Pre-Installation Guidelines & Checklist

Dry Ice Manufacturing System - Direct Slice machines
DS500E | DS1000E

The Cold Jet Project Lead and Customer Project Lead who will oversee the successful installation and maximize the performance of the direct slice machine:

Cold Jet Project Lead	Telephone	Email

Customer Project Lead	Telephone	Email

Contents


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Introduction

Before any direct slice machine can be installed, the owner/operator must prepare the site for installation and operation. It is the owner's responsibility to verify all the necessary preparations have been made to the installation site and meet the specifications and guidelines detailed in this publication. This may include but is not limited to:

- Providing an indoor space with standard industrial flooring.
- Installing a liquid CO_2 tank and supply pipeline system up to the connection point at the direct slice machine.
- Installing a gaseous CO_2 exhaust pipeline from the direct slice machine to free vent or recovery system at a safe position.
- Installing a power supply that is sufficient and up to code.
- Providing proper room ventilation and other CO_2 safety measures.
- Determine which options and other manufacturing accessories to add/prepare for maximizing production performance and capabilities.
- Ensure that the conveyer line in which the direct slice machine should operate fits the direct slice machine.

The owner is responsible for transmitting the specifications in this publication to other third-party contractors involved in the pre-installation preparations of the site. Failure to properly prepare the site may delay the installation and/or optimal performance of the direct slice machine.

The graphics used in this manual may show direct slice machine details and installation components that may be different than what is actually used. Components may have been removed for illustrative purposes or the continuing improvement of the direct slice machine's design may cause changes that are not included in this publication.

Unpacking & Inspecting

Both DS500E and DS1000E have been assembled and tested at Cold Jet's test center before being crated and shipped as one unit. Follow the steps below to unpack and inspect the machine from the shipping container.

1. Examine the shipping container for any damages that may have occurred during transport.
2. Remove the machine, box(es) that contain accessories, and discard packing material, braces, and ties.
3. Examine the machine for any external damage that may have occurred during transport.
4. Open the cabinet doors of the machine and examine the machine for any internal damage that may have occurred during transport.
5. Open the front cabinet door and locate the box on the machine floor containing user documentation, optional spare parts kit(s), and other accessories.

Refer to the packing slip for a list of the components shipped with the machine. Document any damage that has occurred to the shipping container or the machine with photos and contact Cold Jet's project lead (refer to the "Cold Jet Project Lead" on the front page or the contact details of the appropriate office on the last page).

Transporting & Lifting

Always transport the machine in the upright position using a forklift. Pick up the machine from the side with the forks fully engaged and adjusted to the maximum width (refer to "Figure 1: Transporting and Lifting the Machine."). please give extra attention to the bottom part of the machine, as the truck can damage the machine if the forklifts fork hit the tube or the pressure unit output.

Forklift Requirements	**DS500E**	**DS1000E**
Load Capacity	2000 kg (4409 lb.)	2500 kg (5512 lb.)
Fork Length (Minimum)	2 m (79 in)	2 m (79 in)

The weights and dimensions of the machine are described in the following table:

Weights and Dimensions	**DS500E**	**DS1000E**
Shipping Weight Transport (Includes Pallet/Crate)	1340 kg (2954 lb.)	1830 kg (4034 lb.)
Shipping Crate Dimensions (LxWxH)	1640 x 1430 x 2650 mm (64.5 x 56.5 x 104 in)	2200 x 1440 x 2650 mm (86.5 x 56.7 x 104 in)
Machine Weight	1310 kg (2888 lb.)	1800 kg (3968 lb.)
Machine Dimensions (LxWxH)	1330 x 1330 x 2410 mm (52.5 x 52.5 x 95 in)	1890 x 1330 x 2410 mm (74,5 x 52,5 x 95 in)

