



RCS120, RCS90 AND RCS40



## Refrigerated Cooling System Getting Started Guide

Revision C Issued April 2016

## 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**

Please click the [TA Manual Supplement](#) link to access the following important information supplemental to this Getting Started Guide:

- TA Instruments Trademarks
- TA Instruments Patents
- Other Trademarks
- TA Instruments End-User License Agreement
- TA Instruments Offices

## 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

### *Safety Standards*

#### **For European Economic Area**

(In accordance with Council Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits.)

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

#### **For United States and Canada**

UL61010-1 Third Edition/CSA No. 61010-1, 2012, Safety requirements for electrical equipment for measurement, control and laboratory use- Part 1:General requirements

#### **Other**

IEC61010-1:2010

# **Electromagnetic Compatibility Standards**

## **For Australia and New Zealand**

CISPR 11:2011 Industrial, scientific, and medical equipment–Radio frequency disturbance characteristics–Limits and methods of measurement.

## **For European Economic Area**

(In accordance with Council Directive 2014/30/EU of the European Parliament and of the Council of 26 of February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility.)

EN61326-1: 2013 Electrical equipment for measurement, control, and laboratory use-EMC requirements-Part 1: General Requirements (for class A equipment).

## **For Canada**

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




## **For United States**

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

## Safety

### Instrument Symbols

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

Symbol	Explanation
	This symbol on the RCS 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 RCS.
	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.
	<p>This symbol on the rear access panel indicates that you must unplug the instrument before doing any maintenance or repair work.</p> <p>If you are not trained in electrical procedures, do not remove the instrument covers unless specifically instructed to do so in the manual. Maintenance and repair of internal parts must be performed only by TA Instruments or other qualified service personnel.</p>

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: The cooling head assembly contains coated Fiberfrax material. Excessive handling of this material could cause Fiberfrax particles to be emitted into the air. See <http://www.tainstruments.com> for the SDS 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 <http://www.tainstruments.com> for la fiche technique santé-sécurité pour les mesures de sécurité à observer en cas d'utilisation du Fiberfrax.**

**WARNING:** The RCS contains hazardous materials (i.e., flammable refrigerants). Contact TA Instruments prior to packaging for shipment.

**AVERTISSEMENT:** Le RCS contient des matières dangereuses (à savoir, les réfrigérants inflammables). Contactez TA Instruments avant l'emballage pour l'expédition.

**WARNING:** The RCS contains the following refrigerants:

**AVERTISSEMENT:** Le RCS contient les réfrigérants suivants:

R404A  
R290  
R508B  
R14  
R-1270  
R-1150

Varying amounts of each, but in all cases, substantially less than 500 grams of each.

Des quantités variables de chacun, mais dans tous les cas, nettement inférieure à 500 grammes de chacun.

**WARNING:** Due to the size and weight of the cooling accessory, the RCS90 and RCS40 should always be lifted by two people to prevent injury. Do not slide the RCS90 or RCS40 as this may damage the feet on the unit. Use two people to lift the accessory when moving it to another position. The RCS120 is a floor-standing accessory that is not meant to be lifted.

**AVERTISSEMENT:** En raison de la taille et le poids de l'accessoire de refroidissement, l'RCS90 et RCS40 doivent toujours être levées par deux personnes pour prévenir les blessures. Ne pas glisser le RCS90 ou RCS40 car cela pourrait endommager les pieds sur l'appareil. Utilisez deux personnes pour soulever l'accessoire lors de son déplacement vers une autre position. Le RCS120 est un accessoire de sol-debout qui ne sont pas destinés à être levée.

## *Electrical Safety*

You must unplug the instrument before doing any maintenance or repair work; voltages as high as 120/230 VAC are present in this system.

**DANGER:** 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.

**DANGER:** 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.

**WARNING:** The RCS must not be powered from a power distribution strip of the type commonly used.

**AVERTISSEMENT:** Le RCS ne doit pas être alimenté à partir d'une bande du type de distribution d'énergie utilisée

## *Water Condensation*

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

**AVERTISSEMENT:** Certaines surfaces du DCS et du RCS deviennent froides pendant l'utilisation du RCS. 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.

## *Thermal Safety*

The cell surfaces can be hot enough to burn the skin during a sample run. If you are conducting a sub-ambient 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 RCS and DSC system may get extremely cold during cooling experiments. This presents a danger to exposed skin coming in contact with and adhering to the cold surfaces. We recommend that you do not remove the DSC lids when the instrument is at sub-ambient temperatures to prevent moisture buildup in the system. However, if you do remove the lids or handle any cold surfaces, use forceps or gloves to prevent injury.

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

**CAUTION:** Moving the insulated hose or removing the RCS head when the instrument is at sub-ambient temperatures will damage the refrigerant suction line and can result in reducing long-term performance of the cooler.

**MISE EN GARDE:** Déplacement du tuyau isolé ou en enlevant la tête RCS lorsque l'instrument est à des températures sous-ambiante endommagera la ligne d'aspiration de réfrigérant et peut entraîner une réduction de la performance à long terme du refroidisseur.

## *Temperature Range*

**WARNING:** Do not exceed 100°C with the RCS cooling head installed and the RCS power off. Serious damage and/or injury could occur.

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



**CAUTION:** For the RCS120 and RCS 40, do not run experiments above 400°C. Do not run extended isothermal experiments at 400°C. For the RCS 90, do not run experiments above 550°C. Do not run extended isothermal experiments at 550°C.

**MISE EN GARDE:** Pour la RCS120 et RCS 40, ne pas exécuter des expériences supérieures à 400 ° C. Ne pas faire fonctionner les expériences isothermes étendues à 400 ° C. Pour le RCS 90, ne pas exécuter des expériences supérieures à 550 ° C. Ne pas faire fonctionner les expériences isothermes étendues à 550 ° C.

