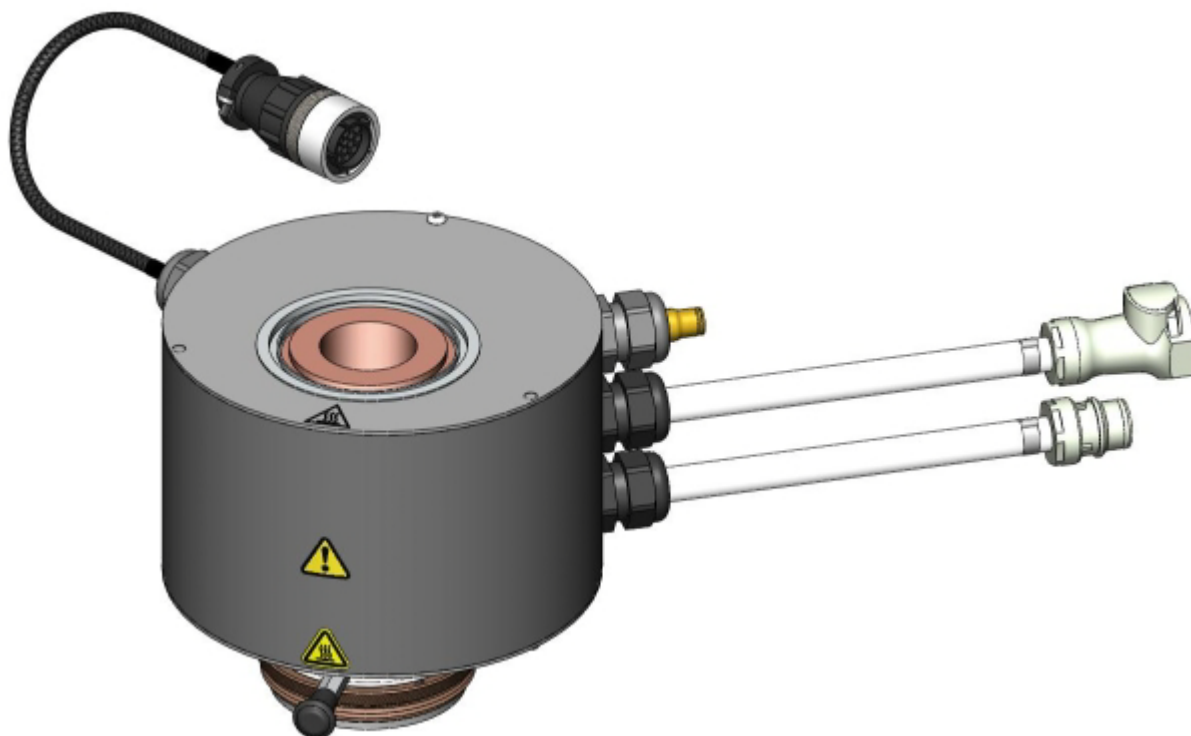


# ARES-G2

## Advanced Peltier System (APS)



## Getting Started Guide



## 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.

	<p><b>A WARNING indicates a procedure that may be hazardous to the operator or to the environment if not followed correctly.</b></p> <p><b>Un AVERTISSEMENT indique une procédure qui peut être dangereuse pour l'opérateur ou l'environnement si elle n'est pas correctement suivie.</b></p>
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## Regulatory Compliance

### *Safety Standards*

#### **For Canada**

CAN/CSA-C22.2 No. 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements.

CAN/CSA-C22.2 No. 61010-2-010 Particular requirements for laboratory equipment for the heating of materials.

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

(In accordance with Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.)

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements + Amendments.

EN 61010-2-010:2003 Particular requirements for laboratory equipment for the heating of materials + Amendments.

#### **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


(In accordance with Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.)

EN61326-1:2006 Electrical equipment for measurement, control, and laboratory use-EMC requirements-Part 1: General Requirements. Emissions: Meets Class A requirements per CISPR 11. Immunity: Per Table 1 - Basic immunity test requirements.

## 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

	<p><b>WARNING: If this accessory is used in a manner not intended or specified in this manual, the protection provided by the accessory may be impaired.</b></p> <p><b>AVERTISSEMENT: L'utilisateur de cet accessoire est prévenu qu'en cas d'utilisation contraire aux indications du manuel, la protection offerte par l'équipement peut être altérée.</b></p>
---	--



There are several major areas of concern pertaining to personal safety when using the Advanced Peltier System (APS). Please refer to the sections below.

