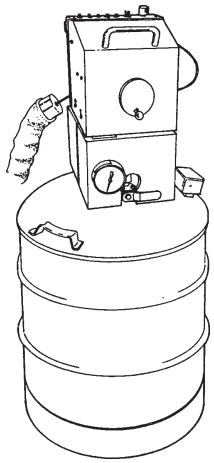
TA Instruments 109 Lukens Drive New Castle, DE 19720

Thermal Analysis & Rheology

A Subsidiary of Waters Corporation



Liquid Nitrogen Cooling Accessory

Operator's Manual

PN 991300.001 Rev. H (Text and Binder)
PN 991300.002 Rev. H (Text Only)
Issued November 1999

© 1991, 1993, 1994, 1995, 1996, 1999 by TA Instruments, Inc
109 Lukens Drive
New Castle, DE 19720

Notice

The material contained in this manual is believed adequate for the intended use of this instrument. If the instrument or procedures are used for purposes other than those specified herein, confirmation of their suitability must be obtained from TA Instruments. Otherwise TA Instruments does not guarantee any results and assumes no obligation or liability. This publication is not a license to operate under or a recommendation to infringe upon any process patents.

TA Instruments TA Operating Software and Module, Data Analysis, and Utility Software and their associated manuals are proprietary and copyrighted by TA Instruments, Inc. Purchasers are granted a license to use these software programs on the module and controller with which they were purchased. These programs may not be duplicated by the purchaser without the prior written consent of TA Instruments. Each licensed program shall remain the exclusive property of TA Instruments, and no rights or licenses are granted to the purchaser other than as specified above.

Table of Contents

Notes, Cautions and Warnings

This manual uses Notes, Cautions, and Warnings to emphasize important and critical instructions.

NOTE: A NOTE highlights important information about equipment or procedures.

♦ ***CAUTION:*** **A CAUTION emphasizes a procedure that may damage equipment or cause loss of data if not followed correctly.**

!WARNING **A WARNING indicates a procedure that may be hazardous to the operator or to the environment if not followed correctly.**

Safety

Read this section and understand the Safety precautions before proceeding with installing or using the LNCA.

Safe Handling of Cryogenic Materials

Liquid nitrogen is used as a cooling agent in many thermal analysis tests. Because of its extremely low temperature (-196°C) it will burn skin. You **must** use extreme care when when working with liquid nitrogen or other cryogenic materials.

Liquid Nitrogen Can:

1. Cause serious skin burns
2. Replace the air in the room you are in
3. Generate very high pressures if trapped in lines or containers.

Handling Liquid Nitrogen

1. Wear goggles or a face shield and wear gloves that are easily removed. Wear high-topped shoes with pant legs *outside* the tops for extra protection.

2. Transfer the liquid slowly to prevent thermal shock to the container and excessive turbulence to the liquid nitrogen. If liquid nitrogen is poured into a container that is at room temperature, the liquid nitrogen will boil violently. Use extreme caution to prevent the boiling liquid from contacting you.

!WARNING

Potential Asphyxiant

Liquid nitrogen can cause rapid suffocation without warning.

Store and use in an area with adequate ventilation.

Do not vent LNCA container in confined spaces.

Do not enter confined spaces where nitrogen gas may be present unless the area is well ventilated.

The warning above applies to the use of liquid nitrogen. Oxygen depletion sensors are sometimes utilized where liquid nitrogen is in use. Please refer to the "Safety" section of this manual for more detailed instructions regarding the use of the LNCA.

3. Use only approved low temperature containers.

4. Make sure liquid nitrogen containers are vented to prevent pressure build-up.

If Burned by Liquid Nitrogen

1. Flood the area (skin or eyes) IMMEDIATELY with large quantities of cool water, then apply cold compresses.

2. See a doctor IMMEDIATELY if the skin is blistered or if the liquid nitrogen came in contact with your eyes.

Room Ventilation

Liquid Nitrogen evaporates quickly at room temperature and could replace the air in a room. Only use liquid nitrogen in a well ventilated room.

Oxygen Absorption

Liquid Nitrogen will absorb oxygen from the air. It is possible for the purity of liquid nitrogen to change as it evaporates from a container. If you suspect a lot of liquid nitrogen has evaporated the remaining liquid should be analyzed for oxygen content before using if for any purpose where high oxygen content is dangerous.

Pressure Build-up

Liquid Nitrogen should not be stored in a sealed container, as tremendous pressure could result and an explosion is possible.

The LNCA is designed to always be vented to the room when not supplying liquid nitrogen to the test module. The pressure build up in the LNCA when it is supplying liquid nitrogen to the test module is limited by the controller. Also a pressure relief valve is designed into the system and a rupture disk has been installed on the dewar as a secondary backup.

♦***CAUTION:*** **Never plug or cap the vent line to the LNCA. Always make sure the LNCA system is installed correctly.**

♦***CAUTION:*** **Never allow liquid nitrogen to be trapped in the supply line from the test Module to the LNCA or the fill line from the bulk storage tank to the LNCA.**

The sequence for opening and closing valves is important to prevent trapping liquid nitrogen in the fill tube. When the Autofill feature is connected it is important that the manual fill valve on the LNCA remain open at *all* times, and the manual valve on the bulk storage tank *never* be closed unless the bulk storage tank is empty or at least 15 minutes has elapsed since the solenoid valve at the bulk storage tank has closed. This time allows the liquid nitrogen to vaporize before sealing the area between the solenoid valve and the valve on the bulk storage tank.

Never remove the LNCA solenoid valve arrangement at the bulk storage tank without closing the bulk storage tank valve first.

When connecting and removing the LNCA solenoid valve arrangement remember to wear goggles and gloves.

♦***CAUTION:*** **Do not use high pressure bulk tanks. The LNCA is designed for lower pressure bulk tanks. Using high pressure tanks will damage gauges, causing the LNCA to work improperly and raise the potential for injury.**

Water Condensation

The LNCA surfaces get cold during use of the LNCA for both filling and supplying liquid nitrogen to the test module. The cold surfaces cause condensation and, in some cases, frost to build up. This condensation may drip to the floor. Provisions to keep the floor dry should be made. Install the rubber catch trough around the LNCA tank to catch moisture as it drips down the sides of the tank. A bucket may be placed under the nozzle to catch excess moisture. If any moisture does drip to the floor, be sure to clean it up promptly to prevent a slipping hazard.

Electrical Safety

High voltages (120 VAC) are present in this instrument, only qualified service personnel should remove covers and make repairs.

The power at the instrument *must* be turned off and the interface cable removed before any service or repair work is started.

Chapter 1: LNCA Overview

Introduction

The LNCA (Liquid Nitrogen Cooling Accessory) is a universal cooling accessory for use with TA Instruments Analyzers. It can be used with the Differential Scanning Calorimeters (DSC) models 2010, 2910, and 2920, the Dynamic Mechanical Analyzer (DMA) model 983, and with the Dielectric Analyzer (DEA) model 2970.

The LNCA has been designed for automatic refilling from a low pressure (25 psi maximum) bulk storage tank that can be located within 6 feet of the LNCA. The LNCA is also capable of being filled manually by disconnecting it from the test module and rolling it to a bulk storage source.

The LNCA retains rate and heater controls for use with DSC 910, 912 and 920 units (which are no longer available from TA Instruments). However, the LNCA design allows direct control by the 2010, 2910, 2920, 2970, and 983 modules; therefore, the heater switches and rate controls are automatically deactivated.

NOTE: Before proceeding be sure you understand and follow the safety precautions in the prefix of this manual.

Specifications

The specifications in Tables 1.1, and 1.2 apply to the Liquid Nitrogen Cooling Accessory.

Table 1.1 LNCA Technical Specifications

LNCA Liquid Nitrogen Capacity	50 Liters
Size	115 cm (45") high by 48 cm (19") in diameter
Power requirements	120 volts at 3 amps, 50-60 Hz, +/-15 volts at 0.5 amps. Power from module using interface cable only.
Weight	(empty) 30 kilograms (65 pounds) (full) 70 kilograms (154 pounds)
Cooling Capacity	-150°C with all instru ments
Pressure Relief	70 kPa (10 psi) relief valve
Pressure Gauge	(Bulk Storage) 0-420 kPa (0-60 psi) (LNCA Storage) 0-210 kPa (0-30 psi)

(table continued)

Table 1.1 (continued)

Liquid Nitrogen Tubes	(Feed) 180 centimeters (6') insulated from LNCA to instrument. (Fill) 180 centimeters (6') insulated with shutoff solenoid from Bulk storage to LNCA.
LNCA Fill Modes	Automatic - Bulk Storage within 180 cm (6') of LNCA Manual - Remote filling at bulk storage location
Bulk Storage Tank	Use low pressure supply tank only. Recommended filling pressure is 20 – 25 psi.

Table 1.2 shows the performance specifications for LNCA/DSC cooling. These specifications are based on operation with a full and pressurized liquid nitrogen tank.

Table 1.2 LNCA/DSC Performance Specifications

Temperature Range	-150°C to 725°C with the DSC Cooling Accessory in place

Linear Cooling Rates

Rate	Temperature	Peak-to-Peak Baseline Noise
Up to 5°C/min	400°C to -150°C	<0.120 mW
Up to 20°C/min	400°C to -50°C	<0.120 mW
20°C/min and up	Depends on the temperature range of interest. May be higher accompanied by increased curvature of the baseline of the cooling curve.	

Linear Heating Rates

Rate	Temperature	Peak-to-Peak Baseline Noise
5 to 20°C/min	-100°C to 400°C	<0.120 mW

Some decrease in capacity for fast cooling rates may be observed as the level of liquid nitrogen in the LNCA tank nears the bottom. Below the minimum level for acceptable use, the Low Coolant light is activated, and the heaters are disabled. Under heavy demands, such as quench cooling on an unpressurized tank (first use since filling), a small delay will be observed while the tank heaters bring the LNCA to full operating pressure.

The Pressure Gauge can be used as an indicator showing the pressure in the LNCA when running a test.

NOTE: The LNCA vents to atmosphere with a pressure reading of zero if no filling or testing is currently in progress.

Table 1.3 LNCA/DMA 983 Performance Specifications

Operating Temperatures	-150˚C to 500˚C
Quench Cooling	< 10 minutes 400˚C to 25˚C < 10 minutes 25˚C to -100˚C
Programmed Cooling	Maximum -10˚C per minute. The minimum temperature of -150˚C can be obtained at 5˚C per minute.

Theory of Operation

Nitrogen gas at -196°C can provide some cooling; however, to provide enough cooling to reach low temperatures or to cool rapidly, liquid nitrogen is also needed. The heat of vaporization of liquid nitrogen speeds the cooling process. An ideal cooling source would provide cold gas for low cooling demands, a mixture of gas and liquid for intermediate cooling, and liquid alone for maximum cooling. The LNCA approaches this ideal by the use of pressure to control the amounts of gas and liquid delivered to the cell.

The LNCA uses up to three selectively switched 125-watt heaters to vaporize the liquid nitrogen and obtain required pressures of up to 40 kPa (6 psi). As the liquid is heated, vapor is collected and routed through an orifice, and then past a mixing jet. At the same time, liquid from the bottom of the tank is forced through a second tube to the mixing jet. See Figure 1.1.