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# Chapter 1:

## Introducing the RCS

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### Overview

The Refrigerated Cooling Systems (RCS) are used for extending the temperature range of the instrument and allowing sample testing at sub-ambient temperature. There are three different models offered by TA Instruments—the RCS120, RCS90 and the RCS40. All models have a cooling head, which is made up of an internal heat exchanger, anti-condensate heaters, and various other components. The cooling head fits over the DSC cell.



**Figure 1** RCS120 (left), RCS90 (middle), RCS40 (right).

- The RCS120 consists of a three-stage vapor compression refrigeration system with an attached cooling head. The RCS120 can be used for experiments requiring cooling within an operating range of  $-120^{\circ}\text{C}$  to  $400^{\circ}\text{C}$ . The maximum rate of cooling depends on the temperature range of your experiment.
- The RCS90 (shown in the figure above) consists of a two-stage, cascade, vapor compression refrigeration system with an attached cooling head. The RCS90 can be used for experiments requiring cooling within an operating range of  $-90^{\circ}\text{C}$  to  $550^{\circ}\text{C}$ . The maximum rate of cooling depends on the temperature range of your experiment.
- The RCS40 consists of a single-stage vapor compression refrigeration system with an attached cooling head. The RCS40 can be used for experiments requiring cooling within an operating range of  $-40^{\circ}\text{C}$  to  $400^{\circ}\text{C}$ . The maximum rate of cooling depends on the temperature range of your experiment.

## Instrument Specifications

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

**Table 1: RCS Technical Specifications**

Specification	RCS120	RCS90	RCS40
Instrument compatibility	Discovery DSC	Discovery DSC	Discovery DSC
Size (without transfer line)			
Height	88 cm (34.6 in)	46 cm (18.5 in)	26 cm (10 in)
Width	35.6 cm (14.5 in)	26 cm (10 in)	26 cm (10 in)
Depth	56 cm (22 in)	51 cm (20 in)	51 cm (20 in)
Weight	102 kg (225 lbs)	47.7 kg (108 lbs)	24.8 kg (55 lbs)
Power requirements	230 VAC/8.5 A/50 Hz or 240 VAC/7.5 A/60 Hz	120 VAC/14 A/60 Hz or 230 VAC/6 A/50 Hz	120 VAC/6.25 A/60 Hz or 230 VAC/4 A/50 Hz
Cooling capacity	−120°C	−90°C	−40°C
Feed hose	120 centimeters (4 ft) insulated from RCS to cooling head		
Refrigerants <sup>a</sup>	R404A R290 R508B R14	R-1270 R-1150	R-1270
Clearance	Additional clearance 45 to 60 cm (18 to 24 inches) is recommended above the RCS to allow routing of the cooling line to the instrument without putting undue stress on the line. Additional clearance 15 to 30 cm (6 to 12 inches) is also recommended at the back, front, and on the two sides to allow adequate dissipation of heat from the RCS condenser. In addition to physical clearance, there must be adequate ambient air flow through in through the cabinet vents and out through the fans in order to provide proper operation of the refrigeration systems.		
Operating environment conditions	Temperature: 15–35°C <sup>b</sup> Relative humidity: 5–80% (non-condensing) Installation Category II Pollution Degree 2 Maximum Altitude: 2000 m (6560 ft)		

a. Varying amounts of each, but in all cases, substantially less than 500 grams of each.

b. RCS120 has a limitation of 24°C.

Table 2 on the next page shows the performance specifications for RCS/DSC cooling.

**Table 2: RCS/DSC Performance Specifications**

Specification	RCS120	RCS90	RCS40
Temperature range	–120°C to 400°C	–90°C to 550°C	–40°C to 400°C
Linear cooling rates	Cooling rates available will vary depending on the temperature range. As a general guideline, cooling rates not greater than 45°C/min can be achieved over the range 400°C to 100°C and cooling rates of 5°C/min can be achieved over the range 400°C to –70°C.	Cooling rates available will vary depending on the temperature range. As a general guideline, cooling rates not greater than 45°C/min can be achieved over the range 400°C to 100°C and cooling rates of 5°C/min can be achieved over the range 400°C to –70°C.	Cooling rates available will vary depending on the temperature range. As a general guideline, cooling rates from 36°C/min to 10°C/min can be achieved over the range from 300°C to 0°C and cooling rates from 10°C/min to 4°C/min can be achieved over the range 0°C to –25°C.
Ballistic cooling	Ambient to –120°C 20 to 23 minutes	Ambient to –90°C 15 to 18 minutes	Ambient to –40°C 12 to 15 minutes

**CAUTION:** For the RCS120 and RCS 40, do not run experiments above 400°C. Do not run extended isothermal experiments at 400°C. For the RCS 90, do not run experiments above 550°C. Do not run extended isothermal experiments at 550°C.

**MISE EN GARDE:** Pour la RCS120 et RCS 40, ne pas exécuter des expériences supérieures à 400 ° C. Ne pas faire fonctionner les expériences isothermes étendues à 400 ° C. Pour le RCS 90, ne pas exécuter des expériences supérieures à 550 ° C. Ne pas faire fonctionner les expériences isothermes étendues à 550 ° C.

**NOTE:** Do not turn off the unit and immediately turn it back on. After the compressors have shut down, allow 30–45 minutes for the RCS120 or 5 minutes for the RCS90 and RCS40 for the internal pressures to equalize before restarting the unit.

# Chapter 2:

## Installing the RCS

---

### *Unpacking/Repacking the RCS*

Retain all of the shipping hardware and boxes from the accessory in the event you wish to repack and ship your accessory.

### *Preparing the Accessory*

Before shipment, the RCS is inspected so that it is ready for operation upon proper installation. Installation involves the following procedures:

- Mounting the cooling head assembly on the DSC cell
- Connecting gas lines to the DSC
- Conditioning the system to remove moisture.

Each of these steps is described in the following sections.

**WARNING:** Due to the size and weight of the cooling accessory, the RCS90 and RCS40 should always be lifted by two people to prevent injury. Do not slide the RCS90 or RCS40 as this may damage the feet on the unit. Use two people to lift the accessory when moving it to another position. The RCS120 is a floor-standing accessory that is not meant to be lifted.