## *Required Equipment*

While operating this accessory, you must wear eye protection that either meets or exceeds ANSI Z87.1 standards. Additionally, wear protective clothing that has been approved for protection against the materials under test and the test temperatures.


## Accessory Symbols

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

Symbol	Explanation
	<p>This symbol indicates that you should read this Getting Started Guide in its entirety. This guide contains important warnings and cautions related to the installation, operation, and safety of the instrument/accessory.</p> <p>Ce symbole indique que vous devez lire entièrement ce guide de démarrage. Ce guide contient d'importants avertissements et mises en garde relatifs à l'installation, à l'utilisation et à la sécurité de l'instrument/l'accessoire.</p>
	<p>This symbol indicates that a hot surface may be present. Do not touch this area or allow any material that may melt or burn to come in contact with this surface.</p> <p>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.</p>

Please heed the warning labels and take the necessary precautions when dealing with these areas. The *ARES-G2 Advanced Peltier System Getting Started Guide* contains cautions and warnings that must be followed for your own safety.

## Thermal Safety Warnings

	<p><b>DANGER: Depending on the circulating fluid used, the temperature range of the APS is <math>-10</math> to <math>150^{\circ}\text{C}</math>. To prevent injury, do not touch the APS or geometry while it is in operation.</b></p> <p><b>DANGER: En fonction du fluide de circulation utilisé, la plage de température de l'APS est comprise entre <math>-10</math> et <math>150^{\circ}\text{C}</math>. Pour éviter des blessures, ne touchez pas l'APS ou la géométrie lorsqu'il est en fonctionnement.</b></p>
---	---

## Additional Safety Warnings

**CAUTION:** Do not operate the ARES-G2 APS accessory unless coolant is circulating through the device. Operation of this device without coolant may cause permanent damage to the APS unit. If you turn off the circulator at any time, press the Environment button on the instrument keypad to disable the temperature controller. Failure to do so could cause significant damage to the APS Peltier elements.

**MISE EN GARDE :** N'utilisez pas l'accessoire ARES-G2 APS tant que le fluide caloporteur ne circule pas dans le dispositif. L'utilisation de ce dispositif sans fluide caloporteur peut provoquer des dégâts irréversibles sur l'APS. Si vous arrêtez le circulateur à un moment quelconque, appuyez sur

le bouton Environnement sur le clavier de l'instrument pour désactiver le régulateur de température. Le non respect de cette précaution pourrait endommager de manière significative les éléments de l'APS Peltier.

### ***Warranty Information***

**CAUTION:** Please take care when using your unit to protect it from misuse or mishandling. TA Instruments offers no warranty after the initial installation of the APS.

**MISE EN GARDE:** Pour protéger l'appareil d'une mauvaise utilisation ou manipulation, faites attention lorsque vous l'utilisez. TA Instruments n'offre aucune garantie après la première installation de l'APS.

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# Chapter 1:

## Introducing the APS

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### Overview

The APS is a Smart Swap™ Peltier temperature-controlled environmental system with a temperature range of –10 to 150°C, with a maximum heating rate of 15°C/min and a temperature accuracy of +/- 0.1°C. Temperature measurement is provided by a platinum resistance thermometer (PRT) in intimate contact with the geometry.

**CAUTION:** Do not operate the ARES-G2 APS accessory unless coolant is circulating through the device. Operation of this device without coolant may cause permanent damage to the APS unit. If you turn off the circulator at any time, press the Environment button on the instrument keypad to disable the temperature controller. Failure to do so could cause significant damage to the APS Peltier elements.

**MISE EN GARDE:** N'utilisez pas l'accessoire ARES-G2 APS tant que le fluide caloporteur ne circule pas dans le dispositif. L'utilisation de ce dispositif sans fluide caloporteur peut provoquer des dégâts irréversibles sur l'APS. Si vous arrêtez le circulateur à un moment quelconque, appuyez sur le bouton Environnement sur le clavier de l'instrument pour désactiver le régulateur de température. Le non respect de cette précaution pourrait endommager de manière significative les éléments de l'APS Peltier.

**CAUTION:** Unless being used in conjunction with the upper heated plate (UHP), the APS is not intended for use with the upper geometry platinum resistance thermometer (PRT). Operating the APS with an upper geometry PRT can result in inaccurate temperature readings or unanticipated APS plate temperatures when no sample is loaded.

