Reformer R2000H

USER MANUAL

Original instruction [English]

12.03.2024
Version 2

CONTENTS


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INTRODUCTION

This manual should be kept with the machine and be readily accessible to machine users. This manual contains information on the safety and operation. The graphics used in this manual may show machine details that may be different than the actual machine. Components of the machine may have been removed for illustrative purposes or the continuing improvement of the machine's design may cause changes that are not included in this publication.
The owner of this machine is responsible for verifying the operator of this machine is properly trained and understands the contents of this manual.

About the R2000H Reformer
Cold Jets R2000H pellet-to-slice reformer is a fully automatic machine, with the flexibility to reform dry ice pellets or nuggets into robust dry ice slices in customer specific dimensions, with up to 450 slice press cycles per hour. Designed to diversify dry ice production capabilities, the R2000H allows to produce from 0,6 kg slice up to 8,0 kg block maintaining the highest capacity of the machine.
Using the recipe program, slice thickness can be changed during production. Slice format is changed in less than 15 minutes by using the Quick-Change Press Head. During production slice thickness is constantly monitored and optimized.
The R2000H is powered by a Beckhoff industrial PC with 15" touch panel for intelligent control. Using servo technology ensures fast and precise motion control. When connected to the internet, R2000H enables Cold Jet CONNECT™ for remote support and maintenance of uptime and performance.


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SYSTEM DESCRIPTION

The operator manual covers the Reformer R2000H. The main parts are described in the machine structure section. Operating/User instruction for add-ons can be found in other materials not included in this manual.

Functional Description
The function of the Reformer R2000H is to reform dry ice pellets or nuggets into robust dry ice slices in customer specific dimensions.
This is performed by a sequence of operations executed by the Beckhoff Panel PC. The Main steps in a normal application are as follows and refer to the P&I diagram 2B0516, which is available through the documentation packet on Cold Jet CONNECT.

1. **Start up**
2. **Production**
3. **Tool change**
4. **Standby**
5. **Shutdown**

The Reformer does not produce the pellets needed to make slices. The pellets are fed to the machine at the top. This is normally done by a conveyer either from a raised level or a z-conveyor. The pellets are then stored in a tank. When the level of dry ice pellets reaches a certain level, the reformer will start reforming the pellets into slices.

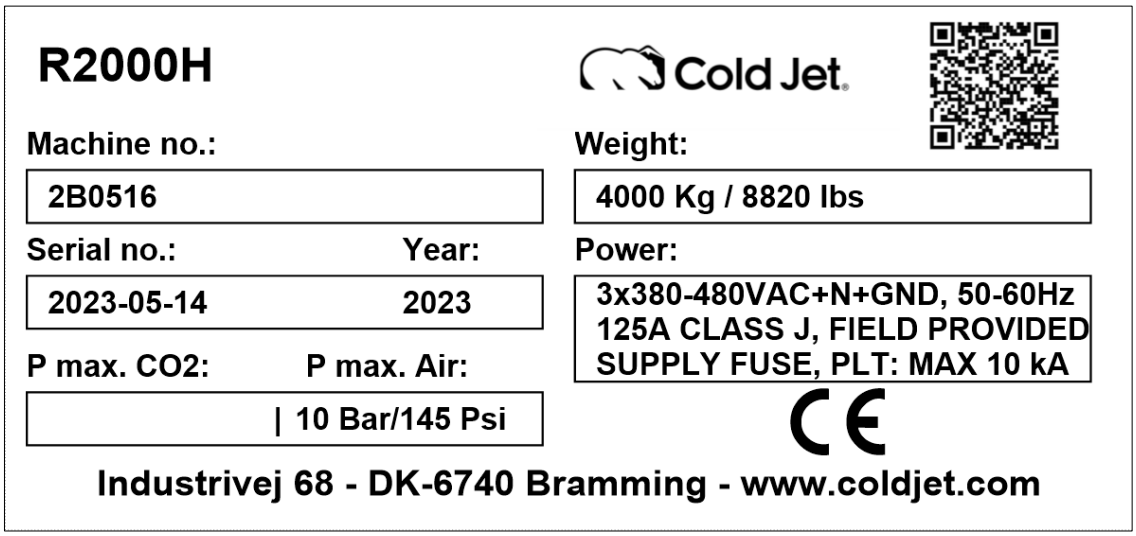
The shuttle runs back, allowing the chamber to be filled with right number of pellets. The shuttle will then be moved to a position where the pellets in the shuttle are just above the tool, dropping the pellets into the chamber. The shuttle moves back to its starting position to be refilled with pellets. The tool will then press the pellets into the die. The tool hydraulic piston will raise, and the shuttle will move forward, pushing out the slice onto the outfeed conveyor and refilling the chamber with slices.

While the shuttle is being filled with pellets the produced slice will be raised from the die by a servo drive below the chamber. When the shuttle is sent forward it will push the produced slices out of the machine to the outfeed conveyor. The outfeed conveyor ensures the slices are transported to there they will be used.

Color detection of the lighthouse

Green:	Machine is ready and there are no alarms (error messages).
Yellow:	Machine has been paused.
Red:	Machine out of operation due to an alarm (error message).

SYSTEM IDENTIFICATION



Data will vary depending on the specific setup of reformer.

Supplier Responsible for the Equipment

Cold Jet ApS
Industrivej 68
DK-6740 Bramming
Denmark
Phone: +45 75 56 15 00
Homepage: www.coldjet.com
Email: info@coldjet.com

TECHNICAL DATA

Rated Output:

Height mm (in)	Weight 125x125 (5”x5”) kg (lb.)	Weight 125x250 (5”x10”) kg (lb.)	Weight 250x250 (10”x10”) kg (lb.)	Capacity kg/h (lb./h)	Press/hr.
	Slice per press 4	Slice per press 2	Slice per press 1		
25,4 mm (1”)	0,63 kg (1,4 lb.)	1,2 kg (2,7 lb.)	2,5 kg (5,5 lb.)	1120 kg (2469 lb.)	450
50,8 mm (2”)	1,2 kg (2,7 lb.)	2,5 kg (5,4 lb.)	4,9 kg (10,8 lb.)	2118 kg (4669 lb.)	432
60,3 mm (2 3/8”)	1,4 kg (3,2 lb.)	2,9 kg (6,4 lb.)	5,8 kg (12,7 lb.)	2503 kg (5520 lb.)	432
63,5 mm (2 1/2”)	1,5 kg (3,4 lb.)	3,1 kg (6,8 lb.)	6,1 kg (13,5 lb.)	1918 kg (4229 lb.)	314
76,2 mm (3”)	1,8 kg (4 lb.)	3,6 kg (8 lb.)	7,3 kg (16 lb.)	2277 kg (5021 lb.)	312

of high-quality dry ice slices, depending on the size of slice chosen

R2000H Main Industrial control panel

Full load current:	75 A
Largest motor FLA:	38,8 A
Largest heater FLA:	1,4 A
Voltage:	480 Y/277 VAC + GND solidly grounded WYE source
Phase and frequency:	3-phase 60 Hz
Max. short circuit current	25 kA rms symmetrical 480 VAC max
UL enclosure type	UL type 12
Supply fuse (field provided)	Class J, max. 100 A, min 480 VAC IRmin 25 kA

Machine Dimensions (mm/inch):

Length:	2258 mm (89 in)
Width:	1658 mm (65 in)
Height:	2400 mm (94 in)
Weight:	4000 kg (8819 lb.)

Noise level:
Below 75 dB(A)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SAFETY REGULATIONS

General Measures

The Cold Jet R2000H manual contains instructions on starting up, operating, and servicing the machine. The operator must follow the instructions in the manual. Moreover, it is important that the owner makes sure that the operator understands the contents of this manual and follows its guidelines and safety regulations.

Personnel Qualifications

Employees who oversee mounting, operation, service, and maintenance must be adequately qualified to take care of such job functions.

