# Q Series

## Liquid Nitrogen Cooling System

## Getting Started Guide

**Revision I** **Issued April 2014**

## Notice

The material contained in this manual, and in the online help for the software used to support this instrument, is believed adequate for the intended use of the 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. TA Instruments also reserves the right to revise this document and to make changes without notice.

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# Introduction

## Important: TA Instruments Manual Supplement

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## Notes, Cautions, and Warnings

This manual uses NOTES, CAUTIONS, and WARNINGS to emphasize important and critical instructions. In the body of the manual these may be found in the shaded box on the outside of the page.

**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.**

**UNE MISE EN GARDE met l'accent sur une procédure susceptible d'endommager l'équipement ou de causer la perte des données si elle n'est pas correctement suivie.**

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

**Un AVERTISSEMENT indique une procédure qui peut être dangereuse pour l'opérateur ou l'environnement si elle n'est pas correctement suivie.**

## Regulatory Compliance

### For Canada

CAN/CSA-22.2 No. 61010.1-04 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements.

CAN/CSA-22.2 No.61010.2.010-04 Particular requirements for laboratory equipment for the heating of materials.

### For European Economic Area

EN61010-1: 2010 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part I: General requirements.

EN61010-2-010: 2003 Particular requirements for laboratory equipment for the heating of materials.

### For United States

UL61010-1 2004 Electrical Equipment for Laboratory Use; Part 1: General Requirements.

# Electromagnetic Compatibility Standards

## For Australia and New Zealand

AS/NZS CISPR11:2004 Limits and methods of measurement of electronic disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment.

## For Canada

ICES-001 Issue 4 June 2006 Interference-Causing Equipment Standard: Industrial, Scientific, and Medical Radio Frequency Generators.

## For the European Economic Area

EN61326-1: 2006 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General requirements, Table 1 - Basic immunity test requirements, Emission requirements for Group 1, Class A equipment.

## For the United States

CFR Title 47 Telecommunication Chapter I Federal Communications Commission, Part 15 Radio frequency devices (FCC regulation pertaining to radio frequency emissions).

# Safety

## *Instrument Symbols*

The following label is displayed on the LNCS for your protection:

| Symbol | Explanation |
|---|---|
|  | This symbol on the LNCS indicates that you should read this Getting Started Guide for important safety information. This guide contains important warnings and cautions related to the installation, operation, and safety of the LNCS.<br><br>Ce symbole indique que vous devez lire entièrement ce guide de démarrage pour obtenir d'importantes informations relatives à sécurité. Ce guide contient d'importants avertissements et mises en garde relatifs à l'installation, à l'utilisation et à la sécurité du la LNCS. |
|  | This symbol indicates that a hot surface may be present. Take care not to touch this area or allow any material that may melt or burn come in contact with this hot surface.<br><br>Ce symbole indique la présence possible d'une surface chaude. Prenez soin de ne pas toucher cette zone ou de laisser un matériau susceptible de fondre ou de brûler entrer en contact avec cette surface chaude. |

Please heed the warning labels and take the necessary precautions when dealing with these areas. This *Getting Started Guide* contains cautions and warnings that must be followed for your own safety.

**WARNING: The operator of this instrument is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.**

**AVERTISSEMENT: L'utilisateur de cet instrument est prévenu qu'en cas d'utilisation contraire aux indications du manuel, la protection offerte par l'équipement peut être altérée.**

**WARNING: Due to the size and weight of the cooling accessory, the LNCS should always be lifted by two people and only when empty to prevent injury.**

**AVERTISSEMENT: En raison de la taille et du poids de l'accessoire de refroidissement, le LNCS doit toujours être soulevé par deux personnes et à vide uniquement pour éviter des blessures.**

**WARNING: The cooling head assembly contains coated Fiberfrax material. Excessive handling of this material could cause Fiberfrax particles to be emitted into the air. See the MSDS sheet for safety measures to be observed when Fiberfrax is used.**

**AVERTISSEMENT: L'ensemble de la tête de refroidissement contient un revêtement en Fiberfrax. La manipulation excessive de ce revêtement pourrait entraîner l'émission de particules de Fiberfrax dans l'air. Voir la fiche technique santé-sécurité pour les mesures de sécurité à observer en cas d'utilisation du Fiberfrax.**

## *Electrical Safety*

You must unplug the instrument before doing any maintenance or repair work; voltages as high as 120/240 Vac are present in this system.

**WARNING: High voltages are present in this instrument. Maintenance and repair of internal parts must be performed only by TA Instruments or other qualified service personnel.**

**AVERTISSEMENT: Présence de tensions élevées dans cet instrument. La maintenance et la réparation des pièces internes doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié.**

## *Handling Liquid Nitrogen*

The LNCS uses the cryogenic (low-temperature) agent, liquid nitrogen, for cooling. Because of its low temperature [–195°C (–319°F)], liquid nitrogen will burn the skin. When you work with liquid nitrogen, use the following precautions:

**WARNING: Liquid nitrogen boils rapidly when exposed to room temperature. Be certain that areas where liquid nitrogen is used are well ventilated to prevent displacement of oxygen in the air.**

**AVERTISSEMENT: L'azote liquide bout rapidement lorsqu'il est exposé à la température ambiante. Assurez-vous que les zones où l'azote liquide est utilisé sont bien aérées pour éviter le déplacement de l'oxygène dans l'air.**

- Wear goggles or a face shield, gloves large enough to be removed easily, and a rubber apron. For extra protection, wear high-topped, sturdy shoes, and leave your pant legs outside the tops.
- Transfer the liquid slowly to prevent thermal shock to the equipment. Use containers that have satisfactory low temperature properties. Ensure that closed containers have vents to relieve pressure.
- The purity of liquid nitrogen decreases when exposed to air. If the liquid in a container has been open to the atmosphere for a prolonged period, analyze the remaining liquid before using it for any purpose where high oxygen content could be dangerous.

The asphyxiant warning below applies to the use of liquid nitrogen. Oxygen depletion sensors are sometimes used where liquid nitrogen is in use.

**WARNING:**
**Potential Asphyxiant**

Liquid nitrogen can cause rapid suffocation without warning.

Store and use in an area with adequate ventilation.

Do not vent the Liquid Nitrogen Cooling System (LNCS) in confined spaces.

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

**AVERTISSEMENT:**
**Asphyxiant Potentiel**

L'azote liquide peut provoquer un étouffement rapide sans prévenir.

Entreposez-le et utilisez-le dans une zone bien aérée.

N'aérez pas le LNCS dans des espaces confinés.

N'entrez pas dans des espaces confinés où l'azote gazeux peut être présent à moins que la zone soit bien aérée.

## *Thermal Safety*

The cell surfaces can be hot enough to burn the skin during a sample run. If you are conducting a subambient test on the DSC, cold could also cause injury. After running any type of experiment, you must allow the DSC cell to return to room temperature before you touch the inner cell surfaces.

**WARNING: Some surfaces of the LNCS and DSC system may get extremely cold when using the LNCS for cooling experiments. This presents a danger to exposed skin coming in contact with and adhering to the cold surfaces. To prevent moisture buildup in the system, we recommend that you do not remove the DSC lid when the instrument is at subambient temperatures. However, if you do remove the lid or handle any cold surfaces, use forceps or gloves to prevent injury.**

**AVERTISSEMENT: Certaines surfaces du LNCS et du système DSC peuvent devenir extrêmement froides lors de l'utilisation du LNCS pour des expériences de refroidissement. Cela représente un danger pour les peaux exposées qui entrent en contact avec les surfaces froides et y adhèrent. Pour éviter l'accumulation de la moisissure dans le système, nous recommandons de ne pas retirer les couvercles du DSC lorsque l'instrument est à basse température. Cependant, si vous retirez le couvercle ou manipulez des surfaces froides, utilisez des pinces ou des gants pour éviter des blessures.**

## *Water Condensation*

**WARNING: Some of the DSC and LNCS surfaces get cold during use of the LNCS. The cold surfaces can cause condensation and, in some cases, frost can build up. This condensation may drip to the floor. Make provisions to ensure the floor dry stays dry. A slipping hazard may result if the condensation is not cleaned up.**

**AVERTISSEMENT: Certaines surfaces du DCS et du LNCS deviennent froides pendant l'utilisation du LNCS. Certaines surfaces froides peuvent provoquer la condensation et dans certains cas, le givre peut s'accumuler. Cette condensation peut s'écouler et toucher le sol. Prenez des dispositions pour vous assurer que le sol reste sec. Si la condensation n'est pas nettoyée, il peut en résulter un risque de dérapage.**

## *Temperature Range*

**CAUTION: Do not exceed 100°C with the LNCS cooling head installed and the LNCS not being enabled. Serious damage to the cooling head could occur.**

**MISE EN GARDE: Ne dépassez pas 100°C lorsque la tête de refroidissement du LNCS est installée et le LNCS n'est pas activé. Cela pourrait provoquer de graves dégâts à la tête de refroidissement.**

**CAUTION: We recommend that you do not use the LNCS when running isothermal experiments above 400°C. The life of the DSC cell heating element can be shortened if the LNCS is used at high temperatures for extended periods.**

**MISE EN GARDE: Nous recommandons de ne pas utiliser le LNCS lorsque vous effectuez des expériences isothermes supérieures à 400°C. La durée de vie de l'élément chauffant de la cellule DSC peut être réduite si le LNCS est utilisé à des températures élevées sur de longues périodes.**

# Table of Contents

# *Chapter 1:*

# Introducing the LNCS

## *Overview*

The LNCS (Liquid Nitrogen Cooling System) is a cooling accessory for use with TA Instruments Analyzers. It can be used with the Differential Scanning Calorimeter (DSC) models Q100 and Q1000.