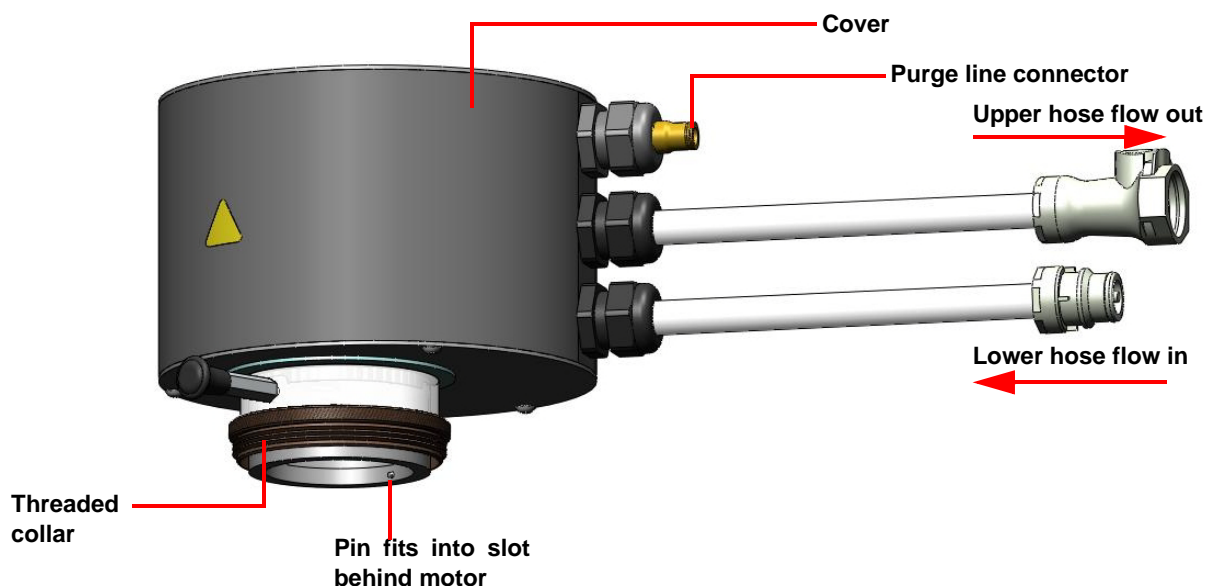
**MISE EN GARDE:** À moins de l'utiliser conjointement avec la plaque supérieure chauffée (UHP), l'APS n'est pas conçu pour être utilisé avec le thermomètre à résistance de platine de la géométrie supérieure (PRT). L'utilisation de l'APS avec un PRT de la géométrie supérieure peut entraîner des relevés de température inexacts ou des températures inattendues au niveau de la plaque APS lorsqu'aucun échantillon n'est mis en place.

## Product Description

Unlike other Peltier temperature systems, the APS features parallel plate (cone and plate), as well as concentric cylinder geometries. A wide variety of testing geometries and accessories to meet the most demanding applications are available. The concentric cylinder geometries include conical end, recessed end, and double gap systems all conforming to DIN standards, along with vaned and helical designs. The new quick-change lower plate comes standard with a 60-mm diameter hardened chromium surface and a unique bayonet fixture that allows the user to quickly and easily adapt the plate surfaces (such as cross-hatched or sandblasted to minimize sample slippage, stainless steel or titanium for corrosive materials, or disposable plates for curing applications).

The APS also features an efficient solvent trap cover for blocking evaporation during testing of volatile materials. The solvent trap cover minimizes free volume around the sample and is heated by the APS heat transfer ring to ensure uniform temperature control around the entire sample. The APS comes standard with gas ports for the option of purging the sample environment with an inert gas.

The APS (assembly shown below) mounts onto the motor using a threaded collar. The motor anvil knob (thumbscrew) fastens the rotating shaft of the APS to the instrument, and the threaded collar secures it to the motor housing.



**Figure 1** APS assembly.

The two hoses shown in [Figure 1](#) above supply fluid between the APS and the fluid source (typically a fluid circulator). The purge line connector shown in [Figure 1](#) can be used to provide a dry purge gas to the APS to prevent condensation or ice build-up during sub-ambient temperature operations.

# Chapter 2:

## Setting Up the APS

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This chapter briefly describes the setup of the Advanced Peltier System (APS) on the ARES-G2.