**AVERTISSEMENT:** En raison de la taille et le poids de l'accessoire de refroidissement, l'RCS90 et RCS40 doivent toujours être levées par deux personnes pour prévenir les blessures. Ne pas glisser le RCS90 ou RCS40 car cela pourrait endommager les pieds sur l'appareil. Utilisez deux personnes pour soulever l'accessoire lors de son déplacement vers une autre position. Le RCS120 est un accessoire de sol-debout qui ne sont pas destinés à être levée.

**CAUTION:** To avoid mistakes, read this entire chapter before you begin installation.

**MISE EN GARDE:** Pour éviter de commettre des erreurs, lisez tout le chapitre avant de commencer l'installation.

## Inspecting the System

When you receive the RCS Accessory, look over the accessory and shipping container carefully for signs of shipping damage, and check the parts received against the enclosed shipping list.

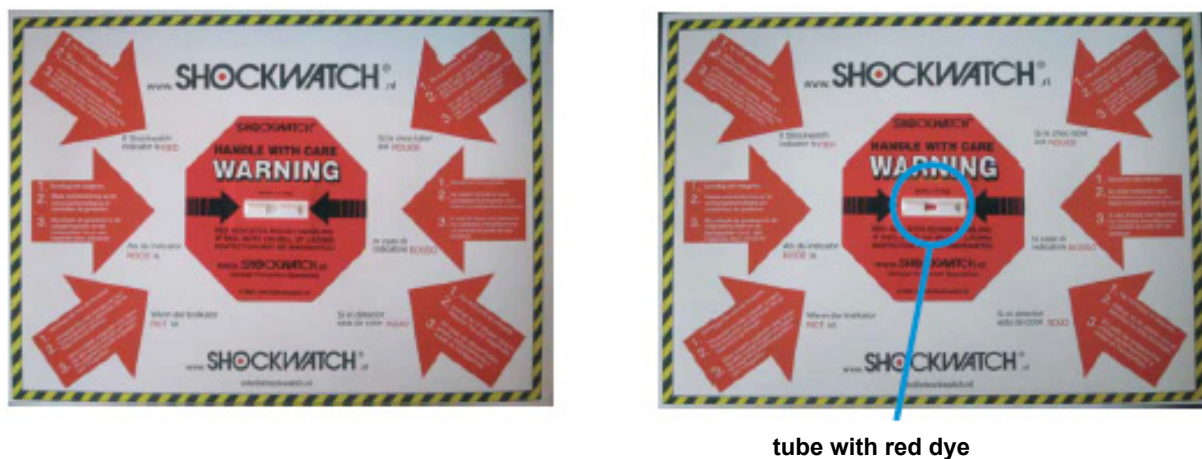
- If the accessory is damaged, notify the carrier and TA Instruments immediately.
- If the accessory is intact but parts are missing, contact TA Instruments.

**RCS120 only:** Take note of the tilt sensor that is affixed to the packing container. The tilt sensor turns red if the container tips onto its side or is upended. The tile sensor will not activate under normal handling conditions or aircraft take-offs. Shipments that arrive with the indicator ball bearing in a different position from the companion label should inspect the product for possible damage and contact TA Instruments.



**Figure 2** RCS120 TiltWatch tilt sensor: Correct position (left); incorrect position (right).

Inspect the ShockWatch device. ShockWatch devices contain a tube filled with red liquid held in suspension. When the device is subjected to an impact exceeding a specified G-level, the shock disrupts the surface tension of the liquid, releasing the highly visible red dye into the length of the tube — creating a permanent and immediate indication of mishandling. Normal movement or roadshock won't affect the device. Once activated, the device cannot be reset. Shipments that arrive with the tube filled with red liquid should inspect the product for possible damage and contact TA Instruments.



tube with red dye

**Figure 3** Correct position (left); incorrect position (right).



## *Adjusting the Anti-Tilt Bar Feet (RCS120 only)*

The RCS120 comes with a pre-installed anti-tilt bar. Adjust the anti-tilt bar feet until they touch the floor. Slide the 17 mm nut on the bottom of each foot to the top of the foot, and then tighten the nut using a 17 mm wrench or an adjustable wrench.



**Figure 4** Adjust the feet on the anti-tilt bar.



**Figure 5** Anti-tilt bar installed.

## Mounting the Cooling Head

The RCS unit connects to the DSC cell via a cooling head. This cooling head is made up of an internal heat exchanger, anti-condensate heaters, and various other components. The following steps describe the procedure for making the connection between the DSC and the RCS unit.

**NOTE:** Since the RCS creates cold surfaces that could serve as condensation sites for any moisture which is present, it is important that the conditioning procedure described later in this manual be followed when initially mounting the RCS cooling head or anytime the cooling head is removed and remounted.

### Removing the Discovery DSC Cover

**NOTE:** Ensure the cell is at a temperature where contact with the cell will not cause a burn.

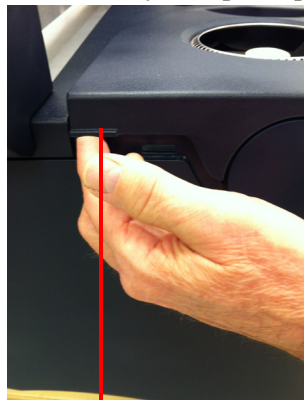
#### *Discovery DSC2500, DSC250, and DSC25*

- 1 If an Autosampler is present, it must be moved away from the cell by pressing **Lid Open/Close** button



on the user interface or on the controller.

- 2 Carefully lift up and pull the top cover off of the Discovery DSC.