If the employees do not possess sufficient knowledge, they must be instructed and trained properly. If necessary, this can be arranged in cooperation with the manufacturer of the machine.
The owner of the machine shall make sure that the operator, who is to work with the Cold Jet R2000H, fully understands the importance of studying the content of the manual and complying with the SAFETY REGULATIONS described on the following pages as well as those placed on the machine.

Contraindications

Cold Jet Machines are designed to operate for long periods of time. The machine is designed with an HMI that enables the operator to act upon errors that might occur during operation. The machine should only be operated with the doors closed. Entering the machine, for service purposes etc. should be done in a way that allows the Contained CO2 to reach a safe level and the temperature to fall for certain areas.
Machines with moving parts inside can cause injury, therefore they are designed with door switches that disable the machines from running when opened/activated.

Security and Risk

The Cold Jet R2000H is designed to comply with the EC Declaration of Conformity for Machinery. Therefore, using the machine does not pose a risk to the operator when the instructions in this manual are followed carefully.
It is important that the operator carefully follows the safety signs on the machine and the safety regulations described later in this manual and that the operator reads and understands the content of this manual before starting up the machine. Installation must be carried out according to the instruction" Unpacking and preparations before installation".

The machine may only be installed by authorized personnel, that is electricians with knowledge of the Council Directives BT 2014/35/EU and EMC 2014/30/EU (or similar directives in other parts of the world).

Safety Labels

The symbols used on the machine were developed by the International Organization for Standardization (ISO) and are defined below. These symbols may include yellow warnings triangles, blue mandatory action circles, or red prohibited action circles.

Danger of Suffocation

Dry ice pellets are CO2 in solid form. At ordinary atmospheric pressure, CO2 can only exist in this solid form at temperatures of -79°C (-110°F) or lower. Therefore, during dry ice production, the CO2 will immediately be heated and thus transform from solid form into gas form.

Please note:

Since the specific gravity of CO2 is higher than that of ordinary atmospheric air, the air with its contents of oxygen will be replaced by CO2 if the dry ice production is taking place in small or insufficiently ventilated rooms.

Therefore, please note the following:

1. Low CO2 concentrations (3-5%) cause headaches and fast breathing.
2. CO2 concentrations of (7-10%) cause headaches and nausea and may result in unconsciousness.
3. Higher CO2 concentrations result in unconsciousness and at worst it may cause suffocation.

High CO2 concentrations may result in unconsciousness due to displacement of oxygen. Therefore, always make sure to provide sufficient ventilation of the working area, and always avoid producing dry ice in small rooms.

Static Electricity

Dry ice can cause electrostatic discharges. However, the equipment bonded to ground to minimize electrostatic discharge, and the warning sign is only meant to instruct the operator to avoid placing the equipment in rooms containing explosive gasses.

Also, it is recommended to use a plastic shovel in the dry ice container.

Danger of Congelation

CO2 in solid form has a temperature of -79°C /-110°F or lower at atmospheric pressure and can therefore cause serious congelation injuries.

IMPORTANT!

The dry ice is extremely cold; therefore, do not touch parts of the machine which are in direct contact with the dry ice without wearing appropriate protective clothing and gloves.

Pinch Point Hazard

If the covers on the Cold Jet R2000H is removed, the operator will be exposed to pinch point hazard.

Danger of burns

If the covers on the Cold Jet R2000H are removed, the operator will be exposed to very hot components.

It is recommended to monitor temperatures on the HMI and not remove covers before temperatures are at below +35°C / 95°F.

Wear Protective Gloves

During work with dry ice and the R2000H, the operator must wear protective gloves in order to avoid contact with dry ice or with parts of the machine which are in direct contact with the dry ice.

How to Lift / Transport

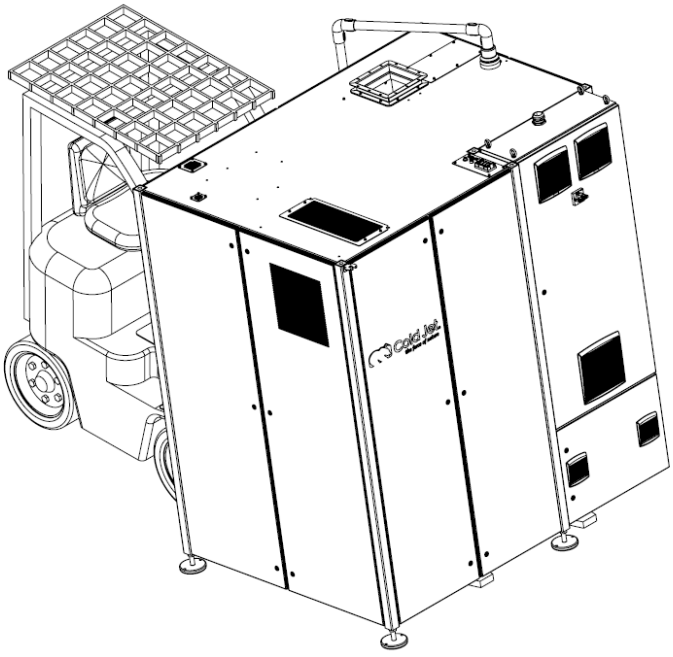
1. Always lift the reformer according to the lifting Instruction in this manual.
2. Mind that the R2000H requires a forklift capable of lifting at least 6000 kg.
3. Lifting over persons and animals is prohibited.
4. Always use a forklift truck to transport the reformer.
5. Pick up the reformer from the side as shown in the drawings.
6. Transport the reformer upright.
7. Make sure that the forks are sufficiently long to fully engage the reformer.
8. Always check that the forks are adjusted to maximum width.

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. When lifting the machine be sure that the forks are lifted evenly as they can bend the electrical cabinet if they are tilted before lifting.

Forklift Requirements	**R2000H**
Load Capacity	6000 kg (13228 lb.)
Fork Length (Minimum)	2.5 m (99 in)

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

Weights and Dimensions	**R2000H**
Shipping Weight Transport	3850 kg (8488 lb.)
Shipping Crate Dimensions (LxWxH)	1860 x 2500 x 2584 mm (73.2 x 98.4 x 101.7 in)
Machine Weight (Incudes Hydraulic oil)	4000 kg (8819 lb.)
Machine Dimensions (LXWXH)	2258 x 1658 x 2400 mm (89 x 65 x 94 in)



SAFETY OPERATION

Emergency Stop
All equipment is connected to the general emergency system for the R2000H.
When an emergency-stop device is activated, all components located in the emergency zone will be disconnected from their power source.
Machine safety
There are machine safety measures in the following areas:

- Hydraulic press
- Shuttle
- Eject
- Outfeed conveyor

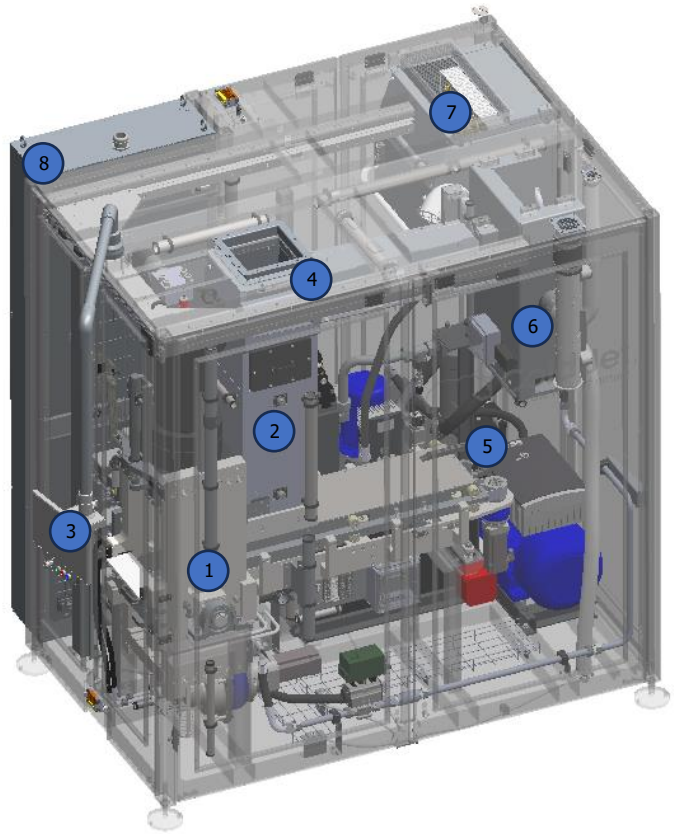
The R2000H has safety door switches that will deactivate the machine if opened.

