JETCHILL

Manual

Disclaimer

JetChill Ltd supply equipment and products which enable entertainment operators to provide their customers with smoking drinks.

Solid carbon dioxide (dry ice) is dispensed from a gas cylinder via a filling nozzle into drinking vessels. Alcoholic/non-alcoholic beverages are then poured into the same vessel which causes a physical change to the dry ice which results in the creation of carbon dioxide gas (smoking effect).

JetChill have endeavored to ensure their products are safe when used correctly and in accordance with the instructions contained in this manual. JetChill have sought independent expert evaluation on the safety of their machine, the drinks vessels, and the manner in which they are to be used.

The Public Analyst report confirms that the JetChill system, when used as intended, poses no risks to the health and safety of the user or persons consuming the drinks that are dispensed from it.

JetChill Ltd. cannot be held responsible for any injuries or claims, both civil or criminal, caused by the use of the equipment and products, contrary to the following guidelines.

1.0

INTRODUCTION

Introduction - Congratulations

You are now the proud owner of a JetChill Machine which will enable you to give your customers a truly exhilarating experience when consuming beverages.

JetChill drinks use dry ice (solid carbon dioxide) in combination with room temperature liquids, to create smoking drinks. Dry ice is a 'food safe' substance. However, there are health and safety hazards associated with this very low temperature of this substance, which mean it must be handled with care. Uncontrolled exposure to dry ice will cause ice burns to the human tissue. Consumption of dry ice crystals or pellets can cause burns to the esophagus and stomach.

JetChill equipment is CE, UKCA, EMC, FCC certified. The equipment provided includes the JetChill dry ice dispenser Machine and the associated, safe drinking vessels into which the dry ice is pressure-filled. Further glasses can be purchased in addition to this package.

This quick guide outlines how JetChill equipment is to be used safely. Please always consult the complete User Manual for all instructions.

HOW IT WORKS

Bespoke drinking vessels are placed into the JetChill machine where small amounts of dry ice are then dispensed into a chamber in the drinkware, holding the dry ice in place perforated diffuser.

A measured amount of dry ice is injected and then locked into the chill chamber in the bottom of the drinking vessel where it is kept separate from the liquid by a perforated diffuser. It is this Diffuser that prevents all but small non-hazardous flakes from entering the main chambre and ultimately being consumed by the customer.

The drinkware is then removed from the machine and inverted so that the drink can be poured in by the server or by the customer. The physical effect that happens when the drink and the dry ice combine is almost instant.

The combination of the dry ice and liquid creates gas (the 'smoke effect') which will pour over the sides of the drinkware and will look theatrical and last for several minutes**.** The drink can be consumed at any point after the ambient liquid has been added and can continue to be consumed after the evervescent effect has ceased.

On occasion, small but visible flakes of dry ice can be released from the chamber into drink. These small flakes are safe for consumption. The amounts do not present a risk to health. (See Public Analyst data in the complete User Manual appendices).

The dry ice poses no significant food safety concerns and its presence in a drink does not render the drink hazardous to health or unfit for human consumption.

There are safety hazards associated with the use of the JetChill equipment, but these are analogous to those associated with handling other equipment, or the routine connection of cellar gas cylinders. As a result of the hazards, there are details of safe systems of work to be followed later in the manual.

Any person using the JetChill system will need to be suitably trained and be able to show they are competent to use the equipment safely. Training information is contained in this “Quick Guide”, in the complete User Guide and is also available on-line. As with all health and safety training, it will be the responsibility of the responsible person to ensure all users of JetChill know how to do this safely.

Maintenance and Servicing

It is essential that you maintain the equipment in a safe condition and carry out weekly checks found in in section 3.

Regular user checks must be carried out of the carbon dioxide cylinder and the 'JetChill' dispenser.

During the regular checks the following must be completed;

- Check for signs of leakage from the carbon dioxide cylinder and take appropriate action. Check the connections of the JetChill. Look for visual damage e.g., dents.

- A maintenance checklist is included in this section and it is recommended that the user of the equipment completes the checklist before each use and/or on a weekly basis.

- We recommend all customer visual check the drinkware once a week making sure there is no damage, which can lead to an unsafe application of the technology.

JetChill Machine :

1. The JetChill Machine is under Warranty for the first 12 months from delivery. Any faults must be reported to JetChill as a matter of urgency, with the device being returned for repair/replacement dependant on instruction from JetChill
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2. Send the machine back to JetChill every 12 months for maintenance. JetChill will review the machine and carry out routine checks and will then return the equipment to the user.

3. Should the equipment become faulty during use, it should be returned to JetChill for repair – costs may be incurred depending on warranty agreements.

Introduction – Safety Guidance

How does the JetChill system work?

- The JetChill machine hose screws onto a liquid CO_2 Siphon/Dip tube canister.
- When charging the drinking vessels using the machine, a solenoid opens and liquid CO_2 is converted into solid CO_2 (dry ice).
- The JetChill machine creates dry ice snow which is less compact and sublimates quicker, than a dry ice pellet.
- A controlled amount of the dry ice snow is injected into a safety chamber in the bottom of JetChill drinkware.

Is it possible for consumers to swallow any dry ice?

- Yes. Large chunks are not recommended for consumption; however, small flakes can be consumed and do not cause injury or illness. Small numbers of tiny flakes can float loose after the chamber has been charged which can be released into the liquid. User diligence can remove any loose flakes by tapping the drinkware after charging prior to filling with the desired beverage.

What are the effects of swallowing dry ice?

- The Leidenfrost effect is a physical phenomenon in which a liquid, close to a surface that is significantly hotter than the liquid's boiling point, produces an insulating vapor layer that keeps the liquid from boiling rapidly. In addition, the internal body heat rapidly sublimes the dry ice flakes. The fact that the dry ice is in flake form, and held in a chamber is important. The chamber keeps large or significant flakes from being released into the drink. Any flakes present in the drink will not cause harm if consumed. The drinkware is manufactured from polycarbonate and the chamber is molded/sonically welded to keep both the chamber bases and dry ice flakes secure.

Is the process automated?

- Yes. The charging of the drinkware is fully automated and takes place behind a protective shield. The drinkware is added and then the lid of the machine is closed. The drinkware will only charge with the lid in the down position. It takes around 15-20 seconds to charge JetChill Cocktail Drinkware & 10 seconds for JetChill Shot Drinkware. Once charged, the server will then manually pour the desired beverage on top of the dry ice chamber.

What amount of dry ice is dispensed per serve?

The JetChill machine is calibrated to deliver consistent volumes of dry ice based on dispensing time into JetChill drinkware. Each machine is calibrated to deliver a consistent quantity of dry ice. The amount can vary by 10% depending on whether the gas cylinder is full or depleted. Each machine will require annual servicing by the manufacturing company JetChill LTD to ensure this quality standard is maintained.

- JetChill Cocktail drinkware can be charged with a maximum of 15g (0.35 oz) of dry ice.
- JetChill Shot drinkware can be charged with a maximum of 8g (0.18 oz) of dry ice.

Using the correct cylinder

The JetChill Twin Jet is only compatible with a liquid CO_2 canister with a eductor/siphon/dip tube.

The liquid CO_2 cylinder used with the JetChill machine is different to standard carbonating gas CO_2 used on beer lines. Cylinders of CO_2 liquid have a white stripe on the side. Also ensure that the CO_2 to be utilized with the JetChill is food grade.

Liquid CO_2 cylinders must not be connected to existing beer dispensing systems. The liquid CO_2 cylinder will be stored and connected near to where the JetChill machine is being used rather than in the cellar where drinks gas cylinders are typically stored and connected. The connection of CO_2 cylinders to the JetChill system should only be undertaken by trained staff.

The drinking vessels provided by JetChill have been designed to be durable if used in the correct manner. Extreme force or incorrect use will cause the vessel to break. We always advise that you check your drinkware weekly and replace it if fractured or cracked.

It is unlikely that the customer can come into direct contact with the dry ice and therefore the risk of frostbite burns is minimal.

The drinking vessel is designed with a safety chamber in the base, into which the dry ice is automatically injected via the Twin Jet machine.

The drinking vessel can be washed in a standard drinkware washer and should be heat treated to 80°C (176°F) to ensure thorough sterilisation.

Any damaged drinking vessels should be disposed of (local recycling schemes may apply). All JetChill Drinkware is made from food grade Polycarbonate.

2.0

QUICK START

Quick Start

User Guide – Requirement

Your safety and the safety of others is very important. We have provided important safety messages with in this appliance guide. **Always read and obey all safety messages.**

The black triangle with a white exclamation mark is the safety alert symbol. This symbol alerts you to potential hazards that can hurt you and others.

Warning - You can be seriously injured if you don't follow instructions in this manual. 

All safety messages will identify what the potential hazard is, how to reduce the chance of injury, and describe what can happen if the instructions are not followed.

This manual is provided with each machine and is intended to help you to keep your machine running free from problems. It is also available to download from our website www.Jetchill.com.

TRAINING REQUIREMENTS

It is essential that those members of staff and others who are responsible for operating the JetChill equipment, including the dispensing of the smoking drinks, are competent and well trained in all aspects of the task.

Health & Safety laws require that any employee, and others, who may be exposed to risk whilst at work, or resorting to premises, shall have suitable training so that they can recognise hazards and risks and understand the control measures which need to be put in place to manage these risks.

Training needs to be constantly refreshed To prevent the procedures from falling short of the standards required. Training should cover the safe operating procedures required for using the equipment.

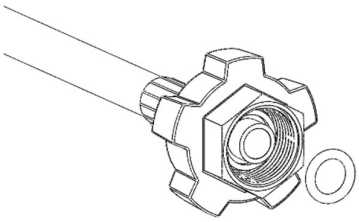
JetChill have produced a step-by-step guide for training purposes. It will be sensible for all employers and responsible persons to record who has been trained and when. To this end, a staff training record template has been included.

Start Guide - Setup

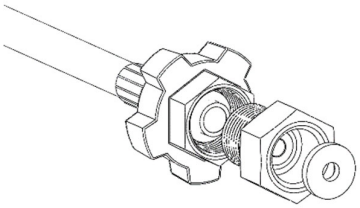
STEP 1

- Ensure black Rubber O- Ring is on the cylinder end of the UK Hose
- Ensure white Nylon Washer is on the cylinder end of the USA Brass hose adapter

UK

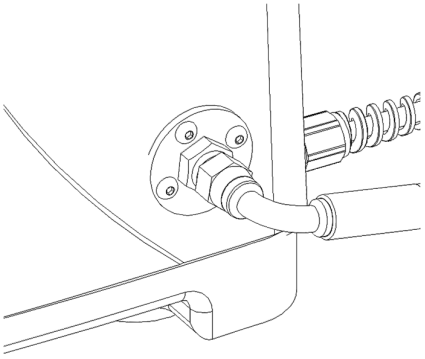


USA



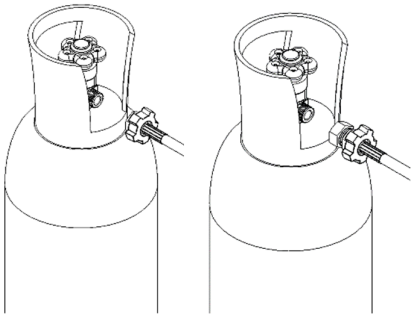
Step 2

- Screw the JIC end of the hose on to the external connector of the JetChill machine using the 17mm Spanner supplied



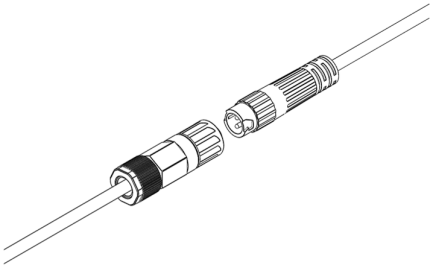
STEP 3

- For the cylinders, hand screw the hose clockwise tight, onto a cylinder of Food Grade liquid CO_2 with Dip/Siphon tube. A wrench can be used to fit the hose.