The Liquid Nitrogen Cooling System (LNCS) allows automatic and continuous temperature control within the range of –180°C to 550°C. The LNCS tank is pressurized to deliver the liquid nitrogen to the heat exchanger, which in turn cools the cell.

The LNCS (shown here) can be autofilled in your laboratory using the DSC touch screen or through the instrument control software. This requires a low pressure 170 kPa gauge maximum (25 psig) bulk storage tank to be located within 1.8 m (6 feet) of the LNCS. See Chapter 3 for information on filling.

**Figure 1** LNCS.

# *Components*

The LNCS is made up of a 50-liter dewar, liquid delivery tower, an electronics control box, and a cooling head that is connected to the control box by a 1.8-meter (6-foot) long feed/exhaust hose. See the figure below.

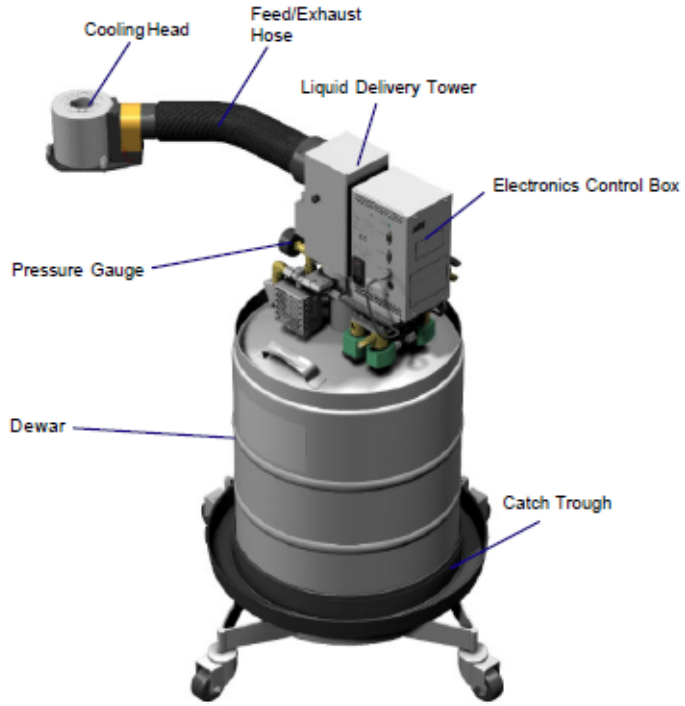


**Figure 2** Major components of the LNCS.

The dewar can be pressurized either internally or externally. Internal pressurization limits the capabilities (primarily temperature responsiveness) of the cooler as the liquid level decreases. It also consumes more liquid nitrogen, therefore reducing the available usage time of the dewar.

External pressurization is preferred for optimal performance and is accomplished with a nitrogen gas source at the users facility regulated to between 55 and 70 kPa gauge (8 and 10 psig). A three-way valve on the LNCS controls the operating mode.

There are five plumbing fittings that you can access for normal operation:

- The first two are for connection of the cooling head and feed/exhaust hose. They are located at the top of the liquid delivery tower. One fitting (0.25-inch tube) is for the LN2 supply to the heat exchanger (in the cooling head) and the other fitting (3/8-inch tube) is for the exhaust gas from the heat exchanger. For instructions on attaching these lines, see Chapter 2.
- There are two fittings for connection to a bulk LN2 source for filling purposes, one which is controlled by a solenoid valve and the other for manual filling. For instructions on the use of this port see Chapter 3.
- The last fitting is the attachment point for the external dewar pressurization line, an 55 to 70 kPa gauge (8 to 10 psig) nitrogen source, which is used to control the operating pressure of the dewar to deliver nitrogen to the heat exchanger. Use of this port is optional as self-pressurization is available.

# *Instrument Specifications*

The table found below contains the technical specifications for the LNCS.

**Table 1: LNCS Technical Specifications**

| Item/Area | Specification |
|---|---|
| Instrument compatibility | DSC models Q100 and Q1000. |
| LNCS liquid nitrogen capacity | 50 L |
| Size<br>Height<br>Diameter | <br>115 cm (45 in)<br>48 cm (19 in) |
| Weight | 51 kg (113 lbs) empty<br>87 kg (193 lbs) full |
| Power requirements | 100–240 Vac; 47–63 Hz, 180 VA |
| Cooling capacity | –180°C |
| Pressure relief | 90 kPa gauge (13 psig) for Dewar<br>345 kPa gauge (50 psig) for fill line |
| Pressure gauge | 0 to 210 kPa gauge (0 to 30 psig) |
| Liquid nitrogen feed hose | 1.8 m (6 ft) insulated from LNCS to heat exchanger |
| Liquid nitrogen fill hose | 1.8 m (6 ft) insulated from LNCS to bulk storage. Supplied with union and adapter for bulk storage connection. |
| Bulk storage tank | Use low pressure bulk supply tank only. Recommended source pressure is 140 to 170 kPa gauge (20 to 25 psig) |
| Operating environment conditions | Temperature: 15–35°C<br>5% to 80% RH from 15°C to 31°C, decreasing to 66% RH at 35°C (non-condensing)<br>Installation Category II<br>Pollution Degree 2<br>Maximum Altitude: 2000 m (6560 ft) |

**CAUTION: We recommend that you do not use the LNCS when running isothermal experiments above 400°C. The life of the DSC cell heating element can be shortened if the LNCS is used at high temperatures for extended periods.**

**MISE EN GARDE: Nous recommandons de ne pas utiliser le LNCS lorsque vous effectuez des expériences isothermes supérieures à 400°C. La durée de vie de l'élément chauffant de la cellule DSC peut être réduite si le LNCS est utilisé à des températures élevées sur de longues périodes.**

# *Chapter 2:*

# Installing the LNCS

## *Unpacking and Inspecting the System*

Inspect the contents of the LNCS shipping box. You should retain the shipping container and packing materials at least until the unit has been successfully installed and verified to be functioning correctly, and you may wish to retain them in case you want to repack and ship your LNCS.

If the LNCS 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 accessory until an authorized representative of TA Instruments has repaired it.

Contact your TA Instruments representative if parts are missing.

# *Before Installing the LNCS*

Installation of the LNCS is generally the same for all types of DSC instruments.

**WARNING: Read the safety precautions for handling cryogenic materials (located in the safety section of this manual) before filling the LNCS. Whenever you handle liquid nitrogen, wear goggles or a face shield and gloves large enough to be removed easily.**

**AVERTISSEMENT: Lisez les précautions de sécurité à prendre lors de la manipulation des matières cryogéniques (disponibles dans le section sécurité du présent manuel) avant de remplir le LNCS. Portez des lunettes de protection ou un écran facial et des gants assez grands pour être retirés facilement chaque fois que vous manipulez de l'azote liquide.**

**WARNING: Unplug the power cord before beginning any service or repair work.**

**AVERTISSEMENT: Débranchez le cordon d'alimentation avant de commencer des travaux d'entretien ou de réparation.**

## Choosing a Location

Because of the sensitivity of experiments using the LNCS, it is important to choose a location using the following guidelines. Refer to the *DSC Q Series Getting Started Guide* for more detailed information. Your LNCS should be:

### *In*

- A temperature-controlled area.
- A clean environment.
- An area with ample working and ventilation space. Refer to the technical specifications in Chapter 1 for the accessory's dimensions.

### *Near*

- A power outlet (100–240 Vac, 50 or 60 Hz).
- Your TA Instruments thermal analysis controller computer and DSC.

### *Away from*

- Dusty environments.
- Exposure to direct sunlight.
- Direct air drafts (fans, room air ducts).
- Poorly ventilated areas.