**Pull up on tab to remove cover**



**Figure 6** Remove the top cover (DSC2500 shown).

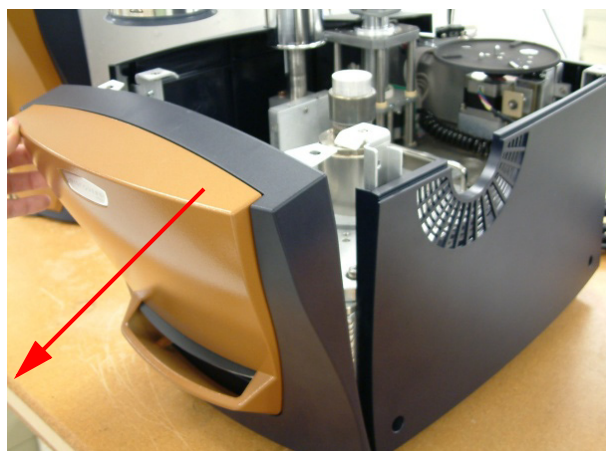
## Discovery DSC

- 1 Press the **Lid**  button on the Discovery DSC keypad to close the AutoLid, as shown in [Figure 7](#).
- 2 Remove the three top-cover screws circled in the figure below.



**Figure 7** Discovery DSC top cover.

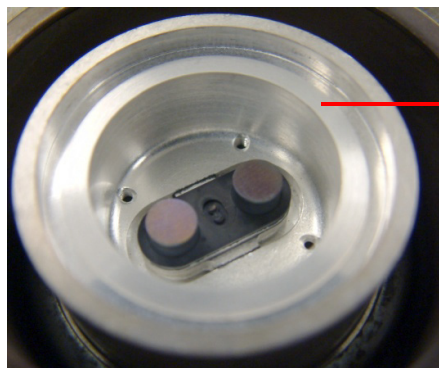
- 3 Press the **Lid** button on the DSC keypad to open the AutoLid on your instrument.
- 4 Remove the Autosampler tray and Autosampler sample waste bin from the top cover. Refer to [Figure 7](#) for locations.
- 5 Gently raise and rotate the Autosampler arm to the left (when facing the instrument) so that Autosampler cover and arm do not impede removal of the top cover.
- 6 Carefully lift up and pull the top cover away from the Discovery DSC (to the right when facing the instrument).
- 7 Once the top cover is removed, remove the front cover by pulling it away from the instrument (towards you if facing the instrument).



**Figure 8** Removing the front cover.

## Mounting the Cooling Head

- 1 Verify that the DSC cell surface (indicated in the figure below) on the top of the silver block is not damaged or compromised. If any irregularities such as dents, buildup, contaminants, or oxidation are observed in the silver, contact your local TA Instruments Service Representative for details on re-dressing the cell.



Verify that this inner cell lip is free of irregularities

**Figure 9** Surface of silver block.

- 2 Verify that the DSC cell cooling flange and the matching surface of the RCS cooling head are not damaged or compromised. Also inspect the graphite gasket that sits between the copper heat exchanger and the nickel flange. If any irregularities such as dents, buildup, contaminants, or oxidation are observed, contact your local TA Instruments Service Representative for details on re-dressing the flange.
- 3 Position the RCS near the DSC.

**NOTE:** For the most effective operation, the RCS90 and RCS40 should be on a separate bench and at the same level as the DSC. Mounting the RCS90 or RCS40 below the level of the DSC will deteriorate cooling performance. Due to the size and weight of the RCS120, the RCS120 unit should be placed on the floor.

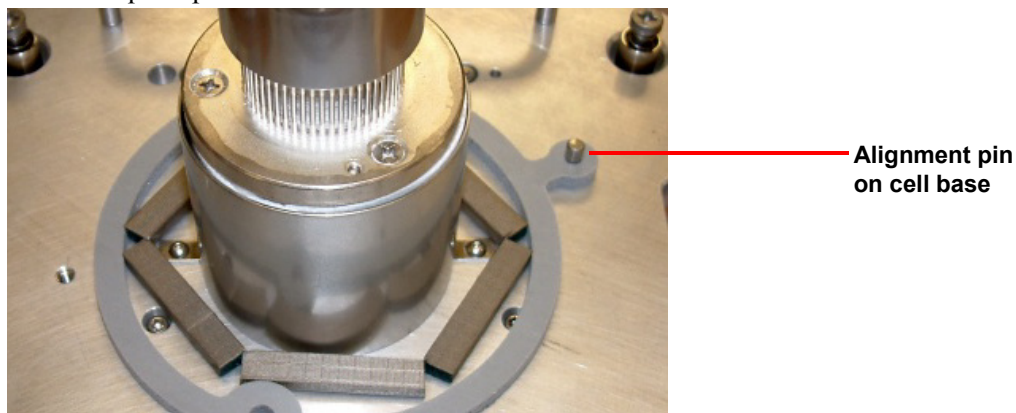
**CAUTION:** Take extreme care not to damage the silver block shown in [Figure 9](#). The silver surfaces on the cell are soft and, if damaged, must be replaced by a TA Instruments Service Representative.

**MISE EN GARDE:** Prenez soin de ne pas endommager le bloc d'argent représenté sur la figure 9. L'argent les surfaces de la cellule sont souples et, si elles sont endommagées, doivent être remplacés par un service de TA Instruments Représentant.

**CAUTION:** The RCS cooling hose contains two refrigerant lines, and sharp bends or kinks will damage them. Route the lines to prevent bends in the cooling hose.

