

CRYOQUIP INC.

**OPERATORS HANDBOOK
for**

KRYOSPRAY® SERIES II

LIQUID NITROGEN CONTACT BATH FREEZER

**CBF XX10
AUTOMATIC START-UP**

1993 - 1997

Generic

Packaging - Processing
Bid on Equipment
1-847-683-7720
www.bid-on-equipment.com

OPERATIONAL CAUTIONS

DO NOT TO ATTEMPT TO LIFT CONVEYOR WHEN FROZEN.

DO NOT ATTEMPT TO REMOVE CBF LIDS WHEN FROZEN.

ALLOW FREEZER TO WARM UP FOR 30 MINUTES BEFORE ATTEMPTING TO REMOVE LIDS OR OPEN DOORS.

READ MANUAL THOROUGHLY BEFORE ATTEMPTING TO OPERATE SYSTEM.

AFTER ONE WEEKS INITIAL OPERATION, CHECK CONTACT BATH FREEZER BELT TENSION. CARE SHOULD BE TAKEN NOT TO OVER TENSION BELT. CHECK BELT TENSION EVERY 2 WEEKS THEREAFTER FOR 3 MONTHS. THEREAFTER MONTHLY CHECK (SEE MAINTENANCE SECTION).

KEEP BATH FREE OF OPERATIONAL DEBRIS AT ALL TIMES.

DO NOT ATTEMPT TO REMOVE NITROGEN FROM THE BATH BY ADDING WATER.

BEFORE INITIAL START-UP EXAMINE ELECTRICAL CABINET FOR LOOSE COMPONENTS AND CONNECTIONS.

ALWAYS ENSURE SYSTEM "ON" PUSH-BUTTON IS DEPRESSED BEFORE ATTEMPTING TO START ANY SYSTEM.

PREFACE

THE OPERATOR HANDBOOK AND INSTRUCTION MANUAL ARE INTENDED TO DESCRIBE THE FEATURES OF THE CRYO-CHEM / CRYOQUIP KRYOSPRAY II LIQUID NITROGEN CONTACT BATH FREEZER AND TO GIVE GUIDANCE ON ITS EFFECTIVE OPERATION, CLEANING, AND SIMPLE MAINTENANCE, TO ENABLE THE FREEZER TO OPERATE TO ITS MAXIMUM POTENTIAL.

THE HANDBOOK IS NOT INTENDED TO BE A "WORKSHOP" MANUAL AS THE USE OF SUCH IS NOT CONSIDERED NECESSARY WITH THIS EQUIPMENT.

IT SHOULD BE READ IN CONJUNCTION WITH DETAILED INSTRUCTIONS ON THE SAFE USE AND HANDLING OF LIQUEFIED CRYOGENIC GASES WHICH SHOULD BE READILY AVAILABLE FROM THE GAS COMPANY. SOME SAFETY ISSUES ARE DISCUSSED WITHIN, BUT THEY SHOULD BE CONSIDERED TO BE THE MINIMUM READING ON THIS IMPORTANT SUBJECT.

PLEASE READ THIS MANUAL BEFORE OPERATING THE FREEZER.

PLEASE NOTE THE OPERATIONAL CAUTIONS.

PRE-COMMISSIONING

THERE ARE A NUMBER OF ITEMS THAT NEED ATTENTION TO ENABLE THE CONTACT BATH FREEZER TO BE PREPARED FOR INITIAL COMMISSIONING.

A pneumatic supply of **nitrogen** gas should be connected to the control box. A 3 inch push-in fitting is provided. An internal regulator should be adjusted to give a 25 psig supply to the level control system. *(see appropriate section in this manual).*

A pneumatic supply of regulated clean dry air, 100 psig, should be connected to the solenoid valve of the conveyor lift arrangement situated underneath the freezer at the exit end. A 3 inch elbow push-in fitting is provided. This is not required if the built in compressor package is fitted.

The control cabinet should be connected to a 208 volt 3 phase 60 hertz supply. The supply should enter the cabinet as convenient to the site wiring, but, the main fused connection terminals are located in the upper right hand side of the power cabinet.

The contact bath freezer itself is ready to operate. Ensure that all materials placed inside the freezer during transit are removed, and that the interior of the freezer is completely free of surplus items. The contact bath freezer has been fully tested in accordance with factory procedures. It is recommended that the initial on site start-up be carried out by a Cryoquip factory trained engineer.