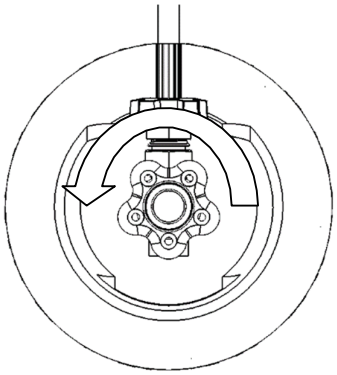
STEP 4

- **Plug power lead** into mains and screw the connection together.



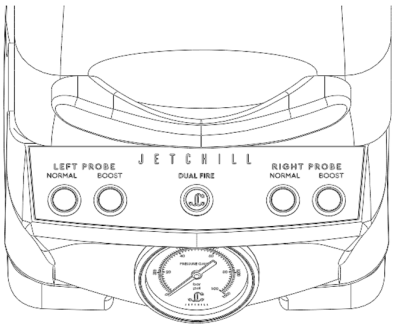
STEP 5

- Ensure the canister is secured by strap/chain to a fixed place.
- Open the cylinder valve by hand, turning the valve 90 degrees. anticlockwise.
- Ensure connection is not frosting or making a hissing sound from CO_2 gas leakage.
- The pressure gauge at the front of the machine should be between 50-58 bar



STEP 6

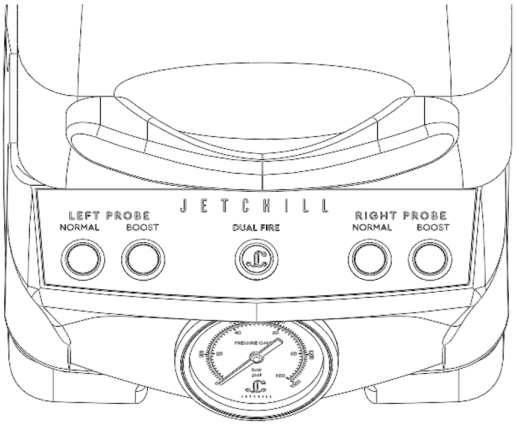
- Close lid and press DUAL Charge Button once to prime Gas through Machine. This should be completed without the presence of a drinking vessel.



STEP 7

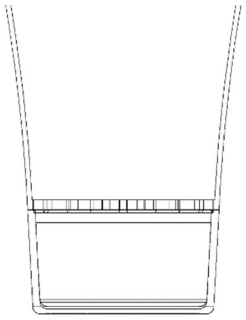
- Place dry JetChill Drinkware on Machine Probes and ensure Drinkware sits correctly on the probe nipples. Pull the clamp over the glasses which will lock them into position.
- Press **NORMAL** left to charge the left drinkware only for 10 seconds.
- Hold **BOOST** left to charge the left drinkware only until desired fill is reached.
- Press **NORMAL** right to charge the Right drinkware only for 10 seconds.
- Hold **BOOST** right to charge the Right drinkware only until desired fill is reached.
- Press **DUAL** to charge drinkware for 10 seconds.

If the back light turns red, this indicates a potential issue, ensure that the lid is fully closed, and the safety switch is activated allowing operation.



STEP 8

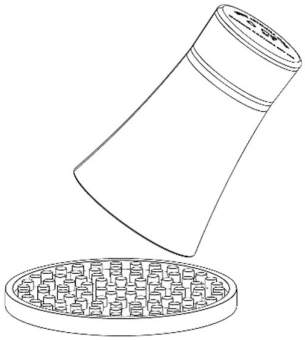
- Charged Drinkware Chamber should be 90% full of dry ice leaving a gap for the drink to create the smoking and chilling effect.



- Open Lid and remove Drinkware.

STEP 9

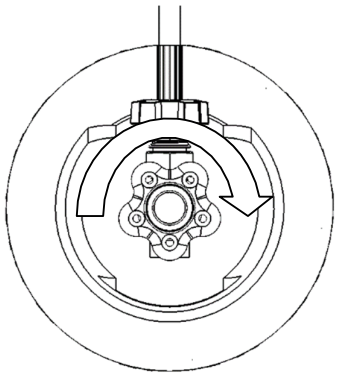
- Turn charged drinkware upside down and tap drinkware on the glass tapper provided to remove excess dry ice above diffuser.
- The server will then manually pour the desired drink in the drinkware.



Quick Start Guide – Post Use

STEP 10

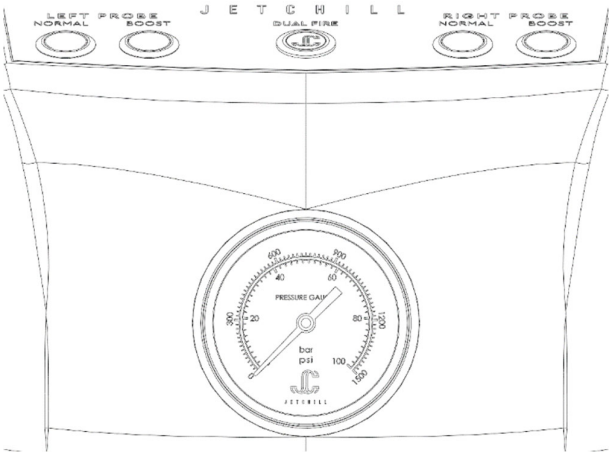
- To change cylinder or at end of a session, close the cylinder valve by hand turning valve 90 degrees clockwise.



STEP 11

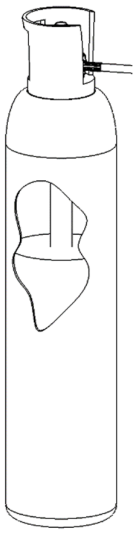
After changing of the cylinder;

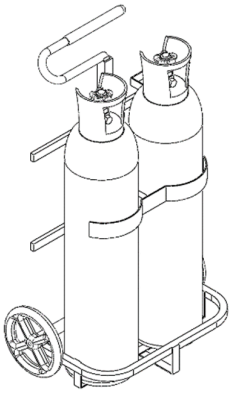
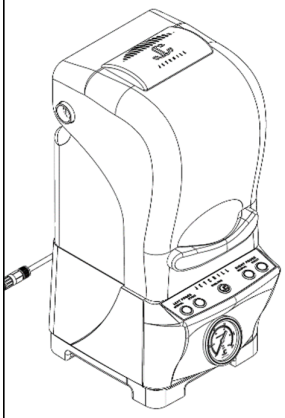
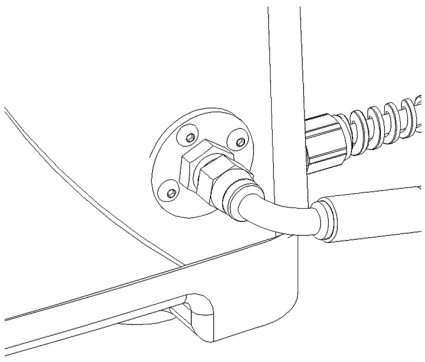
- Press the DUAL Fire Button once to purge the machine.
- The dial will be pointing at 0 Bar
- You are now ready to change the cylinder or turn off the machine.

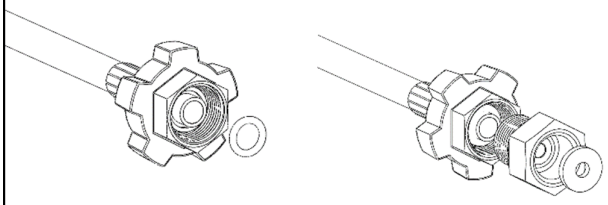
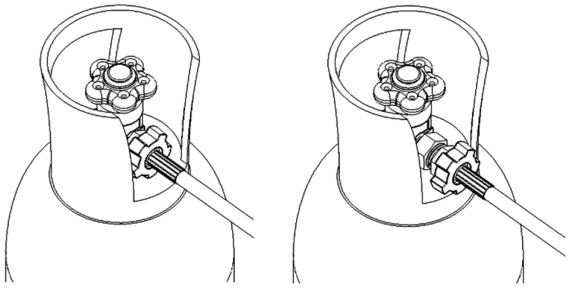


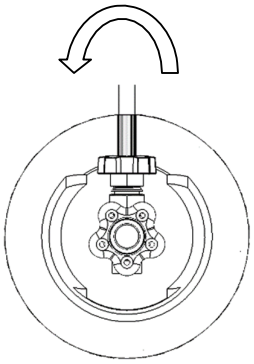
3.0

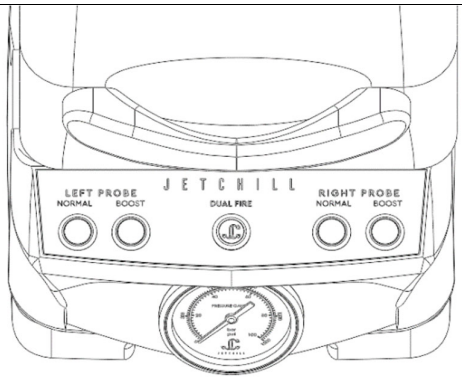
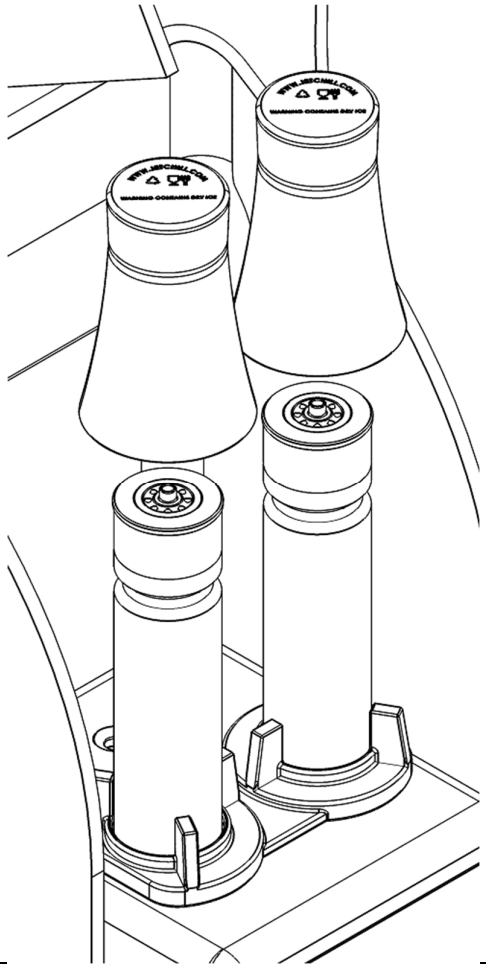
USER GUIDE