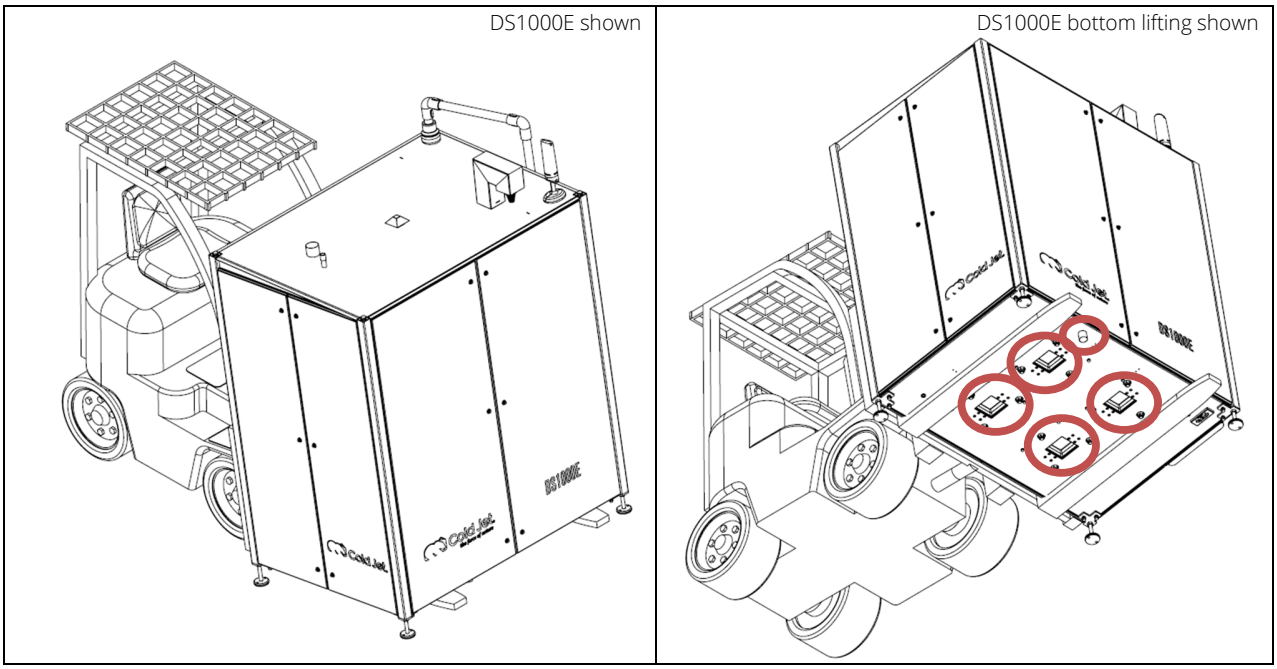


Figure 1: Transporting and Lifting the Machine.

Pre-Installation by the Customer

Pre-Installation of the machine at the site must be carried out by the owner/operator. After that, a Cold Jet technician will arrive on-site for the final commissioning, start-up, and training. Machine owner/operators are responsible for the physical installation, utility connections, and CO_2 supply required to put a new machine into service.

For an overview of a typical dry ice production system, refer to "Dry Ice Production System" on page 6.

Production Space Requirements

- Adequate ventilation, natural or forced, must be provided to prevent the build-up of CO_2 during production.
- A system to monitor CO_2 levels that will alert personnel when CO_2 levels become too high and pose a danger.
- The machine shall be sheltered from the wind and weather and operate in an environment with an ambient temperature between 5°C and 35°C (41°F and 95°F).
- The machine must be placed on a horizontal, concrete floor with adequate load-carrying capacity.
- The minimum clearance of 1300 mm (51.2 in.) must be observed so that the cabinet doors can be opened and the machine can be serviced. The height of this machine from the floor to the top of the light tower is 2410 mm (95 in.) must also be considered. Allow for a minimum clearance of 200 mm above the machine for any overhead piping and cabling (refer to "Figure 2: Minimum clearances" on page 5).