INTRODUCTION

A typical cryogenic contact bath freezing system installation consists of a contact freezer, connected by an insulated supply line to a liquid nitrogen storage tank located outside the building.

Electrical and pneumatic supplies and an exhaust gas vent are necessary. Water may be connected for cleaning (optional).

The product is conveyed through the freezer by a stainless steel mesh conveyor, sized in accordance with the type of product being processed, and driven by a variable speed drive. Product guide rails, flights and inserts are provided to control the product on the belt. The conveyor surface projects from the freezer at the off load and to facilitate product removal.

Fully removable lids and a belt raising system facilitates the cleaning of the direct contact freezer, and a product debris tray is provided at the on load end. The belt automatically removes debris from the bath and deposits it into the tray. An easy open compartment gives access to the tray, which must be emptied from time to time during processing.

The product is fed into the direct contact freezer through the top loading port falling directly into the liquid nitrogen bath for instantaneous crust freezing. Product must be introduced to the full width of the top loading port and be free from clumped material. It is recommended that some device be utilized to prevent clumped product from entering the direct contact freezer. **Water ingress should be avoided at all times.** The depth of liquid nitrogen should be varied to achieve the desired level of freeze, regarding the type and geometry of the product and the production rate.

An emergency stop-button is mounted on the control panel.

The unit has a minimum of moving parts to give long, trouble-free service with a minimum of simple maintenance.

CONTROL SYSTEM FEATURES

THE CONTACT BATH FREEZER HAS A NUMBER OF UNIQUE CONTROL AND SAFETY FEATURES THAT ARE BENEFICIAL TO ITS EFFECTIVE OPERATION. THESE ARE EXPLAINED BRIEFLY BELOW AND IN MORE DETAIL IF APPROPRIATE IN THE MANUAL.

Automatic start-up

The freezing tunnel is fitted with an automatic start-up feature which requires only one switch to be pulled to start-up the exhaust blower and pulled again to start the freezer. The control system is fitted with a sequenced relay system which switches on all the elements of the freezer in the correct sequence, and only if it is safe to do so. Indicator lamps show the state of start-up. The sequence is complete and the freezer fully operational within one minute. A single switch turns the freezer off.

Liquid nitrogen system

The freezer is fitted with either single or dual liquid nitrogen connections, and single or twin feed pipes located at the mid point of the contact bath freezer.

The pipes are fitted with angle fittings to diffuse the flow of liquid nitrogen. The end of the pipe is open to facilitate cleaning.

The control of the liquid flow to the contact bath freezer is achieved via single or twin solenoid valves. Appropriate lamps will illuminate according to the supply condition. The level of liquid is also annunciated (*see later*).

Safety systems

The system is fitted with a number of safety devices and an emergency stop-button. In the event of any safety device being activated the system will not restart automatically. The cause of the safety device activation must be established and rectified. The SYSTEM-ON push-button on the control panel must be depressed before the system will be ready to be restarted.

Control cabinet

The contact bath freezer is fitted with a single control cabinet, containing the level control system and the "power components".

Clean mode

The control system incorporates a switch, mounted on the cabinet, to enable the various systems to operate for commissioning, cleaning and maintenance purposes. The switch selects "clean" mode on or off, and also enables the contact bath freezer conveyor lift mechanism. In clean mode the extract fan will operate and the liquid nitrogen supply is isolated.

Belt speed control

The contact bath freezer is fitted with a DC direct drive motor, which through a reduction gearbox drives the conveyor. The speed is varied by means of an SCR controller. Speed is indicated, digitally, in feet per minute.

Liquid level control

The liquid nitrogen level indicator is an electro/pneumatic device that measures the hydrostatic level of liquid nitrogen in the bath. The system is calibrated such that the analogue indicator displays the actual level of liquid above the belt.

The system requires a low pressure (25 psi) supply of **NITROGEN GAS**, which should be connected to the 3 inch push in pneumatic connector located in the side of the control panel.

DO NOT USE A COMPRESSED AIR SUPPLY OF ANY DESCRIPTION. THE SYSTEM WILL NOT OPERATE CORRECTLY.