The ratio of liquid to gas at the mixing jet is a function of tank pressure, which is controlled automatically by the heater circuitry. When a small amount of cooling is needed, the pressure is low, the gas flow is slow, and no liquid is forced up through the mixing jet. When a large amount of cooling is needed, the pressure is high, the gas flow is rapid, and large amounts of liquid are forced up through the mixing jets and mixed with the gas. The liquid nitrogen mist that is created continues out the transfer tube to the instrument. At intermediate values of cooling, less liquid is mixed with the gas.

The exact control operation will be described in the chapter that pertains to the specific test module being used.

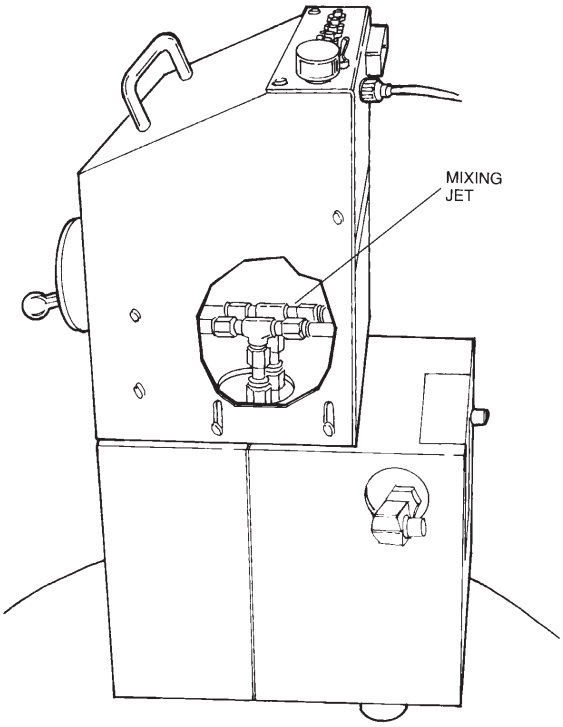


Figure 1.1
Mixing Jet

The operation of the LNCA is very simple. This is the sequence of operation (refer to Figure 1.2 for an illustration of the numbered parts):

1. Instrument requests coolant.
    1. Heater in LNCA is turned on.
    2. Feed solenoid valve #5 opens.
    3. LNCA fill valve #7 is closed.
    4. Vent valve #6 is closed.

2. Instrument no longer requests coolant.
    1. Heater in LNCA is turned off.
    2. Feed Solenoid valve #5 closes.
    3. LNCA fill valve #7 is opened.
    4. Vent valve #6 is opened.

For more detailed information refer to the chapter on the specific instrument being used.

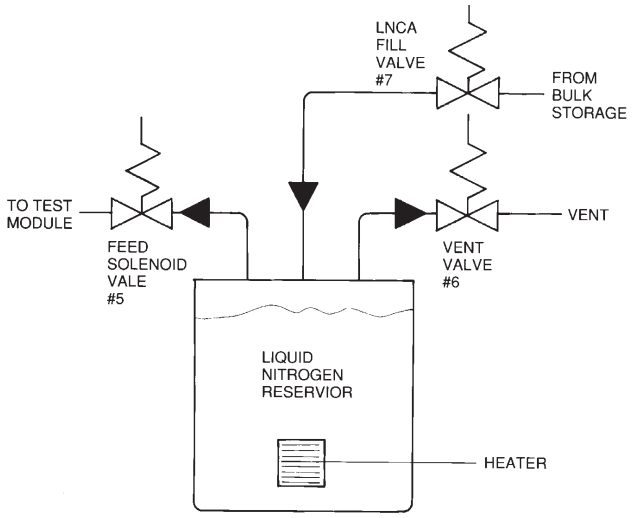


Figure 1.2 LNCA Schematic Operation

Description of Components

The following illustration shows the major parts of the TA Instruments LNCA. Refer to Table 1.3 for a descriptions of these parts.

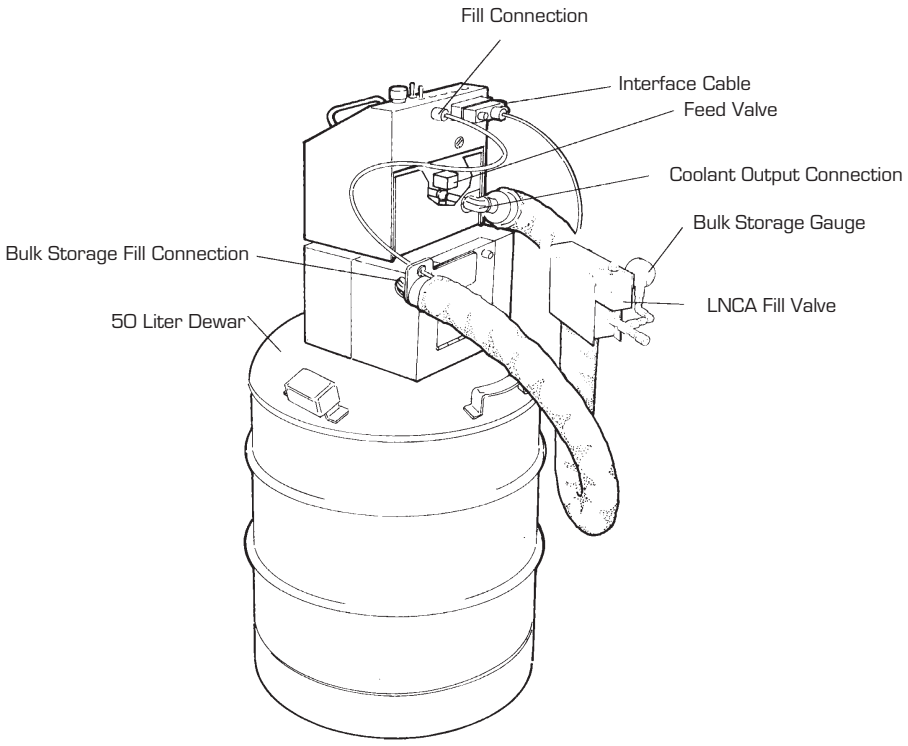


Figure 1.3 Major Parts of the LNCA

Table 1.3
LNCA Components

Item	Description
50 Liter dewar	The thermally-insulated storage vessel for liquid nitrogen.
Bulk Storage Fill Connection	Allows the LNCA to be refilled automatically or manually by connecting appropriate tube.
Bulk Storage Gauge	A pressure gauge located with the LNCA fill valve at the low pressure bulk storage tank to indicate pressure in the bulk storage tank.
Coolant Output Connection	Allows connection of feed tube to instrument and supplies mixture of liquid and gaseous nitrogen to instrument.
Feed Valve	An automatic solenoid valve that opens to supply a mixture of liquid and gaseous nitrogen to the test module.
Fill connection	This is the electrical connection for the bulk storage solenoid valve and bulk storage empty sensor.

(table continued)

Table 1.3 (continued)

Item	Description
Interface Cable	Provides the power and the control signals from the instrument to the LNCA. This cable is different for each instrument. Be sure to use the cable specified for your instrument.
LNCA Fill Valve	An automatic solenoid valve located at the low pressure bulk storage container that is used to refill the LNCA automatically.

Top Section of LNCA

Figure 1.4 illustrates the parts of the top section of the LNCA. Refer to Table 1.4 for a description of the individual parts.

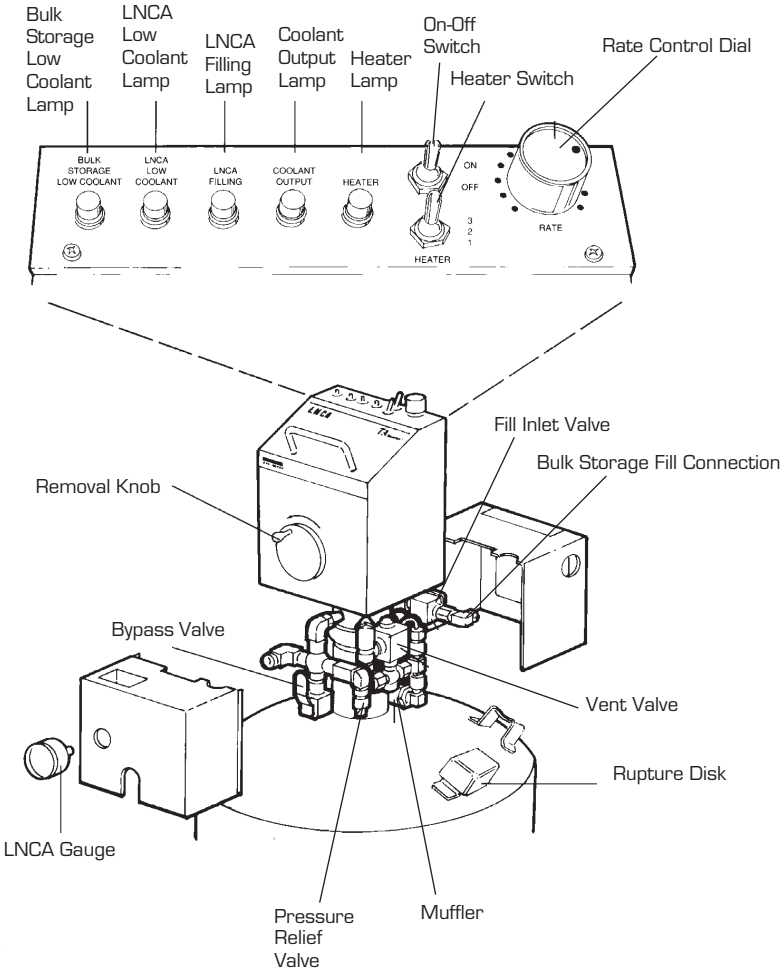


Figure 1.4 Top Section of the LNCA

Table 1.4
Parts of the Top
Section of the LNCA

Item	Description
Bulk Storage Fill Connection	Allows the LNCA to be refilled automatically or manually by connecting appropriate tube.
Bulk Storage Low Coolant Lamp	Indicates when the liquid nitrogen level in the bulk storage tank is low. When this lamp is on, the auto refill process has stopped. The lamp will go off (reset) when the experiment has reached the end of the segment in progress, or after the 2010, 2910, or 2920 has been operating for one minute.
Bypass Valve	A valve that can be opened when manually refilling the LNCA to reduce the fill time.
Coolant Output Lamp	Indicates when liquid and gaseous nitrogen is being supplied from the LNCA to the instrument.

(table continued)

Table 1.4 (continued)

Item	Description
Fill Inlet Valve	A manual valve that allows manual refilling of the LNCA if the auto fill system is not connected.
Heater Lamp	Indicates when the LNCA heaters are on.
Heater Switch	For manual operation—allows selection of 1, 2, or 3 heaters. This switch function is deactivated automatically when using the 2900 series instruments and the 983 DMA.
LNCA Filling Lamp	Indicates when the LNCA is automatically being refilled.
LNCA Gauge	A pressure gauge located near the Bypass valve to indicate the pressure in the LNCA.
LNCA Low Coolant Lamp	Indicates when the liquid nitrogen in the LNCA is below the level for adequate operation. When this lamp is on the power to the LNCA heating elements is automatically turned off.

(table continued)

Table 1.4 (continued)

Item	Description
Muffler	Located at the exit to the vent valve, it reduces the noise level during the refilling process.
On-off Switch	Turns the LNCA power on. This switch must be on for the LNCA to supply coolant to the instrument and to refill the LNCA automatically from Bulk Storage Container.
Pressure Relief Valve	A pressure relief valve that opens automatically to relieve pressure inthe LNCA above 10 psi.
Rate Control Dial	For manual operation—allows overlapping of coolant and instrument heaters. This control function is deactivated automatically when using the 2900 series instruments and the 983 DMA.