Required performance level PLr = c Implemented in category = Cat3.

There is danger of congelation / frost bites by touching machine parts cooled down by dry ice.
To prevent congelation, the entire machine enclosure is provided with locks and requires special tools to open.

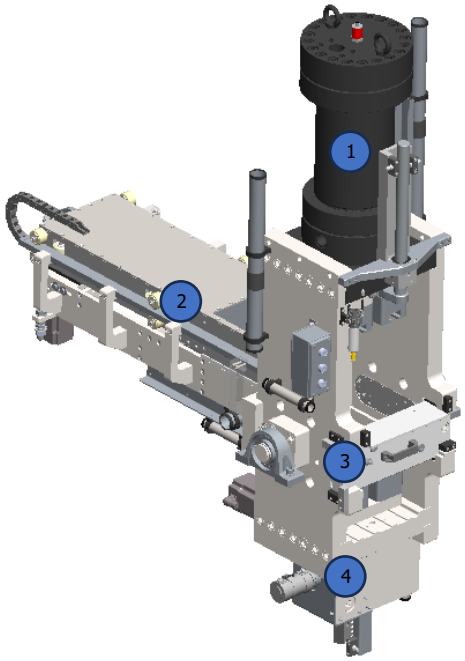
MACHINE STRUCTURE

R2000H



1. Process unit
2. Hopper
3. HMI screen
4. Shutter
5. Hydraulic station
6. Dehumidifier
7. Oil-cooler.
8. Electrical cabinet

Process unit



1. Hydraulic cylinder
2. Shuttle
3. Chamber
4. Eject

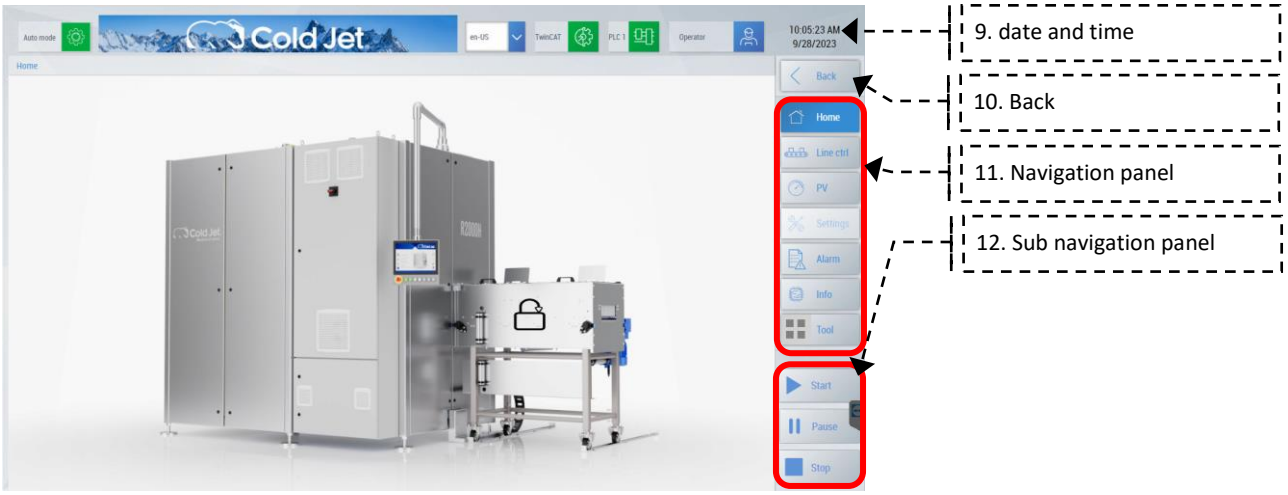
MACHINE CONTROL

The R2000H is controlled through the HMI screen. The machine cannot operate without a line control, set up either as an external line control or inside the R2000H.

Home screen

The home screen of the reformer shows if the machine is running. If any alarms are present the first three alarms will show instead of the cold jet banner logo at the top. The language setting, the status on the TwinCAT system and the PLC, which level you are logged into, date and time. The right-hand side holds a control panel that remains the same top bottoms to navigate the HMI.

1. Login level
2. PLC selection
3. TwinCAT
4. Language selection
5. Cold Jet logo, will change to the first three alarms if any are present
6. Auto or manual mode. The color shows if the machine is running.
7. Image of R2000H with outfeed conveyer
8. Lock/unlock button for outfeed conveyer.



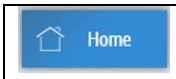
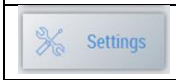
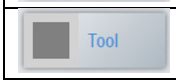
Login level (1)
The login level shows which level is currently logged in. The bottom can also be pressed to show the menu with the function to logout or switch user. The different users have different authentications and require password.

User levels:	**Permissions:**
User: Operator **Password: not required**	Can view everything, start / stop the system, and choose between the different recipes.
User: Recipe Change	Same as 'Operator' + - Edit the recipe. - Perform tool change.
User: User	Same as 'Recipe Change' + - Run control modules in manual.
User: Service, Cold Jet, Administrator	Same as 'user' + Additional functions.

Remember to log out if a user level that should not be available for others has been used.

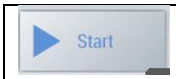
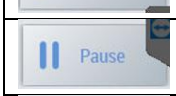
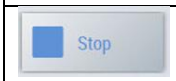
Lock / unlock button for outfeed conveyer (8)
The outfeed conveyer shown on the home screen, has a lock on it. When the lock is pressed it will unlock. Being unlocked gives multiple alarms, as shown in the screenshot.
When the machine is running the lock screen will disappear as it is not possible to unlock the outfeed conveyer.

Navigation panel (11)

	Home screen	The main screen, where outfeed conveyer can be unlocked.
	Line control screen	This is where the entire line is managed. This is specific for each setup.
	Process values diagram screen	Screen showing the process value diagram, detailed overview of the R2000H.
	Settings menu	Additional settings.
	Alarm screen	Screen to see both active and historical alarms.
	Info screen	Information screen.
	Tool screen	Screen to both change receipt and tool change.

Sub navigation panel (12)

The lower part of the navigation panel links to additional functions within the different menus. These will be covered in each section. For the home screen the sub navigation panel functions as an operation panel with the following functions:

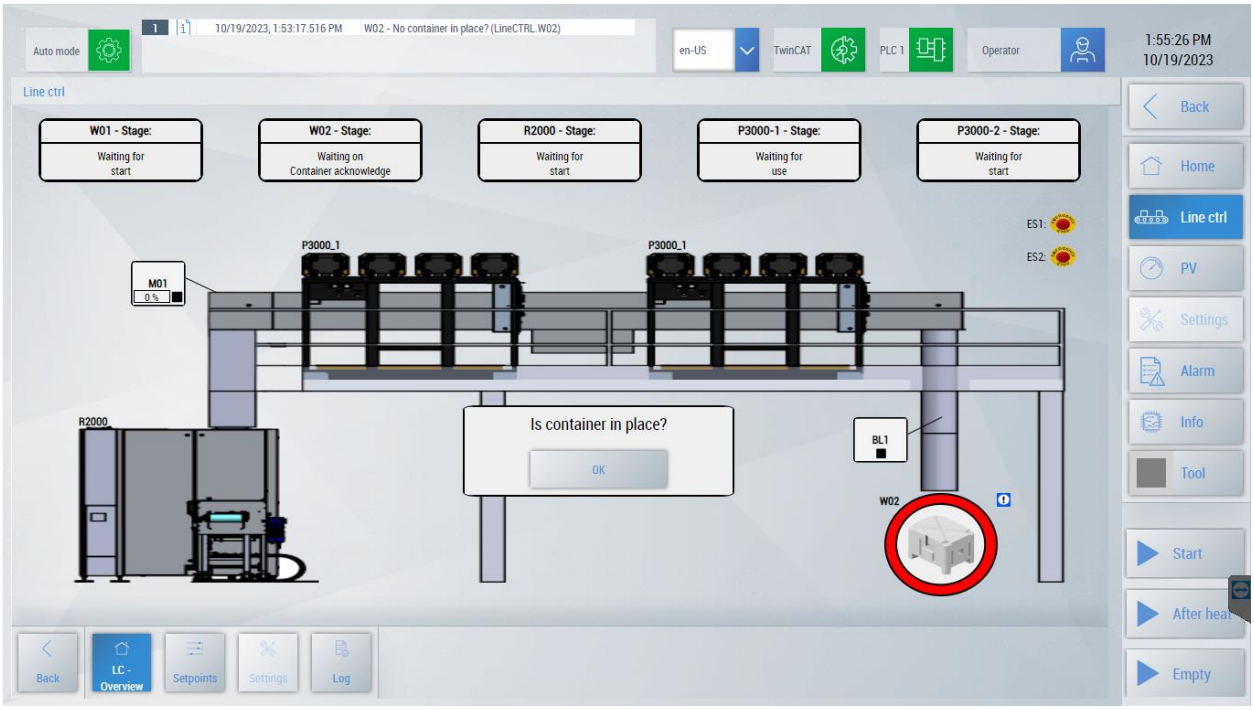
	Start the entire line including the R2000H.
	Pause the reformer.
	Stop the line and run the stop procedure.

Cold Jet logo (5)

When the machines have an alarm or information, the Cold Jet logo will change to the first three alarms. These can be pressed. This works the same way as pressing the alarm bottom in the navigation panel.

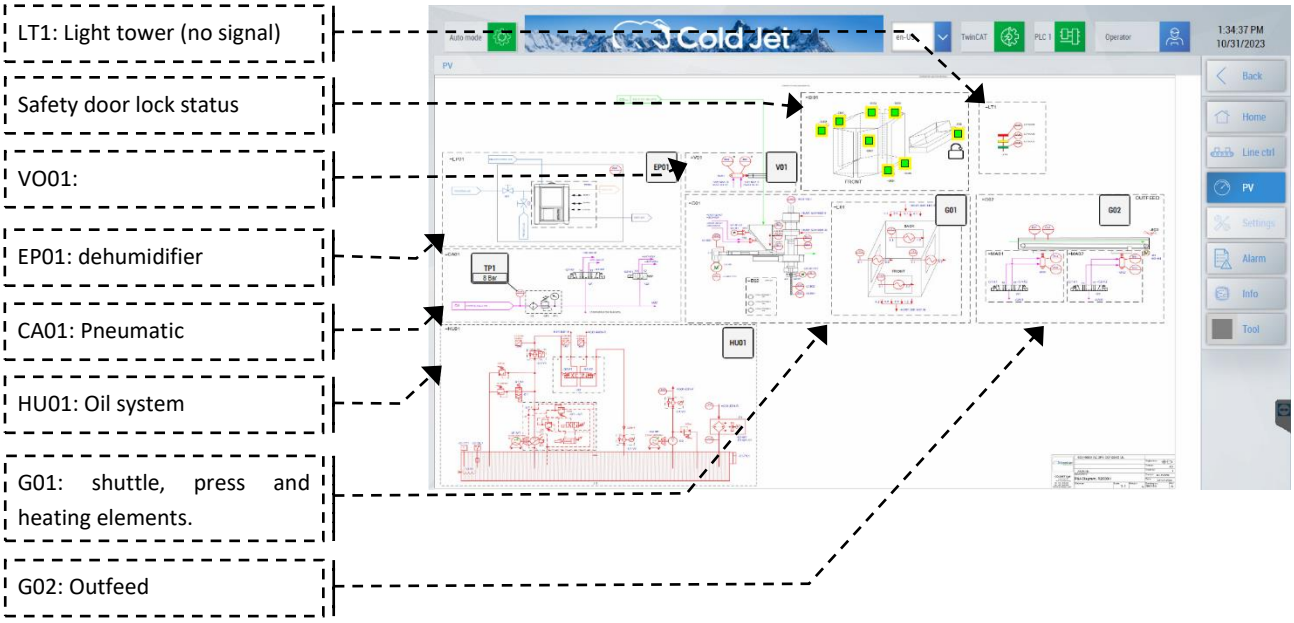
Line Control (8)

The line control is where the main function of the reformer line will be controlled. This is individually for each site. Line control will not be covered by the reformer manual. Below is an example of a line control.



Process values

The process values show the P&ID diagram. By pressing the different areas of the PI diagram, the area will be shown zoomed in. Components are available with a tag, showing current value and status. If an error occurs, it will show up on the general page, and to find which tag it is linked to, zoom in to the specific part.



The different tags consist of a grey square, with a tag name, a value, and a status. In the top right corner, an additional symbol will show if an alarm occurs. Symbol explanation:

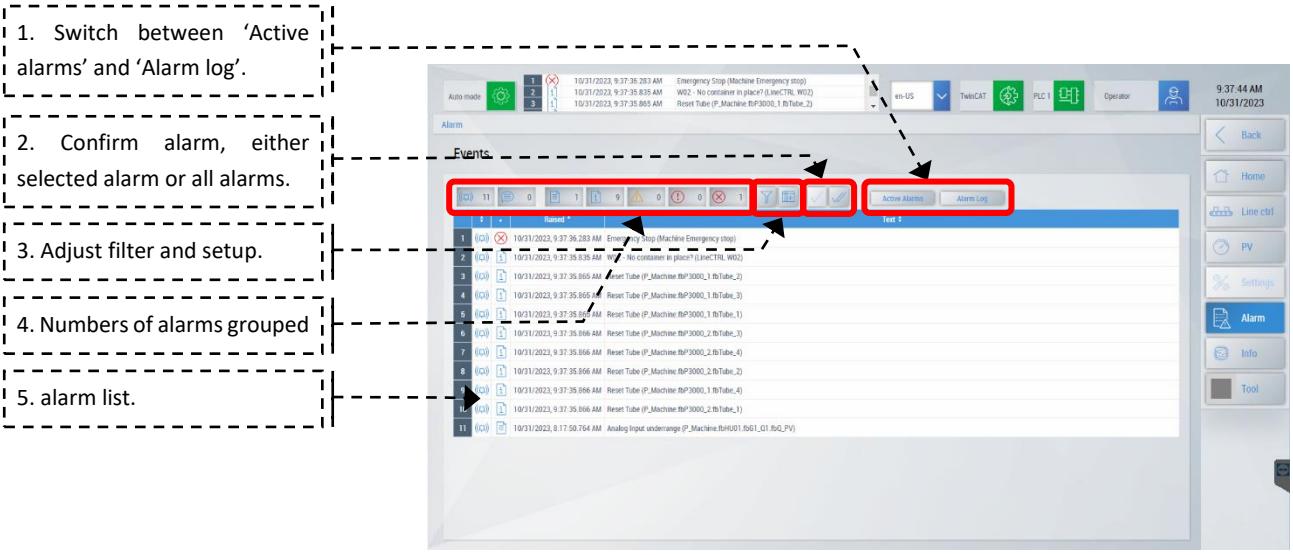
▶	Status run / active
■	Status stop / not active
⏸	Status pause / not active
🔔	Warning / Critical error, cannot run
ⓘ	Information, can still run
⚠	Warning / noncritical error, can still run
✋	When in manual mode this function can be manually operated (requires user level login)

Settings menu

The settings menu is for service and Cold Jet operation only. Therefore, the images from the screen are not displayed in this manual.