The pressure and flow rate of the nitrogen gas, have been factory set and do not require adjustment. **See inside of panel for calibration markings.** If these settings are altered, the level indication will not longer be accurate. If there is any doubt regarding the settings contact the factory.

The analogue indicator has three pointers. The black pointer indicates the actual liquid level. *Note that it will not immediately indicate a depth of liquid upon commencing to fill, as there is a depth of liquid below the belt.* **ZERO (0)** inches coincides with the forward belt level. The left hand red pointer controls the minimum level. If the liquid level is below this setting, **LOW LEVEL** indication lamp will be illuminated after time delay TD1 engages. The right hand red pointer controls the maximum level. The solenoid valve(s) controlling the liquid flow, will be energized below the pointer, and a **VALVE ON** indication lamp will be illuminated. On initial filling both valves are energized (the second after time delay TD1 engages). When the level coincides with the right hand pointer, the solenoid valves will close and the indication lamp will be extinguished.

Low level alarm

The contact bath freezer is fitted with a timed low level alarm. On initial filling the low level alarm annunciator will be illuminated after time delay TD1 engages. The alarm is timed to coincide with the bath fill rate. If the bath has not filled during the time allowed, the low level alarm will light and open the second solenoid valve. This occurrence is a normal situation and is dealt with automatically.

Normally the bath will fill and cover the low level setting on the level controller and the low level alarm will be disabled and the annunciator lamp will extinguish.

Low gas pressure

In the event of a loss of control gas flow, the system fails to low level and annunciates an alarm condition. In addition a control gas pressure switch de-activates the filling valves and annunciates this condition, **LOW GAS PRESSURE**.

This and the combination of low level alarm indicates a loss of the control gas flow. This condition is extremely rare. The source of this gas, which has to be nitrogen, is either the top gas from the bulk storage tank or vaporized gas from the liquid feed line to the bath. In either case if there is no control gas available, there will be no liquid nitrogen either, and the risk of over filling the bath is eliminated.

In the event of a loss of power to the freezer the level indicator continues to give an accurate level reading.

Contact bath freezer conveyor lift

The contact bath freezer conveyor is fitted with a raise and lower mechanism. It operates only in **clean** mode. Once enabled, the two push buttons on the control cabinet control the raising "**CONVEYOR UP**" and the lowering "**CONVEYOR DOWN**" of the conveyor. The push button has to be depressed to activate the system. If released the conveyor will stop at the position it has reached. Overloading the cylinders is not possible if the push button remains depressed when the conveyor has reached its highest or lowest position. Over pressure will be relieved automatically.

THE ACTUATORS AND PISTONS MUST BE FREE OF ICE TO OPERATE SATISFACTORILY. PREMATURE OPERATION OF THE LIFT MECHANISM COULD RESULT IN SEVERE DAMAGE.

CONTACT BATH FREEZER FEATURES

Carcass

The entire carcass is manufactured from heavy duty gauge, type 304, stainless steel, double wall construction, hermetically sealed, inert gas tested for integrity and insulated with eight inches of expanded polyurethane foam. Foam density will not exceed 2 lbs/sq. feet. Manufacturing procedures will ensure the integrity of the foam such that there will be minimal distortion after cool down and no significant evidence of frost patches in middle areas of panels. Welds will be polished.

Removable lids

The freezer is fitted with three or four removable lids. Each lid is supplied with two handles to facilitate removal from the freezer. The lids are constructed similarly to the main carcass and insulated with two inches of expanded polyurethane foam. The lids are fitted with a double P silicone seal to prevent gas escape.

Top loading port

The removable lids incorporate a top loading port to facilitate the loading of product directly into the liquid nitrogen. The port is closed by means of an insulated cover with a handle. Always close off the top loading port when the freezer is not in use.

Conveyor

The conveyor belt has been specifically developed for the duty at -320°F. The belt is entirely manufactured from type 304 stainless steel, all welded construction. The wire mesh is supported by 1/4 inch diameter rods welded to heavy duty links, by which the belt is driven through the freezer. The belt mesh may be filled with UHMW polyethylene inserts effectively making the belt "solid" but retaining its essential flexibility.

The belt is fitted with flights to aid product removal and enhance control of the product through the liquid bath.