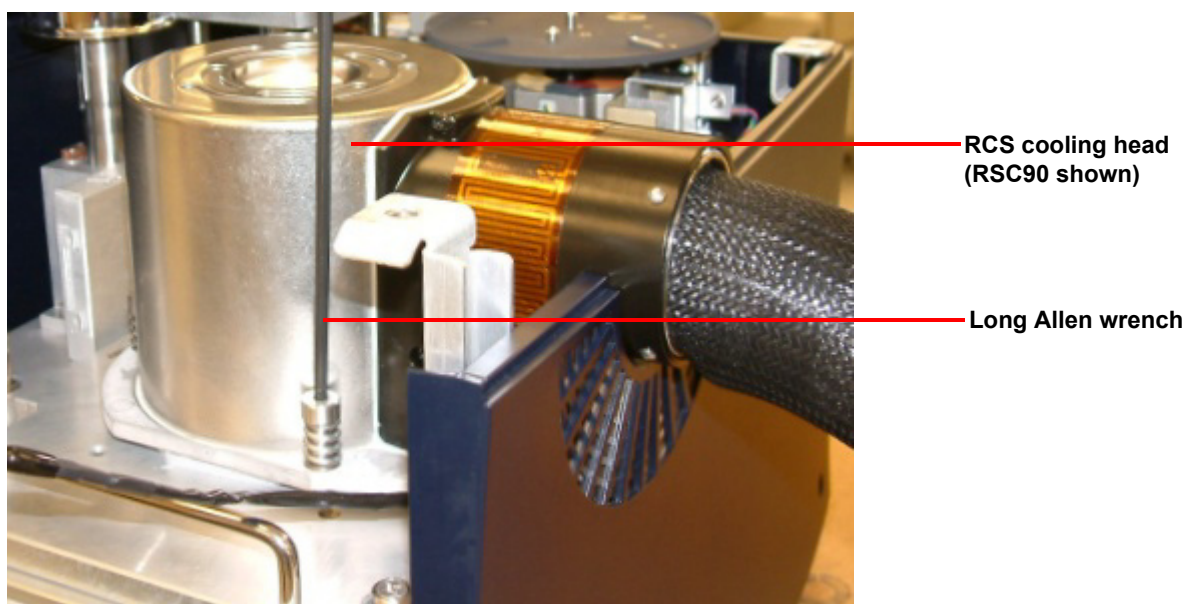
**MISE EN GARDE:** Le tuyau de refroidissement RCS contient deux lignes de fluide frigorigène, et coudes ou plis pointus les endommagera. Route des lignes pour éviter les coudes dans le tuyau de refroidissement.

- 4 Align the pin on the cell base (shown in the figure below) with the corresponding slot in the RCS cooling head and carefully lower the cooling head over the cell. Be particularly careful to avoid bumping the top surface of the cell with the cooling head, as any damage to the cell surface could adversely affect subsequent performance.



**Figure 10** Exposed DSC cell with alignment pin (facing instrument).

- 5 Make sure that the bottom of the cooling head fully seats on the cell base plate.
- 6 Obtain a long 5/32-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 RCS plate while holding onto the cooling head. You may need to push down while you tighten the screw 3 to 4 turns. DO NOT fully tighten yet.

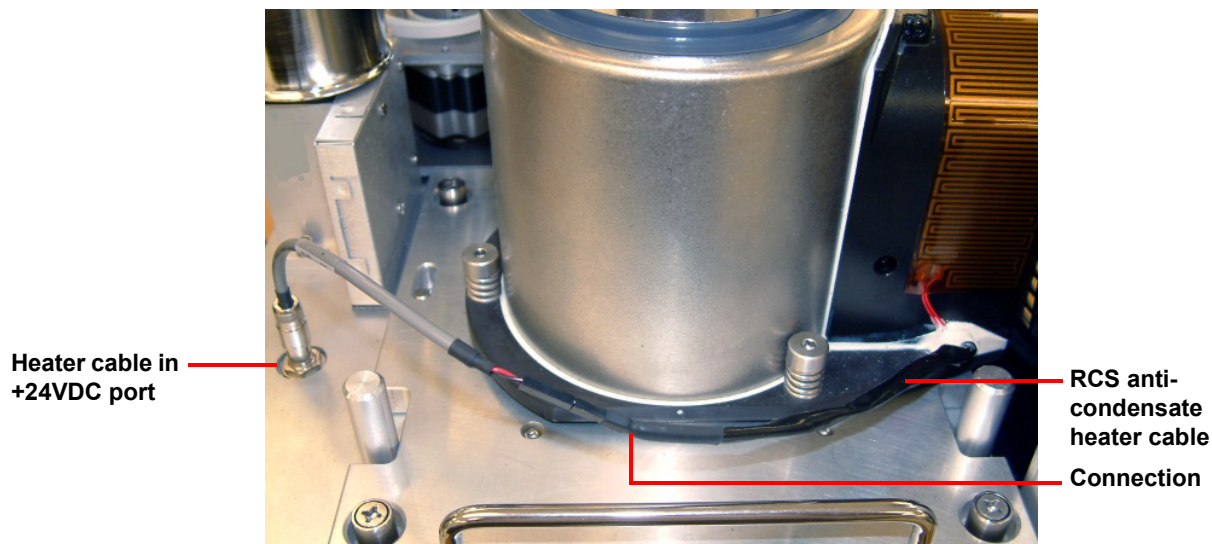


**Figure 11** Installing the RCS cooling head.

- 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 them touch the bottom. Do not over tighten.
- 9 Obtain the RCS heater cable from the kit. Plug the connector into the +24 VDC port to the left of the DSC cell, as shown in [Figure 12](#).

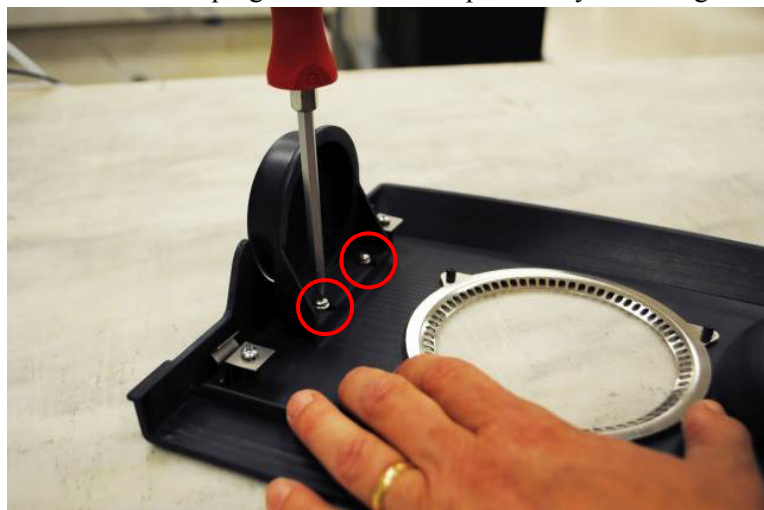


- 10 Plug the heater cable connector into the RCS cooling head cable connector, as shown in the figure below.