## Installing the Catch Trough

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

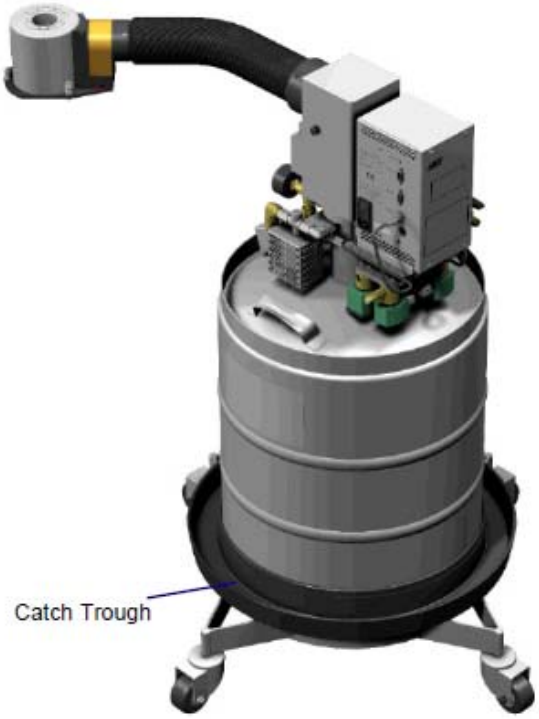


**Figure 3** LNCS catch trough.

The catch trough is installed as follows:

**1** Using a 5/8-inch wrench on the brass fitting, screw the plastic valve into the fitting until it is hand tight with the handle facing out.

**2** Slip the catch trough down over the tank. Move the catch trough down as low as possible on the tank as shown in the figure to the right.

**3** Place the stainless steel band clamp over the inside edge of the trough using the molded lip as an alignment guide. Tighten the clamp with a screwdriver to seal the trough to the tank. Do not over tighten the clamp.

**4** The trough can be emptied 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.

# *Installing the LNCS*

Installation of the LNCS with either the DSC Q2000/Q1000 or Q200/Q100 is exactly the same. This section provides a set of instructions that you can use to install the LNCS on either DSC instrument.

**CAUTION: If your liquid nitrogen source has more than 170 kPa gauge (25 psig), then a pressure regulator must be added to ensure that no more than 25 psig is delivered to the LNCS transfer line. 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.**

**MISE EN GARDE: Si la source de votre azote liquide a une pression manométrique supérieure à 170 kPa (25 psig), alors vous devez ajouter un régulateur de pression pour vous assurer que la pression manométrique fournie au GCA [conduite de transfert LNCS] ne dépasse pas 170 kPa (25 psig). Le non respect de cette limitation de pression peut endommager l'électrovanne de remplissage, prolonger à l'excès la durée de remplissage et provoquer l'activation de la soupape de détente de pression.**

## Installing the Cooling Head

Follow the instructions below to install the cooling head on the DSC:

1. Remove the DSC lid(s). Select the **Control/Lid/Open** function on the instrument control software to raise the AutoLid from the cell and cause it to move out of the way, or manually remove the Q20/Q10 lids.
2. Pull the plug on the side of the unit cover out to remove it. Then remove the screws attaching the cell cover to the unit cover (see the figure below). Three screws are located on the side (Q2000/Q1000) and one is located on the top. Retain the screws.

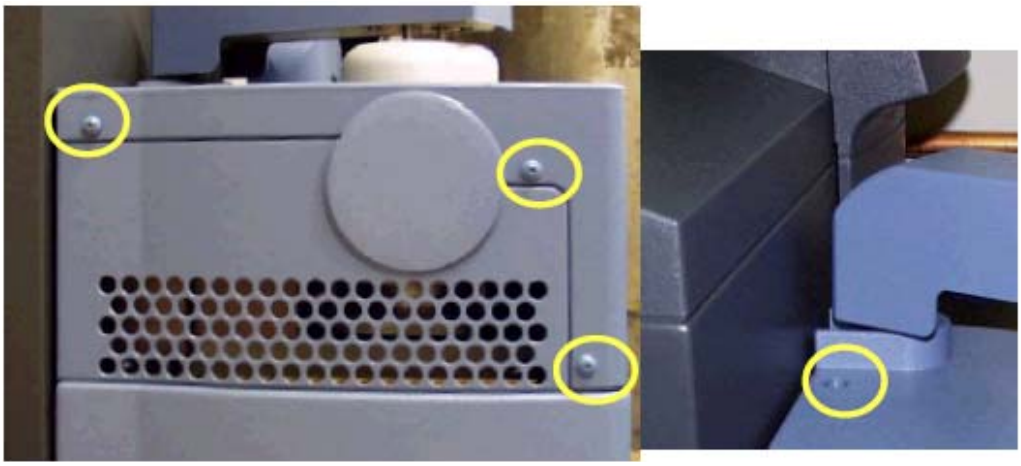

**Figure 4** LNCS screws to remove.

3 If your instrument has an Autosampler installed, lift up the cover to release the tabs and pull the cover towards you to remove it fully (shown in the figure below).

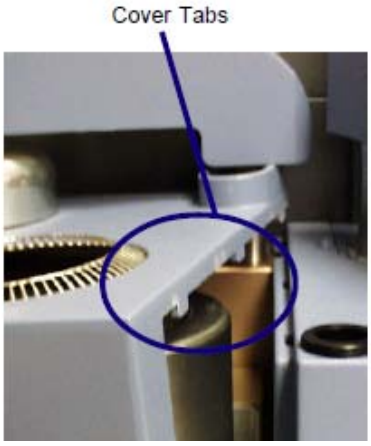


**Figure 5** LNCS Autosampler cover tabs.

If you do not have an Autosampler, you will have to remove additional screws to release the cover. Then pull the cover towards you to remove it fully. The cell will be exposed.

4 If the heat exchanger hose is already attached to the LNCS dewar, you will need to loosen the supply and exhaust fittings before mounting the cooling head on the DSC cell. Refer to the next section for guidance, if needed. This allows the hose to rotate freely when positioning the cooling head in the steps to follow.

5 Align the pin on the cell base (shown here) with the corresponding slot in the LNCS Cooling Head base. Carefully lower the head over the cell and make sure it is fully seated.

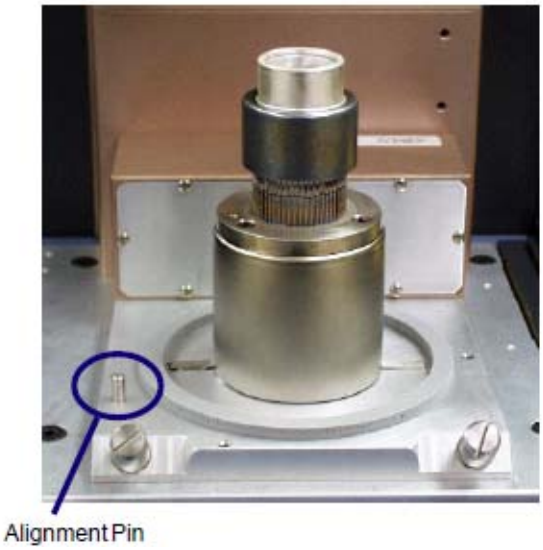


**Figure 6** Cell base alignment pin.

6 Obtain a long 3/32-inch hexagonal (Allen) wrench from the accessory kit.

7 Insert the tip of the wrench into any one of the three captive screws in the LNCS plate while holding

onto the cooling head. (See the figure below.) DO NOT fully tighten the screws yet.

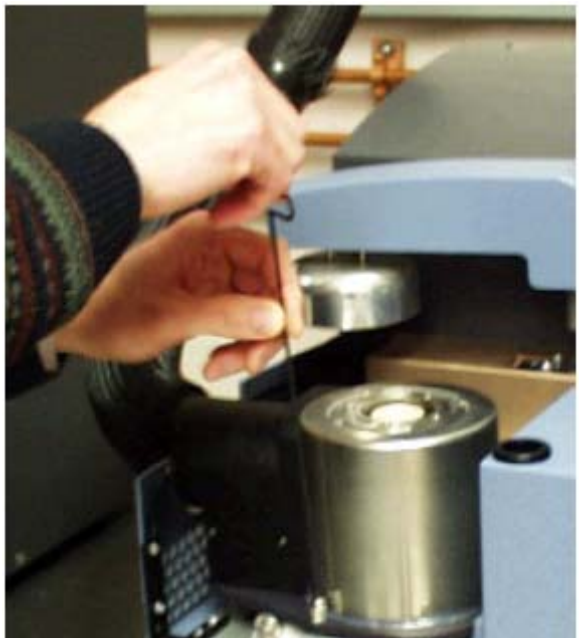

**Figure 7** Installing the cooling head.

**8** Repeat step 7 for the two remaining captive screws. After you have started each screw, go back and tighten down all three screws until you feel the shoulders touch the bottom. Do not over tighten.

**9** Slide the cover back over the cell and replace the screws removed originally.

**10** Obtain access to the back of the LNCS and the back of the instrument.

**11** Locate the interconnect cable. Plug one end of the cable into the 15-pin D instrument connector on the LNCS. Plug the opposite end of the cable into the port labeled COM2 on the back of the DSC instrument (see the figure below).