Conveyor support system

The conveyor support system maintains the belt in a "tight" configuration, achieved by the use of shaft mounted roller chain drive sprockets, low friction hold down sprockets and belt support rails. UHMW bearings are utilized throughout the immersed drive arrangement. The rails are fitted with UHMW polyethylene wear strips to minimize friction. The drive components are mounted from two conveyor side plates, which are mounted in the freezer via the main drive shaft only. The entire drive and belt arrangement is therefore free to expand and contract from one end.

Drive system

The drive system is low friction and driven from one end only by means of direct drive to an electric motor and reduction gear box. Speed is varied by means of an externally mounted DC variable speed controller. Belt speed is digitally indicated. The drive shaft and side plates are assembled utilizing a double bearing arrangement. The bearings themselves are all fabricated from UHMW. The bearings are mounted "out board" of the drive system side plates, and are thus protected from possible contamination by the product. Drive sprockets are all stainless steel. The drive system operates normally in the belt raised position.

Product guide rails

Product guide rails are mounted from the drive system side plates. They are fabricated from 10 gauge stainless steel and are designed to be extremely strong. The rails unbolt from the side plates to facilitate cleaning (optional). The rails prevent product debris becoming associated with the belt links. The product guide rails do not hold the belt down and maintain its shape. There is no metal to metal contact between the guide rails and the belt. The guide rails simply guide the product through the freezer and protect the belt links and hold down sprockets.

Liquid nitrogen bath

The liquid nitrogen bath built into the profile of the carcass is configured to accommodate either an in-feed, or a top loading conveyor arrangement without modification. The "tight" conveyor system enables the bath to be very shallow utilizing minimum quantities of nitrogen below the belt. The nitrogen enters the bath through one or two fill tubes, between the belts to minimize liquid disturbance during replenishment. The shallow bath is also easy to clean. The bath is fitted with a large drain hole to facilitate wash water removal.

Liquid nitrogen level control

The level of liquid nitrogen within the bath can be maintained between zero and 4.9 inches of water above the forward belt and is controlled by mean of a tamper proof electro/pneumatic control system. Level is indicated by an analogue meter in the control panel. Maximum liquid level above the belt is 4.9 inches of water. The level control is accurate to approximately 2 of an inch. The measuring tube is situated away from the working liquid bath, in order to afford protection from debris, and ensure the accuracy of the level control. The tube is easily removed for cleaning if required. Nitrogen gas must be utilized for this system. (See CBF level chart in the back of this manual).

Debris tray

A removable debris catchment tray is located at the in feed end to catch the debris being removed from the bath by the return belt. It is accessible by opening the lower plenum door, and handles are provided to facilitate removal. The access door is fitted with screw knobs.

Liquid Nitrogen fill pipe

The freezer is fitted with either single or twin open ended fill pipes. The nitrogen discharges between the forward and return belt arrangement and is designed to prevent excessive splashing during the filling procedure.

Conveyor lift mechanism

The conveyor arrangement is fitted with twin lifting jacks at the product exit end. The jacks are pneumatically operated and controlled by solenoid flow and vent valves. The air pressure needed is generated either by an external pressurized source or by an electrically driven pump arrangement situated in a freezer mounted control box. The pump (if fitted) is activated by depressing the "conv up" push button. There is a slight delay before the conveyor starts to lift as the pressure in the pump builds sufficiently to operate the jack. The jacks are lowered by depressing the "conv down" push button which vents the air from the cylinders at a controlled rate. In the event of an air supply failure, the jacks will vent very slowly and the conveyor will descend very slowly.

The conveyor arrangement must be mechanically supported if it is to be raised for any length of time. **NEVER OPERATE OR CARRY OUT WORK ON THE FREEZER WITHOUT SUPPORTING THE RAISED CONVEYOR ARRANGEMENT.**

THE SYSTEM IS *NOT* DESIGNED TO OPERATE WHILE FROZEN.

SEVERE DAMAGE WILL RESULT TO THE SYSTEM COMPONENTS IF ANY ATTEMPT IS MADE TO RAISE THE CONVEYOR WHILE FROZEN. ALLOW THE JACKS TO THAW COMPLETELY BEFORE ATTEMPTING TO OPERATE THE SYSTEM.

Keep hands and fingers away while lowering conveyor assembly.

Do not place any part or all of your body under conveyor when it is in the raised position unless the conveyor is properly supported.