(table continued)

Table 1.4 (continued)

Item	Description
Removal Knob	Disengages the Control Head from the tank when turned counterclockwise. This separation allows the tank to be moved for manual refilling without disconnecting the head assembly from the instrument.
Rupture Disk	Located on dewar, the rupture disk provides added safety to prevent excessive pressure build up between the inner and outer vessel, if an inner vessel failure occurs.
Vent Valve	An automatic solenoid valve that opens to relieve pressure when the testing is complete and to allow refilling of the LNCA.

Chapter 2: Installing the LNCA

Unpacking and Inspecting

By the time you are reading this manual, you have already done a certain amount of unpacking. Continue to unpack and inspect the contents of the LNCA shipping box. Retain the shipping container and packing materials until the unit has been successfully installed and verified to be functioning correctly.

If the LNCA received rough handling in shipment and signs of damage are apparent, contact the carrier immediately for advice on how to make a claim. Please call TA Instruments to advise us of the problem. DO NOT use or install the instrument until an authorized representative of TA Instruments has repaired it.

Contact your TA Instruments representative if parts are missing.

Hotlines

United States of America

For Technical Assistance ..... (302) 427-4070

To Order Instruments
and Supplies ..... (302) 427-4000

For Service Inquiries ..... (302) 427-4050

Sales ..... (302) 427-4000

TA Instruments has a worldwide network of representatives, please refer to the Appendix for a list of subsidiaries. To obtain more detailed information about how to contact your local representative, call the Sales number above or send a request by Fax to International Sales at (302) 427-4001.

Installing the LNCA

The Installation of the LNCA is similar regardless of the instrument it is to be connected to.

The major difference in installation will be whether you are able to use the autofill mode or not.

WARNING

Read the safety precautions for handling cryogenic materials (located in the prefix of this manual) before filling the LNCA. Wear goggles or a face shield and gloves large enough to be removed easily whenever you handle liquid nitrogen.

The following are general guidelines to use when installing the LNCA.

1. Check the clamp holding the LNCA Controls to the dewar. Sometimes during shipment this clamp loosens. Access to the clamp is obtained by opening the door on the lower shroud.

2. The Autofill feature is connected to the LNCA the same way for all instrument installations.

3. Connecting the LNCA to an instrument requires that a specific interface cable be used. Make sure the proper cable is being used for this installation. Four cables are supplied with the LNCA for use with the different instruments.

4. The transfer tube connections from the LNCA to the instrument are the same, except that 90° elbow fittings have been supplied for some cooling accessory connections.

General Installation Instructions

The installation of the LNCA with each type of instrument varies slightly. This section provides a general set of instructions that you can use to install the LNCA on any instrument. For details on any particular type of instrument, refer to the appropriate section later in this chapter.

The LNCA is designed to be filled automatically from a *low pressure* (20 to 25 PSI) bulk storage liquid nitrogen container. If you will not be using the Autofill feature, go directly to page 3-11 for manual filling instructions.

♦ ***CAUTION:***

If your liquid nitrogen source has more than 25 psi, then a pressure regulator must be added to insure no more than 25 psi is delivered to the LNCA. Failure to limit the pressure may result in damage to the fill solenoid valve, cause excessive fill times, and cause the safety pressure relief valve to activate, and even cause the non-repairable rupture disc to rupture.

To use the auto refill capability, follow these steps:

1. Arrange the low pressure bulk storage source physically close enough, within 183 cm (6 feet), to the LNCA so that the special autofill tube can be easily connected between the source and the LNCA. Likewise the LNCA and the instrument need to be in close proximity to allow connection of the control cable and the 183 cm (6-foot) transfer tube.

2. Adapting the LNCA for automatic refilling is very easy:

   a. Make sure the manual Bypass valve at the front of the shroud is closed.

   b. Open the door on the lower shroud and make sure that the manual fill inlet is open and then close the door.

   c. Attach the bulk storage fill tube to the LNCA, making sure that the flange on the mounting bracket is positioned in the slot in the lower shroud door.

   d. Attach the other end of the bulk fill tube assembly to the bulk storage container. Care should be taken to insure the pressure gage is vertical before tightening the fitting. Also, loop the safety chain around the bulk storage tank top ring and secure it around the chain. This safety chain prevents the gauge and solenoid valve from falling if they are dropped when being disconnected.

   e. Connect the bulk fill connector to the LNCA.

3. Connect the transfer tube from the LNCA to the instrument and make sure the fittings are tight. The transfer tube connection at the instrument will vary depending on the type of heat exchanger and instrument that you are using.

See the appropriate section for the type of instrument you are using.

4. Make sure the power to the instrument is off and the power switch on the LNCA is in the off position.

5. Make sure you have the correct interface cable(s) and connect it to the rear of the instrument and to the LNCA. See the section of the manual appropriate to the type of instrument you are installing with the LNCA.

!WARNING

The instrument power switch *must* be off before connections are made.

6. Turn on the power to the LNCA and the instrument after connecting the proper interface cable.

Installing the Drain Valve

Ice and frost are created during normal use of the Liquid Nitrogen Cooling Accessory. The LNCA catch trough is designed to prevent water from dripping onto the floor creating a potential hazard when the ice and frost melt.

The drain valve may be needed to occassionally empty water from the catch trough. To install the condensate drain valve, use a 5/8-inch wrench on the swage nut, screw the elbow into the fitting until it is hand tight with the valve pointing down (see the figure below).

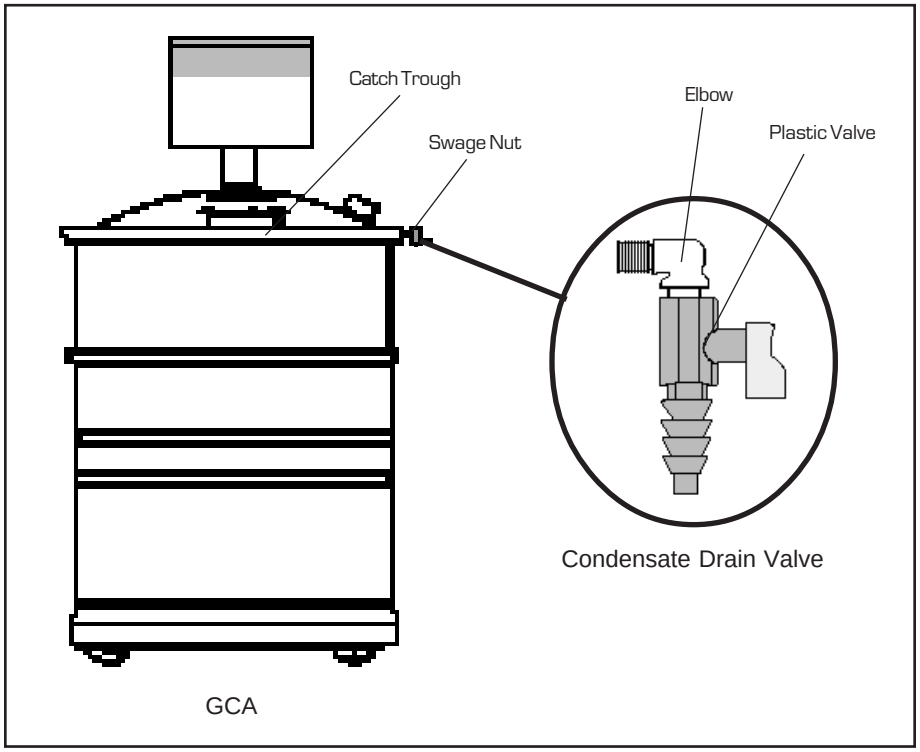


Figure 2.1
Drain Valve Installation

Empty the LNCA catch trough periodically by opening the valve and draining the water into a suitable container, or a hose can be connected to the valve and routed to a floor drain or large container.

♦ ***CAUTION:***

During manual filling operations, do not over fill the LNCA tank causing liquid nitrogen to spill into the catch trough.

Now that the LNCA has been completely installed, turn to the next chapter for the instructions needed to fill the accessory with liquid nitrogen.

Installing the LNCA on the DMA 983

Follow the directions found on pages 2-7 through 2-9, with the following exceptions.

Coolant Transfer Tube Installation

The DSC 983 does not operate with a heat exchanger, unlike the DSC 2910 and 2920. Connect the LNCA coolant transfer tube to the purge/cooling inlet on the back side of the DMA 983 instrument, see the figure below.

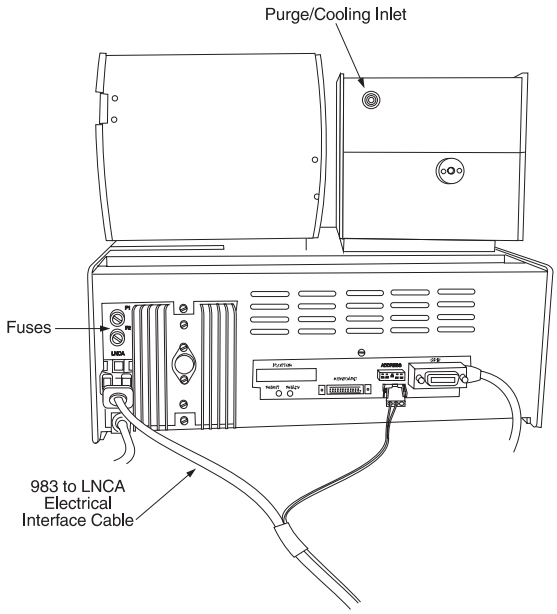


Figure 2.2
DMA 983 - Connecting the LNCA Coolant Transfer Tube to the Purge/Cooling Inlet

Cable Connections

To connect the LNCA to the DMA 983, a single cable (PN 991283.901) with two cords connected is used. See Figure 2.2 for an illustration showing you how to make the two connections at the DMA instrument.

Installing the LNCA on the DSC 2010

The Liquid Nitrogen Cooling Accessory (LNCA) is used to achieve continuous, programmed sample cooling with the DSC 2010 Cell. With the LNCA installed, the temperature range of DSC experiments is –150°C to 725°C.

To operate the LNCA with the DSC Cell, you must first install the LNCA heat exchanger over the DSC Cell, and then connect the LNCA to the heat exchanger. Modification of the DSC 2010 cell, as is required to install the LNCA heat exchanger, results in permanent changes to the cell. Once modified, the DSC 2010 can no longer be used with the Refrigerated Cooling System. Furthermore, while the LNCA heat exchanger may be removed and the nickel cover replaced, it is recommended that you leave the LNCA heat exahanger attached to your DSC 2010, once it is installed.

Installing the DSC Cell Heat Exchanger

When you perform subambient experiments using the LNCA, you will need to install the DSC Cell Heat Exchanger and the DSC insulation tape, as follows:

!WARNING

Wear protective gloves when working with the insulation tape. Familiarize yourself with the MSDS for the insulation material as skin, eye, and respiratory irritation may occur, if you are exposed to the material.

!WARNING

Before you begin, make sure the cell has cooled to ambient temperature to avoid injury.

1. Turn the instrument POWER switch to the OFF position.

2. Remove the bell jar, O-ring seal, cell cover, and silver lid from the DSC cell.

♦ ***CAUTION:*** **Make sure that the power to the 2010 module is OFF before installing the heat exchanger.**

3. Remove the three (3) retaining screws, then *carefully* remove the thermal radiation shield surrounding the heater. (see Figure 2.3).