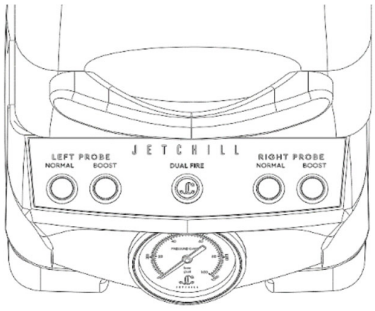
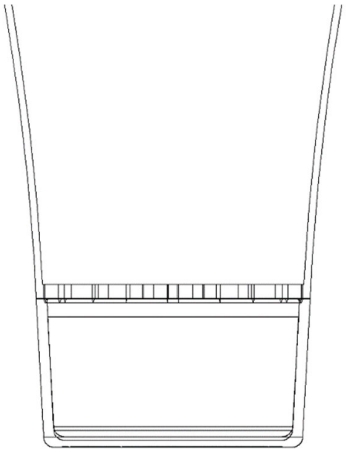
Action	Image	Failure To Take Action
STEP 1 Read JetChill H&S Pack Read Cylinder supplier safety data sheet Train Staff	**BOC example in COSHH section**	• CO_2 Cylinders are held under high pressure (50 bar+), misuse may cause serious injury • CO_2 Gas is an asphyxiant, handle with care as overexposure may cause serious injury
STEP 2 Write a risk assessment Read Confined Space Regulations	**Risk Assessment & Confined Space Regulations example in COSHH section**	• Solid Dry Ice is -79°C (-110°F), handle with care as misuse may cause freeze burns • Cylinder use in confined space may cause serious injury ⚠
STEP 3 Order food grade liquid CO_2 with a Dip Tube		• If no Dip Tube then Cylinder will not dispense Dry Ice • Non food grade Cylinders may be contaminated ⚠

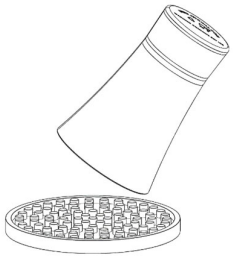
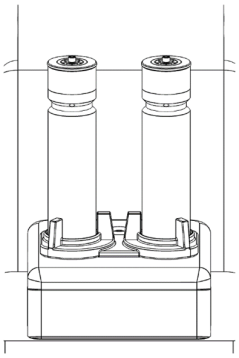
Action	Image	Failure To Take Action
STEP 4 Secure using trolley / chain / strap If using front of house in a venue only bring out 2 Cylinders (1 trolley) at a time • Ensure the Canister is secured by strap/chain to a fixed place.		• If Cylinder falls valve may snap, pressurised Cylinder may then propel itself resulting in serious injury • More than 2 loose Cylinders in an area increases risk of serious injury
STEP 5 Remove Machine from Box and check for damage Check Box contains Cylinder Hose, Power Lead and Spanner		• Machine will not work without correct Cylinder Hose • Incorrect Power Lead may cause Machine damage
STEP 6 To change direction of Cylinder Hose loosen Hose at Machine Connection Use the 17mm Spanner from Tool Kit provided		• May result in machine not sitting flush with the table and cause damage or injury

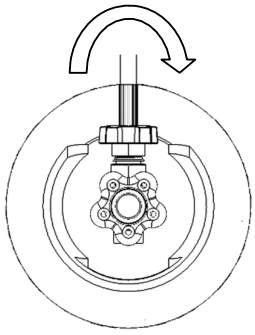
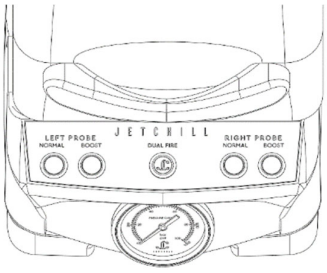
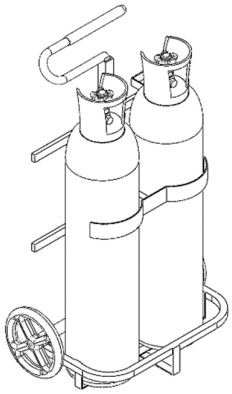
Action	Image	Failure To Take Action
STEP 7 Ensure black Rubber O Ring/white plastic Washer is in Cylinder End of Cylinder Hose		• Connection may frost over and make a hissing sound from CO_2 Gas leaking which may cause injury • May waste CO_2 • Escaping CO_2 may cause frost burns
STEP 8 Hand screw UK Cylinder Hose clockwise onto Cylinder tight Wrench screw USA Cylinder Hose clockwise onto Cylinder tight		• Connection may frost over and make a hissing sound from CO_2 Gas leaking which may cause injury • Drinkware may not charge properly with Dry Ice • Escaping CO_2 may cause frost burns

Action	Correct	Failure To Take Action
STEP 9 Plug Power Lead into Mains and screw to flying lead from machine.		• Plugging and unplugging power lead without unscrewing may damage the power lead
STEP 10 Open Cylinder valve by hand turning valve 90 degrees anticlockwise Check the pressure gauge is showing the bottle has a pressure of 42-59 Bar		• Machine will not make Dry Ice
STEP 11 Ensure Cocktail/ Shot Drinkware is dry and ensure they are damage free		• Drinkware may freeze to Machine Probe when charging, do not pull or twist drinkware which may damage Probe. • If Drinkware freezes do not use Machine for 5 minutes to allow the Drinkware to unfreeze

Action	Image	Failure To Take Action
STEP 12 Press Dual Charge Button once to prime Gas through Machine Press NORMAL Charge Button (10 second)		• Over charging Drinkware (including Drinkware frozen to Probe) may cause damage to Drinkware and Machine
STEP 13 Open Lid, place 2 clean dry JetChill Drinkware onto Probes Ensure Probe Nipple protrudes into Drinkware Safety Chamber Once complete, close the lid		• Non JetChill Drinkware may cause serious injury • Wet Drinkware may freeze to Probe • Incorrect Drinkware location may damage Nipples and create Dry Ice outside Safety Chamber

Action	Image	Failure To Take Action
STEP 14 Press NORMAL left to charge left drinkware Hold BOOST left to charge the left drinkware Press NORMAL right to charge the Right drinkware Hold BOOST right to charge the Right drinkware Press DUAL to charge both drinkware		• Over charging a drinkware (including a drinkware frozen to Probe) may cause damage to Drinkware and Machine
STEP 15 Charged Drinkware Chamber should be 90% full of Dry Ice Leaving small gap (when Drinkware turned right way up) for Drink to create smoking and chilling effect		• Dry Ice will not last as long in Safety Chamber • Drink effect will not last as long or chill the drink as much as it should

Action	Image	Failure To Take Action
STEP 16 Turn charged Drinkware upside down and tap to remove excess any Dry Ice above Safety Chamber Diffuser Drinkware now ready to serve		• Excess Dry Ice in Drinkware Body may cause freeze burns if consumed with drink ⚠
STEP 17 Pour non carbonated Drink into drink-ware Leave gap of 3cm (1.18”) from Drink to top of Drinkware for Dry Ice smoke Smoking and chilling effect will last for 3/4 mins		• Drink will not produce the maximum Dry Ice smoking and chilling effect
STEP 18 Wipe away any excess Dry Ice on Probe from continuous use with Sanitised Cloth		• Dry Ice buildup on Probe may freeze Drinkware to Probe • Probe Nipple may become damaged • Dry Ice may form outside Safety Chamber due to incorrect Drinkware location

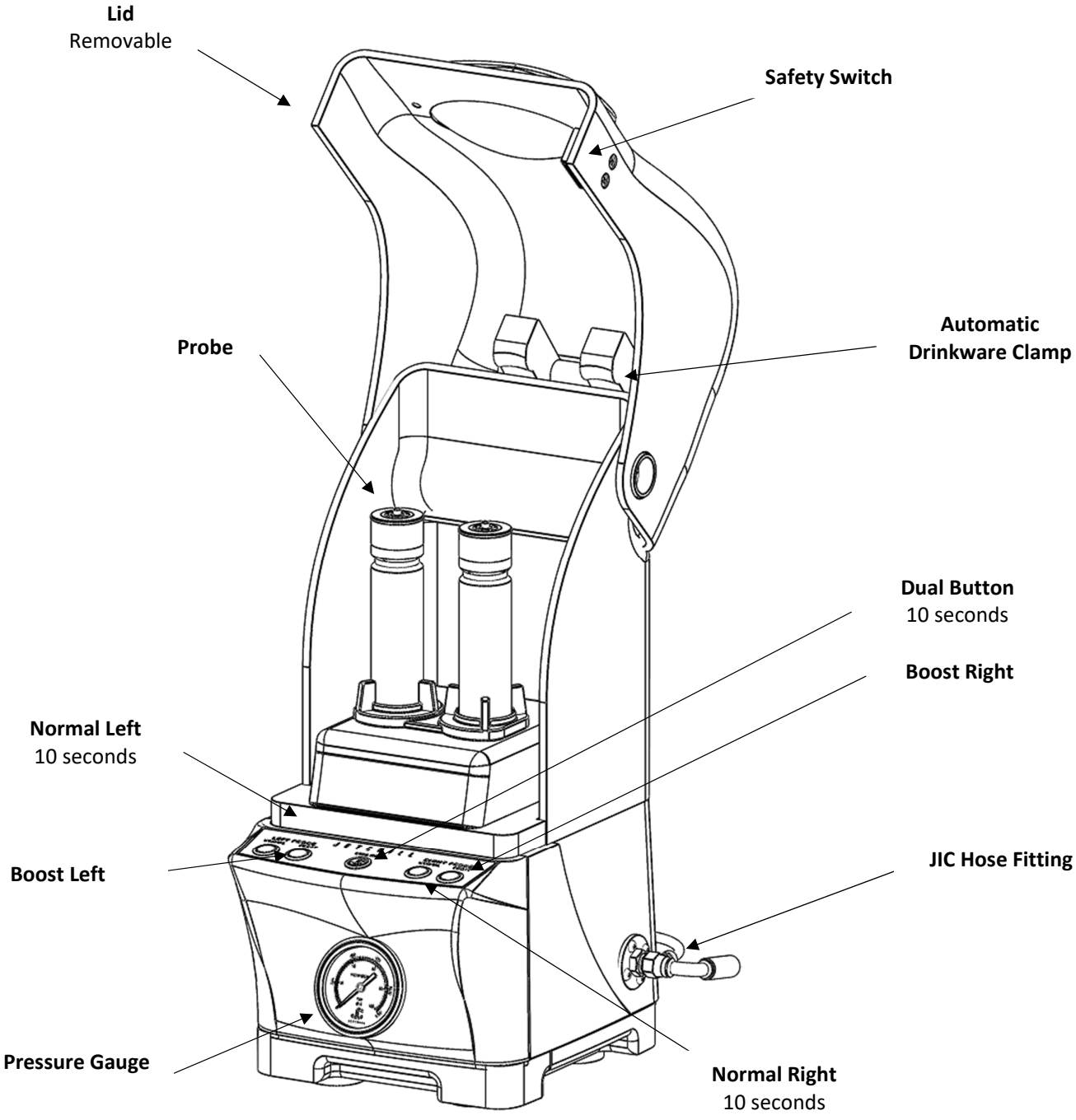
Action	Image	Failure To Take Action
STEP 19 Close Cylinder Valve by hand turning valve clockwise Ensure pressure gauge shows 0 Bar		• CO2 will come out at pressure when Hose is unscrewed which may cause injury ⚠
STEP 20 Press DUAL Charge Button once to purge Gas through Machine If changing Cylinder. Purge the machine as above, once finished, unscrew the Hose then screw Hose onto a new Cylinder		• Removes excess Gas in the Hose which prevents back pressure dislodging black Rubber O Ring in Cylinder end of Hose
STEP 21 Transport + store Cylinders in accordance with Cylinder supplier Safety Data Sheets		• Mishandling of Cylinders may cause serious injury ⚠