Do not service conveyor in the raised position unless the conveyor is properly supported.

Do not attempt to service or disconnect air lines when the conveyor is in the raised position.

SAFETY

Nitrogen

Gaseous nitrogen constitutes 78% of the air we breathe. It is non-toxic and odorless and it will not support combustion. However, if it is released in a confined space, it can displace sufficient air to make the atmosphere incapable of sustaining life.

Atmospheres containing less than 18% oxygen are potentially dangerous and no one should enter atmospheres containing less than 20% oxygen. Entering an oxygen deficient atmosphere can cause unconsciousness virtually instantaneously and without warning. Atmospheres containing less than 10% oxygen can produce brain damage or even death.

Liquid nitrogen is an extremely cold liquid; at atmospheric pressure its temperature is -320° (-196°C). It is colorless and has a viscosity and density, which is less than that of water. The very low temperature can cause cold burns on contact with the skin or other medical conditions associated with low temperatures.

Avoidance of low temperature hazards

Before making any changes or repairs to the freezing equipment (lines, valves, the freezer itself), the liquid nitrogen flow should be shut off and the lines cleared of liquid nitrogen.

Personnel should wear insulating gloves before touching any equipment which is likely to be cold.

The whole of the interior of the freezer when in service is very cold and personnel should not open tunnel doors and touch any of the interior surfaces unless they are wearing gloves.

Avoidance of Oxygen deficiency hazards

Exhaust System and Factory Ventilation

The used nitrogen gas is removed from the freezer by the exhaust duct and fan. A small amount of nitrogen gas shall escape from the freezer and will not be extracted by the exhaust fan. This is quite normal and safe provided the workplace is well ventilated. Ventilation of the area around the freezer is achieved by drawing into the exhaust duct a certain amount of air known as "defrost" air. Defrost air serves two purposes:-

1. It dilutes the liquid nitrogen gas from the freezer so that frost does not build up on the exhaust fan and reduce its efficiency or cause it to fail.
2. It ventilates the workplace to ensure that any small liquid nitrogen escape is diluted.

Clearly, for effective ventilation, sufficient free access must be allowed into the factory for fresh make-up air to replace the defrost air. The room in which the freezer is situated must have an adequately sized opening to fresh air.

The ventilation of the room in which the freezer is situated and the exhaust system together form a safety system. Neither should be modified without expert assistance from your gas company or Cryoquip, Inc..

NOTE: If any factory modifications are being made consider carefully the influence they might have on air movement and ventilation. If in doubt contact your gas company or Cryoquip, Inc. for advice.

The defrost air intake may have a baffle or damper fitted to it. This will have been set when the system was commissioned and must not be disturbed.

When freezing hot products such as flash-fried meat products, it is not always possible to see the cold gas escaping from the on-load end of the tunnel because the gas is too warm to cause a cold fog.

In these cases, a portable oxygen monitor should be used if there are any doubts about the effectiveness of the freezer exhaust system.

Turbulence Fans (Not applicable on Immersion Freezers)

The turbulence fans ensure that the product being frozen is cooled by the cold gas. If these fans are not running then the efficiency of the freezer will decrease. This will have three effects:

1. Excessive liquid nitrogen will be used which may generate more nitrogen gas than the exhaust system can vent.
2. The cold gas may cause the exhaust fan to ice up and fail.
3. The quality of the food product may be degraded.

The fans operating close to the temperature sensor are particularly important since they ensure that the cold control system "sees" the correct temperature and supplies only the right amount of liquid nitrogen. These fans must always be kept working. If they should fail they can be exchanged in an emergency with fans and motors from elsewhere in the freezer, which are not so essential for safe operation.

Control Temperature.

It is essential to use the correct control temperature for safe operation otherwise excessive liquid flowing into the freezer can create a safety hazard as already described.

The correct set point for the control temperature will have been determined during commissioning. It is possible that changes in the food product or in the throughput rate may necessitate a change in this set point to maintain optimum freezing performance.

Always consult Cryoquip before using a set temperature colder than minus 120°F. They will recommend any engineering changes needed to cope with colder temperatures.

Always ensure that all turbulence fans are working and that the exhaust is removing the cold gas before you adjust the set temperature.