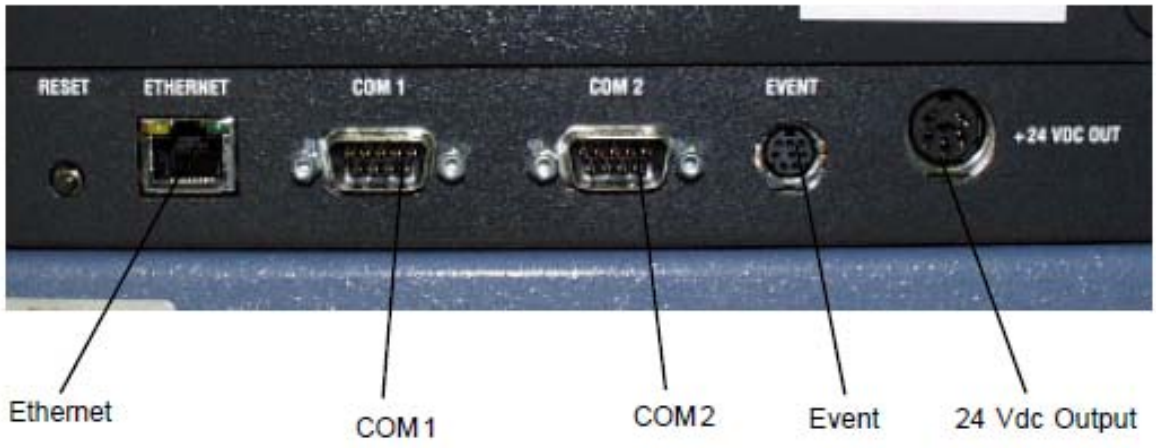


**Figure 8** DSC back panel.

**12** Make sure that the large hose is not sharply bent or folded. It should curve gently between the instrument and the LNCS.

**13** If you loosened the supply and exhaust fittings in step 4 to allow the hose to rotate freely, retighten those fittings now.

**14** Check the AutoLid alignment and adjust, if needed. See the DSC Q Series Getting Started Guide, Chapter 3 “Aligning the AutoLid” for the procedure.

**15** Follow the instructions on the next page to connect the cell base purge and the cooling gas (LNCS purge) line.

## Connecting the Base and LNCS Purge Lines

Two other purges are required in addition to the standard DSC cell purge when the Liquid Nitrogen Cooling System (LNCS) is used. One purge, the Base Purge, is used to continuously purge the base of the cell. The other purge, the LNCS Purge, is used to automatically purge the interior of the LNCS cooling head when the cell is open during loading/unloading samples under Autosampler control, and during cell conditioning. Follow the instructions below to connect the lines for those purges.

**1** Locate the Base Purge port. It is one of the four ports on the right rear of the instrument as shown in the figure below.

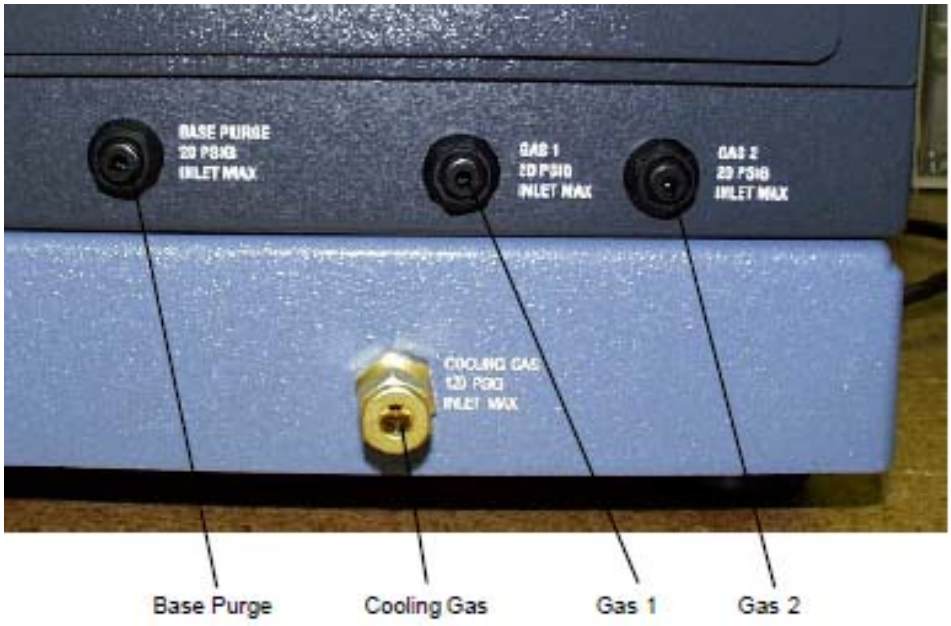


**Figure 9** DSC back panel.

**2** Make sure that the pressure of your gas source is regulated to 140 kPa gauge (20 psig). Dry nitrogen is the recommended gas.

**3** Use 1/8-inch O.D. tubing to connect the gas source to the Base Purge. Teflon® TFE tubing is recommended. An orifice in the instrument will automatically regulate the flow rate (300 to 350 mL/min) for proper operation.

**4** Locate the Cooling Gas port on the right rear of the instruments (as shown in the figure above). The LNCS Purge will be connected to that port.

**5** Make sure that the pressure of your gas source for the LNCS Purge is also regulated to 140 kPa gauge (20 psig). Dry nitrogen should be used.

**NOTE**: Since both the Base Purge and LNCS Purge will be exposed to temperatures below ambient, the gases used should be moisture-free. Nitrogen gas of 99.999% purity is recommended.

**6** Use 1/4-inch O.D. tubing to connect the gas source to the Cooling Gas port on the back of the DSC instrument for the LNCS Purge. Teflon® TFE tubing is recommended. A solenoid valve, automatically regulated by the Advantage Q Series™ software, determines when the LNCS Purge is on. An orifice in the instrument automatically regulates the flow rate to (300 to 350 mL/min) for proper operation.

## Connecting the LNCS Lines

After you have mounted the cooling head (also called the heat exchanger) on the DSC cell, follow these instructions to connect the supply and exhaust lines:

**1** Loosen the captive screws on either side of the top cover of the liquid delivery tower. Pull the cover straight up to remove it.

**2** Obtain the 1.8-m (6-foot) long feed hose with its attached cooling head. At the opposite end from the cooling head are two lines that need to be connected to the LNCS liquid delivery tower. The figure here identifies the two lines that will be attached.

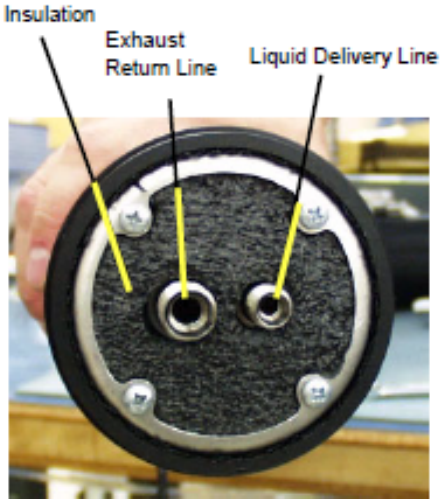


**Figure 10** Liquid delivery and exhaust return lines.

**3** Using a 9/16-inch wrench attach the smaller liquid supply line to the smaller fitting as shown in the figure below.

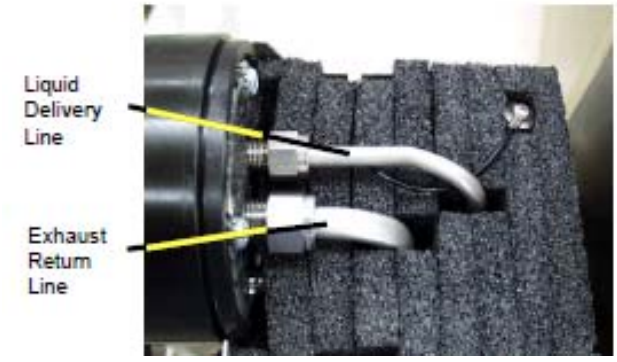


**Figure 11** Connecting the lines.

**4** Using an 11/16-inch wrench attach the larger exhaust return line to the remaining fitting as shown in the figure above.

**5** Replace the top cover over the liquid delivery tower.

**6** Screw in the captive screws on the sides of the cover until they bottom out (finger tight).

**7** Connect the 8-pin DIN cooling head connector to the port on the back of the LNCS electronics control box. See the figure below for the location of the connectors.