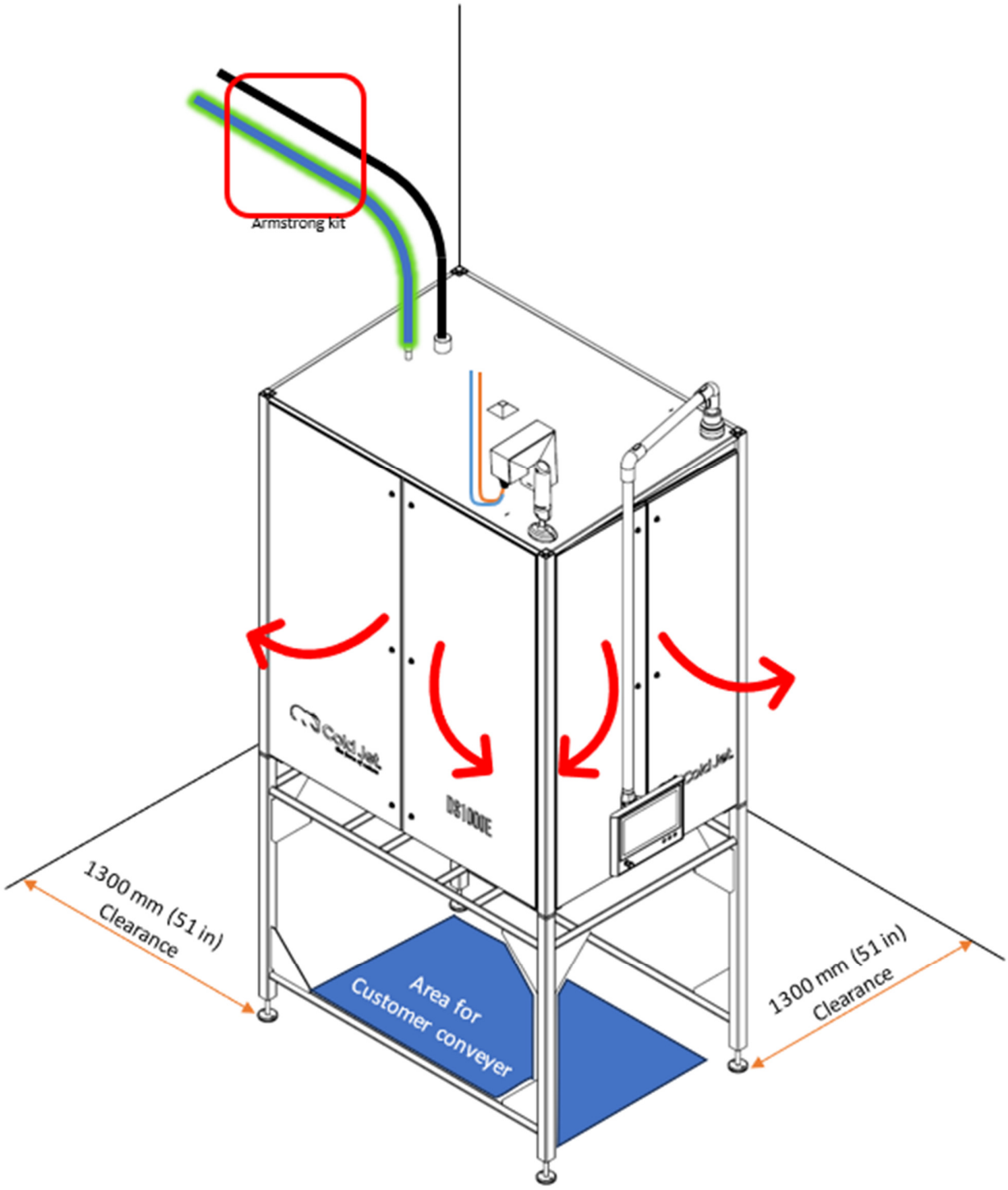
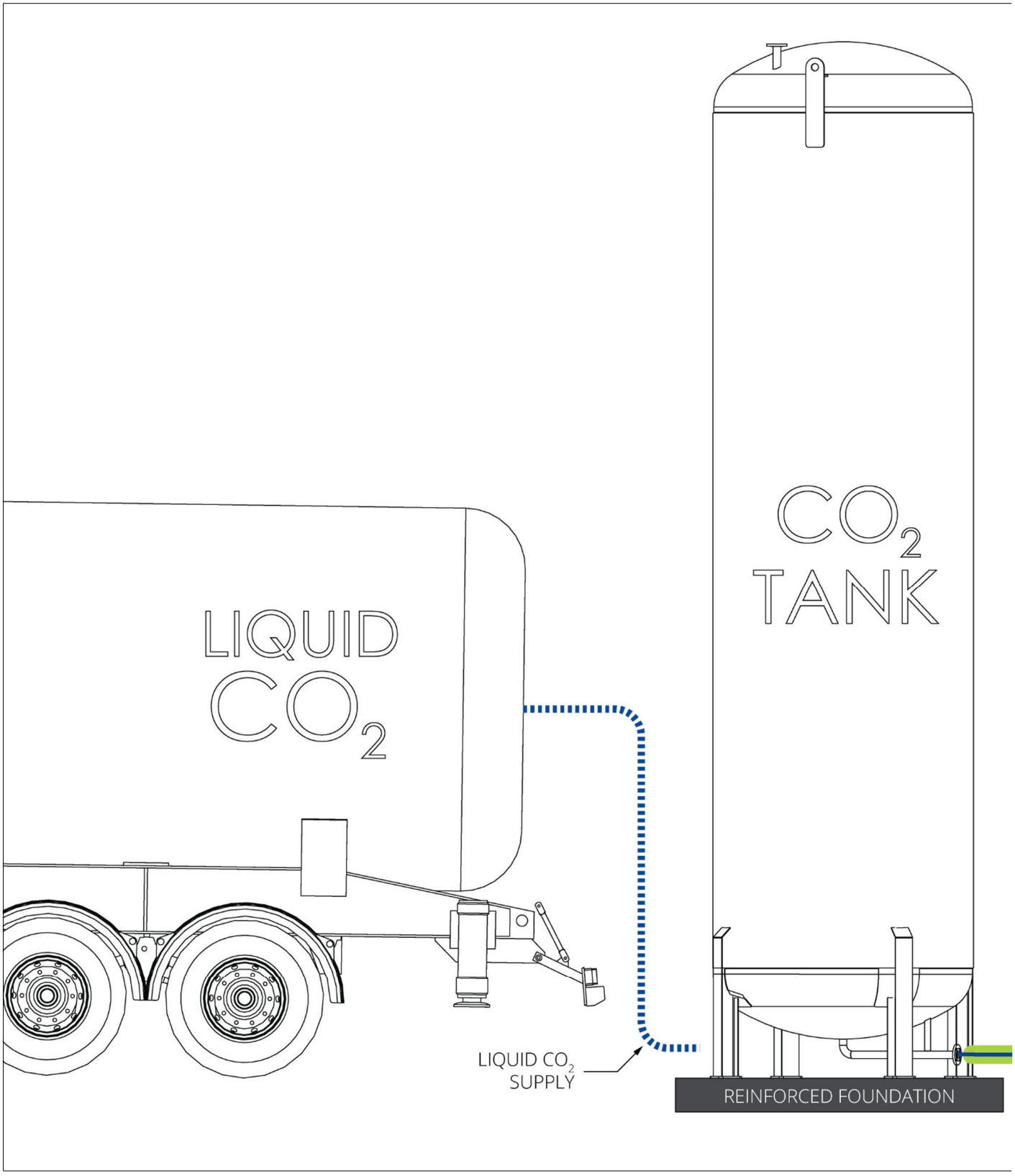