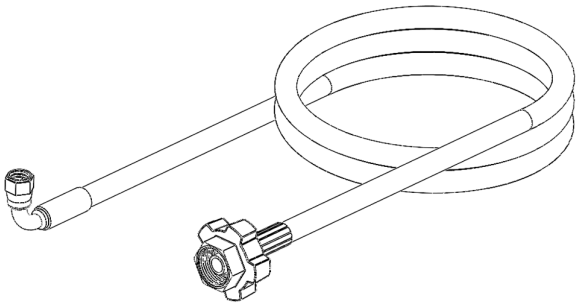
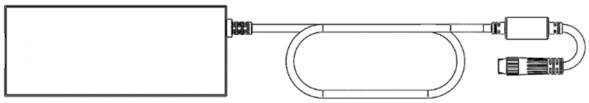
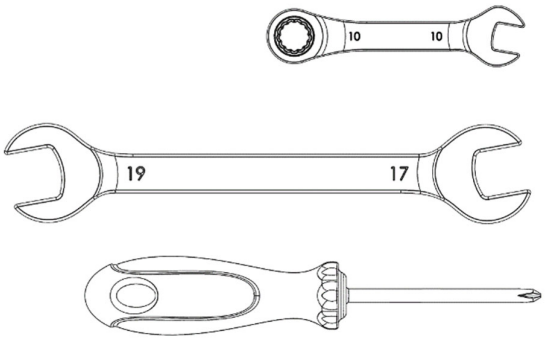
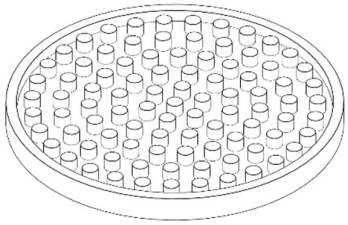
4.0

JETCHILL PRODUCT

SPECIFICATION
Pro Machine

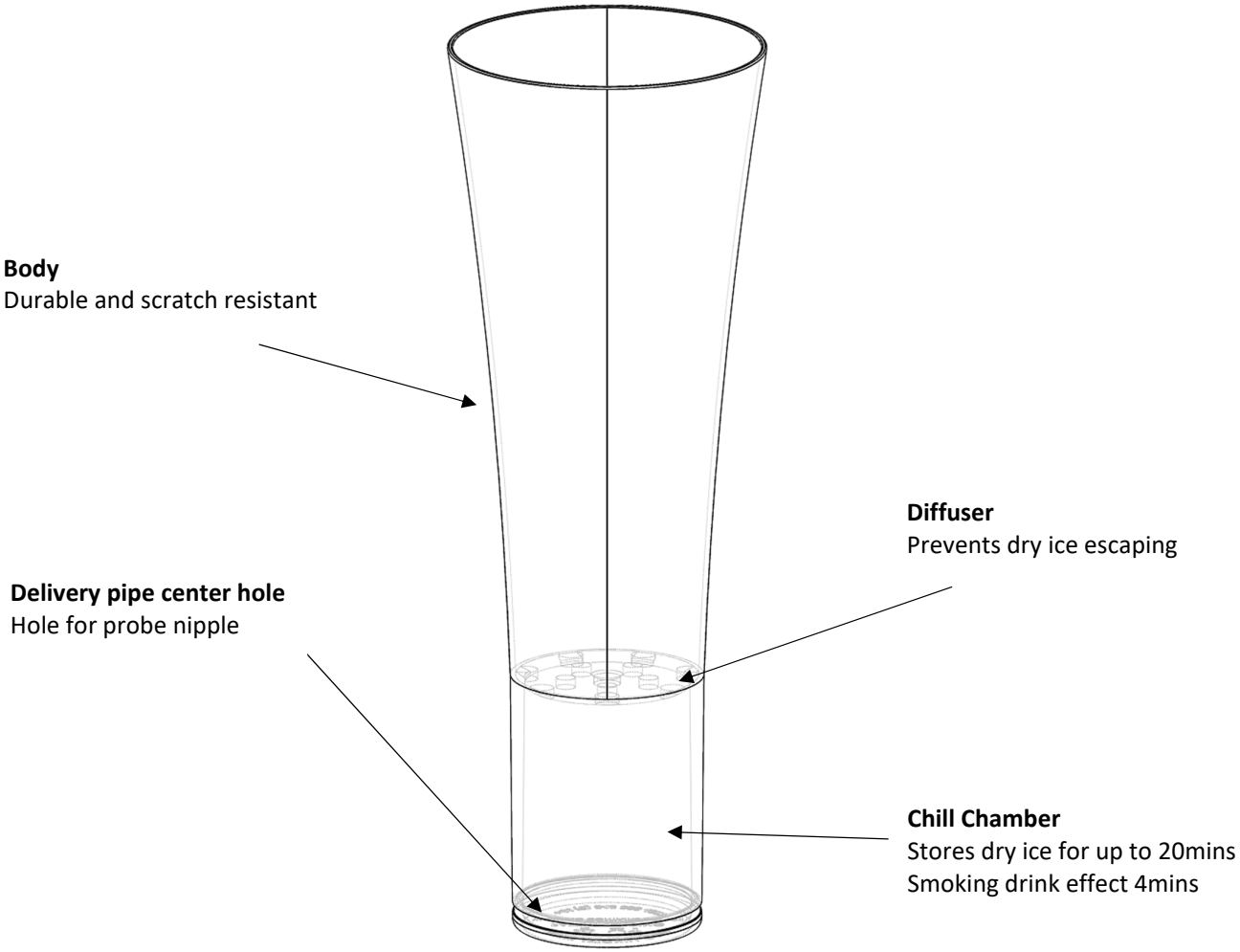
SPECIFICATIONS:
Operation: Semi - Automatic
Material: PC, ABS, SS 316, Delrin
Machine Overall Size: 50cm x 21 x 27 (19.7" x 8.3" x 10.6")
Total Weight: 11kg (24.4lbs)



Product	Spec	Image
CYLINDER HOSE	British Standard BS 341 Part 1 No. 8 USA CGA 320	
POWER SUPPLY (Universal)	100-240V 5A	
Tool Kit	19-17mm spanner 10mm Spanner PH1 75mm Screwdriver	
Glass Tapper	Food Grade Rubber Tapper	

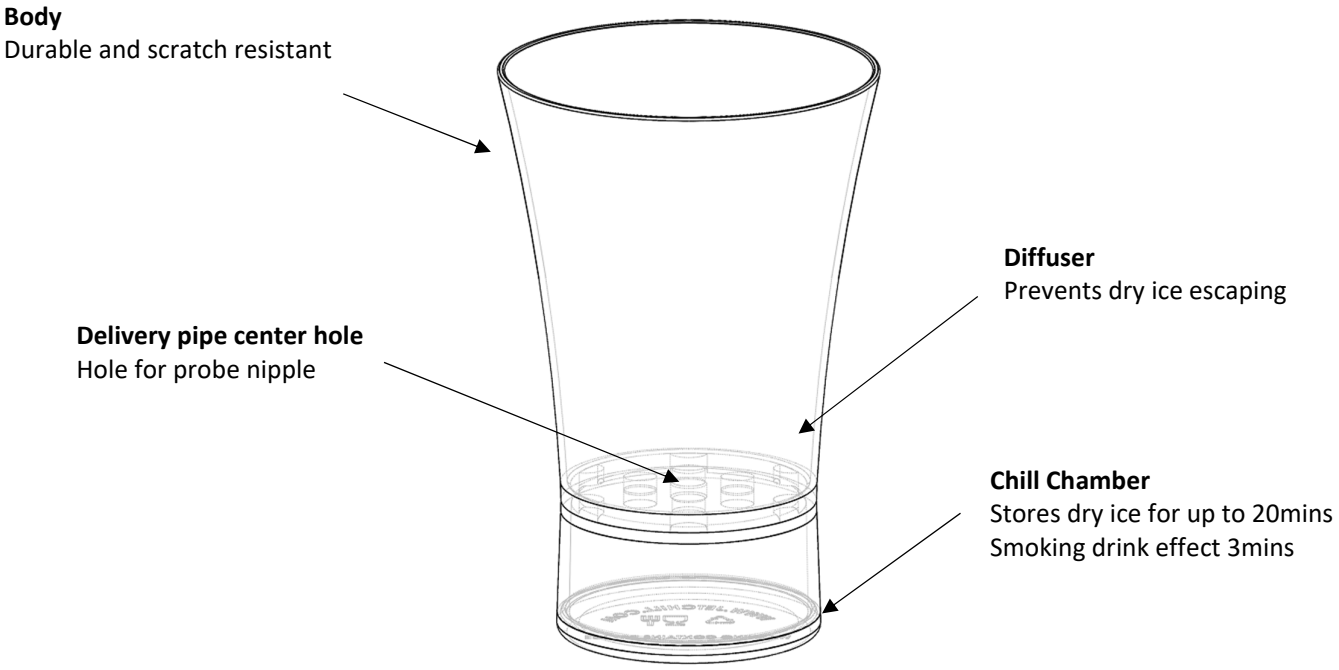
SPECIFICATIONS:

Material:	Food Grade polycarbonate	
Size:	19cm x 4 x 5	(7.5” x 1.6 x 2)
Volume:	200ml	(7oz)
Weight:	50g	(1.11lb)
Warning:	Not for use with dry ice pellets	



SPECIFICATIONS:

Material:	Food Grade polycarbonate	
Size:	9cm x 4 x 4	(3.5” x 1.6 x 1.6)
Volume:	50ml	(2oz)
Weight:	20g	(0.04lb)
Warning:	Not for use with dry ice pellets	