**Figure 12** Installing the heater cable on the DSC.

- 11 Uninstall the plug from the DSC top cover by removing the two screws holding it in place.



**Figure 13** Removing plug from DSC top cover (Discovery DSC2500 shown).

- 12 **For Discovery DSC2500, DSC250, and DSC25:** Once the cooling head is secured to the cell and the heater cable is properly installed, replace the top cover on the instrument. Continue to the section [“Selecting the Cooler in the Software” on page 22.](#)

**For Discovery DSC:** Once the cooling head is secured to the cell and the heater cable is properly installed, replace the front cover on the instrument.

- 13 Slide the top cover over the instrument and RCS hose.
- 14 Replace the DSC top cover screws that were originally removed, and the Autosampler tray and the Autosampler sample waste bin.
- 15 Continue to the section [“Selecting the Cooler in the Software” on page 22.](#)

## Selecting the Cooler in the Software

- 1 Select the correct cooler type on the **Discovery DSC > Cooler** setting within the TRIOS software **Options** window.
- 2 Set the RCS power switch to the OFF (0) position
- 3 *RCS90 and RCS40 only*: Set the RCS control switch (on the front of the RCS) to **EVENT**.

**NOTE:** The **EVENT** setting allows the RCS to be controlled by the system software. **MANUAL** keeps the RCS turned on continuously until it is manually shut off by the operator.

- 4 Obtain access to the back of the RCS and the back of the instrument.
- 5 Connect the event cable to the RCS **EVENT CONTROL** port. The red lead is connected to the red port and the black lead is connected to the black port.



**Figure 14** Event connection on back of RCS.

- 6 Plug the other end of the event cable into the **EVENT** port on the back of the DSC.
- 7 Plug the power cable into the back of the RCS and into a power outlet.
- 8 Check the (Auto)Lid alignment and adjust, if needed. See the *Discovery DSC Getting Started Guide* for more information.
- 9 Connect the base purge line as directed in the next section.

## Connecting Gas Lines

An RCS purge is required (in addition to the standard DSC cell and base purge, which is connected through **GAS 1**) when the Refrigerated Cooling System (RCS) is used. The RCS purge is connected through the **COOLING GAS** connection, and is used to automatically purge the interior of the RCS cooling head when the cell is open during loading/unloading of samples while under DSC Autosampler control, and during cell conditioning. Follow the instructions below to connect the lines for those purges.

### Discovery DSC2500, DSC250, DSC25

- 1 Locate the **GAS 1** port on the back panel of the Discovery DSC. The GAS 1 port is used to purge the sample area and is also used as a base purge. As such, an inert gas such as nitrogen must be used in this port, not helium or air. A base purge is required when a sub-ambient cooling accessory is used.

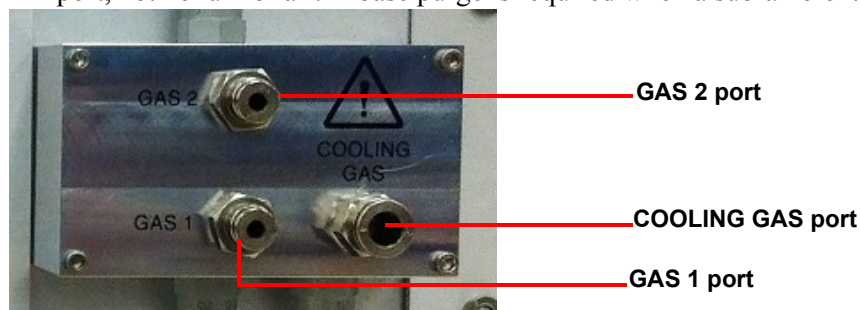


Figure 15 GAS ports.

- 2 Locate the **GAS 2** port. The GAS 2 port is also used to purge the sample area and is used when a purge gas other than GAS 1 is desired or when gas switching during an experiment is needed.
- 3 Connect the primary gas line to the **GAS 1** port.
- 4 If desired, connect a secondary gas to the **GAS 2** port.

**NOTE:** The flow rate is controlled through settings chosen using the instrument control software.

- 5 Make sure that the pressure of your purge gas source is regulated to 140 kPa gauge (20 psig, 34 kPa gauge (5 psig) for oxygen if used as GAS 2).

**CAUTION:** The GAS 1 and GAS 2 lines feeds into a pressure relief valves that are set to 170 kPa gauge (25 psig). The source pressure setting should not go above this value.

**MISE EN GARDE:** Les conduites de gaz 1 et 2 alimentent une soupape de détente de pression réglée à 170 kPa (pression manométrique) (25 psig). Le réglage de la pression à la source ne doit pas dépasser cette valeur.

- 6 Specify the connected gas on the **Discovery DSC > General** page of the TRIOS Options.
- 7 Set the flow rate to the recommended value of 50 mL/min for your experiments through the control panel options within TRIOS Instrument Control software.

**NOTE:** If you are using a “house” laboratory supply rather than bottled gas, it is highly recommended that you install an external drier and a 5- $\mu$ m filter.

- 8 Locate the **COOLING GAS** fitting on the back panel of the Discovery DSC.



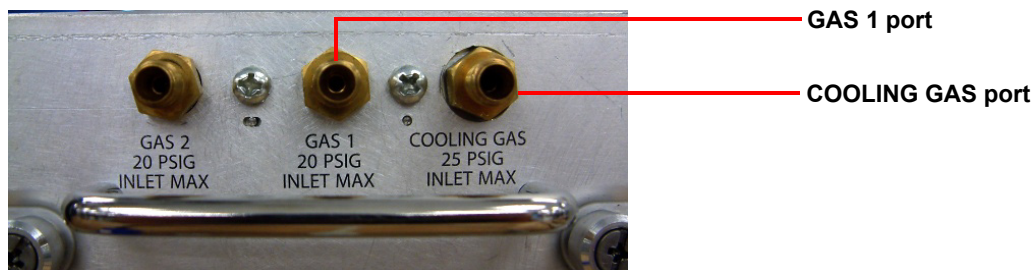
**CAUTION:** The COOLING GAS line feeds into a pressure relief valve that is set to 170 kPa gauge (25 psig). The source pressure setting should not go above this value.