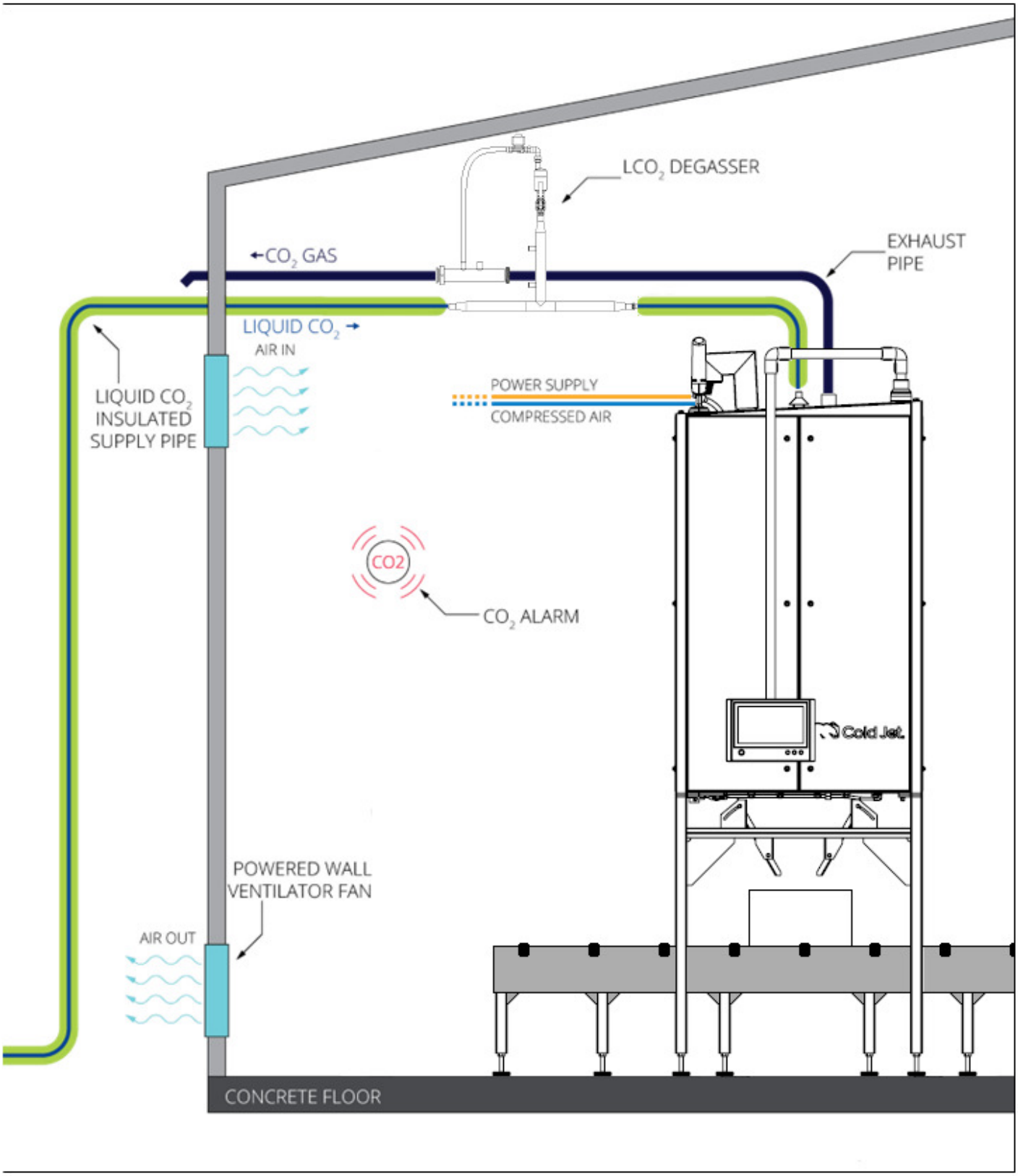