♦ ***CAUTION:*** **Do not twist or apply excessive force to the radiation shield mounting plate when removing the shield. Damage to the furnace supports could result.**

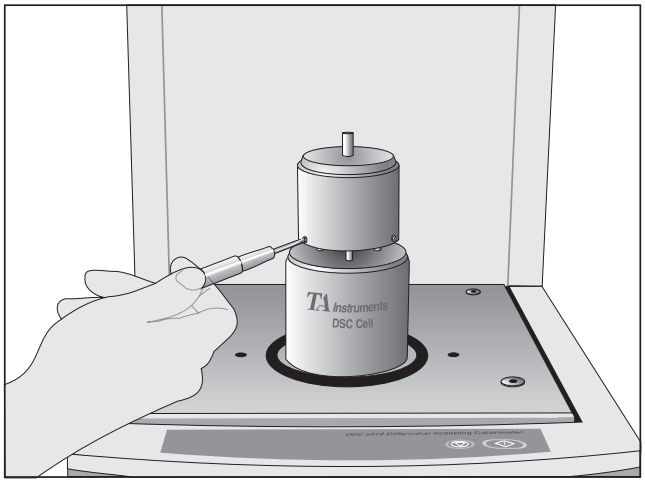


Figure 2.3 Removal of the Thermal Radiation Shield

4. Place the three gaskets onto the cell base plate as shown in Figure 2.4, aligning the holes in the gaskets over the two threaded holes in the base plate.

5. Thread the two hex-socket screws through the gaskets several turns, do not tighten all the way down at this point.

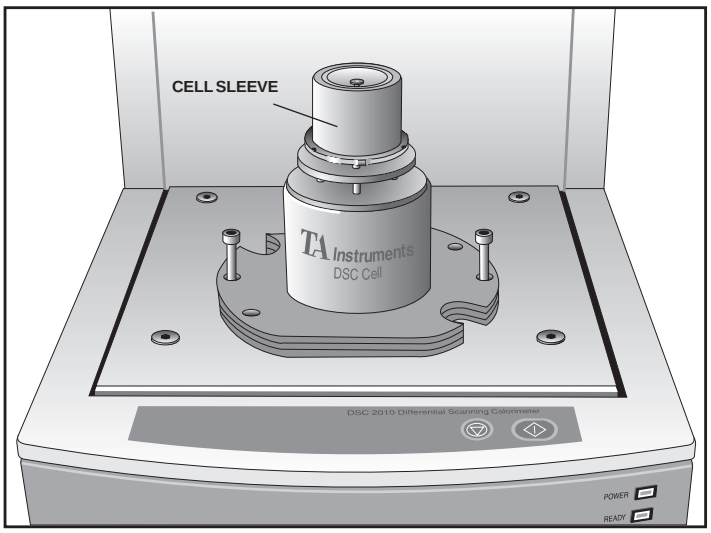


Figure 2.4 Position of the Gaskets

6. Remove the three screws that secure the cell sleeve to the cell heater support.

7. Gently lift up on the sleeve, while applying small clockwise and counterclockwise twisting forces, to carefully remove the cell sleeve.

NOTE:

Take care when removing the cell sleeve. It is important to avoid deforming the cell support or causing the cement under the sleeve to fall off. However, small amounts of cement dust are normal and will not have any adverse effect on performance. Cracks in the cement are also normal and occur due to shrinkage during the curing process.

8. Install the insulation tape on the cell as directed in the following steps. The purpose of the insulation material is to obtain maximum performance from the DSC when it is used with the LNCA. The insulation ensures a uniform temperature around the cell, which lowers noise (μW) and flattens the baseline.

   a. Position the insulation beginning at the back of the cell sleeve and allowing 3.2 mm (1/8 inch) to extend above the top of the cell (see Figure 2.5).

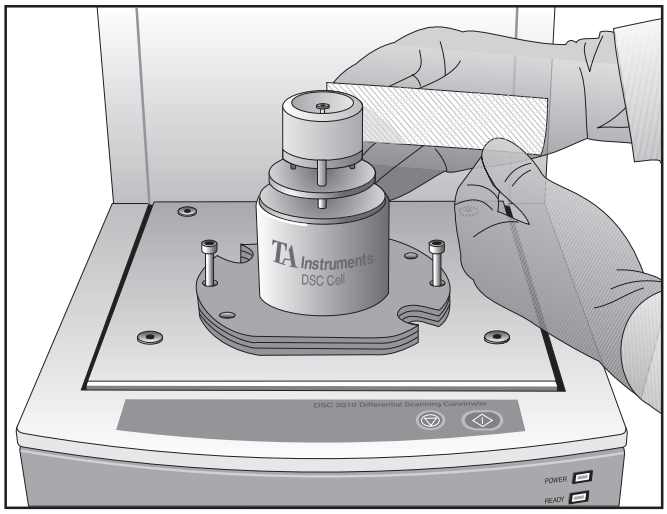


Figure 2.5 Installing the Insulation on the DSC Cell

   b. Apply the insulation slowly and evenly, wrapping the insulation around the cell and stretching it as you go. When you reach the midline on the back of the cell, where the ends of the insulation will meet, it is very important to form a butted insulation seam (with no overlap and minimal gapping.)

c. Use scissors to cut off any excess insulation at the seam to prevent overlap, then cut off any stray threads around the top of the cell.

d. Gently fold the insulation that extends above the cell inward toward the center of the cell. This is to prevent the heat exchanger from dislodging the insulation when it is installed.

9. Plug in the heat exchanger cable as shown in Figure 2.6 below.

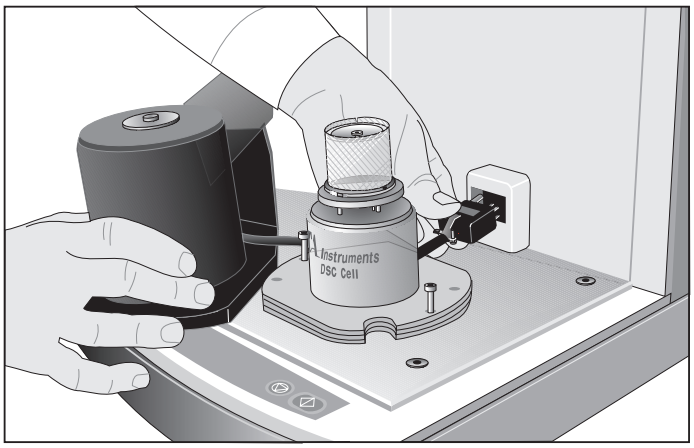


Figure 2.6 Plugging in the Heat Exchanger

10. Carefully lower the heat exchanger assembly down over the DSC cell with the gas inlet port facing toward the left side of the cell base (see Figure 2.7).

♦ ***CAUTION:*** **The heat exchanger assembly contains coated fiberfax material. Excessive handling of this material could cause fiberfax particles to be emitted into the air. See the MSDS sheet for safety measures to be observed when fiberfax is used.**

If the cell is twisted or canted, it can bind against the inside of the heat exchanger, causing periodic slippage during heating or cooling scans.

This slippage can cause shifts in the DSC heat flow baseline. The cell should be aligned with the heat exchanger so that the exchanger assembly slides smoothly up and down on the cell and sits squarely on the rubber gasket at the base.

11. Align the holes in the heat exchanger with the hex-socket screws in the gaskets. Once the heat exchanger is in place, rotate it clockwise into the locking position.

12. Tighten the hex-socket screws to secure the DSC Cell Heat Exchanger to the cell base plate (refer to Figure 2.7 on the next page). When bolted in place, the heat exchanger must not press against the outside of the cell furnace. With proper installation, it should be possible to move the cell very slightly in all lateral directions by pressing with a finger against the inner furnace wall.

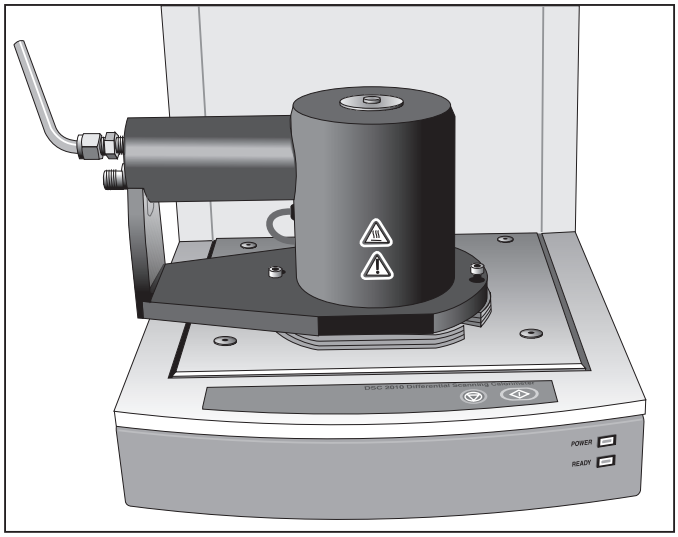


Figure 2.7 DSC Cell Heat Exchanger Assembly on the DSC 2010

WARNING

Do not block the nitrogen gas outlet port on the heat exchanger. Avoid prolonged contact with the cold outlet gas stream.

13. Place the silver lid on the cell and the two new lids on the DSC cell heat exchanger.

NOTE: When running subambient, use a dry nitrogen purge through the vacuum port (100–150 mL/min) to eliminate moisture buildup.

Before you can begin to use the cell, you must burn off the adhesive material used during installation of the insulation.

NOTE: Use an exhaust system to carry away the fumes that are generated during the decomposition of the adhesive.

Burn-Off Procedure

1. Use a minimum of 50 cc/min of nitrogen purge in the Purge Port on the back of the cell base.

2. Remove all lids, except the silver lid, which covers the sample chamber of the cell.

3. Run the following method:

   Equilibrate at 300°C
   Ramp 10°C/minute to 600°C
   Isothermal for 10 minutes.

4. Adjust the nitrogen purge to the desired flow rate.

5. Calibrate the cell as described in the manual.

6. Connect the LNCA transfer tube to the heat exchanger, following the instructions found beginning on page 2-21.

NOTE: Removal of heat exchanger will require a repeat of the insulation process.

Connecting Cable and Tubes

The new components installed in this section are shipped with the LNCA or come from the LNCA/DSC installation kit. Before you begin this procedure, follow the steps in the previous section to install the DSC heat exchanger.

! WARNING

Liquid nitrogen trapped in tubes and valves can cause dangerous pressure buildup, if it vaporizes. Never use tubing or valve configurations that could trap liquid nitrogen in your LNCA system.

1. Connect the LNCA coolant transfer tube from the LNCA feed valve to the stainless-steel union on the block housing. See Figure 2.8.

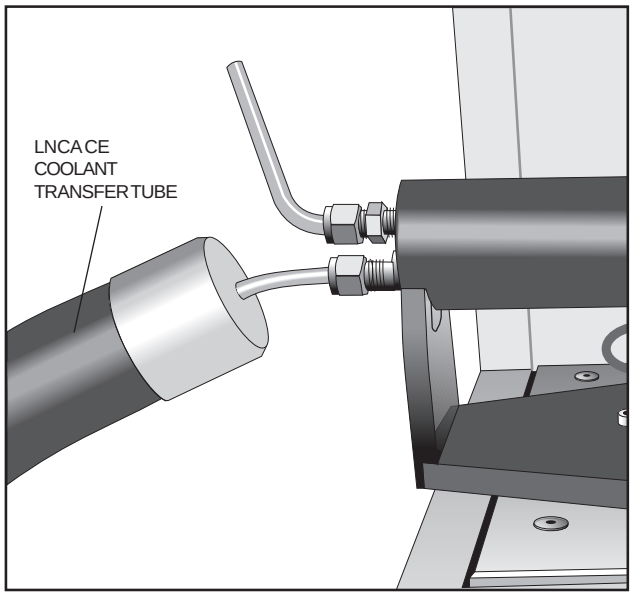


Figure 2.7
Installing the LNCA Coolant Transfer Tube

2. Install the short, black foam insulation tubing over the exposed stainless steel end of the LNCA coolant transfer tube. This tubing is slit so that you can install and remove it without disconnecting the LNCA coolant transfer tube.