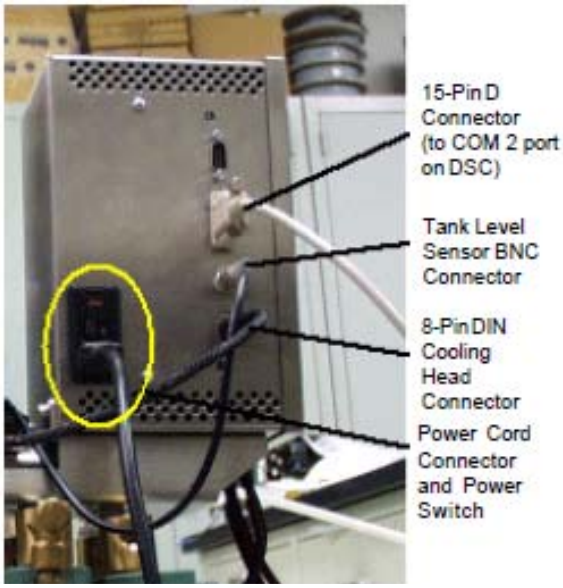


**Figure 12** LNCS electrical connections.

**8** Connect the tank level BNC connector from the liquid delivery tower to the electronic control box, if it is not already in place.

**9** Connect the 15-pin D connector cable to the instrument port on the LNCS electronic control box. The opposite end will go to the COM 2 port on the back of the DSC.

**NOTE**: A <HAR>-marked (harmonized) power cable meeting the standards of the country of installation is required for the European Economic Area.

**10** Plug the power cord into the electronic control box and into the power outlet.

**11** Toggle the power switch on the back of the LNCS electronics control box to ON.

**12** Connect the house nitrogen gas to the nitrogen gas supply hookup, as shown in the figure below, if the LNCS is to be pressurized externally.

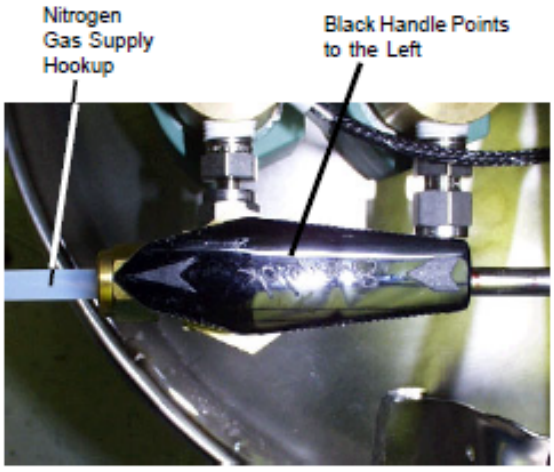


**Figure 13** Setup for external pressurization.

**13** Turn the black handle to the left (towards the nitrogen gas supply hookup) for external dewar pressurization. (See the figure above.) The supply line, a 50 to 70 kPa gauge (8 to 10 psig) nitrogen source, is used to control the operating pressure of the dewar to force LN2 into the heat exchanger.

**WARNING: Do not use compressed air to pressurize the LNCS. Large amounts of liquid oxygen could accumulate in the dewar, creating a safety hazard.**

**AVERTISSEMENT: N'utilisez pas l'air comprimé pour pressuriser le LNCS. De grandes quantités d'oxygène liquide pourraient s'accumuler dans le dewar, créant ainsi un risque pour la sécurité.**

**14** If you want to use internal dewar pressurization, turn the black knob to the right, as shown in the figure below. No supply line needs to be connected.


**Figure 14** Setup for internal pressurization.

You are now ready to fill the Liquid Nitrogen Cooling System. Follow the instructions in the next chapter.

# *Chapter 3:*

# Operating and Maintaining the LNCS

The LNCS must be filled from a bulk storage tank of liquid nitrogen. There are two methods that can be used to fill the LNCS:

- *Autofilling* refers to the automatic filling of the LNCS from any source. Local autofilling is the most convenient method of filling the tank. Autofill uses a function controlled from the DSC instrument control software. You can also perform an autofill sequence at a remote location, if power is available to run the unit.
- *Manual filling* is the method that must be used if no power is available to allow autofilling. Manual filling is normally done at some remote location where electricity is not accessible.

This chapter discusses the different methods used to fill the LNCS, along with information on conditioning, using, and maintaining the LNCS.

# *Connecting and Autofilling the LNCS*

To use the local filling capability you will first need to connect the cooling accessory to a bulk source of liquid nitrogen as directed below, then fill the dewar. After the initial filling, you can set up the software to have the LNCS autofilled after experiments.

**1** Arrange the low pressure bulk storage source physically close enough, within 1.8 m (6 ft), to the LNCS so that the autofill transfer tube can be easily connected between the source and the LNCS. Likewise the LNCS and the instrument need to be in close proximity to allow connection of the 1.8-m (6-ft) transfer hose.

**2** Connect the LNCS for automatic filling as follows:

**a** Attach the transfer tube to the LNCS Autofill fitting (shown in the figure below)..

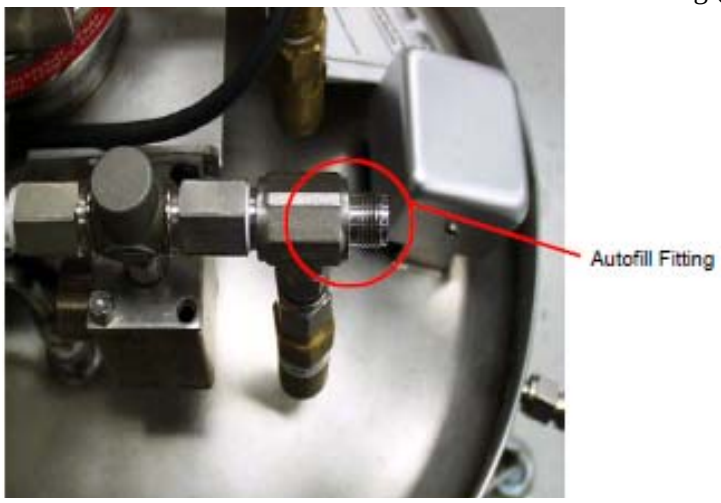


**Figure 15** LNCS autofill fitting.

**b** Attach the other end of the transfer tube to the bulk storage container using the union and adapter fitting (provided in the accessory kit).

**3** Install the cooling head on the DSC as directed in Chapter 2, if it is not already installed. The cooling head must be in place on the cell and the cell must be operational before filling the LNCS.

**4** Turn on the power to the LNCS and the instrument.

**5** Fill the dewar with liquid nitrogen before beginning an experiment following the directions in the next section.

## Initial Autofilling

The LNCS must be filled before cooling experiments can be performed on DSC Q Series instruments. Follow the instructions in this section to fill the LNCS.

Using the Thermal Advantage Q Series Explorer, connect to the desired instrument. Select **Control/ LNCS/Fill** from the instrument control main menu. The LNCS will be filled automatically.

The autofill will shut off when the dewar is full, the bulk storage tank is empty, or the LNCS tank pressure is below 1 psig for more than 1 minute. Once the dewar has been filled initially, you can set up programmed autofilling as directed in the next section.

## Programmed Autofilling

“Autofilling” also refers to the automatic refilling of the LNCS from the bulk storage tank between runs. This section tells you how to set up the LNCS and the connected instrument to allow autofilling.

The Q Series instruments automatically control the LNCS, which regulates pressure, supplying liquid nitrogen to the cooling head.

To automatically refill the LNCS with liquid nitrogen after an experiment on a Q Series instrument is completed, access the **Tools/Instrument Preferences/DSC Page**, select **LNCS Autofill if below**, then enter the desired percent.

**NOTE**: The LNCS is normally filled from a bulk tank located near the unit. If you need to fill your LNCS dewar with liquid nitrogen from a remote source (i.e., source not located near your unit), follow the directions beginning on the next page.

# *Remote Filling of the LNCS*

**WARNING: When performing the remote fill procedure described on page 30, always ensure that the manual cap fittings are securely in place on the supply and return lines BEFORE filling the LNCS. If the supply and return lines are not capped, they will discharge liquid nitrogen during remote filling.**

**AVERTISSEMENT: Lorsque vous effectuez la procédure de remplissage à distance décrite en page 31, assurez-vous toujours que les raccords manuels de capuchon sont solidement installés sur les conduites d'alimentation et de retour AVANT de remplir le LNCS. Si les conduites d'alimentation et de retour ne sont pas fermées, elles vont libérer de l'azote liquide pendant le remplissage à distance.**

In addition to autofill, there is the ability to perform a remote fill sequence at a remote location (away from the controller and instrument), if power is available to run the unit. Pressing and holding the **Fill** button on the side of the electronics control enclosure for 3 seconds or longer initiates an autofill. This same button will reset the LNCS if pressed for less than three seconds.

**NOTE**: Power must be available at the remote filling location for remote fill to function.

These sections describe both the automatic and manual remote filling methods.