JETCHILL

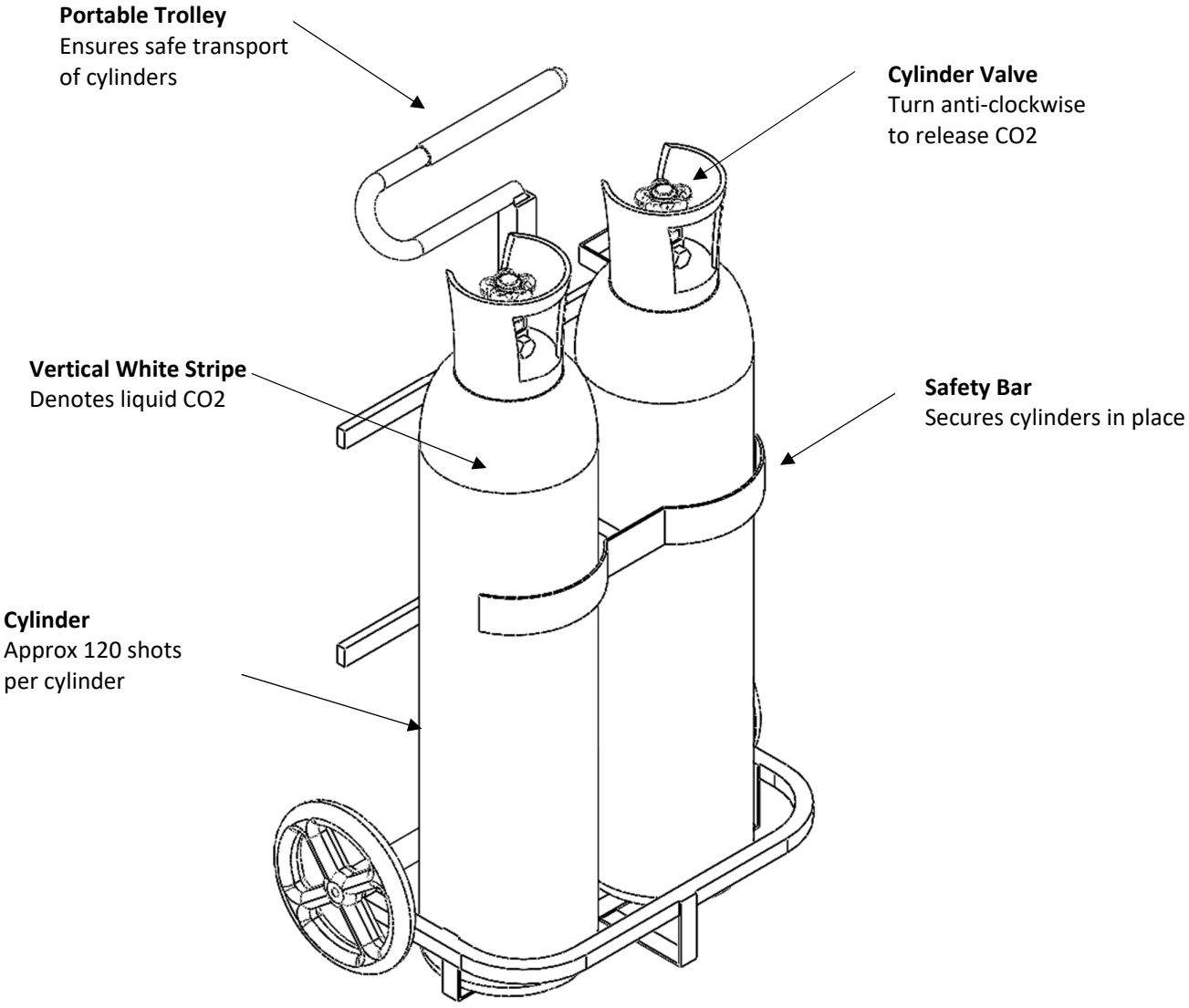
5.0

DRY ICE/ CARBON DIOXIDE CYLINDERS

SPECIFICATIONS:

Operation:	Food grade liquid CO_2 Cylinder (50 bar) with Eductor/Syphon/Dip Tube	
Material:	Steel	
Size:	60cm x 15 x 15	(24” x 6 x 6)
Volume:	3.8L	(0.83gal)
Weight:	6.35kg (Full)	(14lb)
Options:	Cylinder can also be strapped to a wall or other permanently fixed body	

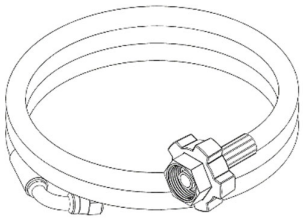
The machine is compatible with all canister sizes as long as the canister specification is adhered to

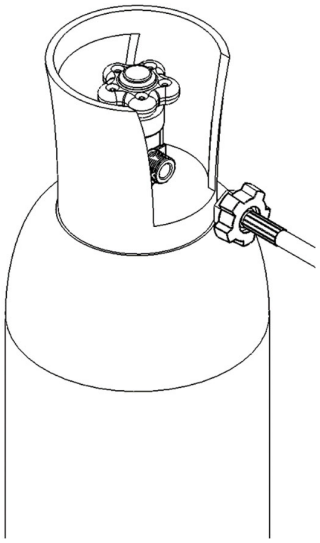


Food grade liquid CO_2 Cylinder (50 bar) with Eductor/Siphon/Dip Tube

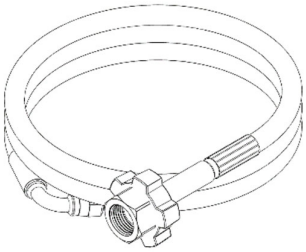
- CO_2 cylinder with a dip tube (denoted by vertical white stripe) connects to Jetchill machine
- Dip tube enables machine to withdraw liquid (instead of vapour) so machine can create solid dry ice
- Cylinder can be rented or purchased from cylinder supplier
- Most suppliers will deliver/collect/refill, to/from an address and also collection/return from/to a venue
- Each country has choice of national and local suppliers (information available upon request)
- May also be identified by an annotated indicator ring under the cylinder valve

UK Connection





US Hose



Physical Properties and Handling

Gaseous state

At ambient temperature (+15°C (+59°F)) and atmospheric pressure, CO_2 has a density of 1.87 kg/m^3 (0.12 lb/ft^3) and is 1.5x heavier than air. It is a colourless and odourless gas and diffuses along the ground collecting in low-lying areas such as pits and cellars.

Carbon dioxide is classified as a non-toxic gas, but it does start to affect breathing at concentrations of circa. 1%, with effects becoming more serious with increasing concentration.

Carbon dioxide is a non-flammable gas.

Liquid State

Carbon dioxide can exist as a liquid below the critical temperature of +31°C (+88°F) and above the triple point with a temperature of -56.6°C (-70°F) and 5.08 gauge (bar).

CO_2 is transported, stored, and handled in liquid form, either at ambient temperature (in cylinders or non-insulated storage tanks, at a pressure of 45 – 65 bar) or refrigerated (in insulated tankers and storage tanks) at a temperature range of -35°C (-31°F) to +15°C (+59°F) and a pressure of 12 to 25 bar. The CO_2 in this state is a liquid, at its boiling point.

Below the triple point CO_2 can only exist in the solid and gas phase. Therefore, liquid CO_2 cannot exist at atmospheric pressure. When the liquid CO_2 is depressurised below the triple point pressure of 5.08 bar to atmospheric pressure it is transformed to dry ice and gas. Consequently, when the liquid CO_2 is released into the atmosphere, a dense white fog of powdery solid carbon dioxide particles and vapour is produced.

Solid state (Dry ice)

The expansion of liquid CO_2 to atmospheric pressure is used to produce CO_2 snow at a temperature of -78.5°C (-110°F). The snow can be pressed into dry ice blocks or pellets.

Dry ice should be handled in insulated containers.

Chemical Properties

Carbon dioxide does not support combustion. When dissolved in water, carbonic acid (H2CO3) is formed. The pH - value of carbonic acid varies from 3.7 at atmospheric pressure to 3.2 at 23.4 bar.

The carbonic acid provides the biting taste of soda water and it reacts in alkaline solutions producing carbonates. It has very few vigorous reactions with other substances except under conditions of high temperature and pressure in the presence of reactive substances such as Sodium and Magnesium.

Hazards of Carbon Dioxide

Substantial Release of

Carbon Dioxide

Any substantial release of carbon dioxide is potentially hazardous, this hazard is exasperated by application inside a poorly ventilated building. Enclosed low-lying areas, where CO_2 gas could accumulate in high concentration, are particularly hazardous because the gas is slow to disperse within poorly ventilated buildings.

In the case of a substantial release of carbon dioxide in confined areas, evacuate all personnel as soon as possible. Never enter such areas before they are properly ventilated

When confined spaces must be entered before they are properly ventilated, the person entering such areas must be well trained and wear self-contained air breathing apparatus.

Canister respirators give no protection in atmospheres containing dangerous concentrations of carbon dioxide.

Well- t r a i n e d personnel should be connected to a rope/tether to the person entering the gas-filled area, for rescue purposes.

Substantial releases of carbon dioxide may occur through:

- Failure of the cylinder or pipe work containing carbon dioxide.
- Release from a relief valve (safety measure).
- Failure of connections, e.g. flexible hoses, flanges etc.
- Failure of a regulating device resulting in gas release through the body vent holes.
- Failure of a valve device resulting in gas release through probes

Low Temperature of Product: Extreme Cold. The snow produced from leaks of liquid carbon dioxide is extremely cold (-78.5°C (-110°F)) and may cause frost bites if touched with bare hands. If carbon dioxide snow comes into contact with the eyes it may cause severe eye injury.

Touching of pipes and connections containing liquid carbon dioxide may cause frost bite. Where there has been a major release of gas, the atmosphere will be very cold and visibility is likely to be limited. These factors can make escape or rescue difficult.

Dry Ice Plugs in Pipes and Hoses

Dry ice plugs can be formed inside hoses and piping when liquid carbon dioxide is decreased below its triple point pressure of 5.08 bar. The dry ice can be compacted into a plug which can trap gas.

The pressure behind or within a plug may increase as the dry ice sublimes until the plug is forcibly ejected or the hose or pipe ruptures. A dry ice plug may be ejected from an open end of hose or pipe with enough force to cause serious injury to personnel, either from the impact of the dry ice plug and/or the sudden movement of the hose or pipe as the plug ejects. Liquid carbon dioxide must be purged from the hose or pipe before reducing the pressure below 5 bar. This can be done by supplying carbon dioxide vapour to one end of the hose or piping system to maintain the pressure above the triple point whilst removing the remaining liquid from the other end.

Cylinder labelling
Cylinders are labelled in accordance with national regulations.

Users of carbon dioxide are advised to carefully read and observe the precautionary information on the labels. If a cylinder is not clearly marked it should not be used and the supplier of the cylinder should be contacted.

NOTE - It is unlawful to remove cylinder labels/marking.

Some cylinders have an additional label on the body or valve guard. This contains important information on the use of cylinders which should be carefully read and observed.

Typical Cylinder Label
Comments to the label can be summarized as:
Carbon Dioxide
EEC No. 2046969
UN No. 1013
Compressed Gas
Supplier Details
Green

- Asphyxiant in high concentrations
- Keep container in a well ventilated area
- Do not inhale gas
- Use no oil or grease
- Vapour pressure 57.3 bar (20°C (68°F))

Carbon Dioxide cylinders used in Food and Medical applications contain additional information according to legal requirements.

Cylinder Position
Cylinders without syphon (dip) tubes must only be used in the vertical position with the valve uppermost. They are for the discharge of CO_2 gas at limited flow rates. If the cylinders are not used in the vertical position, they could discharge liquid.

Pre-Use Check
For ambient temperatures above 22°C (72°F) care should be taken to ensure gas is present at the cylinder valve before connection i.e. there is no snow present. Note this action should be done in a suitably ventilated area.

Cooling Effect
As gas is discharged, liquid will evaporate, and the gas pressure will be maintained. With the cooling effect produced by evaporation, it is quite normal for a layer of frost to form on the outside of the cylinder during discharge. The gas flow will be limited by the rate at which the heat required for evaporation can enter the cylinder and any attempt to obtain a higher flow will result in reduced supply pressure.

NOTE - Excessive flow rates may result in the formation of 'dry ice'' in the cylinder which will then be apparently empty. However, any 'dry ice' will sublime and restore pressure within the cylinder as it warms up. Dry ice has a surface temperature of -78.5°C (-110°F) and care should be taken to avoid frost burns.

Cylinder Handling

General Handling Instructions
Before handling cylinders a note should be taken of Manual Handling Regulations. Cylinders must always be handled as high-pressure containers. Care must be taken to avoid violent external blows on the cylinder or valve. Under no circumstance must the cylinders be dropped or used as roller supports. Any cylinder which suffers visible damage during handling or use must be set aside immediately and clearly marked. An assessment of the apparent damage should be made by a competent person and further action then agreed with the supplier.

Use Of Trolleys

Various types of proprietary trolleys are available for holding and moving one or more cylinders at a time. These may be used to ensure safe handling. Care must be taken to ensure the chain or other cylinder retaining arrangements are correctly secured before movement. Please see the manufacturers manual for any trolleys to be used.

Other Handling
If mechanical handling of cylinders is employed, with or without the use of pallets, care must be taken that cylinders do not roll, shift or fall.

Protective Equipment
Protective gloves (EN:511 Standard thermal and cold-resistant gloves) should be always worn for the manual handling of cylinders, to minimise the risk of hand injury. During discharge, parts of the cylinder and valve are likely to become very cold and therefore there is also the risk of frostbite if the cylinders are handled

with unprotected hands, particularly if hands are wet.