3. Install the accumulator *(optional)* to collect excess coolant as follows:

   a. Unscrew the vent tube to remove it from the heat exchanger.

   b. Attach the elbow connector to the vent tube by pushing the end of the vent tube into the connector. Then tighten the fitting to hold securely.

   c. Screw the accumulator onto the threaded part of the elbow fitting. You can position the opening to the accumulator as desired, it does not need to be tightly attached (see Figure 2.9).

   d. Screw the vent tube back into the heat exchanger, positioning it so that it is horizontal.

NOTE: When positioning the accumulator, make sure that the vent opening does not point towards the operator, as cold gas will be escaping.

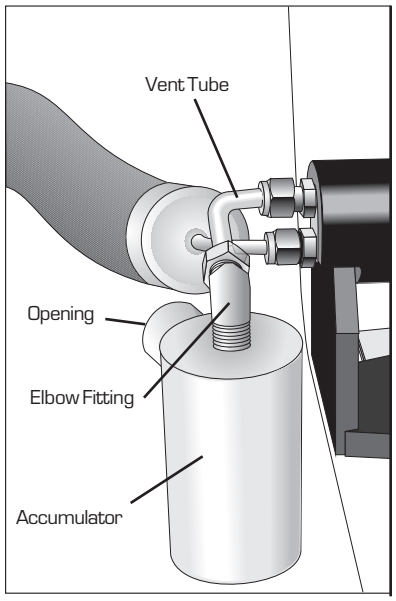


Figure 2.8 Installing the Accumulator

4. Make sure the power to the module is off and the LNCA power switch is in the OFF position.

WARNING

All power must be OFF before you connect the LNCA cable to the LNCA.

5. Connect the LNCA/DSC interface cable from the MODULE CONTROL connector on the LNCA Adapter (Figure 2.10) to the LNCA connector on the back of the DSC module. Tighten the thumbscrews at the MODULE CONTROL connector on the LNCA Adapter.

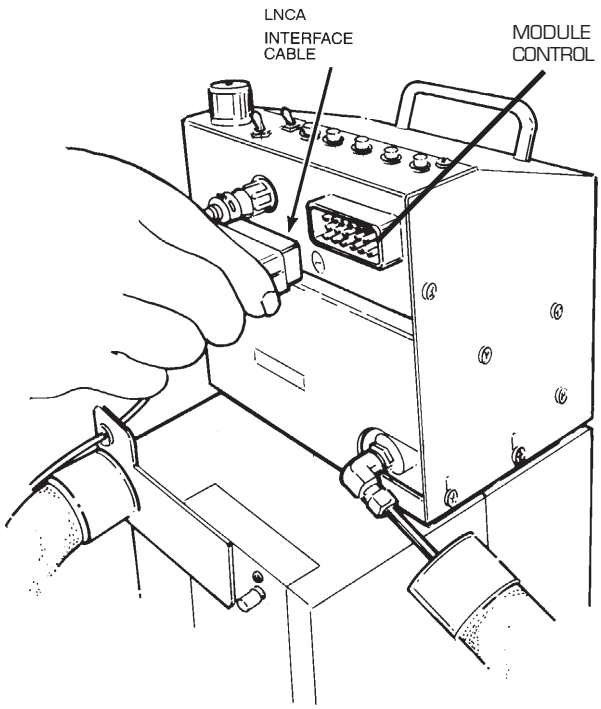


Figure 2.10 Connecting the LNCA Interface Cable to the LNCA Adapter

6. Turn on the LNCA. Your instrument is now ready for normal operation.

Installing the LNCA on the DSC 2910 & 2920

The Liquid Nitrogen Cooling Accessory (LNCA) is used to achieve continuous, programmed sample cooling with the standard and dual sample DSC cells. With the LNCA installed, the temperature range of DSC experiments is -150°C to 725°C.

To operate the LNCA with a DSC cell, you must first install the DSC heat exchanger over the DSC Cell, and then connect the LNCA to the DSC heat exchanger. The heat exchanger comes in the LNCA/DSC installation kit, which also contains the following:

- 1 heat exchanger
- 3 gaskets
- 2 cell lids
- 2 thumbscrews
- 1 insulated coupling hose
- 1 LNCA interface cable.

NOTE: The instructions provided in this section pertain to both the DSC 2910 and the DSC 2920 instruments. For illustration purposes, however, only the DSC 2920 has been pictured.

Installing the DSC Heat Exchanger

Follow the steps below to mount the heat exchanger and prepare your DSC Cell for subambient experiments using the LNCA. All new components installed in this section come in the LNCA/DSC installation kit.

1. Remove the bell jar, O-ring seal, and cell cover, from the DSC Cell (see Figure 2.11).

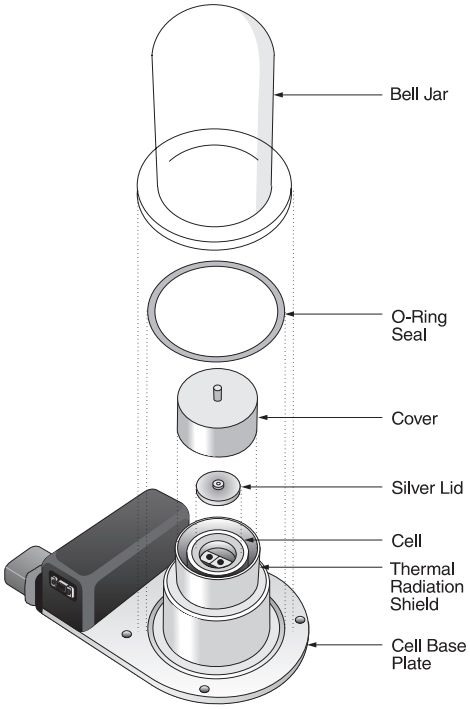


Figure 2.11 Disassembling the DSC Cell

WARNING

Make sure the cell is at ambient temperature before touching it or burns could result.

2. Check that the instrument POWER switch is off.

♦ ***CAUTION:***

Power to the instrument must be OFF before you perform these procedures.

NOTE:

If you remove the thumbscrews on the DSC 2920, the power to the cell is automatically disconnected. (This does not apply to the DSC 2910.)

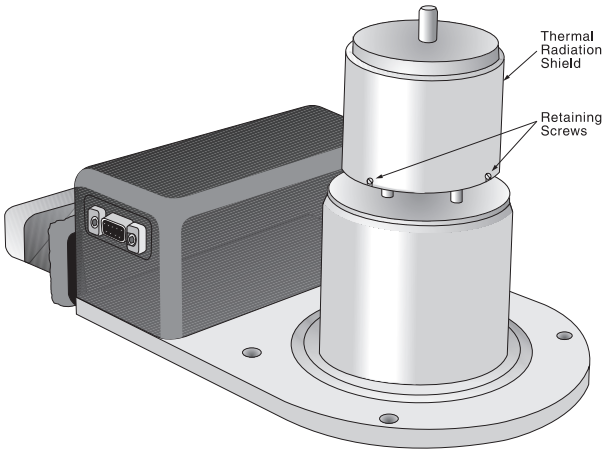


Figure 2.12
DSC Standard Cell

3. Loosen the three retaining screws on the thermal radiation shield and remove it by pulling it straight up. The slots in the shield allow easy removal (refer to Figure 2.12 for location of screws).

NOTE:

For increased performance, you can install the optional DSC insulation tape on the 2910 or 2920 cell at this point. Follow the instructions given for the DSC 2010 found on pages 2-13 through 2-15, steps 6 through 8, before going on to step 4 on page 2-26.

4. Fit the three new gaskets onto the cell base plate (see Figure 2.13), aligning the holes in the gaskets over the two thumbscrews.

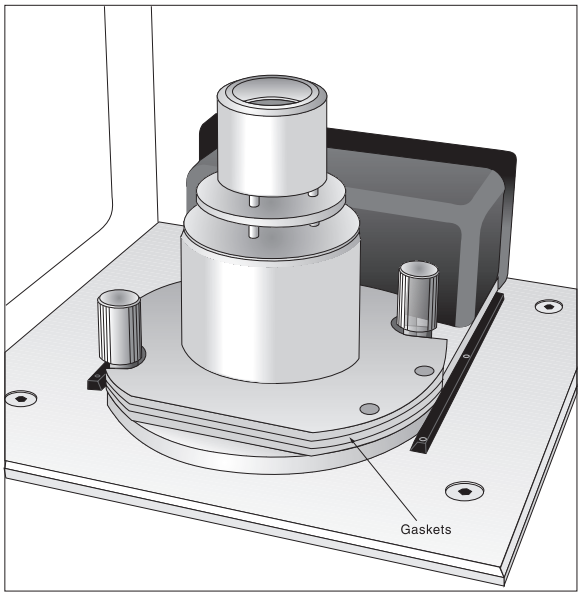


Figure 2.13 Installing the New Slotted Gaskets

5. Align the arm of the heat exchanger to the left and carefully lower it down over the thumbscrews, taking care not to hit the cell. See Figure 2.14.

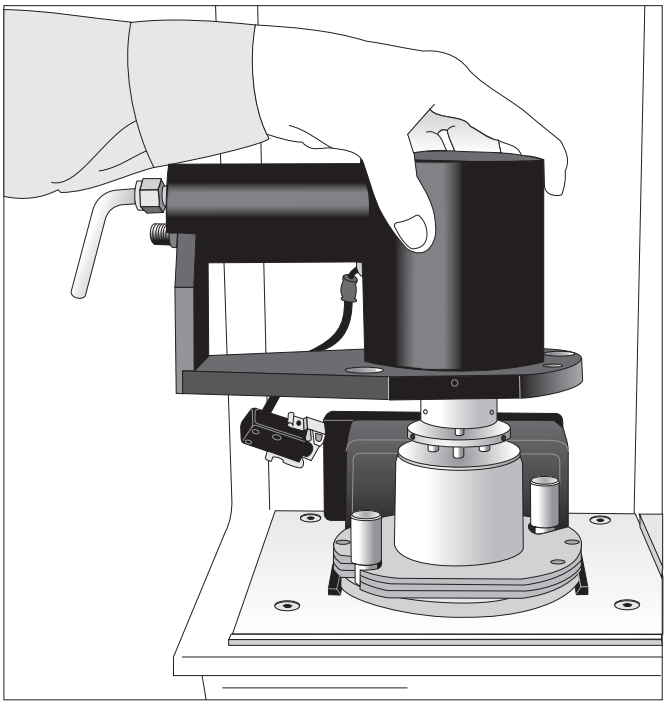


Figure 2.14 Installing the Heat Exchanger

♦ ***CAUTION:***

The heat exchanger assembly contains coated fiberfax material. Excessive handling of this material could cause fiberfax particles to be emitted into the air. See the MSDS sheet for safety measures to be observed when fiberfax is used.

If the cell is canted it can bind against the inside of the heat exchanger, causing periodic slippage during heating or cooling scans.