Check the exhaust system is capable of venting all the cold gas after you have adjusted the set temperature and again when the system has settled to the new temperature. If you have doubts, contact your gas company or Cryoquip, Inc..

The advice given is summarized in the following WARNINGS.

WARNINGS

- **THE VENTILATION OF THE ROOM IN WHICH THE FREEZER IS SITUATED AND THE EXHAUST SYSTEM TOGETHER FORM A SAFETY SYSTEM. NEITHER SHOULD BE MODIFIED WITHOUT EXPERT ASSISTANCE FROM CRYOQUIP.**
- **THE FREEZER MUST NEVER BE USED IF THE EXHAUST FAN OR VENT IS INOPERATIVE AS THE NITROGEN GAS ESCAPING INTO THE WORKPLACE WILL CREATE A HAZARD.**
- **NEVER REDUCE THE SET TEMPERATURE TO RECTIFY A FALL-OFF IN FREEZING PERFORMANCE UNLESS YOU ARE SURE THAT THE CHANGES ARE DUE ONLY TO A CHANGE IN THE PRODUCT BEING FROZEN.**
- **ALWAYS CONSULT CRYOQUIP BEFORE USING A SET POINT COLDER THAN -120⁰F.**
- **WHEN FREEZING HOT PRODUCTS, USE AN OXYGEN MONITOR IF THERE IS ANY DOUBT ABOUT THE EFFECTIVENESS OF THE EXHAUST SYSTEM.**

OPERATION

NOTE: Controls and switches mentioned in this procedure are housed in a NEMA type 4x (flange mounting disconnect enclosure) mounted on the main frame of the freezer. It is very accessible for the operator to control the whole system operation. On the front of the control panel are the belt speed indicator, heavy-duty push button switches, process indication lamps, and jumbo-mushroom head "EMERGENCY STOP" button.

PRE-START CHECKS

1. Visually inspect the freezer and check that:-
 - a. The interior of the freezer is clean, and **dry**.
 - b. The belt is free of obstructions.
 - c. No foreign material is present.
2. Refit:-
Interior items that have been removed for cleaning.
3. Check:-
 - a. That the lid seals are dry and replaced in position.
 - b. The drain valve is closed.
 - c. The top port cover is in place.
4. At the storage tank, check that:-
 - a. The tanks contains sufficient liquid for the work in hand.
 - b. The blow-down valve is shut.
 - c. Open the main liquid nitrogen supply valve.

START-UP PROCEDURE

1. Switch on the electrical supply to the freezer by closing the main electrical isolator and the local electrical isolator on the control panel (if fitted). Main power indicating lamp should be illuminated. If not check power supply.
2. Pull the start button once to energize the exhaust blower, and pull again to energize the freezer. The freezer will begin a sequenced start up automatically and systems will start (time delayed) in the following sequence:

Exhaust blower ON

System ON
Belt ON
Cryogen valves ON

Set the belt speed desired. Check that all green lights for the various systems are illuminated.

The liquid solenoid valve(s) will open (energize) allowing liquid to flow into the freezer. The indicating lights "low level" and valve #1 and valve #2 are illuminated. When the desired level is reached (preset) the valve lights will extinguish and the valves will close (de-energized). Note that the low level light will extinguish as soon as the liquid level rises above the low level pointer.

3. When the desired level of liquid nitrogen is reached product may be conveyed into freezer either through the top port or directly on the in-feed conveyor.

SHUT-DOWN PROCEDURE

1. Close the main liquid cryogen supply valve. (Close the liquid cryogen valve local to the freezer if one is fitted.)
 - a. After 20 minutes open the blow-down valve.
 - b. Close the blow-down valve when pressure has been relieved.
2. Leave the system running until all the remaining liquid nitrogen within the bath has been vaporized. Approximately 1 hour depending upon conditions. Adjust the belt speed to maximum to assist the vaporization procedure.

DO NOT ATTEMPT TO DRAIN LIQUID NITROGEN FROM THE BATH.

DO NOT ATTEMPT TO ASSIST THE VAPORIZATION BY ADDING WATER

DO NOT ATTEMPT TO BALE LIQUID NITROGEN FROM THE BATH

ALLOW TIME FOR THE LIQUID NITROGEN TO VAPORIZE

3. Press SYSTEM START/STOP push-button.
4. Switch OFF the main power supply.

EMERGENCY SHUT-DOWN

Press the EMERGENCY STOP push-button located on the control panel.