The use of protective safety footwear should also be considered for anyone handling numbers of cylinders regularly.

CO_2 cylinders contain a gas under pressure and the use of eye protection is recommended when connecting and disconnecting cylinders.

Cylinder storage

Storage Recommendations
Outdoor storage is recommended where possible.

Carbon dioxide cylinders should be stored in a well ventilated area. Store in an area that's cool, and away from elevation. Don't place them anywhere where there's a lot of traffic, as this will increase the likelihood of cylinder damage. Be sure that they're easy to reach, but secure where they are.

Avoid storage in direct sunlight or near steam pipes, radiators or other sources of heat.

CO_2 tanks and cylinders should be stored in areas with a temperature less than 51.7°C (125°F).

Use of Carbon Dioxide

General Advice
It is important to ensure that the equipment used is suitable for purpose and in a good state of repair.

During use the cylinder should be in the vertical position, with the valve uppermost and the cylinder firmly secured against a wall or other suitable support.

Valve Operation
Cylinder valves supplied by gas companies open by turning anti-clockwise. They are of the on/off type, which are unsuitable for flow control or pressure regulation. An additional control valve must be incorporated with the ancillary equipment if flow control or pressure regulation is required. This regulator is inside the JetChill machine set to 55-58 bar.

Do not use excessive force or any form of wrench to open the valve. If the valve spindle will not move, this will indicate that the valve operating mechanism has been damaged. The cylinder must then be labelled to indicate the fault and

returned to the supplier.

Equipment
Ensure the equipment coupled to the cylinder has the correct thread.

All installed ancillary equipment, such as valves, piping, hoses or other fittings, coupled directly to a cylinder must be leak tight and designed and constructed for high pressure CO_2 use. Any equipment which is of doubtful design or origin must not be employed.

Operation
Turn off the cylinder valve when CO_2 is not required.

Operating instructions should be clearly laid down and displayed in the working area concerned with the cylinder installation and associated equipment. Reference must be made to the detailed equipment data and instructions available from suppliers when operating instructions are prepared.

Safety Considerations
Pipework shall have safety devices to protect against pressure rises above its design pressure. In any system where there is a possibility of other materials or products returning to the cylinder, causing contamination and possible corrosion, a non-return valve must be fitted.

When the cylinder has been emptied, the valve should be closed, leaving a small positive pressure in the cylinder to prevent contamination and internal corrosion. Some cylinders are fitted with residual pressure devices. These maintain a small positive pressure within the cylinder at all times.

After Use
After use, ensure that the pressure in the equipment has been released before the cylinder is disconnected. Return the empty cylinder to the supplier as soon as possible.

Summary of recommendations

- Use EN:511 standard thermal and cold-resistant gloves for handling cylinders.
- Do not drag cylinders (this will cause wear to the base, especially for aluminium alloy cylinders).
- For capped cylinders, ensure the cap is fitted when they are being stored or transported.
- External damage of cylinders and valves (e.g. by welding or striking electric arcs or impact by sharp objects) must be avoided.
- Do not use cylinders as rollers or work supports.
- Secure CO_2 cylinders during transport on vehicles to prevent movement.
- A cold and wet or frosted cylinder could indicate a leakage and appropriate measures should then be taken. Ensure cylinders valves are turned off immediately in the event of a suspected leak.
- Any stamping or means of identification must not be altered.
- Never heat cylinders e.g. by direct flame, electrical devices, or hot water, to raise the pressure or the flow rate.
- Cylinders must never be directly connected to low pressure equipment.
- Cylinders used for the discharge of CO_2 gas (without dip tube) must be connected to a suitable reducing valve to obtain a desired pressure and flow rate.
- Cylinder valves are unsuitable for pressure and flow regulation.
- To prevent contamination and internal corrosion, the cylinder should be returned for filling with a positive pressure.
- Do not attempt to transfer CO_2 from one cylinder to another.
- Keep cylinder valve outlets and other CO_2 equipment free from contaminants.
- Do not repair or modify cylinders, cylinder valves or safety relief devices (bursting discs). Any damage should be made known to the supplier.

Refilling

For safety reasons cylinders owned and supplied by companies may only be filled by, or on the authority of that company.

Maintenance

The cylinders and any associated equipment are a high-pressure installation and arrangements must be made to ensure that it is covered by an adequate system of inspection and maintenance. National regulations require owners of cylinders used in CO_2 service to inspect internally and externally and hydraulically test at regular intervals.

Action in the event of fire
Evacuate the area and call the emergency services.

Carbon Dioxide and Fire
No fire risk will arise with CO_2, which is non-flammable, but care needs to be taken if the fire is in an area adjacent to a CO_2 storage area or usage point. A rise in the outside temperature will rapidly be transmitted to the contents of the cylinders and the internal pressures will increase.

If pressures reach the design pressure of the safety bursting discs, these will rupture and discharge the contents to atmosphere. If possible, cylinders should be moved immediately away from the area to a safe cool place. However, since the product is non-flammable, and in view of the safeguard afforded by the cylinder bursting discs, no serious risks should be taken by personnel in attempting removal, in the event of a cylinder disc bursting, causing a gas leak in an enclosed or poorly ventilated area, persons should follow the gas leak procedures below.

Firefighting efforts should otherwise be concentrated on isolating cylinders from heat and flames as far as possible and spraying them with water to keep contents cool.

If any cylinder is involved in a fire, it must be set aside, clearly marked and the supplier must then be contacted immediately. If the metal of the cylinder has been subjected to a high temperature, some change in the metal structure may occur, rendering the cylinder unfit and dangerous for further use as a pressurised container.

Action In the Event of a Gas Leak
Evacuate personnel from areas where a high concentration of CO_2 could accumulate and away from the point of leakage. Where practicable, steps should be taken to isolate the leakage. Provided that the evacuation procedure is put into effect, the escape of CO_2 is unlikely to cause harm to personnel or property. No serious risks should therefore be taken by personnel attempting to isolate the leakage. Personnel should otherwise concentrate on ensuring evacuation of all affected areas is complete.

Areas affected by CO_2 gas should be entered with extreme caution. Self-contained breathing apparatus (minimum half hour) must be worn by personnel attempting to rescue or isolate leakage.

First Aid (Exposure to CO_2 Gas)

Take In case of oxygen deficiency: take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). If breathing is difficult, trained personnel should administer emergency oxygen. If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Get medical attention immediately. Treatment is urgently required. Transport to a hospital.

Skin Contact

In the unlikely event that a user/ consumer has skin contact with the dry ice, quickly remove the effected party from the source of contamination. DO NOT attempt to rewarm the affected area on site. DO NOT rub area, flush with water, or apply direct heat. Carefully cut around clothing that sticks to the skin and remove the rest of the garment. Do not remove frozen clothing from frostbitten areas. Loosely cover the affected area with a sterile dressing. DO NOT allow victim to drink alcohol or smoke. Get medical attention immediately.

Eye Contact

Immediately and flush with large amounts of gently flowing water for at least 15 minutes, occasionally lifting the upper and lower eyelids. DO NOT attempt to rewarm. Cover both eyes with a sterile dressing. Get medical attention immediately. Treatment is urgently required. Transport to a hospital.

Ingestion

Ingestion is not considered a potential route of exposure. On the provision the equipment is used as intended by JetChill following the instructions provided in this user guide.

JETCHILL

6.0

RISK ASSESMENT AND SAFETY DOCUMENTS

It is the responsibility of every employer to assess the risks of their work activities to employees and others who may be affected, i.e. customers, members of the public.

The sale of smoking drinks has the potential to be a hazardous activity if proper procedures are not followed and people can be affected by freeze burns and general discomfort if they come in to contact with Dry Ice.

In addition, the dispensing of the Dry Ice using carbon dioxide Cylinders and the charging mechanism can be hazardous if proper and safe procedures are not followed.

JetChill has drafted generic Risk Assessments for the use of their equipment and the sale/serving of the smoking drinks. It is recommended that you use the generic assessments and further develop these to reflect the conditions at your own venue. Add extra risk assessments if you will be using the JetChill equipment in any ways or for any activities in addition to those covered.

License holders/users of the equipment are responsible for completing their own site-specific Risk Assessments and can use their own standard Risk Assessment template or the blank template included in this section.

The important aspect of any risk assessment is the pragmatic review of potential hazards and risks and the implementation of control measures so that those hazards and risks are reduced to the lowest acceptable level, including elimination.

Once the risk assessment has been completed it must be communicated to staff and they must be provided with appropriate training.

It is recommended that you include some copies of site-specific risk assessments in this section.

The risk assessments are intended as a guide, and you must ensure that their risk assessment is reflective of your operation, hazards, and control measures you have implemented.

ACTIVITY	LOCATION	COMPLETED BY	DATE	APPROVAL DATE
Preparation and sale of smoking drinks	**Bar**			

Step 1 What are the hazards?	Step 2 Who might be harmed and how?	Step 3 What are you already doing? What further action is necessary?	Step 4 How will you put the assessment into action? By whom and when will it be completed?	Step 5 Review due Review history
Handling, Transportation and Storage of solid and gas CO_2.	Staff and guests of the function.	Transport: Always ensure that there is adequate ventilation during transportation and before entering the load compartment to unload the product.	Carbon Dioxide (solid and liquid) Safety Data Sheets in the cab or driver's compartment of any vehicle carrying Dry Ice or CO_2 Cylinders.	Inspected / tested at suitable intervals thereafter during the course of the event.
Handling, Transportation and Storage of solid and gas CO_2: Temperature Related (burn like damage).	Staff and guests of the function.	Operation: Cylinders and solid CO_2 used only in a well ventilated area by those trained to manage it appropriately. Personal Protective Equipment, especially safety gloves, must be worn.	Access to operating area restricted to trained personnel. New users of Dry Ice should receive instruction in its use from experienced users.	Inspected / tested at suitable intervals thereafter during the course of the event.
Handling, Transportation and Storage of solid and gas CO_2: Vapour Related (danger of asphyxiation).	Staff and guests of the function.	Avoidance of Oxygen Depletion/Asphyxiation: Carbon dioxide should normally be used only in a well-ventilated area.	Equipment to be operated outdoors or in a well ventilated area. Access to operating area restricted to trained personnel.	Inspected / tested at suitable intervals thereafter during the course of the event.
Transport, Storage and Use of Compressed Gas Cylinders	Staff and guests of the function.	Control Measures: Physical: Cylinder trolleys used. Secure racks for storing. Manual Handling: It is important that users only of appropriate physique attempt to collect or to move these objects. Sitting: Cylinders are to be kept in suitable racks or stations. CYLINDERS MUST NEVER BE LEFT FREESTANDING.	Access to operating area restricted to trained personnel. New handlers should receive instruction in its use from experienced handlers.	Inspected / tested at suitable intervals thereafter during the course of the event.