Figure 2: Minimum clearances

Direct slice Production System setup (example)




LCO2 DEGASSER
EXHAUST PIPE
←CO2 GAS
LIQUID CO2 →
AIR IN
LIQUID CO2 INSULATED SUPPLY PIPE
POWER SUPPLY
COMPRESSED AIR
CO2
CO2 ALARM
Cold Jet
POWERED WALL VENTILATOR FAN
AIR OUT
CONCRETE FLOOR

Liquid CO_2 Supply System

Cold Jet recommends the supply line for the liquid CO_2 from the storage tank to the pelletizer to be direct (with limited bends) and well insulated. This will help prevent the formation of gas and maintain the temperature of the liquid CO_2 thus improving the performance of the pelletizer.

It is the responsibility of the installer of the liquid CO_2 supply system to determine the best supply line route and the insulation needed. Use the data guidelines below to design and install the liquid CO_2 supply system:

Liquid CO_2 Supply System	**DS500E**	**DS1000E**
Supply Pressure (Min-Max)	13-18 bar -30°C to -20°C (189-261 psi -22°F to -4°F) Optimum performance range 15-16 bar -24°C to -26°C C (232-290 psi -11°F to -15°F)	
Supply Pressure Range	+/- 1.0 bar (14.5 psi)	
Supply Pressure (Recommended PBU Setting)	16.5 bar (240 psi)	
Flow Rate - Minimum	1000 kg/hr. (1984 lbs./hr.)	2200 kg/hr. (4850 lbs./hr.)
Flow Rate - Maximum	5280 kg/hr. (11640 lbs./hr.)	10560 kg/hr. (23281 lbs./hr.)
Max volume withdrawal (PBU-Dimensioning)	*	*
Pelletizer Design Pressure / PRV setting	27.6 bar (400 psi)	
Liquid CO_2 Line Size Recommended ID	25 mm (0.98 in)	25 mm (1.0 in)
Liquid CO_2 Connection at Pelletizer	EU: 3/4-inch BSP / US: 3/4-inch NPT	
Liquid CO_2 Line Insulation	Min. 75mm (3.0 in) Industrial Insulation - (Urethane Foam - PVC/Alu jacket)	