FAULT FINDING

This fault-finding table lists possible fault symptoms and their cure. If the suggested cure does not work, refer the problem to your gas company or contact Cryo-Chem.

Note: Before investigating a fault, check that all push-buttons and controls are correctly set.

SYMPTOM	FAULT	REMEDY
System fails to start	<ol style="list-style-type: none"> 1. Emergency stop closed. 2. Mode selection switch is in OFF position. 	<ol style="list-style-type: none"> 1. Open emergency stop button. 2. Select correct position. maint or ON
Exhaust fan fails	<ol style="list-style-type: none"> 1. Thermal overload tripped. 2. Fuse blown (FU-M). 	<ol style="list-style-type: none"> 1. Push reset button of OL1. 2. Check/repair fuse.
Exhaust fault	<ol style="list-style-type: none"> 1. Exhaust fan OL1 tripped. 2. Drive tripped. 	<ol style="list-style-type: none"> 1. Push reset button OL1. Check fuse. Clean fan impeller. 2. Contact supplier.
Belt fault illuminates	<ol style="list-style-type: none"> 1. Thermal overload tripped OL2. 2. SCR drive tripped. 3. Fuse blown. (FU-2) 	<ol style="list-style-type: none"> 1. Reset overload. 2. Contact Cryo-Chem. 3. Check fuse
Freezer fails to fill	<ol style="list-style-type: none"> 1. Solenoid valve closed. 2. Level control not set. 3. No nitrogen supply. 4. No nitrogen signal. 	<ol style="list-style-type: none"> 1. Check operation. 2. Check operation. 3. Check input supply and supply to level controller. 4. Check for blocked fill tube.
Level control erratic	<ol style="list-style-type: none"> 1. Sensor tube blocked. 2. Gas pressure too high. 3. Gas flow rate too high. 4. Loose pneumatic lines. 	<ol style="list-style-type: none"> 1. Remove and clean. 2. Check and adjust 3. Check and adjust. 4. Check and tighten fittings.

Low level alarm	<ol style="list-style-type: none"> 1. Liquid level below bottom pointer. 2. Timer not timed out. 3. Insufficient flow rate of liquid nitrogen. 	<ol style="list-style-type: none"> 1. Wait for bath to fill. 2. Check time operation. Check filling speed. 3. Check and adjust, contact Cryo-Chem or your gas company.
Liquid level incorrect	<ol style="list-style-type: none"> 1. Nitrogen gas flow rate incorrect. 2. Nitrogen gas pressure incorrect. 3. Zero setting incorrect. 	<ol style="list-style-type: none"> 1.2 Check flow rate and pressure to give CFH reading on flow gauge. 3. Check zero setting with LN at belt level.
Lift system relief valve blows	<ol style="list-style-type: none"> 1. Compressor running with cylinder at top position. 2. Compressor running with cylinder frozen. 	<ol style="list-style-type: none"> 1. Cease operation of compressor. 2. Allow cylinder to thaw out completely before use.
Lift system not operating	<ol style="list-style-type: none"> 1. Cylinder frozen. 2. No air pressure. 3. Mode selection switch in OFF position. 	<ol style="list-style-type: none"> 1. Allow cylinder to thaw out completely before use. 2. Check air pressure and or operation of compressor. Check regulator settings. 3. Check switch position.

CLEANING

CONTACT BATH FREEZER

The freezer should be cleaned on a regular basis so that it stays in a hygienic condition. Ideally the freezer should be cleaned every time it warms to room temperature.

On the freezer there are various removable items all of which require cleaning.

- a. Main lids and top port lid (if fitted)
- b. Product guide rails (optional removal)
- c. End covers/baffles
- d. Debris tray

The main conveyor belt arrangement can be raised clear of the bath to facilitate cleaning. A pneumatic lifting device is provided for this procedure. It is not necessary to remove the center and load end lids in order to raise the belt.

Raise and lower buttons are located on the main control panel.

DO NOT ATTEMPT TO RAISE CONVEYOR WHEN FROZEN

CLEANING PREPARATION CAUTIONS

Allow 20 minutes after evaporation of liquid nitrogen before cleaning starts.

Do not use force to remove lids or components within the freezer.