**MISE EN GARDE:** La conduite du gaz de refroidissement alimente une soupape de détente de pression réglée à 170 kPa (pression manométrique) (25 psig). Le réglage de la pression à la source ne doit pas dépasser cette valeur.

**9** Connect the 1/4-inch O.D. tubing from the gas source to the **COOLING GAS** fitting.

## Discovery DSC

- 1 Locate the **GAS 1** and **COOLING GAS** ports on the back of the DSC.

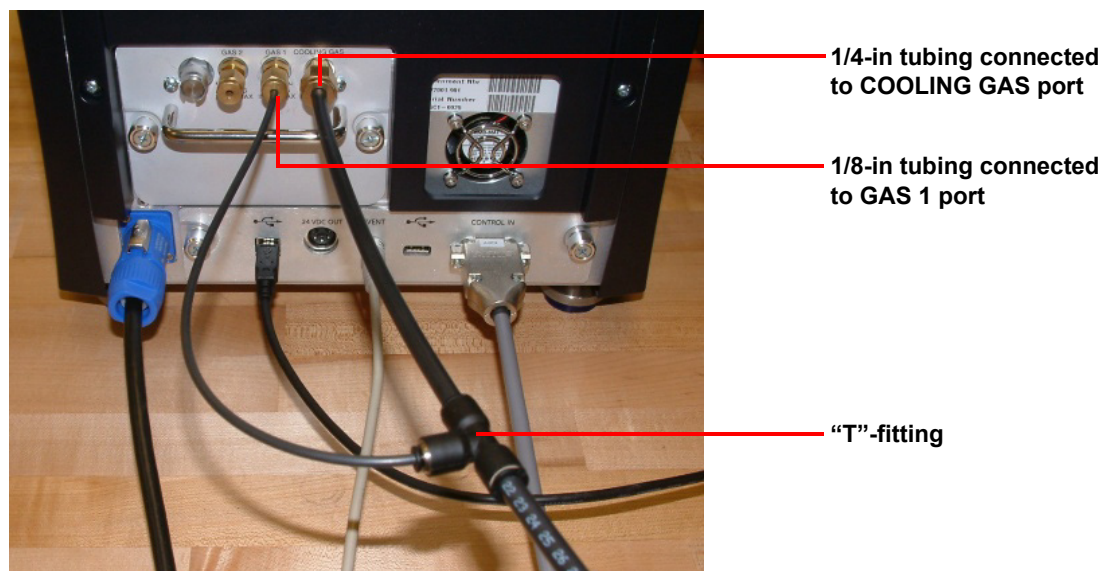


**Figure 16** Gas ports on back of Discovery DSC.

- 2 Ensure that the pressure of your cooling gas is regulated to 140 kPa gauge (20 psig). Dry nitrogen should be used.

**NOTE:** The gases used should be moisture-free. Nitrogen gas of 99.999% purity is recommended.

- 3 Use 1/4-inch O.D. tubing to connect the gas source to the 1/4-inch port on the “T”-fitting that is included with the Discovery DSC. Then connect 1/4-inch O.D. tubing from the other 1/4-inch port on the “T”-fitting to the **COOLING GAS** port on the rear of the DSC. Teflon<sup>®</sup> TFE tubing with Swagelok fittings is recommended. A solenoid valve automatically regulated by TRIOS software determines when the secondary base purge is on, while the instrument automatically regulates the flow rate.
- 4 Connect 1/8-inch O.D. tubing to the 1/8-inch port on the “T”-fitting. Connect the other end of the tubing to the **GAS 1** port. Teflon TFE tubing with Swagelok fitting is recommended. The instrument utilizes an orifice to regulate the flow rate (300 to 350 mL/min) of the base purge for proper operation.



**Figure 17** Gas line configuration for DSC-RCS system.

# Chapter 3:

## Operating and Maintaining the RCS

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This chapter covers operation, conditioning, and maintenance procedures for the RCS.

### *Starting the RCS*

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

- 1 Select the correct **Cooler Type** (that is, RCS120, RCS90 or RCS40) on the **Discovery DSC > Cooler** setting within the TRIOS software **Options** window.
- 2 Verify that a source of dry nitrogen is connected to the **COOLING GAS** and **GAS 1** ports on the back of the DSC instrument.
- 3 Dry the RCS system before turning on the RCS by following the procedure “**Conditioning the RCS**” found in TRIOS Software Help.
- 4 *RCS90 and RCS40 only:* Verify that the RCS control switch on the RCS is set to **EVENT**.
- 5 Turn the power switch to ON (|). This will turn the compressor on and begin cooling the cell. Once the RCS second-stage compressor (RCS90) or third-stage compressor (RCS120) has started (a few minutes later), the flange temperature will cool rapidly to its operating temperature.

**NOTE:** The **EVENT** setting allows the RCS to be controlled by the instrument control software.

**MANUAL** keeps the RCS turned on continuously until it is manually shut off.

- 6 Verify that the post-test conditions are set as desired in TRIOS software. A Standby Temperature or temperature window above ambient should be used to prevent the cell from cooling down between experiments (typical values are 35°C to 50°C). Once these conditions are verified, set the **Standby Temp** from the **Control Panel** to invoke the standby temperature specified.

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

- 7 Each time the RCS cooling head is installed on the DSC, a conditioning procedure should be run before calibration and experiments are performed. Conditioning is used when the system is first installed and periodically thereafter to dry the system to remove moisture in the DSC cell and cooling head BEFORE turning on the RCS.

For information regarding conditioning the RCS, refer to “**Conditioning the RCS**” in TRIOS software Help.