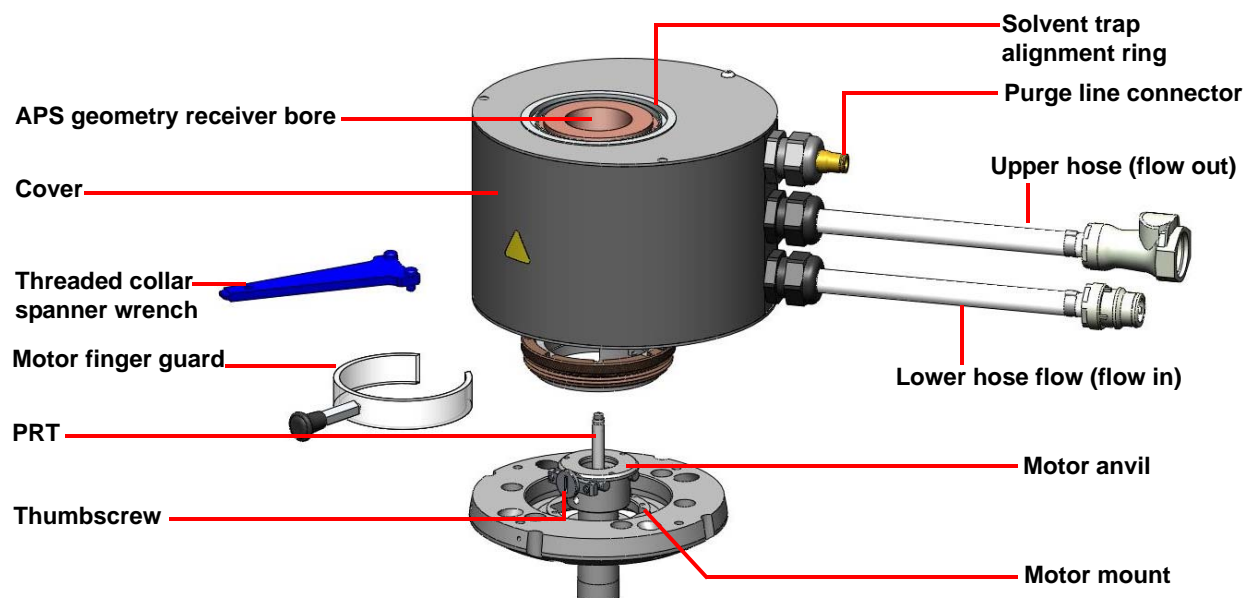
### *Preparing the ARES-G2*

**NOTE:** Refer to your instrument documentation for detailed procedures on removing and reassembling components.

- 1 Raise the stage to maximum height.
- 2 Remove all upper and lower test geometries as well as upper and lower PRTs (if installed), and loosen the anvil thumbscrew on the motor anvil. Refer to [Figure 2](#).
- 3 Thoroughly inspect the geometry mounting surfaces (that is, the transducer anvil and the motor anvil) and clean off any material that may interfere with the mounting of the APS. Also, inspect the area on the motor housing mount where the APS threaded collar will mount. This is essential to ensure proper mechanical alignment between the APS and the instrument.
- 4 The APS accessory is used in conjunction with the environmental controller. Ensure the environmental controller is connected to the ARES-G2 before proceeding. For installation instructions, see [“Connecting the Environmental Controller” on page 31](#).

# Installing the APS

Refer to [Figure 2](#) for an illustrated parts and assembly breakdown.



**Figure 2** Overview of APS assembly and installation.

\*Install the short PRT (for use with concentric cylinder geometries) BEFORE installing the APS. Install the long PRT (for use with plate geometries) AFTER installing the APS. To switch geometries after the APS has already been installed on the instrument, see [“Changing Lower Geometries in the APS” on page 29](#).

Follow these instructions to install the APS:

- 1 From the back of the ARES-G2, remove the two Phillips screws (located to the left of the **ACCESSORY CONTROL** plug). Align the hose management bracket holes with the ARES-G2 screw holes and use the screws to install the bracket onto the back of the instrument, as shown below.