*Data is missing, please contact Cold Jet

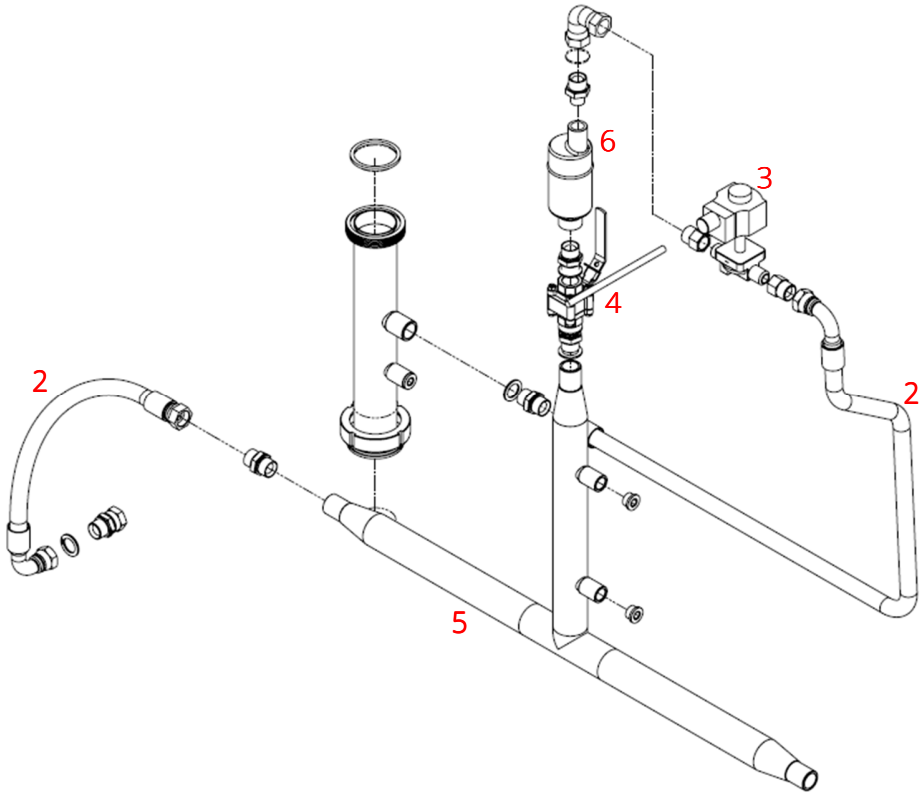
NOTE: If the liquid CO_2 supply line is serving more than one machine, other CO_2 consuming machinery, or is longer than 30 m (100 ft) the owner should consult with the CO_2 piping contractor for an optimal design for a stable and gas-free liquid CO_2 supply to the pelletizer.

NOTE: For CO_2 tank installation and the liquid CO_2 supplier the recommended supply pressure settings are 15-16 bar -24 to -26 C (232-290 psi -11 to -15 F) for optimized output performance and quality. The liquid CO_2 quality in use must meet general purity requirement of commercial industrial/food grade specifications and must be free of oil and have a purity of minimum 99.9%. For optimum performance and high density pellets quality the water (H_2O) content should not exceed 35 ppmv and not be less than 5 ppmv - or equivalent to a dew point temperature of -66°C to -51°C (-86.8°F to -59.8°F). If only very dry CO_2 is present please contact Cold Jet for optimal special extrusion process design and settings.

Liquid CO_2 Degasser System

In order to achieve a consistent, high-quality supply of liquid CO_2 to the pelletizer, Cold Jet recommends the installation of an automatic gas venting system, such as the Armstrong Kit (refer to "Figure 3: Degasser (Armstrong) Kit. Installing an automatic gas venting system will improve the performance of the pelletizer and increase dry ice production.

The installation of the Armstrong Kit, or similar system, is optional and is the responsibility of the installer of the liquid CO_2 supply system and piping up to the pelletizer connection.



1. Safety valve 27.6 Bar (400.3 PSI)	2. Flexible hose	3. Solenoid Valve 25 VDC 5/8”
4. Shut-off Valve BSP	5. Liquid CO2 supply line	6. Free floating lever air/gas vent

Figure 3: Armstrong Degasser

The Armstrong Degasser will need to be integrated into the production system by the customer's piping contractor.

Gas CO_2 Exhaust System

An exhaust pipeline with an internal diameter greater than 3 inches is installed to facilitate the exhaust CO_2 gas from the dry ice production process. The exhaust CO_2 gas must be vented at a safe location outside of the building with a weatherproof outlet that prevents rainwater or other contaminants from blocking or creating back-pressure to the pelletizer.

Additionally, the CO_2 exhaust could have a temperature as low as -27°C (-16.6°F) which may generate condensation. Cold Jet recommends installing an Armaflex insulation or similar product to prevent this condensation from dripping down onto the machine or production room floor.