This slippage can cause shifts in the DSC heat flow baseline. The cell should be aligned with the heat exchanger so that the exchanger assembly slides smoothly up and down on the cell and sits squarely on the rubber gasket at the base.

6. Screw the two large thumbscrews into their positions in the heat exchanger (see Figure 2.15).

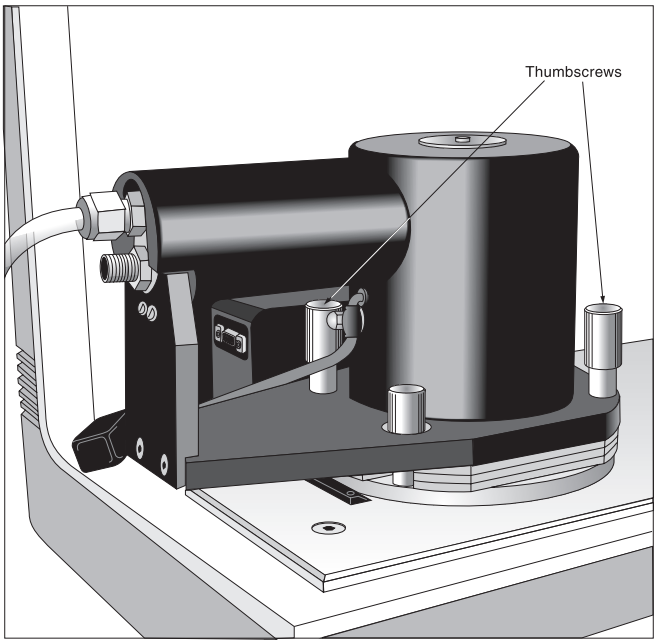


Figure 2.15 Installing the Thumbscrews on the Heat Exchanger

7. Plug in the cable from the heat exchanger. (See Figure 2.16 for the cable setup on the DSC 2920. On the DSC 2920 make sure that the spring clip retainers are fully engaged.)

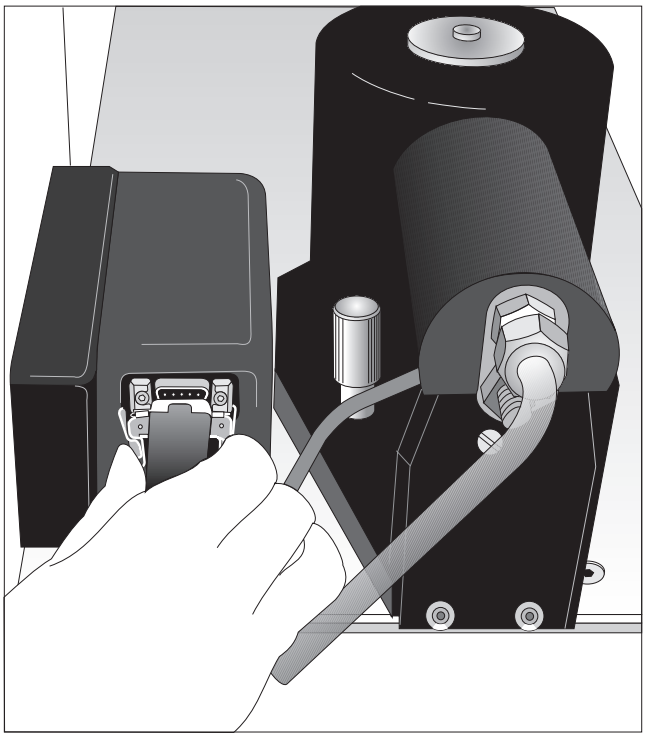


Figure 2.16 Plugging in the Heat Exchanger (DSC 2920 shown)

NOTE:

If you installed DSC insultation tape on your 2910 or 2920 cell, you must perform the "Burn-Off Procedure" found on page 2-18 before using the instrument. This procedure burns off the adhesive material used during the installation of the insulation tape.

Connecting Cables and Tubes for Cooling

The new components installed in this section are shipped with the LNCA or come from the LNCA/DSC installation kit.

WARNING

Liquid nitrogen trapped in tubes and valves can cause dangerous pressure build-up if it vaporizes. Never use tubing or valve configurations that could trap liquid nitrogen in your LNCA system.

1. Follow the steps in the previous section to install the heat exchanger on the DSC 2910 or 2920 instrument.

2. Connect the LNCA coolant transfer tube from the LNCA feed valve to the stainless-steel union on the block housing (Figure 2.17).

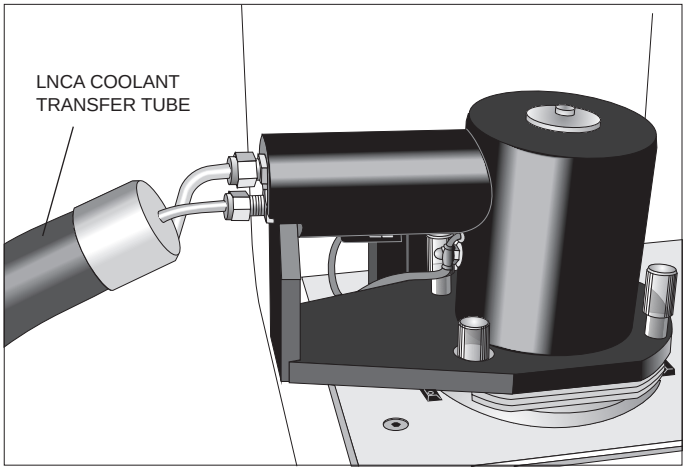


Figure 2.17
Installing the LNCA
Coolant Transfer Tube

3. Install the accumulator *(optional)* to collect excess liquid nitrogen as follows:

   a. Unscrew the vent tube to remove it from the heat exchanger.

   b. Attach the elbow connector to the vent tube by pushing the end of the vent tube into the connector. Then tighten the fitting to hold securely.

   c. Screw the accumulator onto the threaded part of the elbow fitting. You can position the opening to the accumulator as desired, it does not need to be tightly attached (see Figure 2.18).

   d. Screw the vent tube back into the heat exchanger, positioning it so that it is horizontal.

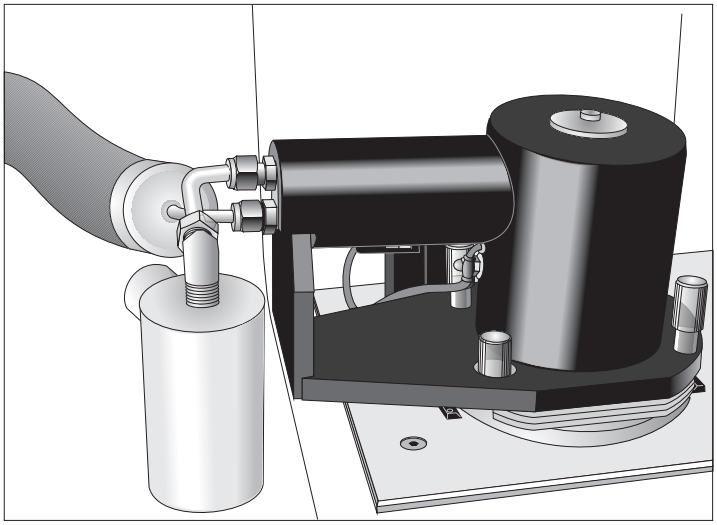


Figure 2.18 Installing the Accumulator

NOTE: When positioning the accumulator make sure that the vent opening does not point towards the operator as cold gas will be escaping.

4. Make sure the power to the instrument is off and the LNCA power switch is in the OFF position.

WARNING

All power must be OFF before you connect the LNCA cable to the LNCA.

5. Connect the LNCA/DSC interface cable from the MODULE connector on the LNCA Adapter (see Figure 2.19) to the LNCA connector on the back of the instrument. Tighten the thumbscrews at the MODULE connector on the LNCA Adapter.

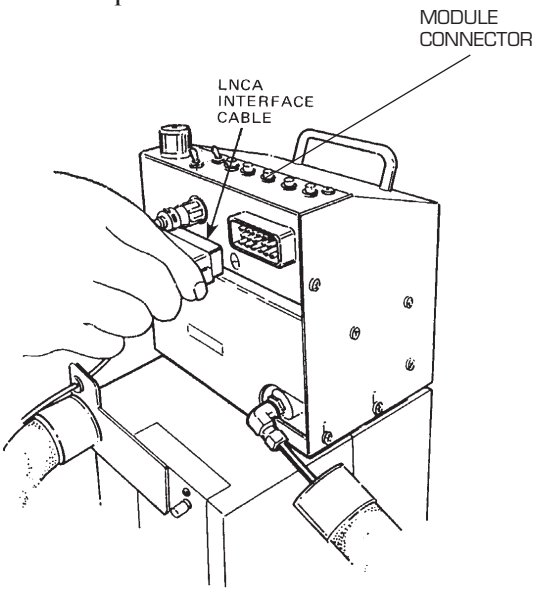


Figure 2.19 Connecting the LNCA Interface Cable to the LNCA Adapter

6. Place the silver lid on the cell and the two new lids on the DSC heat exchanger.

NOTE:

When running subambient, use a dry nitrogen purge through the vacuum port (100 to 150 ml/min) to eliminate moisture buildup inside the cell.

Installing the LNCA on the DEA 2970

The Liquid Nitrogen Cooling Accessory (LNCA) is used to achieve continuous, programmed sample cooling with the DEA 2970. If the LNCA is connected and turned on, it will be used when a cooling method segment occurs and the temperature is below 300°C.

Follow the steps below to install the LNCA on the DEA 2970:

1. Check that the instrument POWER switch is off.

!WARNING **Power to the instrument must be OFF before you perform these procedures.**

2. Connect the interface cable (PN 991317.901) to the LNCA connector on the back of the DEA.

3. Connect the interface cable from the MODULE connector on the LNCA Adapter (see Figure 2.19 on page 2-34) to the LNCA connector on the back of the instrument. Tighten the thumbscrews at the MODULE connector on the LNCA Adapter.

4. Connect the LNCA coolant transfer tube to the output of the LNCA feed valve, see Figure 2.20 on the next page.

5. Locate the LNCA connector on the left side of the funace column. Connect the free end of the insulated coolant transfer tube to the DEA, using the special adapter fitting included in the DEA Accessory Kit. (See the figure below.)

NOTE: The furnace outlet port must be left clear. Do not connect anything to redirect exhaust gas. This will cause partial blockage, which may affect gas flow and heater control.

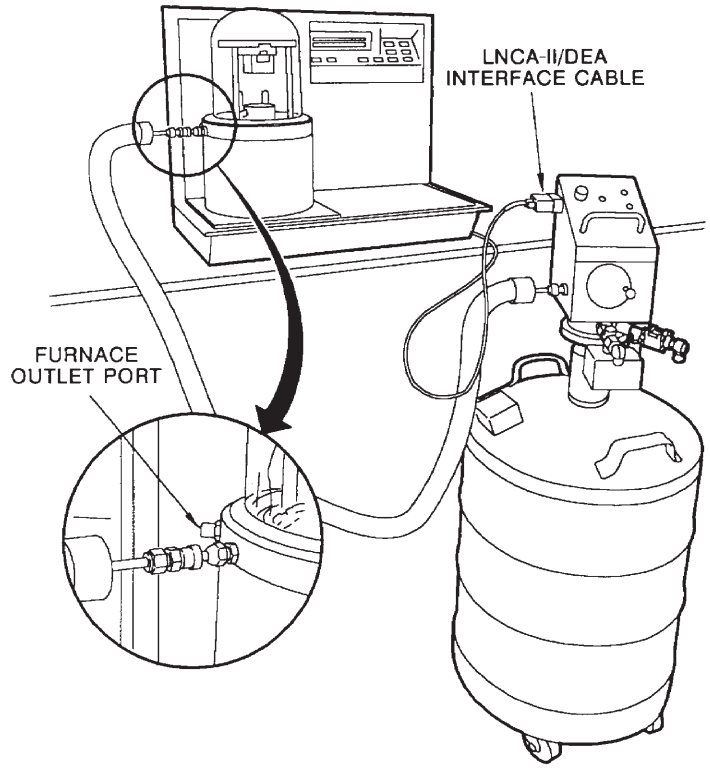


Figure 2.20
LNCA/DEA Connections

Chapter 3: Filling the LNCA

Autofilling the LNCA

Autofilling refers to the automatic refilling of the LNCA from the bulk storage tank, allowing continuous programmed cooling for experiments. This section tells you how to set up the LNCA and the connected instrument to allow autofilling. Turn to the section appropriate to the instrument you are currently using.