Alarm menu

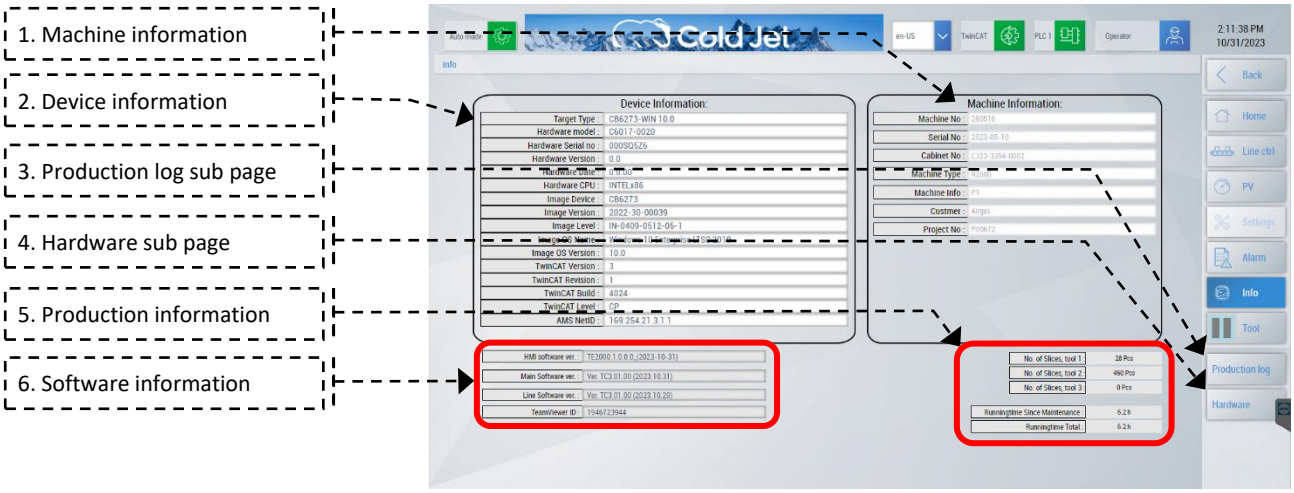
The alarm screen is where all current and alarm log can be found. This page is used when resetting alarms and diagnosing.



Alarm reset is done by either confirming each alarm at a time or all at once (2) after they have been resolved.
To see older alarms use the alarm history by use of the icon in the sub menu (6).

Info page

The info page holds information about the specific R2000H machine and production information.



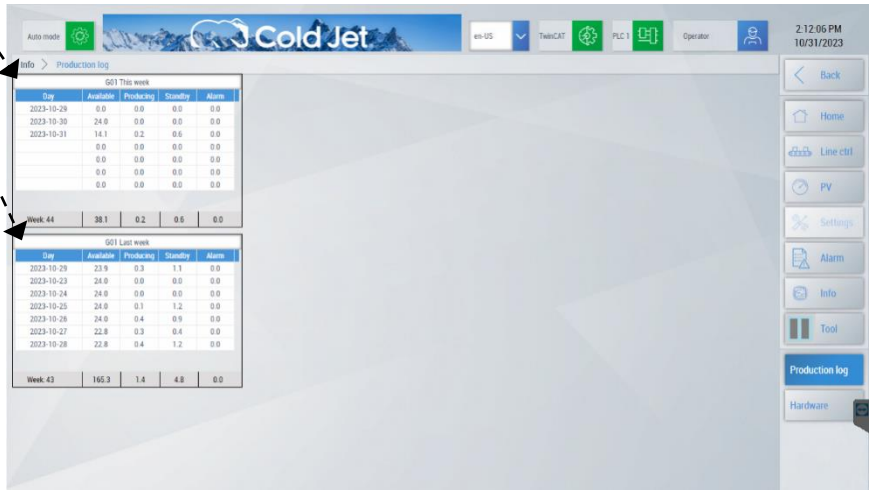
The first page holds machine information (1). This is the same information as shown on the ID tag on the physical machine. The device information (2), the product information (5), and the software information (6). In the sub navigation panel two subpages can be selected. Either production log subpage (3) or hardware subpage (4).

Production log sub page

The production log subpage holds production log from the last two weeks. Here information can be found about availability, production, standby, and alarm. All these values are in hours. The machine adjusts to the input from the pelletizers, which is not reflected in the data. This means that this data cannot be used to see if machines could be further utilized.

7. Production current week

8. Production last week

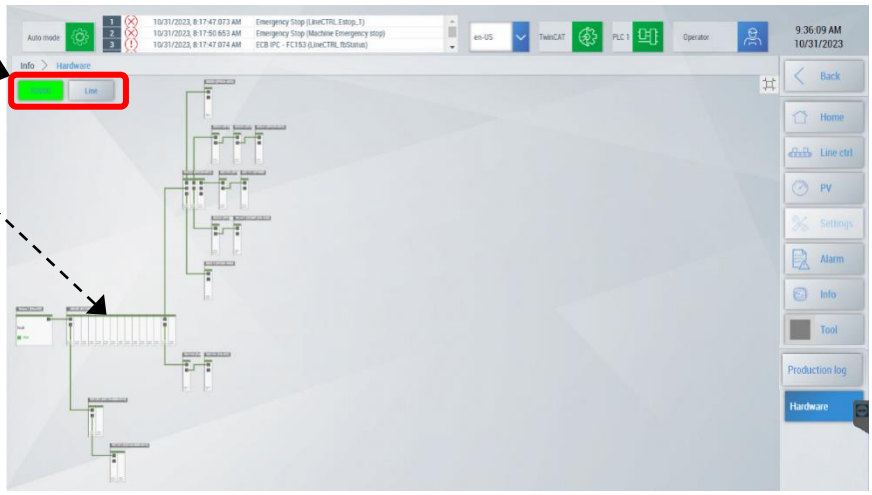


Hardware subpage

The hardware subpage shows the hardware (10) for either the R2000H or the Line control. The green one shows which one is selected (9) and possible to change to either one.

9. selection between the R2000H machine and the Line control.

10. Hardware illustration



Tool

This is the page where recipe is selected from a list, and where tools can be changed.

1. Current recipe
2. Recipe list. Green is selected recipe.
3. Spacer change.
4. Tool change sub-menu

The recipes are listed on the left-hand side (2) of the screen. Select the recipe and press save in the bottom of the recipe menu. The recipe will update to the current recipe (1). Recipes can be changed by pressing the values. Login required to perform this action. The icon in the menu shows which kind of tool has been selected. Not all customers have purchased all three tool types. Tool types:

	Single slice (1 slice)
	Double slice (2 slice)
	Quadruple slice (4 slice)

Tool change

Tool change is selected from the sub navigation panel (4). Login required to perform this task. When performing tool change the HMI will show clear instructions what to do at each step. The following image sequence will show that is done at each step.