Use insulated gloves when handling cold components.

PROCEDURE

Raise belt assembly. Ice may have to be removed from the top of the lift device. Spraying with water will suffice to thaw out the lift cylinders
Clean freezer from exit end to load end in accordance with normal factory procedures.

Run the belt in the raised position if required.

Clean the conveyor belt in accordance with normal factory procedures.

Open drain valve when completely thawed, do not use force.

Wash water will readily drain from the freezer bath.

Stop conveyor.

Close drain valve.

Allow freezer to dry out before re-use.

FREEZER MUST BE DRIED OUT BEFORE RE-USE.

MAINTENANCE

WARNING: The freezer must be allowed to warm up before carrying out any maintenance.

1. Lids	Periodically check integrity of seals if worn or damaged replace.
2. Level tube	Check for any signs of damage or blockage. Keep free of debris. Remove and clean periodically.
3. Conveyer reducer	Drain flush and refill gearbox with synthetic type oil, after the first 100 hours, and thereafter every 2500 hours.
4. Conveyer bearings	DO NOT LUBRICATE. Replace if necessary.
5. Nitrogen valve	Check seals for damage or wear. Check operation of valve.
6. Drain valve	Check seals for damage or wear and check operation of valve. Complete sealing of the valve is essential for safe operation of the freezer.
7. Conveyor tension	Tension conveyor belt by means of the screw adjusters at the exit end. Do not over-tension. Check after 1 week operation. Check 2 times weekly for first 3 months, check monthly thereafter. (See procedure)

BELT TENSION PROCEDURE

Belt tension is the most significant maintenance item and must not be neglected. Belt tension **must** be checked after ONE WEEK OPERATION, thereafter as required by use or at least monthly.

Belt tension problems can be observed **before** they cause significant damage to the freezer and consequent down time.

1. Belt sag will be seen immediately after the belt drive shaft at the inlet on the tunnel or immersion freezer. This sag should NEVER EXCEED 3 inch when pressed down by hand when belt is cold
2. The roller shaft and belt on the freezer exit end will be seen to have a jerky motion.

ALWAYS CHECK BELT TENSION WITH THE FREEZER COLD

Procedure for tensioning belts

ALWAYS TENSION THE BELT WHEN THE FREEZER IS COLD.

DO NOT OVER TENSION THE BELT.

ADJUST BEARINGS 3 INCH ONLY AND RE CHECK TENSION.

CAREFULLY MEASURE BEARING MOVEMENT.

ALWAYS MARK THE INITIAL POSITION OF THE BEARINGS BEFORE COMMENCING TO ADJUST TENSION.

MAINTAIN THE PARALLEL POSITION OF THE IDLER SHAFT.

Mark the bearing position
Loosen the four retaining bolts
Loosen the adjuster screw locking nuts
Screw the locking nuts back approximately 3 inch
Repeat procedure for the opposite bearing

Screw adjusters and push the bearing forward 3 inch
Check the distance between the original position and the new position.
DO NOT MOVE MORE THAN 3 INCH WITHOUT RE-CHECKING BELT TENSION
Repeat procedure for the opposite bearing

Re-tighten retaining bolts, **DO NOT OVER-TIGHTEN**
Re-tighten locking nuts
Check belt operation

Note: Belt operation may not be particularly smooth. These belts are designed to operate at temperatures as low as -320⁰F, where their operation will be smooth.

If any binding or undue tightness is suspected slacken the belt tension

BELTS CONTRACT SIGNIFICANTLY WHEN OPERATING COLD. DO NOT FULLY TENSION WARM BELT. SLACK MUST EXIST IN A WARM BELT. IF IN ANY DOUBT CONTACT CRYOQUIP.

**RECOMMENDED SPARE PARTS LIST
CONTACT BATH FREEZER**

PART NUMBER	DESCRIPTION	QTY.
Emergency spares		
Customer supply	Exhaust fan motor	1
191058	Type P3000 level controller, 0 - 5" H2O	1
Normal spares		
191005-1/191006-1	Door seal, silicone and mylar	20 ft
191249-1	Potentiometer, speed control	1
191099-9	Solenoid valve, : inch NPT	1
183191-1	Bearing, drive + idler shaft	2
183192-1	Bearing, drive and roller	2
183197-1	Hold down sprocket assembly	2