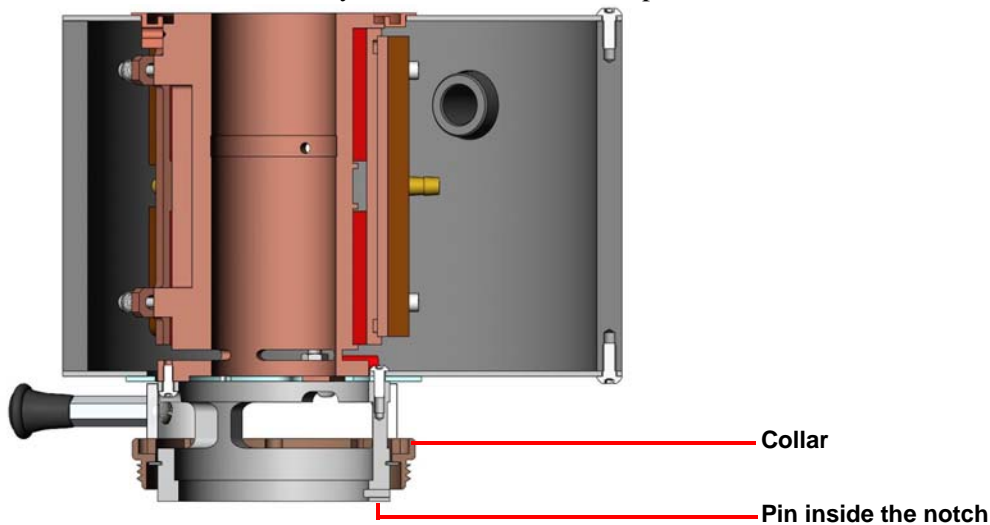


**Figure 3** Hose management bracket installed properly on back on ARES-G2.

- 2 If you intend on installing a concentric cylinder geometry, install the **short** PRT into the motor housing, making sure to align the red dot on the PRT with the flat portion of the motor anvil. Rotate the PRT until it drops into the motor housing.
- 3 Remove the finger guard (shown in [Figure 2](#)) from the APS.
- 4 Position the APS assembly so that the APS hoses are facing right as you face the instrument.
- 5 Slowly lower the APS onto the motor housing, ensuring that the pin is towards the back of the instrument.

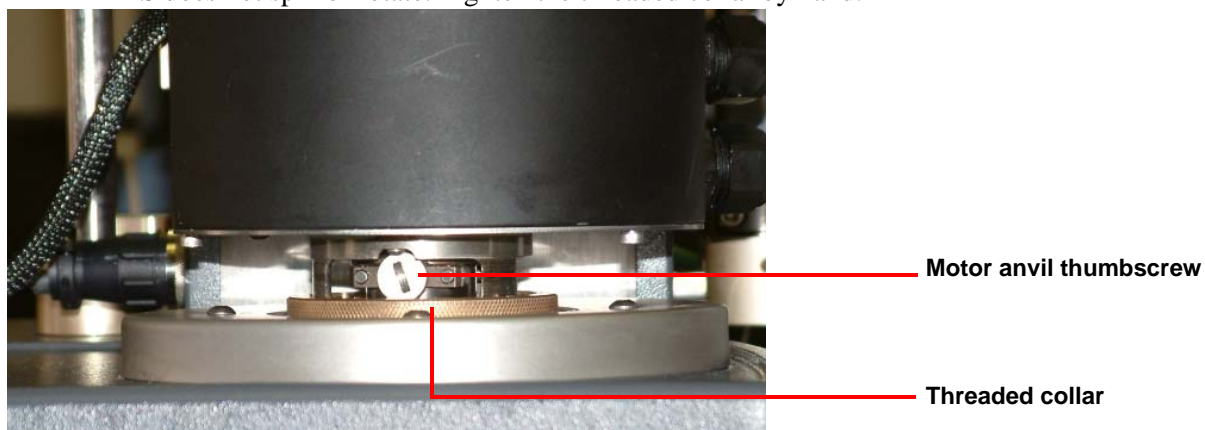
**NOTE:** Before mounting the accessory, thoroughly inspect the geometry mounting surfaces (that is, the transducer anvil and the motor anvil) and clean off any material that may interfere with the mounting of the APS. Also, inspect the area on the motor housing mount where the APS threaded collar will mount. This is essential to ensure proper mechanical alignment between the APS and the instrument.

- a Seat the alignment pin located at the bottom of the APS (see [Figure 4](#)) into the notch in the motor housing (the pin and notch should be located toward the rear of the instrument). It may be necessary to rotate the APS assembly back and forth until the pin falls into the notch.



**Figure 4** APS alignment pin configuration (cross section shown for visibility).

- b Verify that the threaded collar rests in the threaded portion of the motor housing and ensure that the APS does not spin or rotate. Tighten the threaded collar by hand.



**Figure 5** APS secured to ARES-G2.

- c Once the APS is secured, place the two pins on the spanner wrench into two of the holes machined into the threaded collar. Rotate the wrench clockwise to tighten. Do not overtighten the collar.
- 6 If you intend on installing a plate geometry, install the **long** PRT into the APS housing, making sure to align the red dot on the PRT with the flat portion of the motor anvil. Rotate the PRT until it drops into the motor housing.