ACTIVITY	LOCATION	COMPLETED BY	DATE	APPROVAL DATE
Preperation and sale of smoking drinks	**Bar**			

Step 1 What are the hazards?	Step 2 Who might be harmed and how?	Step 3 What are you already doing? What further action is necessary?	Step 4 How will you put the assessment into action? By whom and when will it be completed?	Step 5 Review due Review history
Contact with the Dry Ice causing skin burn.	Customers. Staff dispensing drinks.	Dry Ice is filled into approved containers only where contact is limited. Caps are secured.	Staff training.	
Consumption of Dry Ice causing throat/stomach burns.	Customers.	Quantities and quick Dry Ice sublimation unlikely to cause damage but customers advised to wait a few seconds before consumption of drink.	Staff training. Management to identify 'high jinks' so inappropriate use can be prevented.	
Contact with Dry Ice due to cap being unscrewed from Shot-Tail Drinkware.	Customers.	Staff training to make them aware that removing the base is potentially hazardous, so that they can intervene if they see it happening.	Staff training. Management of customers when using the drinking vessels.	
Contact with Dry Ice due to breakage of drinking vessel.	Customers.	Drinking vessels unbreakable in normal usage and rough use, dropping on the floor.	Staff training. Management of customers when using the drinking vessels.	
Knocking Trays of drinks over causing release of 'smoke' which can be confused with fire smoke.	Staff. Customers.	Staff training to re-assure customers if drinks are spilled that a fire has not started.	Regular staff training at staff team talks.	
Spillages – clean up.	Staff. Customers.	Usual drinks spillage procedures and clearing up. Smoke will dissipate quickly.	Staff training. Available cleaning equipment.	
Reckless use of the drinks e.g. throwing it over fellow customers causing contact with freezing liquid.	Staff. Customers.	Staff training. Management of customers.	Staff training.	
Removal of cocktail drinkware base by customers	Staff. Customers.	Staff training. Management of customers.	Staff training. Management of customers when using the drinking vessels.	

ACTIVITY	LOCATION	COMPLETED BY	DATE	APPROVAL DATE

Step 1 What are the hazards?	Step 2 Who might be harmed and how?	Step 3 What are you already doing? What further action is necessary?	Step 4 How will you put the assessment into action? By whom and when will it be completed?	Step 5 Review due Review history

COSHH

Carbon dioxide and its solid state, dry ice, are classified as a hazardous substance as they have the potential to cause harm.

In normal usage, with appropriate safety procedures, the hazards are deemed to be minimal.

Carbon dioxide and dry ice have the potential to cause skin burns similar to frostbite as the product is at an extremely cold temperature.

If dry ice is ingested in large quantity, it could cause throat and stomach burns due to the extremely low temperature of the product.

Carbon dioxide gas in high concentrations may cause asphyxiation with symptoms of loss of mobility/consciousness.

Staff and others using the equipment provided by JetChill and who follow the safety procedures and training given are not likely to be exposed to any serious hazards from the use of carbon dioxide and dry ice.

The storage of carbon dioxide cylinders must be carried out in accordance with industry best practice and this has been covered in the manual.

The Safety Data Sheet for food fresh carbon dioxide is included in this section.

Emergency/First Aid Procedure

These are listed in the attached Safety Data Sheet and on the detailed COSHH Assessment.

Contact skin burns are best treated by applying clean water for approx. 15 minutes, applying a burn or other dressing and seeking medical attention.

Inhalation of carbon dioxide gas is possible if the storage area is poorly ventilated, and gas is leaking from cylinders. A carbon dioxide detector will alert everyone to high levels of gas concentration, we do advise thew customer to fit a carbon dioxide detector. Rooms must be properly ventilated, and anyone affected by the gas must be removed from the area and given basic first aid whilst medical assistance is sought.

Product Name:	Carbon Dioxide/Dry Ice
What is it used for?	Creating smoking drinks – Dry Ice mixed with ambient temperature liquid creates chemical change
How is it used?	Connecting CO_2 Cylinders onto Dry Ice unit via a reducing valve, to dispense Dry Ice crystals into a drinking vessel
What equipment is used?	CO_2 Cylinder, regulator, connections, pipe work and JC Drinkware

What are the hazards associated with using the substance?	Increased rate of breathing, light headedness, increased heart rate, eye irritation unconsciousness, death. 'Frost bite' type burns to skin on contact with Dry Ice										
Safety Data Sheet attached?	Yes	x	No								
Who will/could be affected?	Staff/Customers entering area where concentration is high. Customers who come into contact with Dry Ice powder										
How long will exposure to the substance last? NB. Customers exposure will be measured in minutes. Staff exposure to carbon dioxide gas will be dependent on the number of drinks to be sold and the time taken to dispense Dry Ice into the drinking vessels.	Less than 15 mins	x	Up to an hour		Over an hour		Over 8 hours				
What control measures are necessary to reduce exposure to the hazardous substances? **a) Personal protective equipment when using Canister?**	Gloves	x	Apron		Face Mask		Goggles	x	Boots / Shoes Other		
If other, describe **b) Increased ventilation**	Yes	x	No								
c) Mechanical ventilation	Yes		No								
d) Controlled dilution	Yes		No								
e) Other – describe:-	Drinking vessels used to contain the Dry Ice and into which the drink is added are basically tamper-proof and customers cannot gain direct access to the Dry Ice										
What training is needed?	General COSHH, safety training, Cylinder training, Identifying signs of gas leak, first aid training for CO_2 exposure, JC Machine training										
Is health surveillance needed?	Yes		No	x							
When all the control measures are in place what is the RESIDUAL RISK of using the product?	Low		Medium	x	High						
What other information is relevant to this Risk Assessment?	Relevant safety data sheets										

Completed by:	
Date:	
Re-assessment Date:	

The UK Confined Space Regulations 1997 (SI 1713) require an employer assessment of the risks posed by dangers such as asphyxiation, explosion, fire and toxic substances, in any space which presents such a hazard.

It also requires the provision of 'safe Systems of work' and appropriate rescue plans.

More information can be found at the following link:
http://www.hse.gov.uk/pubns/indg258.pdf

Health and Safety at Work Regulations 1999
Under the Management of Health and Safety at Work Regulations 1999 (SI 3242), employers are required to assess the risks of each process and task undertaken in the enterprise.

Asphyxiation
One of the most dangerous risks associated with Dry Ice and CO_2 gas use is asphyxiation caused by the reduction of oxygen in the atmosphere due to gases leakage. Systems used to carry gases to their point of use should be leak free. All joints must frequently be tested with an approved leak test.

Guidance notes
As an owner or manager, you have a legal responsibility to make sure that your staff can work safely without risking injury or damage to health. For further information, visit
www.boconline.co.uk/health/gas_safety/gas_risks.

Gas monitoring
Gas monitors indicate the level of a specific gas in an area.
Gas monitors are also available to assist in the indication of increased risk. Monitors indicate where a problem exists, but they do not solve the issue.

Ventilation
JetChill equipment must always be operated in a well-ventilated area.

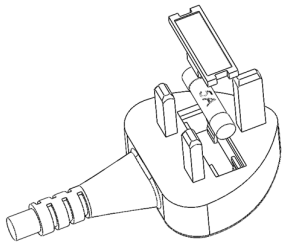
Risk assessment
Full risk assessments are vital.
It is important to understand that operators may be adversely affected.

Traditionally people have put Dry Ice pellets into drinks to create the smoking theatre. There are various issues associated with using Dry Ice pellets that the JetChill System addresses:

No	Description	JetChill Dry Ice Powder	Dry Ice Pellet
1	**Safety**	**Powder** Powder is -79°C (-110°F), large surface area means powder sublimates quickly and turns to ice once drink is added So there is no need to dispose of powder after use	**Compact Pellet** Pellet is -79°C (-110°F), small surface area means pellet cannot sublimate quickly once a drink is added Pellet needs to be disposed of after use
2	**Storage**	**No Waste** Powder comes from Cylinder of liquid CO_2 which can be stored indefinitely and always be on hand, which also makes powder cheaper	**Waste** Pellets have to be ordered and delivered in polystyrene box and must be used within 24 hours before they sublimate
3	**Operation**	**No Operator Contact** The JetChill Machine removes need for Operator to manually handle powder	**Operator Contact** An Operator is required to manually handle the pellet and ensure they use correctly
4	**Drink Temperature**	**Chilled Drink** Powder reduces drink temperature from +20°C (+70°F) (room temperature) to 0°C (+32°F) in 3 minutes	**Room Temperature Drink** Pellet will not reduce drink temperature

7.0

Trouble Shooting

Problem	Check	Y/N	Action	Picture
STEP 1 Machine does not power up.	Is the unit plugged in?	No	Plug and screw power lead into Machine and ensure power lead is connected to outlet	
		Yes	Next check	
	Is the light lit on the Power Supply?	No	Check fuse in main Plug, replace if necessary. Check power socket on Machine end of Power Lead is not damaged. If fuse is OK or socket is damaged, then contact JetChill for replacement Power Supply	
		Yes	Next check	
	Do the LED and blue dual buttons turn on?	No	Contact JetChill as Machine may need to be returned to factory to replace PCB	
		Yes	Machine is ready to use	

STEP 2 Machine LED lights come on and button lights up but drinkware will not charge	Is the LED blue?	No	Fully close Lid	
		Yes	Next check	
	Is the safety switch fully activated to its closed position?	No	There may be something impeding the lid to prevent it from fully closing. Ensure plunger is fully activated to its closed position	
		Yes	Next check	
	Are the 5 buttons working correctly?	No	Contact JetChill as Machine may need to be returned to factory to replace faulty button	
		Yes	Machine is ready to use	

Problem	Check	Y/N	Action	Picture
STEP 3 Machine LED lights are on, blue Charge Button is on but Machine does not produce Dry Ice	Does the Cylinder have a Dip Tube to be able to withdraw liquid?	No	Order a Cylinder with a Dip Tube	
		Yes	Next check	
	Is the Cylinder full? The liquid CO_2 can be depleted and there may only be gas left in the canister	No	Try another Cylinder that is full or order a new full Cylinder	
		Yes	Next check	
	Is your Hose O Ring/Nylon Seal in place?	No	Place replacement black Rubber O Ring/ Nylon Seal on end of Hose If no O Rings/Nylon Seal left contact JetChill	
		Yes	Next Check	

Problem	Check	Y/N	Action	Picture
STEP 4 Machine does not produce full Dry Ice charge in Drinkware	Are Jets clean?	No	Contact Jetchill to resolve this issue.	
		Yes	Next check	
	Is charge time sufficient?	No	Contact Jetchill to resolve this issue.	
		Yes	Next Check	

8.0

Approvals

Scientific Report
Detailing the Chemical Safety for Standard Operation of;
The Jetchill Twin Probe

Prepared by Mark Latham MChem MPhill

Reviewed by Farapack Polymers

on behalf of;
JetChill Ltd. Print Centre Fullwell Road, Sunderland SR6 0HR
November 2023

Executive Summary

This report analyses the chemical safety of the JetChill twin Probe in its normal application. The product charges bespoke vessels with a small quantity of solid CO_2 (dry Ice). It is important to note that the morphology of the dry ice at the point of charging is a powder analogous to that of snow. Upon filling the vessel with a liquid, of any consumable temperature, the dry ice sublimes and effervesces gaseous CO_2 which gives a bubbling effect. The magnitude of this effect is dependant on a number of environmental factors inclusive of temperature of the liquid to be consumed.

During my time as an R&D chemist I have studied dry ice and its application within numerous industries. In this specific instance it is my professional opinion that the due to the morphology of the dry ice, the safety provisions in place within standard usage of the JetChill twin probe and the bespoke vessels chamber arrangement, that the operation of such equipment by competent individuals is not unduly hazardous. In comparison to a pellet of dry ice, this powdered form has a largely greater surface area, reducing the mass of dry ice required to give the desired effect.

In addition to the solid-state dry ice, the volume of gas evolved from the sublimation process is strictly controlled by the capacity of the solid dry ice chamber, and therefore will be insufficient to cause any harm to the user.