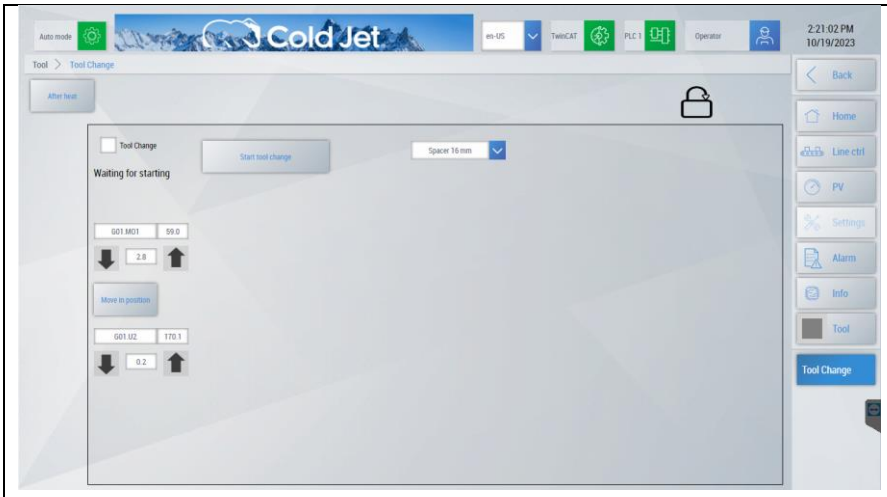
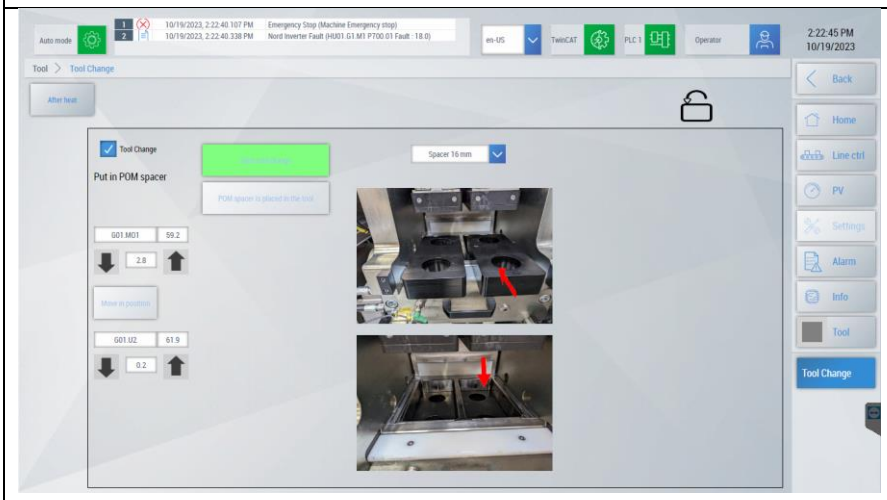
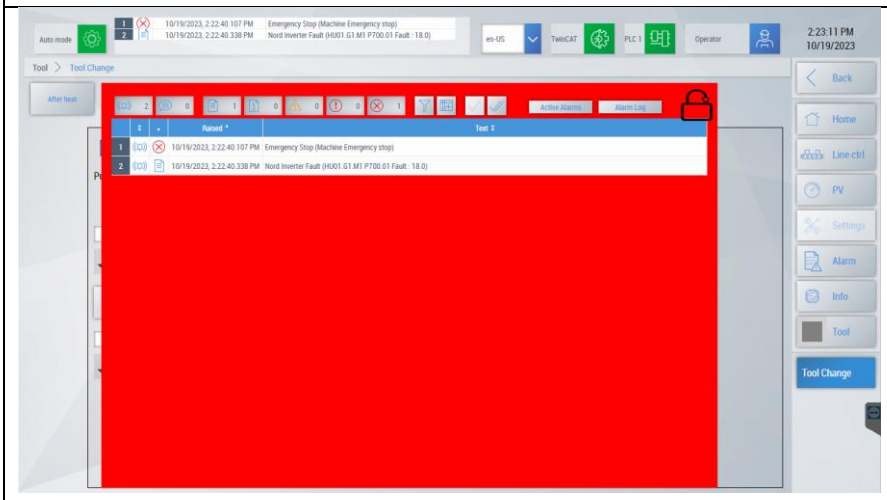
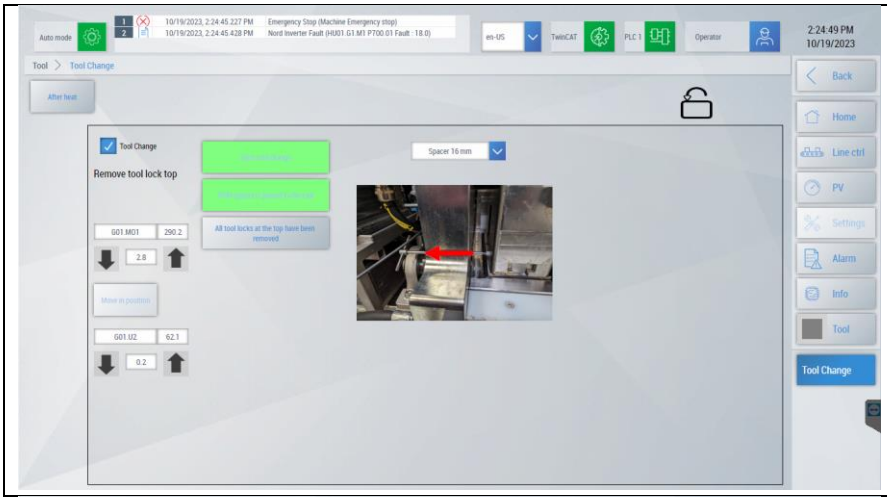
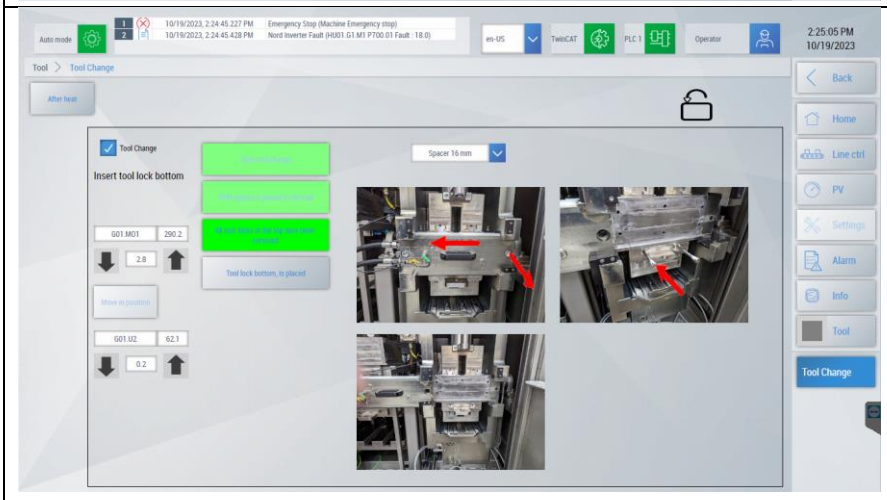
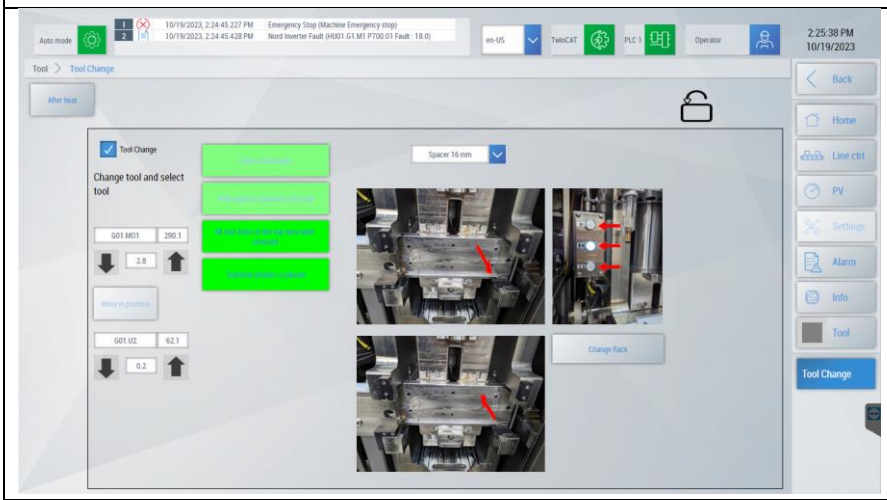
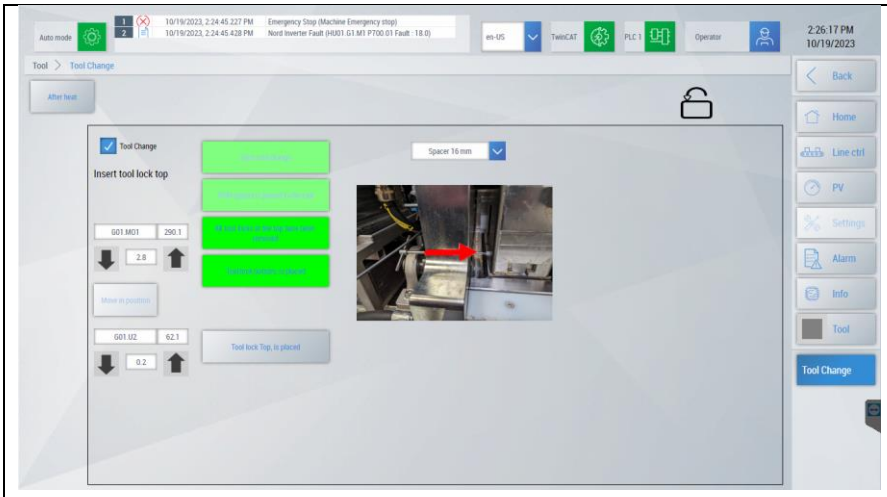
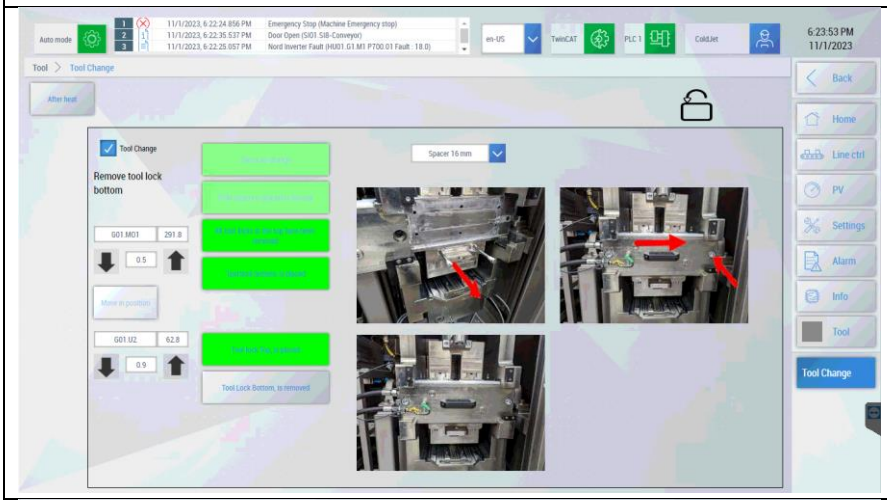
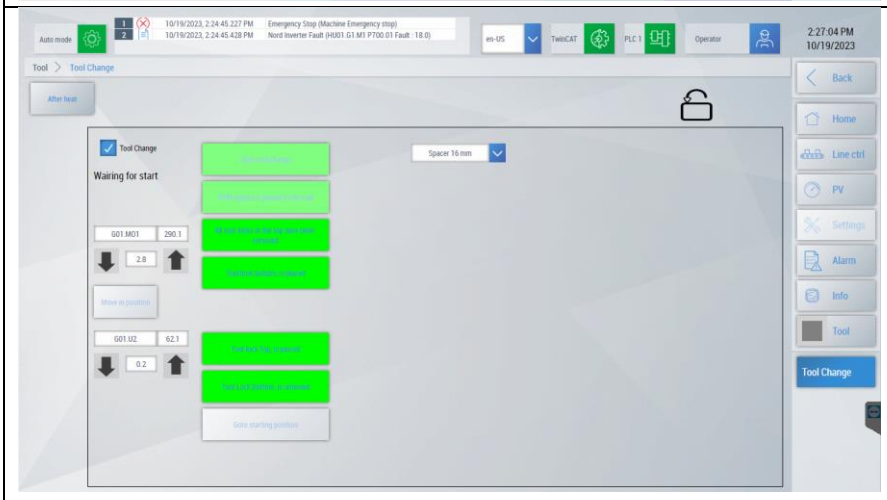
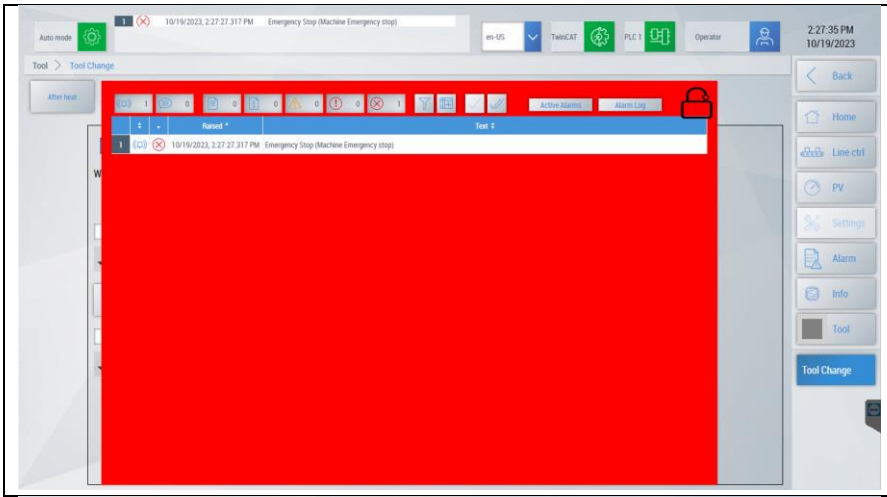