## *Connecting the Circulator*

**CAUTION:** If you turn off the circulator at any time, press the **Environment** button on the instrument keypad to disable the temperature controller. Failure to do so could cause significant damage to the APS Peltier elements.

**MISE EN GARDE:** Si vous arrêtez le circulateur à un moment quelconque, appuyez sur le bouton **Environnement** sur le clavier de l'instrument pour désactiver le régulateur de température. Le non respect de cette précaution pourrait endommager de manière significative les éléments de l'APS Peltier.

The APS is a Peltier device that requires a heat sink fluid circulating through the system. The temperature performance of the APS depends on several factors, including:

- Flow rate provided by circulator
- Heat sink temperature
- Cooling capacity of the circulator at the heat sink temperature

**NOTE:** Circulators that provide heating or cooling capability have an optimum setting for maximum cooling capacity. Consult your applicable circulator documentation for this information.

The general relationship between the heat sink temperature and obtainable temperature range of the APS is as follows:

Temp Range:  $T_{min} = T_c - 40^{\circ}\text{C}$ ;  $T_{max} = T_c + 90^{\circ}\text{C}$

where  $T_c$  = heat sink temperature,  $T_{min}$  = minimum obtainable temperature,  $T_{max}$  = maximum obtainable temperature.

**NOTE:** The specified temperature range of the APS is  $-10^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ . You cannot set temperatures beyond these ranges, even if the formula works out that way.

Example: Heat sink temperature =  $20^{\circ}\text{C}$

$T_{min} = 20^{\circ}\text{C} - 40^{\circ}\text{C} = -20^{\circ}\text{C}$  and  $T_{max} = 20^{\circ}\text{C} + 90^{\circ}\text{C} = 110^{\circ}\text{C}$ . However, the minimum specification is  $-10^{\circ}\text{C}$ , so in this case the temperature range is  $-10^{\circ}\text{C}$  to  $110^{\circ}\text{C}$  at a set point of  $20^{\circ}\text{C}$ .

Follow these steps to connect the circulator to the APS:

- 1 Disable the **Environment** button (circled below) on the instrument keypad.