## Remote Autofill

Follow the directions in this section to fill the LNCS automatically at a remote location:

**1** Turn off the power to the LNCS.

**2** Loosen the captive screws on either side of the top cover for the liquid delivery tower. Pull the cover straight up to remove it as shown in the figure below.

**Figure 16** Removing cover from liquid delivery tower.

**3** Using a 9/16-inch wrench, remove the smaller liquid delivery line from its fitting as shown in the figure below..

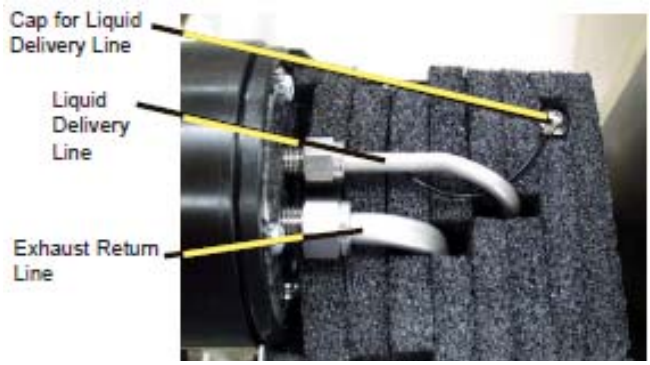


**Figure 17** Removing cover from liquid delivery tower.

**4** Using an 11/16-inch wrench, remove the larger exhaust return line from the remaining fitting as shown in the figure immediately above.

**5** Pull the feed hose off the liquid delivery tower. Located in the top of the tower is the cap for the liquid delivery line (shown in the figure above). Remove the cap with its attached wire from the tower insulation.

**6** Screw the cap onto the liquid delivery line. See the figure below.

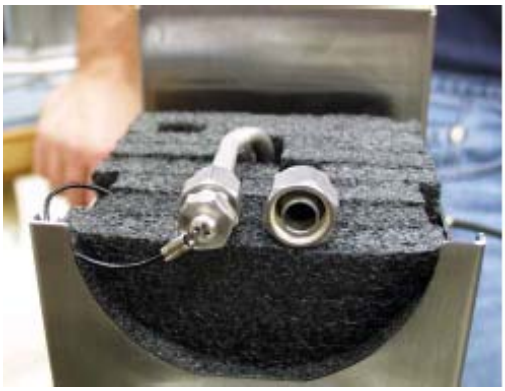

**Figure 18** Cap on liquid delivery line.

**WARNING: When performing the remote fill procedure, always ensure that the manual cap fittings are securely in place on the supply and return lines BEFORE filling the LNCS. If the supply and return lines are not capped, they will discharge liquid nitrogen during remote filling.**

**AVERTISSEMENT: Lorsque vous effectuez la procédure de remplissage à distance, assurez-vous toujours que les raccords manuels de capuchon sont solidement installés sur les conduites d'alimentation et de retour AVANT de remplir le LNCS. Si les conduites d'alimentation et de retour ne sont pas fermées, elles vont libérer de l'azote liquide pendant le remplissage à distance.**

**7** Disconnect the house nitrogen gas supply tube, if connected.

**8** Disconnect the 15-pin D connector cable at the LNCS. Disconnect the 8-pin DIN cooling head connector from the electronic control box.

9 Unplug the power cord, but leave it attached to the LNCS.

10 Roll the LNCS to the location of the bulk storage source and plug the power cord into the closest power outlet.Turn the power switch ON.

11 Make sure that the bulk storage source that will be used for filling the LNCS is a low pressure (maximum 25 psi) container.

12 Connect the transfer hose from the bulk source to the autofill fitting shown in the figure below.


**Figure 19** LNCS autofill fitting.

13 Open the valve on the bulk storage source.

14 Press and hold the **Fill** button (shown in the figure below) on the LNCS control box for 3 seconds to initiate the autofill. The filling will stop automatically when the dewar is full.


**Figure 20** LNCS fill button.

**NOTE**: Cold gas will escape from the LNCS vent during the filling process. The fill process normally takes 15 to 40 minutes depending on the liquid level.

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

15 After the autofill has completed, allow sufficient time for any liquid remaining in the transfer tube to vaporize.

**16** Close the valve on the nitrogen bulk storage tank and immediately disconnect the transfer tube from the bulk source.

**17** Disconnect the transfer hose from the LNCS autofill valve, turn off the power switch, and unplug the power cord.

**18** Return the LNCS to its location near the analysis instrument, and reconnect the cooling accessory by reversing steps 1 to 9.

## Remote Manual Fill

Follow the directions in this section to fill the LNCS manually at a remote location:

**1** Turn off the power to the LNCS.

**2** Loosen the captive screws on either side of the top cover for the liquid delivery tower. Pull the cover straight up to remove it as shown in the figure below..

**Figure 21** Removing cover from liquid delivery tower.

**3** Using a 9/16-inch wrench, remove the smaller liquid delivery line from its fitting as shown in the figure below..

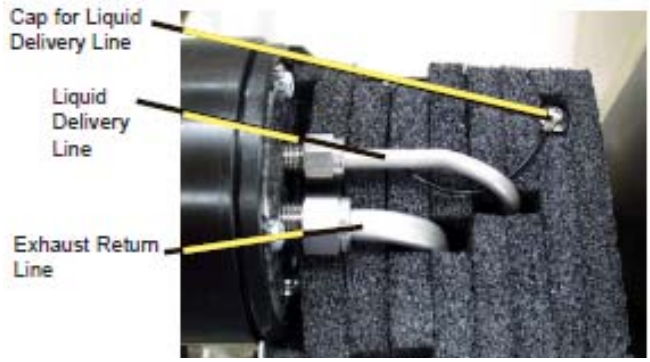


**Figure 22** Removing cover from liquid delivery tower.

**4** Using an 11/16-inch wrench, remove the larger exhaust return line from the remaining fitting as shown in the figure above.

**5** Pull the feed hose off the liquid delivery tower.

**6** Locate the cap for the liquid delivery line (shown in the figure above) in the top of the tower. Remove the cap with its attached wire from the tower insulation.

**7** Screw the cap onto the liquid delivery line. See the figure below.

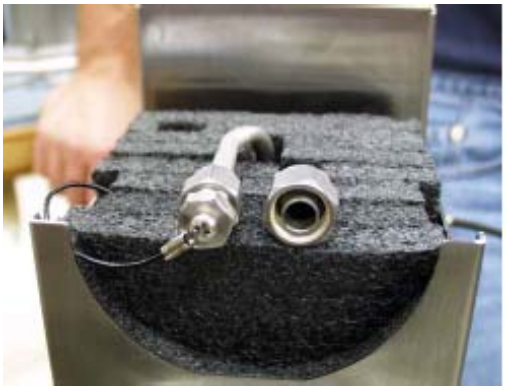

**Figure 23** Cap on liquid delivery line.

**WARNING: When performing the remote fill procedure, always ensure that the manual cap fittings are securely in place on the supply and return lines BEFORE filling the LNCS. If the supply and return lines are not capped, they will discharge liquid nitrogen during remote filling.**

**AVERTISSEMENT: Lorsque vous effectuez la procédure de remplissage à distance, assurez-vous toujours que les raccords manuels de capuchon sont solidement installés sur les conduites d'alimentation et de retour AVANT de remplir le LNCS. Si les conduites d'alimentation et de retour ne sont pas fermées, elles vont libérer de l'azote liquide pendant le remplissage à distance.**

**8** Disconnect the house nitrogen gas supply tube, if connected.

**9** Disconnect the 15-pin D connector cable at the LNCS. Disconnect the 8-pin DIN cooling head connector from the electronic control box.

**10** Unplug and disconnect the power cord from the LNCS.

**11** Roll the LNCS to the location of the bulk storage source.

**12** Make sure that the bulk storage source that will be used for filling the LNCS is a low pressure (maximum 25 psi) container.

**13** Using a 11/16-inch wrench, remove the cap from the manual fill fitting (shown in the figure below).Connect the transfer hose from the bulk source to the manual fill fitting.

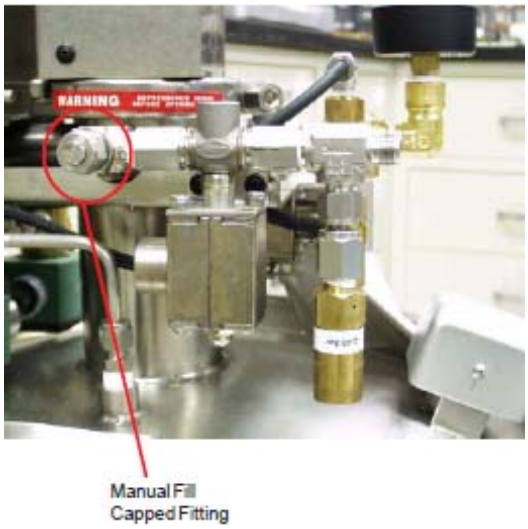


**Figure 24** Manual fill fitting.

**14** Place the dewar on a scale, if one is available, so that you can monitor the weight to determine when the dewar is full.