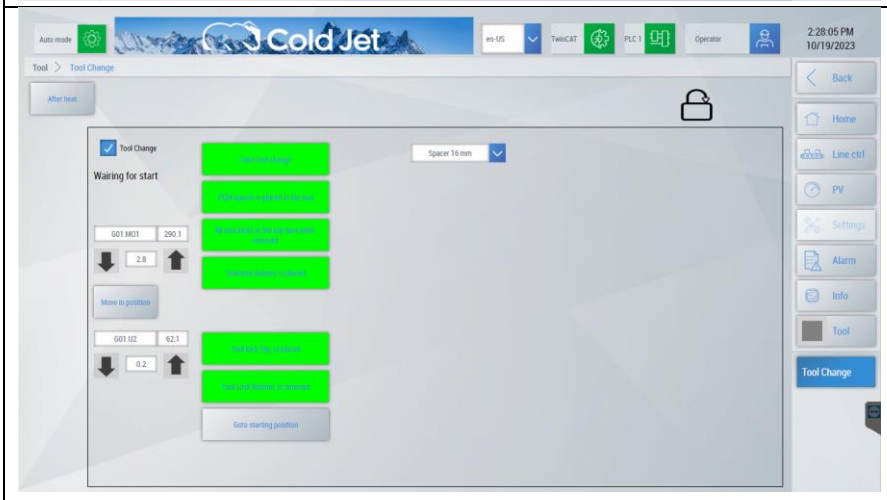
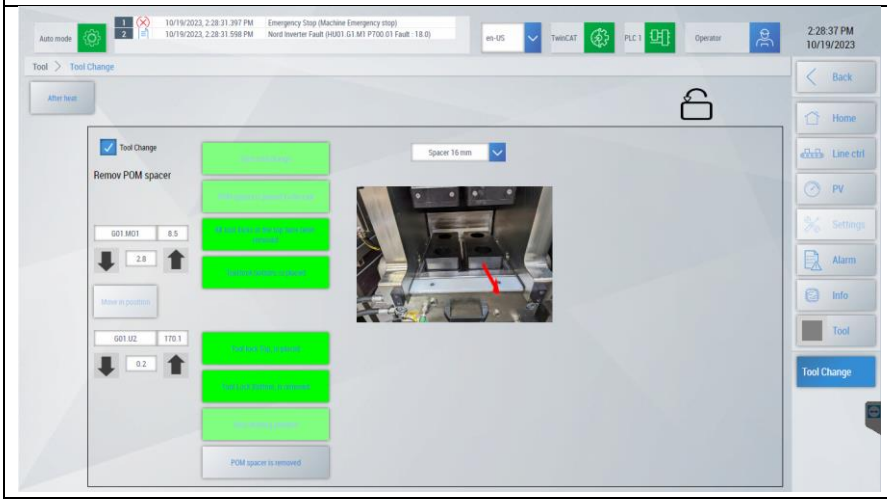
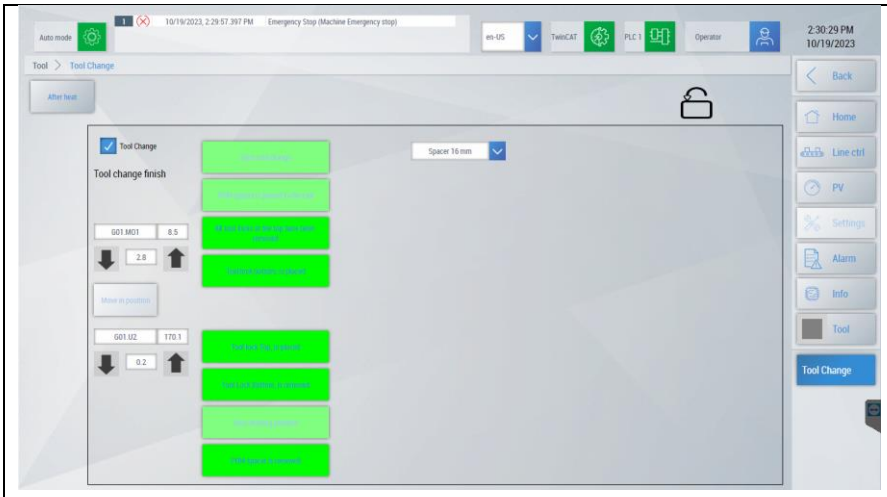
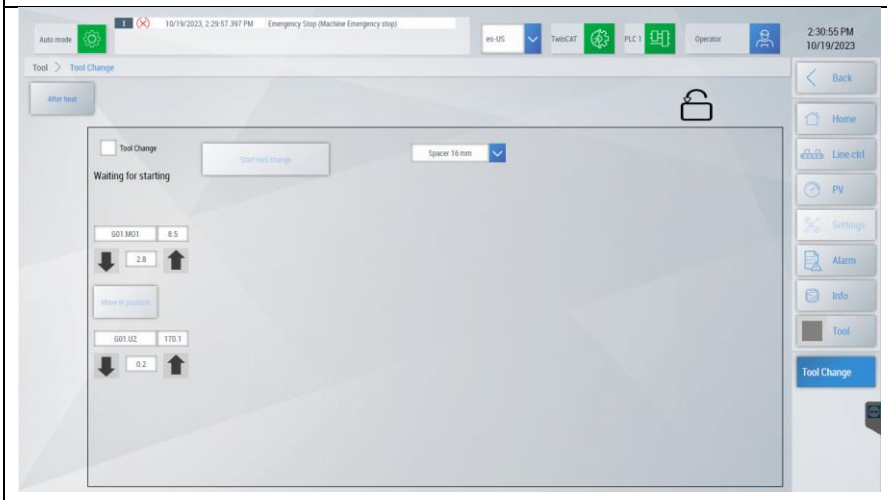
	Login in the top panel Tick off the tool change box The outfeed conveyer will be unlocked when needed, icon is available so that you do not need to change screen to lock/ unlock. Press the 'Start tool change' bottom