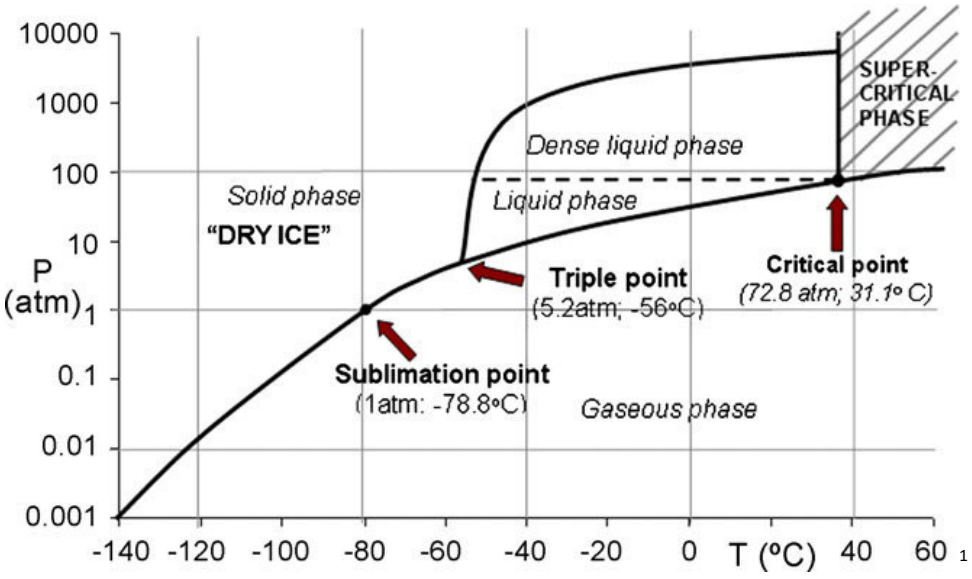
Since a previous version of the JetChill, increased safety features have been included within the instrument. Although this report is fundamentally with regard to the chemical safety of the instrument, it would be neglectful of me to not introduce these features to the reader who potentially operated a previous version of JetChill. The version of the JetChill to which this document pertains includes; pressure release valve, a pressure regulator and a pressure gauge.

A pseudo analogous system for the chilling of drinks which would also present the bubbling effect seen by application of the JetChill is the employment of liquid nitrogen ($N_{2(l)}$) as the consumable. Liquid nitrogen is a significantly more hazardous substance than $CO_{2(s)}$. The boiling point of liquid nitrogen is -195.8°C (-320.5°F, 77.3K) atmospheric conditions, contact of organic matter with liquid nitrogen causes almost instant freezing and in turn embrittlement. It is my opinion that liquid nitrogen should only be handles by fully qualified chemists and in no instances should be utilised in a social environment.

Introduction to Dry Ice

CAS-No.	124-38-9
EC-No.	204-696-9
Synonyms	Dry Ice, Solid Carbon Dioxide, Solidified Carbon Dioxide
Trade Names	Ultralce®,
Mw	44.01gmol^{-1}
Boiling point	-78.5°C
pH	3.7
Water Solubility	1.45gl^{-1} at 20°C
Density	1.562gcm^{-3}

An example safety data sheet (SDS) for Dry ice can be found here.
At atmospheric temperatures and pressures, the density of dry ice is typically 1.562gcm^{-3}. Under these conditions at above -56.4°C, Carbon dioxide changes from a solid to a gas with no intervening liquid form, this process is called sublimation. The opposite process to sublimation is called deposition, where dry ice changes from gas to the solid phase. At atmospheric pressure the point of inflex between sublimation and deposition is at -78.5°C
The comparably low temperature and direct sublimation to gas makes dry ice and effective coolant as it is colder than water or ice and leaves no residue during its state transition.

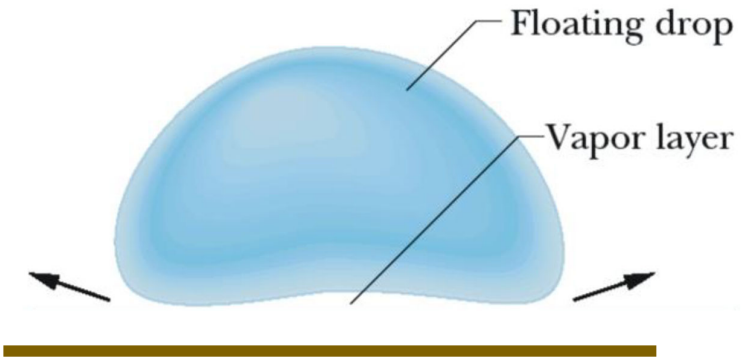


[1]

[1] Mazzoldi, Alberto & Hill, Tim. (2008). CO2 transportation for carbon capture and storage: Sublimation of carbon dioxide from a dry ice bank. International Journal of Greenhouse Gas Control. 2. 210-218. 10.1016/S1750-5836(07)00118-1.

The Leidenfrost Phenomena

The Leidenfrost phenomena describes how, when two media with a large temperature difference meet each other a cushion of gas is formed which prevents any harm In addition the internal body heat rapidly sublimates dry ice flakes The fact that the dry ice is in flake form and held in a chamber is important The chamber prevents all of the flakes from being released, and any that are will not cause harm if consumed The glass is manufactured from polycarbonate and the chamber is moulded/sonically welded inside to keep both the chamber barrier and dry ice flakes secure.



Dry Ice and The JetChill

In normal application the JetChill charges a specific drinking vessel with Dry ice. In order to complete my assessment of the degree of hazard associated with usage I ran the instrument through normal operation 5 times. The data for the magnitude of the charge in terms of mass is given below in table 1.

Glass tare Mass/ g	Filled Mass /g	Dry Ice mass /g
25.89	34.4	8.5
25.89	34.5	8.1
25.89	34.7	8.5
25.89	34.6	8.6
25.89	34.3	8.8
	Average	**8.5**

Table 1. Collated data for mass of charged shot glass using JetChill twin probe.

The chamber within the bespoke glassware has a volume of 19.65cm^3 for the Shot glass. By making the assumption that dry ice fills the cavity evenly under pressure charging this equates to the density of the dry ice being 0.432gcm^{-3} in the shot glass. This density is a factor of under 1 third of that of a dry ice pellet.

CO_2 gas can be treated as an Ideal gas following the Ideal gas law;

$$PV = nRT$$

Where P = Pressure, V= Volume, n = number of moles, R = ideal gas constant (8.314J/k.mol) and T= temperature.

Using this equation each mol of gas has a volume of 22.4L at room temperature and pressure.

8.5g of dry ice is 0.19 mol. 0.10 mol using the ideal gas law gives a volume of 4.256L of gas. This figure is equivalent to the amount found within a standard bottle of coke, proving no concern with the volume of gas evolved from the process.

The process of charging the vessels was repeated on the same already charged vessel an additional five times by means of performing an abuse test. In this instance the excess CO2, follows the exhaust through to the main chambre of the JetChill.

Additional Considerations

Prolonged exposure to dry ice can cause severe skin damage through frostbite. It sublimes into carbon dioxide gas, which could pose a danger of hypercapnia if present at a sufficiently high concentration. However, the amount of carbon dioxide produced, and it effect on ambient air concentration is not disproportionately different to those produced from carbonated drinks and as such the risk is negligible. Also, the dry ice is entrapped within the drinks system, limiting opportunity for physical contact. Production of the dry ice independently of the tumblers, is feasible, but unlikely with properly trained staff and the amount present has a very limited heat capacity to enable it to cause harm. Physical contact with the skin for several seconds produced a sharp cold feeling, allowing sufficient time to remove the ice from contact without any damaging affect. For context, dry ice is not classified as a dangerous substance by the European Union or as a hazardous material by the United States Department of Transportation for ground transportation. When shipped by air or water, it is regulated as a dangerous good, however the Federal Aviation Administration allows airline passengers to carry up to 2.5 kg per person either as checked baggage or carry-on baggage, when used to refrigerate perishables.

Declaration of Conformity 231101

In accordance with BS EN ISO/IEC 17050-1:2010

1. *Product model / product:*

Product	Drinks Equipment
Model/type	Twin Probe 2
Batch/serial no.	JCTP2xxxx

2. *Manufacturer:*

Name	Jetchill Ltd.
Address	Print Centre, Fulwell Road, Roker, Sunderland, SR6 0HR, England

3. *This declaration is issued under the sole responsibility of the manufacturer.*

4. *Object of the declaration:*

Product	Equipment to create ‘smoking’ drinks using carbon dioxide
Specification	Twin Probe 2

5. *The object of the declaration described above is in conformity with the relevant UK Statutory Instruments:*

2016 No. 1101 The Electrical Equipment (Safety) Regulations 2016

2016 No. 1091 The Electromagnetic Compatibility Regulations 2016

2012 No. 3032The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

6. *References to the relevant designated standards used or references to the other technical specifications in relation to which conformity is declared:*

EN 60335-2-75:2004 + Household and similar electrical appliances - Safety - Part 2-75:

A1:2005 + A11:2006 + Particular requirements for commercial dispensing appliances and vending machines

A2:2008 + A12:2010

EN 60335-1:2012 + Household and similar electrical appliances - Safety - Part 1: General requirement

A11:2014 + A13:2017 +

A1:2019 + A14:2019 +

A2:2019 + A15:2021

EN 55014-1:2017 + Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission

A11:2020

EN 55014-2:1997 + Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard

A1:2001 + A2:2008

EN 61000-3-2:2014 Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

EN 61000-3-3:2013 Electromagnetic compatibility (EMC) — Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems,

EN IEC 63000:2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

7. *Additional information:*

Signed for and on behalf of:	Jetchill Ltd.
Place of issue:	Sunderland
Date of issue:	01.11.23
Name:	Robert Flunder
Function:	Director
Signature:	

EU Declaration of Conformity (No. 231101)

In accordance with European Parliament and Council Decision No 768/2008/EC Annex III

EU Declaration of Conformity (No. 231101)
In accordance with European Parliament and Council Decision No 768/2008/EC Annex III

1. Product model / product:

Product	Drinks Equipment
Model/type	JCTWJ - V1.0
Batch/serial no.	JCTWJ-00000-00

2. Manufacturer:

Name	Jetchill Ltd.
Address	Print Centre, Fulwell Road, Roker, Sunderland, SR6 0HR, England
Authorised Representative:	
Name	JetChill LTD
Address	Print Centre, Fulwell Road, Sunderland, SR6 0HR

3. This declaration is issued under the sole responsibility of the manufacturer.

4. Object of the declaration:

Product	Equipment to create ‘smoking’ drinks using carbon dioxide
Specification	Twin Probe 2

5. The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/35/EU	The Low Voltage Directive
2014/30/EU	The Electromagnetic Compatibility Directive
2011/65/EU	The Restriction of Hazardous Substances Directive

6. References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

Reference & Date	Title
EN 60335-2-75:2004 + A1:2005 + A11:2006 + A2:2008 + A12:2010	Household and similar electrical appliances - Safety - Part 2-75: Particular requirements for commercial dispensing appliances and vending machines
EN 60335-1:2012 + A11:2014 + A13:2017 + A1:2019 + A14:2019 + A2:2019 + A15:2021	Household and similar electrical appliances - Safety - Part 1: General requirement
EN 55014-1:2017 + A11:2020	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
EN 55014-2:1997 + A1:2001 + A2:2008	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard
EN 61000-3-2:2014	Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)
EN 61000-3-3:2013	Electromagnetic compatibility (EMC) — Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems,
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Place of issue:	Sunderland
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Position:	Director

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