**15** Open the valve on the bulk storage source and leave it open until the dewar reaches a filled weight of 87 kg (193 lbs)..

**WARNING: If liquid begins to spill from the vent during filling, stop the filling process immediately by closing the valve on the bulk source. This must be done quickly to prevent freeze damage to the unit.**

**AVERTISSEMENT: Si du liquide commence à se déverser de l'aération pendant le remplissage, arrêtez immédiatement le processus de remplissage en fermant la vanne de la source de vrac. Faites-le rapidement pour empêcher que le gel endommage l'appareil.**

**NOTE**: Cold gas will escape from the LNCS vent during the filling process. The fill process normally takes 15 to 40 minutes depending on the liquid level.

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

**16** Close the valve on the nitrogen bulk storage tank.

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

**18** Disconnect transfer hose from the manual fill valve and replace the cap using the wrench to tighten snugly (do not over tighten).

**19** Return the LNCS to its location near the analysis instrument, and reconnect the cooling accessory by reversing steps 1 to 10.

# *Starting the LNCS*

Once the LNCS has been properly installed, follow the steps below to set up the instrument parameters and condition the LNCS-DSC system for optimum performance.

**1** Verify the correct cooler type (e.g., LNCS) on the **Tools/Instrument Preferences/DSC** Page of the DSC instrument control software.

**2** Verify that a source of dry nitrogen is connected to the base purge and cooling gas (LNCS) purge. Select the gas to be used with the Gas 1 port on the back of the DSC instrument (see NOTE below).

**NOTE**: Dry nitrogen is used for the base purge and LNCS purge. But, if the starting temperature is below ambient, helium should be used for Gas 1 (cell purge). If the starting temperature is above ambient, nitrogen may be used.

**3** Dry the LNCS system before turning on the LNCS by following Step 1 of the conditioning procedure found in the next section.

**4** Verify that the post-test conditions (accessed through the **Procedure Page** by clicking the **Post Test** button) are set as desired. A temperature window above ambient should be used to prevent the cell from cooling down between experiments (e.g., typical values are 35 to 50 °C). Once these conditions are verified, select **Go to Standby Temp** from the Control menu to invoke the standby temperature set on the **Tools/Instrument Preferences/DSC** Page.

**NOTE**: The DSC cell should be covered when not loading samples and should not be opened below ambient temperatures.

**5** Proceed to Step 2 of the conditioning procedure found in the next section to further stabilize the DSC-LNCS system after installation. This cyclic experiment allows the DSC-LNCS system to stabilize resulting in optimized baseline and calibration.

**6** Recalibrate the DSC after conditioning the system.

**NOTE**: When setting up experiments, be sure to verify the post-test conditions. A temperature window above ambient should be used to prevent the cell from cooling below ambient between experiments.

# *Conditioning the LNCS System*

Each time the LNCS heat exchanger is installed on the DSC, the following conditioning procedure should be run before calibration and experiments are performed. The first step of conditioning is used when the system is first installed and periodically thereafter to dry the system to remove moisture in the DSC cell and heat exchanger BEFORE turning on the LNCS. The second step is used to stabilize the DSC–LNCS system by cycling the system to optimize baseline performance.

## Step 1: Drying the System

Follow the instructions below:

**1** Verify that the DSC cell is empty and cover the cell. If an AutoLid mechanism is present, verify that the lids are seated properly. (Refer to "Aligning the AutoLid" in the *DSC Q Series Getting Started Guide* or in the online help for instructions to align the lid, if needed.)

**2** Access the **Tools/Instrument Preferences/DSC** Page of the DSC instrument control software. Verify that the correct cooler type (LNCS) is selected, check **Leave LNCS on**, and verify the desired **Standby Temperature**.

**3** Using the DSC instrument control software, access the **Experimental View Summary Page**. Select the **Standard** mode, then select the **Cell/Cooler Conditioning** test template from the list.  his test is performed with the LNCS off.

**4** Click the **Procedure Page**.

**5** Verify the default conditions of 120 minutes at 75 °C and select **Apply**. These conditions are suitable for typical situations.

**6** Access the **Post Test Parameters** window and enter a temperature range window of 35 to 50 °C to return the cell to slightly above ambient. Once the LNCS is operating, it is very important that the cell is always kept at or slightly above ambient temperature before and after experiments.

**7** Start the experiment.

**8** Upon completion of this experiment, the base and cell purges must remain on continuously. If the purges do not remain on, the atmospheric moisture will contaminate the system and, depending on the time involved and relative humidity, the procedure may have to be repeated.

## Step 2: Stabilizing the System

The following cyclic experiment is performed after the first step in order to allow the DSC-LNCS system to stabilize, resulting in optimized baselines and calibration.

**1** Select **Control/LNCS/Cool** from the menu. This will enable the LNCS and begin cooling the cell. Once the LNCS has started, the flange temperature will cool rapidly to its operating temperature.

**2** Verify the instrument preferences and post-test conditions as outlined in steps 2 and 6 in the previous section.

**3** Verify that the cell is emptied and cover the cell.

**4** Observe the Signal Display pane. Verify that **Set Point Temperature** displayed is at the midpoint value of the **Temperature Range** specified on the **Post Test Parameters** window. This indicates that the post test temperature control is active. If the post test temperature control is not active (i.e., the **Set Point**

**Temperature** reads 0.00 °C), select **Go to Standby Temp** from the **Control** menu to invoke the standby temperature set on the **Tools/Instrument Preferences/DSC** Page.

**5** Create and save the following **Custom** method:

1. Data Storage On
2. Equilibrate 50°C
3. Isotherm 60 minutes
4. Mark end of cycle
5. Equilibrate 300°C
6. Mark end of cycle
7. Isotherm 30 minutes
8. Mark end of cycle
9. Equilibrate –180°C
10. Mark end of cycle
11. Isotherm 10 minutes
12. Mark end of cycle
13. Ramp 20°C/min to 300°C (continued on next page)
14. Mark end of cycle
15. Isotherm 10 minutes
16. Repeat segment 8 for 7 times

**6** Start the experiment created in step 5. The flange temperature must be below 100 °C when operating an LNCS. If the run is started when the flange is above 100 °C, then an error message will be posted and the run will be terminated. During normal operation the flange temperature should be less than –145 °C at the start of a run.

**7** After conditioning the LNCS (by performing both the drying and stabilization steps), evaluate the last baseline run in the method above for any artifacts. Calibrate the DSC before running experiments using the LNCS. See the DSC online help for details.

# *Using the LNCS*

Once the LNCS has been properly installed, follow the steps below to set up the instrument parameters and start an experiment.

It is best to start the LNCS before you run an experiment. This allows the LNCS to stabilize and will prevent samples from being exposed to cryogenic temperatures prior to starting a run.

## Starting an Experiment

Before you start the experiment, ensure that the DSC is connected with the controller, the standard and base purge gases are connected, and that you have entered all necessary information through the instrument control software.

**NOTE**: Once the experiment is started, operations are best performed at the computer keyboard. The DSC is very sensitive to motion and might pick up the vibration caused by touching a key on the instrument touch screen.

Start the experiment by selecting **Start** on the instrument control software or by touching the **START** key on the instrument touch screen. When you start the instrument, the system automatically runs the experiment to completion.

## LNCS Starting Conditions

If you are using the Liquid Nitrogen Cooling System (LNCS), the run will start when the flange (shown here), which is part of the cell structure, has reached a temperature  below –160 °C and when the system has detected adequate liquid nitrogen is present. The cell temperature is then set to 20 °C and the experimental method is started.

## Guidelines When Using the LNCS

Once the LNCS is properly installed, the system conditioned and calibrated, the following guidelines should be maintained during standard experimental operation.

- A dry, moisture-free gas source is required for the cooling gas (LNCS) purge and the base purge when using the LNCS, in addition to the standard cell purge gas. Dry nitrogen is recommended for this purge. These gases must remain on continuously. If they do not, the atmospheric moisture will enter and contaminate the system.
- The LNCS Purge is automatically on whenever the cell is opened by the AutoLid to prevent moisture from entering the system. (NOTE: This does not function when the cell lid is manually opened as it is on the DSC Q20/Q10.) It is strongly recommended that the cell lids be in place anytime that a sample is not being actively loaded or unloaded. Turn the LNCS purge on using **Control/Air Cool/On** prior to removing the lids. Turn the LNCS purge off after the lids are in place.
- **Important**: If you are planning to run subambient experiments, use helium as the purge gas. If you are using the LNCS for rapid cooling above ambient (i.e., isothermal crystallization), then nitrogen may be used as a purge gas.

**NOTE**: Please make sure that you run your experiments with the same gas that you used to calibrate the system. For example, if you calibrate using nitrogen, make your runs with nitrogen.