Image of too big spacer	If spacer is too big for tool change the sequence will request to change spacer Set spacer size to the new one and press '…'
	Images of how to add POM spacer will appear and outfeed conveyer will be unlocked. Follow POM spacer placement instruction images. Lock the machine, roll the outfeed conveyer in position and lock the outfeed conveyor.
	When locking the outfeed conveyer alarm list will appear as an overlay. Clear all alarms as they are shown because the machine was opened. When the alarms have been cleared the overlay will disappear.
	Press 'POM spacer is paced in the tool' box

	Image of how to remove all tool locks at the top will appear and outfeed conveyer will be unlocked. Remove the tool locks according to the image. Press the 'All tool locks at the top have been removed' bottom
	Images of how to remove front plate and how to add additional bolts will appear. Remove the bolts and slide the front plate to the left as shown in the image. Add additional bolts as shown in the image. Press 'Tool lock bottom, is placed' when done
	Images of how to change the tool will appear. Take out the current tool. Add the tool that the machine should be changed to Press the tool type matching the tool changed to, on the panel inside the machine.

	Images of how to add bolts to lock the top will appear. Add the bolt according to the image. Press 'Tool lock top, is placed' bottom when done.
	Images of how to remove additional bolts and to slide back the front plate will appear. Remove additional bolts as shown in the image. Slide back the front plate and add the bolts to it as shown in the image. Press 'Tool lock Bottom, is removed' bottom when done
	All images will disappear. Lock the machine, roll the outfeed conveyer in position and lock the outfeed conveyor.

	When locking the outfeed conveyer alarm list will appear as an overlay. Clear all alarms as they are shown because the machine was opened. When the alarms have been cleared the overlay will disappear.
	Press the 'Goto starting position' bottom
	Images of how to remove the POM spacer will appear. Follow the instructions and remove the POM spacer. Place the POM spacer in the tool change rack. Press the 'POM spacer is removed' bottom

	Tool change has been performed and all actions / bottoms are green. Wait for the text below the tool change tick box writes: 'Tool change finish'. Unclick the tool change tick box at the top left Conor.
	The screen will be back to where it was originally.

Repair

The repair/replacement of the following parts can be made by the owner's qualified personnel:

- Error! Reference source not found..
- Replacement of gaskets in hydraulic cylinder.
- Replacement of wear plates on Press- and eject pistons.
- Changing air filter.
- Changing hydraulic pump.
- Changing hydraulic oil at hydraulic station.
- Hopper clean-out and machine thaw up.
- Replacing hammer on hopper.
- Replacing hydraulic hoses.

Safety device replacement intervals

The expected lifetime is 20 years or 100,000 couplings on electromechanical components (contactors and relays) whichever is greater.

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

TERMS OF WARRANTY

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

The liability of the manufacturer under the terms of the CE endorsement as regards safety may become **invalid:**

- If repairs are made using non-Cold Jet spare parts.
- If repairs are made by unqualified personnel.
- If repairs are unsatisfactory due to lack of relevant tools and equipment.

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

LOCK-OUT/TAG-OUT SEQUENCE

Identify all devices and power sources that must be disconnected.

Electrical Cabinet. Cut the power using the input disconnecting switch.

Add sign on machine prohibiting reconnection. After ensuring that no one is exposed and to check that the power sources disconnection was made correctly, press the activation buttons that control the operation of the isolated section to make sure that the disconnection was efficient. After this check then active e-stop. After performing the above operations, the machine will be in lock-out/tag-out and the work may be performed without risk of an unexpected start-up.

If the process involves more than one person;

In the steps shown in the above sections, if there is more than one person involved, each person involved will lock-out and tag-out the power-cutting devices. No one may remove it, except the person adding the lock-out and tag-out. The equipment will not be connected while there is a lock-out and/or tag-out.

Return the machine to its normal operating condition.

Reconnection may be made after performing the repair, maintenance, connection, or other operations and once the equipment is prepared for use.
Inspect the work area and the rest of the machine affected by the lock-out/tag-out, to ensure that no one is exposed. Remove additional protections, if any. Remove all tag-outs and other lockouts. Reconnect all switches that were disconnected and reset the e-stop. The machine is now in service again for normal production.

CONTACT INFORMATION

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

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