Gas CO_2 Exhaust System	**DS500E**	**DS1000E**
Gas CO_2 Exhaust Volume	132 kg/hr (291 lb/hr)	385 kg/hr (489 lb/hr)
Gas CO_2 Exhaust Volume (Standard Conditions)	77 N·m³/hr	224 N·m³/hr
Operating Design Gas CO_2 Pressure (PRV)	1 bar (14.5 psi)	
Max Allowable Back-Pressure	< 1.0 bar (< 14.5 psi)	
Gas CO_2 Line Size Minimum ID	76.2 mm (3 in)	76.2 mm (3 in)
Gas CO_2 Connection at direct slice machine (Welding Stud)	76.2 mm (3 in)	76.2 mm (3 in)

Electrical Service & Supply

The direct slice machine requires a three-phase power supply. The power source must be grounded:

- For machines in the US: use a Solidly Grounded WYE Source.
- For machines outside US: use a TN-S grounding acc. to IEC 60364.
- All phases must be balanced, and voltages must be within ±10%.

The customer is responsible for the electrical installation of the machine. This includes the power cable and main circuit breaker which meet the specifications below. The main circuit must be suitable for proper lock out / tag out in accordance with international and national standards and requirements.

Electrical Service & Supply	**DS500E**	**DS1000E**
Standards	EN 60204-1 & IEC 61439-2	
Voltage AC/ Frequency (EU 50Hz)	3 x 400 V AC + N + PE / 50Hz	
Number of phases	3	
Short Circuit Current, Min / Max	0,5 kA / 10 kA	
Upstream Fuse Max	50 A	100 A
Rated Current (Imax)	40 A	75 A

Instrument Process Air Supply

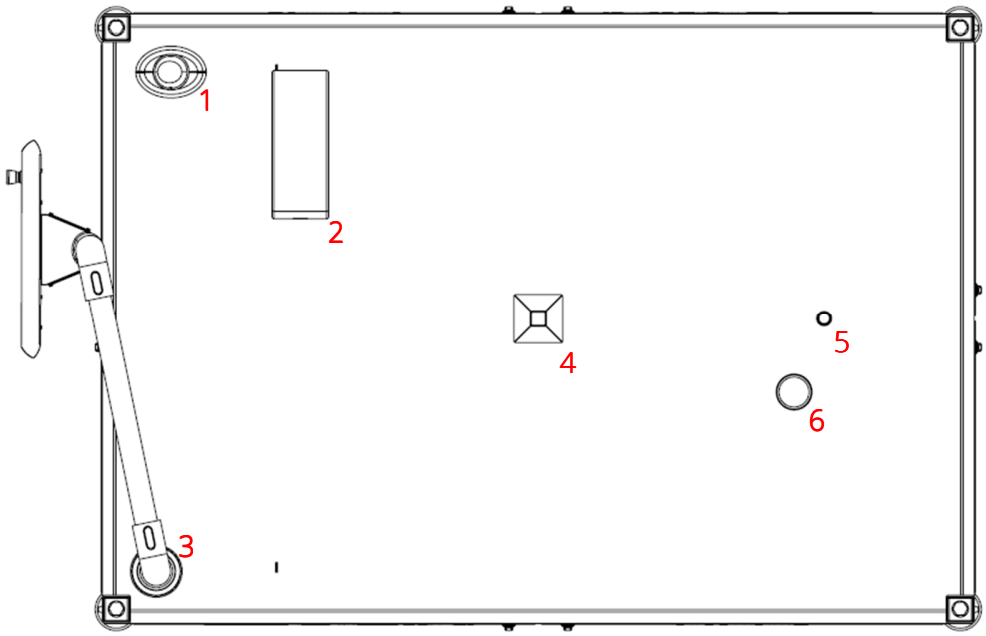
The direct slice machine requires instrument air/CO_2 gas at a minimum pressure of 6 bar (87 psi) as the input to the pressure regulator in the machine.

The customer is responsible for the pneumatic installation of the pelletizer. A valve must be installed to ensure proper safe lock-out/tag-out of the machine with reference to relevant machine safety standards.

Instrument Process Air Supply	**DS500E**	**DS1000E**
Compressed Air Quality	ISO 8573-1, Minimum class 2	
Supply Pressure (MIN-MAX)	6-10 bar (116-145 psi)	
Flow minimum (normal liter)	150 l/min (5.3 cfm)	
Air Connection at Pelletizer	2 x ø10 push in	

Utility Connections

The utility connections are located on top of the pelletizers (refer to "Figure 4: Utility Connections").