- Access the **Tools/Instrument Preferences/DSC Page** of the DSC instrument control software. Verify that the correct cooler type (LNCS) is selected and check **Leave LNCS on**. Check the **LNCS Autofill if below** option, then enter a percentage to automatically fill the LNCS, if desired. This indicates that you want the LNCS to automatically fill at the end of an experiment when the level of liquid nitrogen falls below the specified percent. The fill process, when activated, will fill to completion before advancing to the next scheduled run. If left unchecked, you will need to manually fill the LNCS when needed. (Default = checked, 40%)
- When setting up experiments, be sure to verify the post-test conditions. The temperature window should be enabled and a temperature range above ambient should be used to prevent the cell from cooling down between experiments.
- When setting up an Autosampler sequence, access the **Instrument Preferences/Autosampler Page** and select the desired sequence-end option for the LNCS.
- **Important**: DO NOT open the DSC cell at below ambient temperatures to prevent frost and moisture buildup in the cell. If this occurs, the conditioning and calibration steps may have to be repeated.
- **Important**: Once the DSC-LNCS system has been conditioned, it is recommended that you do NOT turn off the LNCS between runs, if the best possible baseline performance is desired.
- **Important**: Operating without an effective base purge, allowing the cell to remain at the lower temperature limit without heater power (e.g., without post-test conditions) for extended periods of time, and/or removing the LNCS from the cell when the flange temperature is below ambient can result in excessive moisture in the cell and requires extended time for drying such as performing Step 1 of the conditioning procedure..

**WARNING: Do not exceed 100°C with the LNCS cooling head installed and the LNCS power off. Serious damage to the cooling head could occur.**

**AVERTISSEMENT: Ne dépassez pas les 100°C lorsque la tête de refroidissement du LNCS est installée et le LNCS à l'arrêt. Cela pourrait provoquer de graves dégâts et/ou des blessures.**

**CAUTION: We recommend that you do not use the LNCS when running isothermal experiments above 400°C. The life of the DSC cell heating element can be shortened if the LNCS is used at high temperatures for extended periods.**

**MISE EN GARDE: Nous recommandons de ne pas utiliser le LNCS lorsque vous effectuez des expériences isothermes supérieures à 400°C. La durée de vie de l'élément chauffant de la cellule DSC peut être réduite si le LN2P est utilisé à des températures élevées sur de longues périodes.**

- **NOTE**: Once the cooling flange reaches operating temperature, it condenses any moisture present. If the initial moisture level is too high, or if the atmosphere moisture subsequently entering the heat exchanger enclosure is not minimized, then artifacts can be observed in the heat flow signals. Typically, but not exclusively, the artifacts are observed between 0 and 100 °C, which increase in intensity over time.

# *Maintaining the LNCS*

The primary maintenance procedures described in this section are the customer's responsibility. Any further maintenance should be performed by a representative of TA Instruments or other qualified service personnel. Consult the online documentation installed with the instrument control software for further information.

**WARNING: High voltages are present in this instrument. Maintenance and repair of internal parts must be performed only by TA Instruments or other qualified service personnel.**

**AVERTISSEMENT: Présence de tensions élevées dans cet instrument. La maintenance et la réparation des pièces internes doivent être effectuées uniquement par TA Instruments ou tout autre personnel d'entretien qualifié.**

**CAUTION: Before using any cleaning or decontamination method except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.**

**MISE EN GARDE : Avant d'utiliser une méthode de nettoyage ou de décontamination autre que celle recommandée par le fabricant, les utilisateurs doivent s'assurer auprès du fabricant que la méthode proposée n'endommagera pas l'équipement.**

The Liquid Nitrogen Cooling System actually requires very little maintenance. The following items may need attention and are covered in this section:

- Cleaning
- Fuse replacement
- Graphite gasket replacement.

## Cleaning the LNCS

You can clean the LNCS as often as you like. The unit should be cleaned with a household liquid glass cleaner and soft cloth. Wet the cloth (not the unit) with the glass cleaner, and then wipe off the unit and surrounding surfaces.

**WARNING: Do not use harsh chemicals, abrasive cleansers, steel wool, or any rough materials to clean the unit.**

**AVERTISSEMENT: N'utilisez pas de produits chimiques agressifs, de nettoyants abrasifs, de la laine d'acier ou tout autre matériau rugueux pour nettoyer, car vous pourriez égratigner sa surface et dégrader ses propriétés.**

## Replacing the LNCS Fuse

You can replace the fuses found in the power entry module located on the rear of the electronics control box. To check or change these fuses follow the instructions below and refer to the figure as needed:

**1** Turn the cooling accessory off and remove the power cord.

**2** Insert a small screwdriver at the edge of the power entry module door and pry it open.

**3** Insert the screwdriver on the edge of the fuse holder to pull it out of the instrument.

**4** Remove old fuses and replace the fuses only with the type and rating indicated on the instrument's rear panel.

**5** Place fuse holder back into opening and push the door shut.

**6** Replace the power cord and turn the unit back on.

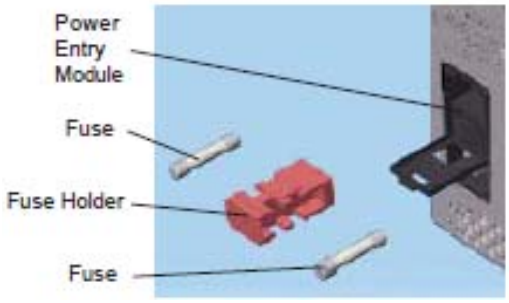


**Figure 25** Replacing LNCS fuses.

## Replacing the LNCS Graphite Gasket

Inside the LNCS cooling head are several items that function to provide a tight seal between the DSC cell and the cooling accessory. If you find that the cooling performance of your unit begins to produce less than desired results, you may need to check the graphite gasket inside the cooling head and replace it, if needed, by following these instructions:

**1** Turn off the power to the unit and wait until the flange temperature is above ambient.

**2** Remove the cooling head. See LNCS installation instructions, if needed.

**3** Turn the cooling head upside down as shown in the figure below..

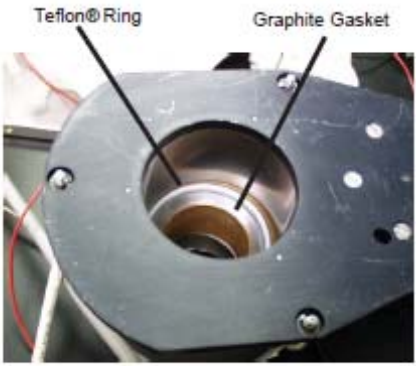


**Figure 26** Inside the cooling head.

4 Inspect the graphite gasket for any tears, holes, or signs of wear. Also inspect the cooling flange on the DSC cell for any graphite residue. Replace the gasket, if needed, by following the next several steps.

5 Using a small flat head screwdriver, pry out the white Teflon® ring that holds the graphite gasket in place. The ring is slotted to allow enough flexibility for removal.

6 Remove the damaged graphite gasket and discard it.

7 Obtain the new gasket and a pair of scissors. Carefully make a cut across the diameter of the gasket on one side to allow installation. (It is shipped uncut to avoid damage during shipping.)

8 Carefully press the new gasket down into the cooling head, taking care not to damage the thin material. Allow the edges of the gasket to slide into the groove located inside the cooling head for that purpose.

9 Replace the white Teflon® ring, with the beveled side facing out, so that it snaps back into place and secures the gasket.

10 Install the cooling head on the instrument again and turn the power on.

11 Check the AutoLid alignment and adjust, if needed. See the *DSC Q Series Getting Started Guide*, Chapter 3 “Aligning the AutoLid” for instructions.

# *Replacement Parts*

The table below lists the replacement parts for the LNCS.

**Table 2: LNCS Replacement Parts**

| Part Number | Description |
|---|---|
| 970408.901 | Cooling Head Assembly |
| 271282.001 | Power supply |
| 970250.901 | Printed Circuit Board, Control, LNCS |
| 271562.001 | Fuse, 2.5A, 250V |
| 970322.901 | Autofill Valve |
| 970323.901 | Autofill Vent Valve |
| 970324.901 | Pressure Build Valve Assembly (L11) |
| 970325.901 | Pressure Build Vent Valve Assembly (L12) |
| 970326.901 | Pressure Control Valve Assembly (L13) |
| 970327.901 | Pressure Control Vent Valve Assembly (l14) |
| 200121.002 | 345 kPa gauge(50 psig) Pressure Relief Valve, Fill Tube Protection |
| 200121.001 | 90 kPa gauge (13 psig) Pressure Relief Valve, Dewar Protection |
| 970374.001 | Gasket, Graphite, Heat Exchanger |
| 970076.001 | Centering Ring Heat Exchanger |
| 970418.901 | Dewar Cap Assembly |

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