**Environment button**

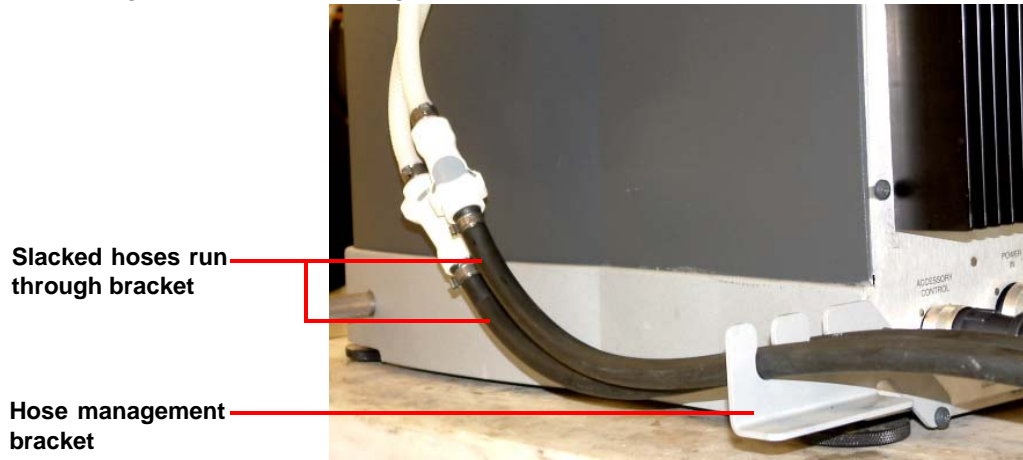
**Indicator lights:**

- Green—function is on
- Red—function is off



**Figure 6** Environment button on instrument keypad.

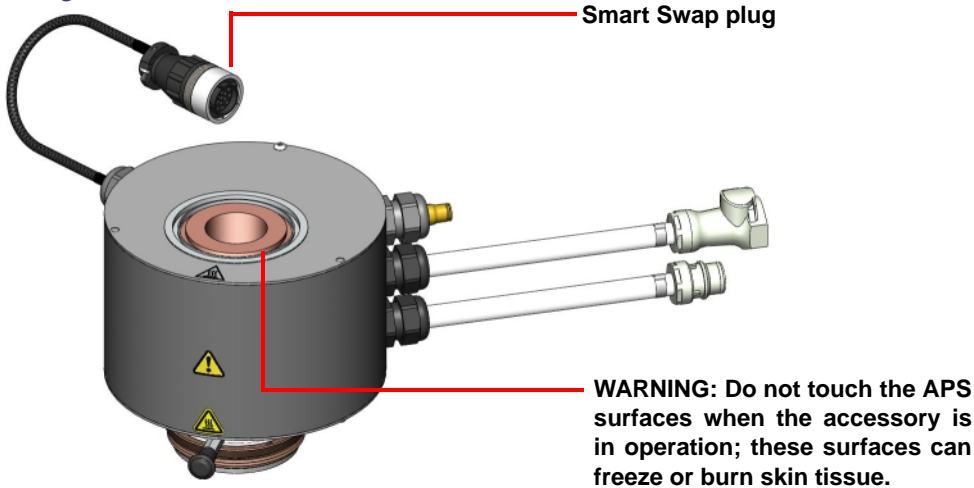
- 2 Position the circulator on the floor below the ARES-G2 work area, allowing yourself ample room to work.
- 3 Power off the circulator before making any connections.
- 4 Connect the lower hose to the outward flow port of the circulator and the upper hose to the inward flow port of the circulator. Refer to your circulator's documentation for identification of the ports.
- 5 Ensure that all hoses are installed completely onto their respective hose barbs and that the hose clamps are tight.
- 6 Position the hoses into the hose management brackets as shown in the figure below. There should be sufficient slack in the hoses to in order to avoid exerting a force on the APS, which may cause a misalignment of the mounting.



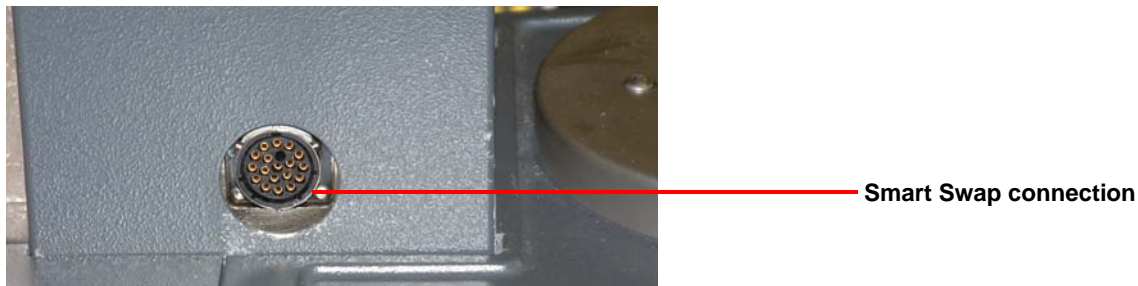
**Figure 7** Hoses run properly through hose management brackets.



- 7 Connect the Smart Swap™ plug (shown in figure below) into the Smart Swap connection (shown in [Figure 9](#)) on the left side of the ARES-G2.



**Figure 8** APS with Smart Swap connection.



**Figure 9** Lower accessory connector on left side of ARES-G2.

## *Filling the Circulator*

Fill the circulator with fluid; the fluid to use depends on the type of circulator in use and the desired operating range of the circulator. Refer to the circulator documentation for fill and temperature settings.

**CAUTION:** Do not operate the ARES-G2 APS accessory unless coolant is circulating through the device. Operation of this device without coolant may cause permanent damage to the APS unit. If you turn off the circulator at any time, press the Environment button on the instrument keypad to disable the temperature controller. Failure to do so could cause significant damage to the APS Peltier elements.

**MISE EN GARDE:** N'utilisez pas l'accessoire ARES-G2 APS tant que le fluide caloporteur ne circule pas dans le dispositif. L'utilisation de ce dispositif sans fluide caloporteur peut provoquer des dégâts irréversibles sur l'APS. Si vous arrêtez le circulateur à un moment quelconque, appuyez sur le bouton Environnement sur le clavier de l'instrument pour désactiver le régulateur de température. Le non respect de cette précaution pourrait endommager de manière significative les éléments de l'APS Peltier.

**NOTE:** Refer to your circulator's documentation for specific filling and operating guidelines, as well as other options for your application.

## Installing the Purge Gas Panel

Follow the instructions below to install the purge gas panel on the FCO mounting bracket rod. Install the purge gas panel on the right side of the instrument when facing it.