1. Light tower	2. Instrument air, Ethernet, and power supply	3. Display arm
4. Vent	5. Liquid CO_2 in	6. CO_2 gas out

Figure 4: Topview of DS1000E

Cold Jet Connect™ Internet Connection

Cold Jet Connect™ is your access to quick and effective remote technical support. Via the internet, a Cold Jet technician can view the machine data in real time and support the owner/ user in for continued optimized machine performance or quick diagnostic of other uptime related issues.

The customer is responsible for the internet connection and the machine, Beckhoff PLC, is connected to internet either directly through an Ethernet ISP or by using a mobile 3G/4G connection. The connection is established with a network cable RJ45 plug.

Figure 5: Internet Connection

Safety

Carbon Dioxide (CO_2) and Dry Ice Properties

At a temperature of -15°C (5°F) under normal atmospheric pressure, carbon dioxide has a density of 1.87 kg/m^3 (0.12 lb/ft^3) and is 1.5 times heavier than air. It is a colorless and odorless gas with a slightly pungent odor at higher concentrations and spreads along the ground. Carbon dioxide gas will collect in low-lying areas such as pits and cellars.

Dry Ice Production Process

The expansion of liquid carbon dioxide at pressures between 15-18 bar (217.6-261.1 psi) to atmospheric pressure is how the pelletizers produce CO_2-snow at a temperature of -78.5°C (-109.3°F). The CO_2-snow is then compressed to form high-density dry ice slices.

Safety Hazards

Dry ice is extremely cold and may cause severe frost bite or tissue damage when in direct contact with exposed skin. Always wear protective gloves and clothing when handling dry ice.

CO_2 is classified as a non-flammable and non-toxic gas. It is normally present in the atmospheric air at a level of approximately 0.04%. It is a normal product of metabolism being held in bodily fluids and tissues where it forms part of the bodies normal chemical environment. Higher concentrations can cause suffocation.

Operate the direct slice machine in a well-ventilated work area with continuous CO_2-level monitoring. The effects of CO_2 are entirely independent of the effects of oxygen deficiency. Therefore, CO_2 concentrations at 3-5% causes headaches, fast breathing and discomfort while higher concentrations may cause unconsciousness, suffocation or respiratory arrest. The legal exposure limit set by OSHA is a 0.5% average over an 8-hour workday and the acute (15 minute) exposure limit set is 3.0%.

Always use a CO_2 monitoring/alarm system when working with machinery that emits CO_2 in a confined room/space.

Operation and maintenance should only be performed by authorized and trained personnel. Below are some basic safety guidelines:

- Follow local governing codes to ensure a minimum standard of safety.
- Wear protective gloves, safety glasses, and ear plugs.
- Operate the pelletizer in a well-ventilated work area with a CO_2 monitoring/alarm system.

Pre-Installation Checklist

The owner should use the checklist below to prepare for the installation of their direct slice machine. It is the owner's responsibility to verify all the necessary preparations have been made to the installation site and meet the specifications and guidelines detailed in this publication.

Check off each item in the checklist as pre-installation preparations are completed. Once the checklist is complete, the owner or responsible party will sign and date the Pre-Installation Confirmation form and return it to Cold Jet.

Completed	Task
☐	The installation site of the pelletizer is indoors, well-ventilated, with sufficient clearances on all sides (including the top).
☐	The installation of the CO2 supply tank is complete and has been filled by the owner-selected CO2 supplier (refer to "Liquid CO2 Supply System" on page 9).
☐	The supply pipeline has been installed and meets the specifications described in "Liquid CO2 Supply System" on page 9.
☐	The exhaust pipeline has been installed and meets the specifications described in "Gas CO2 Exhaust System" on page 10.
☐	The electrical connections are in compliance with the regional specifications described in "Electrical Service & Supply" on page 11.
☐	The instrument air or CO2 gas supply for the pelletizer's pneumatic system has been installed and meets the specifications described in "Instrument Process Air Supply" on page 11.
☐	The appropriate type of communication agreed and prepared.
☐	Internet connection for remote technical support.

Pre-Installation Conformation Form

I hereby verify the pre-installation preparations listed above have been completed.

Customer: _____

Order: _____

Owner/Contact: _____

Signature _____

Date: _____

Notes/Remarks to Cold Jet: _____

Email the signed form to the to the Cold Jet project lead named on the front page

Notes

Contact Information

Find the customer support and technical services contact information for your region in the table below.

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