NOTE: When Liquid Nitrogen enters the dewar for the first time, rapid boil off of the liquid nitrogen occurs. On occasion liquid nitrogen has exited the vent causing the fill sensor to prematurely indicate a full tank. If this occurs during the initial filling, wait a few minutes, and then restart the fill process.

Autofilling 2000 Series Instruments

The LNCA can be used to achieve continuous programmed cooling of the DSC 2010, 2910 or DSC 2920, DEA 2970 and their accessories.

The 2000 series instruments can automatically control the pressure in the LNCA supplying liquid and gaseous nitrogen to its instrument. The 2000 series instruments automatically deactivate the heater switch and rate control on the LNCA control panel.

This chapter will explain how to fill and use the LNCA now that it is connected.

For information on running subambient experiments, refer to the appropriate chapter in the instrument's operators manual.

Initial Filling of the LNCA

The LNCA must be filled before cooling experiments can be performed on 2000 series instruments. Follow the instructions in this section to fill the LNCA with a 2000 series instrument for the first time.

TA Instruments RMX-Based Software

1. Set the method-end conditions to select autofilling at the end of a method.

2. Create, load, and run the following method to initiate filling the dewar.

Jump to 0°C
Isothermal for .2 minutes

The autofill will shut off when the dewar is full, the bulk storage tank is empty, or the LNCA tank pressure is below one psi for more than one minute.

TA Instruments *Thermal Solutions/ Advantage Software*

Select **Control/Auto Fill** on the Instrument Control pop-up **Main Menu**. The LNCA will be filled automatically.

The autofill will shut off when the dewar is full, the bulk storage tank is empty, or the LNCA tank pressure is below one psi for more than one minute.

Refilling the LNCA After an Experiment

To automatically refill the LNCA with liquid nitrogen after an experiment on a 2000 series instrument is completed, you simply select autofilling at the end of an experiment. See the software documentation for instructions. This applies to both the RMX-based software and *Thermal Solutions/Advantage* software.

Autofilling the DMA 983

The autofill feature insures that a continuous supply of liquid nitrogen is available for subambient experiments. It reduces the effort and time involved with refilling the LNCA manually. Following is a list of the features associated with autofilling:

- It allows the bulk storage supply of liquid nitrogen to automatically refill the LNCA on demand from the instrument.
- Typical fill times for automatic refilling will be less than one hour.
- Any autofill cycle will automatically stop if a test is started on the instrument.
- The autofill system is designed so that adequate pressure is maintained in the LNCA during the fill cycle.

When you have completely installed the LNCA as directed in Chapter 2, and are ready to use the autofill system, *open* the low pressure (25 psi max) bulk storage source valve. Do not close this valve again until the bulk storage container is empty, or wait until 15 minutes after the fill sequence has been completed.

Then choose the event setting for the 983, keeping in mind that the event setting affects LNCA operation as seen in Table 3.1 on the next page.

Table 3.1
Effects of the Event Status on the LNCA

Event Setting	Heater Power	Feed Valve	Vent Valve	Fill Valve
Event 1	Enabled	Open	Closed	Closed
Event 0 or end of method	Disabled	Closed	Open	Closed
Event 1 followed by segment and then Event 0	Disabled	Closed	Open	Open

♦ ***CAUTION:***

If the bulk storage supply becomes empty during the autosampler testing the LNCA refill valve will shut off and illuminate the low bulk storage lamp on the control panel; however, the instrument will not stop and will continue to complete the segment request.

NOTE:

The autofill feature is activated by an event 1, followed by an event 0, and a segment that will last for 30 to 60 minutes. If a segment does not follow the event 0, the method will end, the power will be shut off, and filling of the LNCA will not occur.

The following examples show how the external event should be programmed to allow filling the LNCA *before* tests begin, to allow refilling the LNCA *during* testing, or to refill the LNCA *after* completing the testing.

Example 1:

Filling the LNCA *before* using the DMA 983 instrument for subambient testing.

METHOD: LNCA Pre-Use Fill

Segment	Purpose
Data Storage: OFF	Data storage is not needed.
External Event: 1	Autofill will work following event 1.
Isothermal for 0.10 min	Time allows LNCA to recognize Event 1.
External Event: 0	Initiate auto fill sequence.
Jump to 0.00°C	To insure no power to cell heaters.
Isothermal for 60 min.	Normal LNCA fill is 30 to 40 minutes, 60 minutes allows sufficient time for the LNCA to fill and shut off automatically.

Example 2

Filling the LNCA *while* running other analysis.

METHOD: LNCA Cycle Fill

Description	Purpose
External Event: 1	Enable Coolant to flow.
Equilibrated at -100.0°C	Stabilizes the instrument at -100.0°C.
External Event: 0	Additional cooling is not needed in this test and coolant flow to the instrument is stopped. Concurrently, the LNCA begins to refill.
Ramp 10.0°C/min to 200.0°C	Allows thermal conditioning of sample.
External Event: 1	Enables Coolant to flow into instrument and stops the LNCA refilling process.
Ramp 10.0°C/min to -100.0°C	Desired test of sample.
Event: 0	Stops the coolant flow to the instrument and begins refilling the LNCA again.
Ramp 10°C/ min to 300°C	Desired test of sample while LNCA is refilling.

At the instant 300°C is reached, the method will terminate. The AC power to the LNCA will be shut off and the LNCA filling process will be terminated, even if the LNCA is not full. To reinstate the filling cycle a method must be run.

Example 3

Filling the LNCA *after* testing is complete. Possible at the end of the day. These segments are only needed at the end of a temperature test that ended at subambient temperature.

METHOD: LNCA Subambient end Fill

Description	Purpose
Data off	Data not needed.
External Event: 0	Initiates autofill sequence. Stops the supply of Coolant to the instrument, and starts the LNCA filling process.
Jump 25°C	Warms up cell.
Isothermal for 30 min.	Drys cell and allows LNCA to refill.

Manually Filling the LNCA

The LNCA is designed so that it can be filled *manually* as well as automatically. The automatic filling procedure has been discussed previously and these instructions explain the two methods of manually filling the LNCA. The manual fill mode should only be used where a bulk storage reservoir cannot be placed close to the LNCA.

Filling With Head Assembly Removed

Follow the directions in this section to fill the LNCA with the head assembly removed, while maintaining power and supply tubing connections with the instrument.

1. Make sure that the bulk storage source that will be used for filling the LNCA is a low pressure (Max. 25 psi) container.

2. Turn off the power switch on the LNCA.

3. Remove the head assembly from the LNCA by turning the removal knob counterclockwise and then sliding the head assembly off the guides. See Figure 3.1 on the next page.

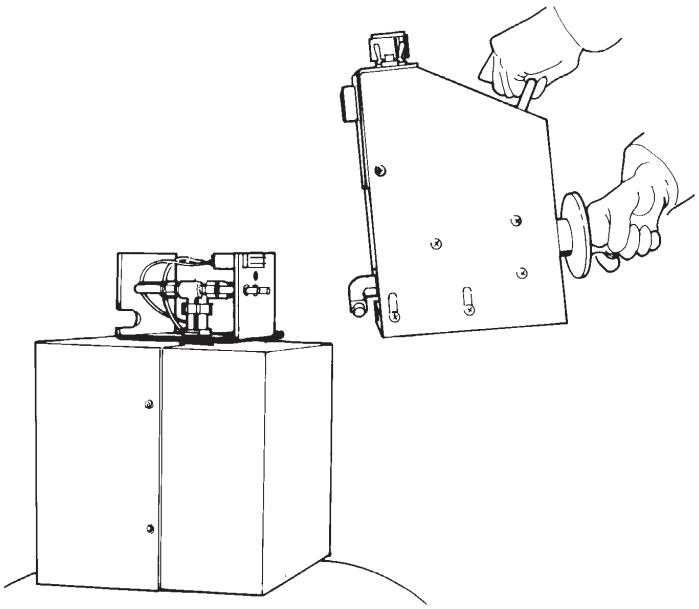


Figure 3.1
Removing the
LNCA Head Assembly

4. Set the head assembly aside in a stable position.

5. Place the two brass caps over the output tubes on the mixing jets. See Figure 3.2 on the next page.

6. The base can now be rolled, if necessary, to the location where the bulk storage source is located.

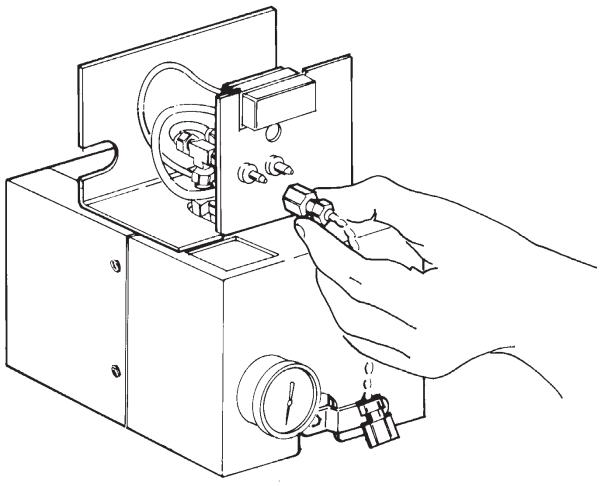


Figure 3.2 Installing the Brass Caps

7. Connect the fill tube to the LNCA bulk storage fill connection.

♦ ***CAUTION:***

Do not use the autofill tube for manually filling the LNCA. Use a coolant feed tube (PN 991078.001) for manually filling the LNCA.

8. Connect the other end of the LNCA coolant feed tube to your liquid nitrogen bulk storage source. Tighten all fittings.

9. Open the Bypass valve on the front of the LNCA base. This will allow the gas to escape from the LNCA allowing it to fill more rapidly.

10. Open the door at the back of the shroud and open the fill inlet valve.

11. Open the valve on the bulk storage source.

NOTE: Cold gas will escape from the LNCA by-pass valve and the vent valve during the filling process. The fill process normally takes 30-40 minutes.

NOTE: Frost will build up on the tubing and parts of the LNCA and storage tank. While the liquid nitrogen is being transferred.

