,82
Vapor Pressure 20 °C: 57,3 bar
Solubility mg/l water: 2000 mg/l
Other data: Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level.

10 STABILITY AND REACTIVITY
Stability and reactivity: Stable under normal conditions.

11 TOXICOLOGICAL INFORMATION
General: No known toxicological effects from this product.

12 ECOLOGICAL INFORMATION
General: When discharged in large quantities may contribute to the greenhouse effect.
Global Warming Potential GWP: 1

13 DISPOSAL CONSIDERATIONS
General: Do not discharge into any place where its accumulation could be dangerous. To atmosphere in a well ventilated place. Discharge to atmosphere in large quantities should be avoided. Contact supplier if guidance is required.

14 TRANSPORT INFORMATION
ADR/RID: Not submitted to ADR/RID.
IMDG: Class 9

UN number and proper shipping name: UN 1845 Carbon dioxide, solid Labels 9
Packing Instruction P003 Packing group III EmS FC, SV
IATA: Class 9
UN number and proper shipping name: UN 1845 Carbon dioxide, solid Labels 9
Packing Instruction P904 Packing group III
Other transport information: Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Ensure adequate ventilation.

15 REGULATORY INFORMATION
Number in Annex I of Dir 67/548: Not included in Annex I.
EC Classification: Not classified as hazardous to health.
Labelling
- Symbols: No symbol required.
- Risk Phrases: RAs Asphyxiant in high concentrations.
Further national regulations: Publication series of Dangerous Goods PGS 15: Storage of packed dangerous goods (published by the Ministry of Housing, Spatial Planning and Environment (VROM)). Working conditions Catalogue AI-18: Laboratory and AI-31: Dangerous Goods (published by SDU Publishing business). Ministry for Social Affairs and Employment: Regulation 4.6-1: Prevention of accidents on the account of storage, use and transport of pressure receptacles. Regulation 4.6-6: Prevention of accidents on the account of asphyxiation by using Carbon dioxide. This substance or preparation above certain volume may have to be included in a SEVESO II submission or any other applicable national regulation.

16 OTHER INFORMATION
Ensure all national/local regulations are observed. The hazard of asphyxiation is often overlooked and must be stressed during operator training. Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
Advice: Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. Details given in this document are believed to be correct at the time of going to press.
Further information: /

We appreciate any suggestions for improvements to the CryoMax Plus! V3P or these guidelines. You can pass these on to CryoTechnics B.V. in Waardenburg. If you would like more copies of these commissioning guidelines, please contact CryoTechnics B.V.