- 8 Recalibrate the DSC after conditioning the system.

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

# *Maintaining the RCS*

This section discusses general RCS maintenance procedures, including cleaning, drying out, and fuse replacement.

If there are problems with the RCS that this manual does not address, contact TA Instruments for service.

## Removing the RCS Cooling Head

Removal of the RCS cooling head is opposite of installation. However, to avoid potentially damaging the graphite gasket located within the cooling head, always ensure that the Discovery DSC flange and the attached RCS cooling hose are at room temperature before attempting to remove the cooling head.

Should you need to replace the RCS cooling head gasket, refer to [“Replacing the RCS Graphite Gasket” on page 28.](#)

## Cleaning the RCS

The RCS must be kept free of dust and debris to allow proper ventilation of the unit. If necessary, turn the power to the cooler off and vacuum the vents to remove any dust buildup that may prevent the fans from moving the proper amount of air flow through the heat exchangers and over the compressors. Wipe the exterior surface of the unit with a damp cloth to remove any dust buildup.

## Replacing the RCS Fuses (RCS90 and RCS40)

**NOTE:** There are no customer-replaceable fuses in the RCS120.

**NOTE:** If you suspect that a fuse needs to be replaced, try the following first. Turn the power switch to the OFF position, then turn it back ON. The power switch on the RCS has an integral breaker. Overload will cause the breaker to trip. Moving the switch to the OFF position to reset the breaker will allow the unit to be turned on again if the cause of the overload has been eliminated. Operating the RCS at high temperatures is one thing that may cause an overload resulting in the breaker trip. If this does not solve the problem, proceed to replace the fuses as follows.

- 1 Place the power switch in the OFF (0) position before attempting the replace a fuse.
- 2 The RCS may contain one or two fuses, depending upon whether you have the 120V/60 Hz model (USA) or the 230V/50Hz model.
- 3 Both fuses can be replaced by turning the fuse holder counterclockwise to remove the holder. The fuse slips out easily.



**Figure 18** Fuse on RCS90.

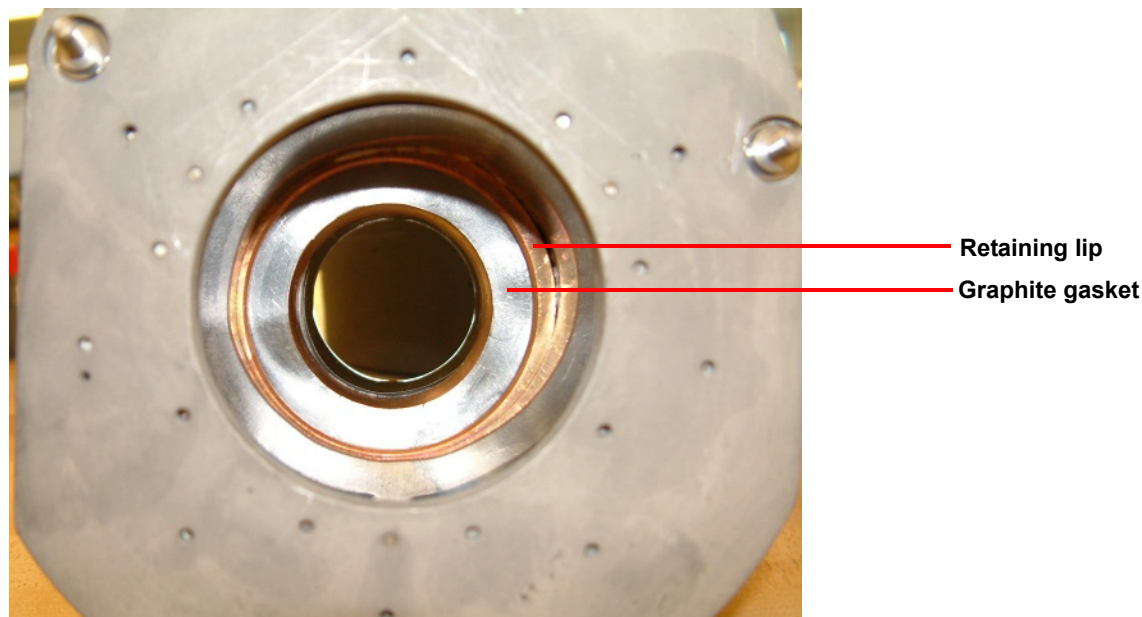
- 4 Insert a new fuse into the holder. Replace fuse with same type and rating only. Place the fuse holder back into the cabinet by turning it clockwise until it locks in place.

## Replacing the RCS Graphite Gasket

The RCS cooler head contains a graphite gasket that acts as a thermal interface between the copper heat exchanger on the cooler head and the nickel flange on the Discovery DSC cell.

The gasket should be replaced if any damage to the gasket is visible. To replace the gasket in the RCS cooling head:

- 1 Locate the gasket within the cooler head, as shown below.



**Figure 19** Graphite gasket location on underside of RCS cooling head.

- 2 Using your fingers, remove the old gasket by sliding it out from under the retaining lip (shown in the figure above) and pulling it out of the cooling head.
- 3 Carefully insert the new gasket into the cooling head, making sure to slide the gasket beneath the retaining lip.
- 4 To ensure proper installation, turn the RCS cooling head right side up (gasket facing downwards). The gasket is properly installed if it remains seated within the cooling head.

## Drying the System

Under certain conditions, it may be necessary to dry out the DSC-RCS system. To remove moisture in the DSC cell and cooling head, refer to TRIOS Help topic “Drying the RCS” in TRIOS software.

## *Replacement Parts*

The table below lists the replacement parts for the RCS120, RCS90, and RCS40.

**Table 3: RCS Replacement Parts**

Part Number	Description
205224.029	Fuse GLA for 120 V/ 60 Hz (0.5A, 250 VAC, Slow Blow)
201242.003	Fuse GLA for 230 V/ 50 Hz (0.4A, 250VAC, Slow Blow)
972271.901	Graphite gasket
920223.902	Event cable