12. Fill the LNCA until spurts of liquid escape from either the vent valve or the bypass valve.

13. Close the valve on the nitrogen bulk storage tank.

14. Allow sufficient time for any liquid remaining in the transfer tube to evaporate.

15. Disconnect the LNCA coolant transfer tube from the LNCA fill inlet valve.

!WARNING **Do not close the LNCA fill inlet valve before removing the coolant transfer tube. Dangerous pressures may build in the coolant transfer tube.**

16. Close the LNCA fill inlet valve and close the door.

17. Close the LNCA Bypass valve, and disconnect the LNCA coolant transfer tube from the nitrogen supply tank.

18. Remove the two brass caps from the output tubes.

19. Replace the control head assembly onto the LNCA tank, and tighten it by turning the REMOVE knob clockwise.

20. Set the power switch on the LNCA to the on position.

Filling Without Removing the Head Assembly

Follow the directions in this section to fill the LNCA with the head assembly in place.

1. Turn off the power to the instrument.

2. Disconnect the LNCA coolant transfer tube from the instrument.

3. Disconnect the LNCA coolant transfer tube from the LNCA coolant output connection.

4. Disconnect the interface cable. See Figure 3.3 on the next page.

5. Make sure that the bulk storage source that will be used for filling the LNCA is a low pressure (Max. 25 psi) container.

6. Roll the base, if necessary, to the location where the bulk storage source is located.

7. Connect the coolant transfer tube to the LNCA bulk storage supply.

NOTE: Adapters, which are not supplied, may be required.

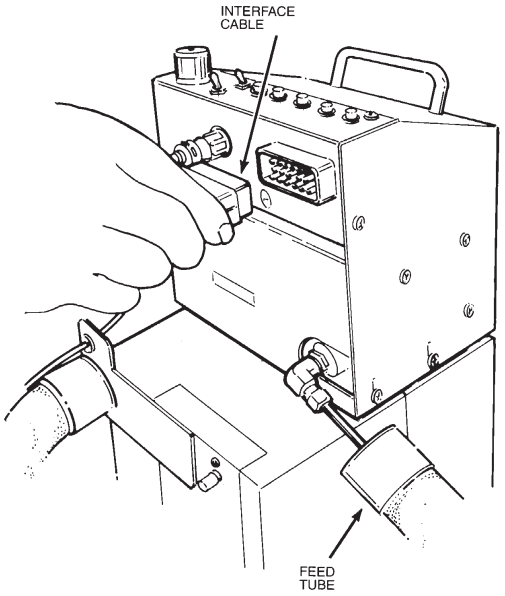


Figure 3.3
Disconnecting the Interface Cable

♦ ***CAUTION:***

Do not use the autofill tube for manually filling the LNCA. Use a coolant supply tube (PN 991078.001) for manually filling the LNCA.

8. Open the Bypass valve on the front of the LNCA base. This will allow the gas to escape from the LNCA allowing it to fill more rapidly.

9. Open the door at the back of the shroud and open the fill inlet valve.

10. Connect the other end of the feed tube to the LNCA bulk storage fill connection.

11. Open the valve on the bulk storage source to begin filling the LNCA.

NOTE: Cold gas will escape from the LNCA by-pass valve and the vent valve during the filling process. The fill process normally takes 30-40 minutes.

12. Fill the LNCA until spurts of liquid escape from either the vent valve or the bypass valve.

13. Close the valve on the nitrogen bulk storage tank.

14. Allow sufficient time for any liquid remaining in the transfer tube to vaporize.

15. Disconnect the LNCA coolant transfer tube from the LNCA bulk storage fill connection.

WARNING **Do not close the LNCA fill inlet valve before removing the coolant transfer tube. Dangerous pressures may build in the coolant transfer tube.**

16. Close the LNCA fill inlet valve and close the door.

17. Close the LNCA Bypass valve, and disconnect the LNCA coolant transfer tube from the nitrogen supply tank.

18. Reposition the LNCA near the analysis module and reconnect the following:

    - Module Control Cable
    - Coolant Supply Tube to both the LNCA coolant output connector and to the analysis module.

Chapter 4: Operating the LNCA

LNCA Operating Instructions

The Liquid Nitrogen Cooling Accessory (LNCA) is a self-contained dewar flask that is connected to the different thermal analyzer instruments by an insulated coolant transfer tube and an electrical interface cable.

This chapter gives you recommendations and procedures that can be used to operate the LNCA in conjunction with your instrument(s). Refer to the section in this chapter appropriate to the instrument that you are using with the LNCA. See Chapter 2 for installation instructions and Chapter 3 for filling instructions.

DMA 983

The LNCA is connected to the DMA 983 by an insulated coolant feed tube and an electrical interface cable. The 983 Control Circuitry monitors the need for coolant and automatically controls the power to the LNCA heaters, to vary the coolant flow as needed to obtain the set temperature. The 983 software bypasses the LNCA rate control dial and heater switch. However the event segment must be used for control.

! WARNING

Read the safety precautions for handling cryogenic materials (located in the prefix of this manual) before installing the LNCA to the DMA 983. Wear goggles or a face shield and gloves large enough to be removed easily whenever you handle liquid nitrogen.

If the LNCA is not connected to the instrument, and has not been filled, refer to Chapter 2 for installing the LNCA and Chapter 3 for filling the LNCA before proceeding.

Manual refilling of the LNCA may be required, if the bulk storage source cannot be located close to the LNCA for auto refilling.

♦ ***CAUTION:***

Do not use the bulk storage autofill tube with the manual refill system.

If you will only be manually refilling the LNCA, and no autofilling will be done, then cable PN 991317.901 can be used. This cable eliminates the need to use the "event" segments to initiate LNCA cooling. This cable is not supplied with

the LNCA, but can be ordered separately if desired. Use the coolant feed tube (PN 991078.001) for filling the LNCA manually.

DMA 983/LNCA Operating Procedure

Follow these steps to use the LNCA with the DMA 983.

1. Connect and fill the LNCA before proceeding.

2. Mount the sample in the clamps and tightly secure the oven and access cover.

3. Make sure the DMA power, DMA heater, and LNCA power switches are switched on.

4. Plug the oven outlet port with a cork stopper, this is very important for efficient cooling. The coolant exits through the port at the rear of the oven.

Example LNCA/DMA Method

This section contains an example method that can be used to cool the DMA 983 experiments.

External Event: 1
Equilibrate Temp: -100°C
Isothermal: 10 minutes
Ramp: 5°C/min to 50°C

(Portion is the Customer's method)

External Event: 0
Motor Drive Off
Jump 0°C
Isothermal 60 min.

(Portion of method to activate LNCA autofill.)

NOTE: You must cool the LNCA coolant transfer tube with a program segment such as initial, isothermal, or equilibrate before running a controlled cooling ramp. Frost collection at the DMA cool inlet is good indicator of a cool LNCA transfer tube.

DSC 2010, 2910, & 2920

Operation of the LNCA with the 2000 series DSC instruments first requires the installation of a heat exchanger as directed in Chapter 2 of this manual.

After the heat exchanger has been installed, fill the LNCA as directed in Chapter 3. To operate the LNCA with the DSC 2010, 2910, or 2920, create a cooling experiment and simply set the software to autofill the LNCA at the end of your experiment.

DEA 2970

Operation of the LNCA with the DEA 2970 first requires the connection of the coolant transfer tube and interface cable as directed in Chapter 2 of this manual.

After the connections have been made, fill the LNCA as directed in Chapter 3. To operate the LNCA with the DEA 2970, create a cooling experiment and simply set the software to autofill the LNCA at the end of your experiment.

Appendix

Parts Ordering Information

Service should only be performed by qualified service personnel. Please contact TA Instruments at one of the offices listed on page A-2 for service or replacement parts. To ensure that you receive the correct part for your unit, be sure to include the part number, description, instrument type, model number, and serial number.

Table A.1
LNCA Parts List

Part No.	Description
991276.001	Block, Delrin Interface, LNCA Auto
991350.901	Board, Main PC, LNCA Auto (A1)
991318.901	Cable, Interconnect, Event
990831.901	Cable, Interconnect, LNCA-2900 Series
991315.901	Cable, Interconnect, LNCA-982
991283.901	Cable, Interconnect, LNCA Auto-983
264197.001	Cover, Switch Seal, 1/4 x 40 thds

(table continued)

Table A.1
(continued)

Part No.	Description
264064.001	Gasket, Neoprene Tank, 3" Dia., LNCA
270172.002	Gauge, Bulk Tank Pressure, 0-60 PSI
270172.001	Gauge, LNCA Tank Pressure, 0-30 PSI
281056.001	Heater Strip, LNCA
991041.901	Jet, Modified Tee, LNCA
991209.901	LNCA Autofill, Complete
991300.001	Manual, Instruction, LNCA Auto
281050.004	O-Ring for Heater Assembly
281050.002	O-Ring for Plug Assembly
991009.901	Plate, Captive
991286.903	Kit, Liquid Sensor - Upgrade
281072.002	Switch, Thermostatic Snap Disc, LNCA

(table continued)

Table A.1 (continued)

Part No.	Description
991075.901	Tank, LNCA Replacement
269961.001	Triac, BTA25-400
991078.001	Tube, Coolant Feed, LNCA
991261.901	Tube, Bulk Feed LNCA Auto
991287.901	Valve, Solenoid, Feed, LNCA Auto (L1)
991285.901	Valve, Solenoid, Fill, LNCA Auto (L3)
991284.901	Valve, Solenoid, Vent, LNCA Auto (L2)

TA Instruments Offices

TA Instruments, Inc.
109 Lukens Drive
New Castle, DE 19720
Telephone: 1-302-427-4000 or 1-302-427-4040
Fax: 1-302-427-4001

HELPLINE—U.S.A.
For technical assistance with current or potential thermal analysis applications, please call the Thermal Analysis Help Desk at 1-302-427-4070.

SERVICE—U.S.A.
For instrument service and repairs, please call 1-302-427-4050.

TA Instruments Ltd.
Europe House, Bilton Centre
Cleeve Road
Leatherhead, Surrey KT22 7UQ
England
Telephone: 44-1372-360363
Fax: 44-1372-360135

TA Instruments GmbH
Max-Planck-Strasse 11
D-63755 Alzenau
Germany
Telephone: 49-6023-9647-0
Fax: 49-6023-9647-77

TA Instruments Belgium
A Division of Waters s.a./n.v.
Raketstraat 60
B-1130 Brussels
Telephone 32-2- 706 00 80
Fax 32-2- 706 00 81

TA Instruments The Netherlands
A Division of Waters Chromatography B.V.
Florijnstraat 19
4879 AH Etten-Leur
Telephone 31-76- 508 72 70
Fax 31-76- 508 72 80

TA Instruments Japan
No. 5 Koike Bldg.
1-3-12 Kitashinagawa
Shinagawa-Ku, Tokyo 140
Japan
Telephone: 813/3450-0981
Fax: 813/3450-1322

TA Instruments France
B.P. 608
78056 Saint-Quentin-Yvelines
Cedex, France
Telephone: 33-1-30-48 94 60
Fax: 33-1-30-48 94 51

TA Instruments Spain
Waters Cromatografía, S.A.
División TA Instruments
Avda. Europa, 21. Pta. Baja
28108 Alcobendas
Madrid, Spain
Telephone: 34-91-661-8448
Fax: 34-91-661-0855

TA Instruments Australia
Unit 3
38-46 South Street
Rydalmere NSW 2116
Autstralia
Telephone: 61-29-9331-705
Fax: 61-29-8981-455

TA Instruments Italy
Division of Waters SpA
via Achille Grandi 27
20090 Vimodrone (MI), Italy
Telephone: 39-02-27421-1
Fax: 39-02-250-1827

Printed in U.S.A.

Index

Symbols

A

B

C

D

F

G

H

I

L

M

O

P

R

S

T

U

V