The APS purge gas panel features a 1/4-inch quick connect inlet port for a customer-supplied inert gas. This port can be supplied with an inert gas of your choice (such as N<sub>2</sub> gas). If desired, you can use the air from the purge line in the rear of the ARES-G2. A WYE connector is supplied in the event that you already have an FCO installed. A 3-way manual control valve (shown in [Figure 11](#)) allows for switching between the main air line and an outside inert gas source.

**CAUTION: Do not exceed 100 psig for the inert gas supply.**

**MISE EN GARDE: Ne dépassez pas 100 psig pour l'alimentation en gaz inerte.**

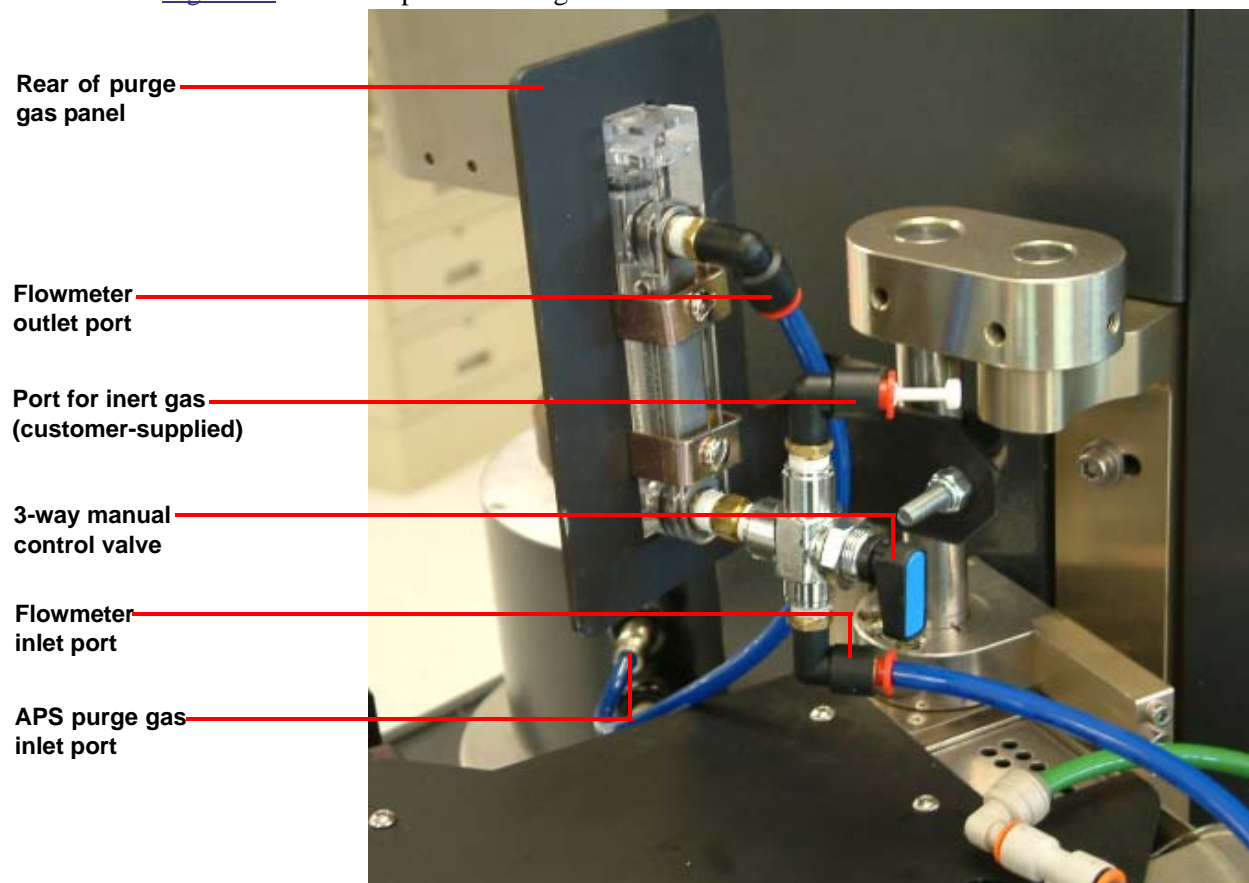
- 1 Attach the purge gas panel to the FCO mounting bracket rod using the U-bolt supplied in the kit. If the ARES-G2 is equipped with an FCO, mount the panel above the FCO. Refer to [Figure 10](#).



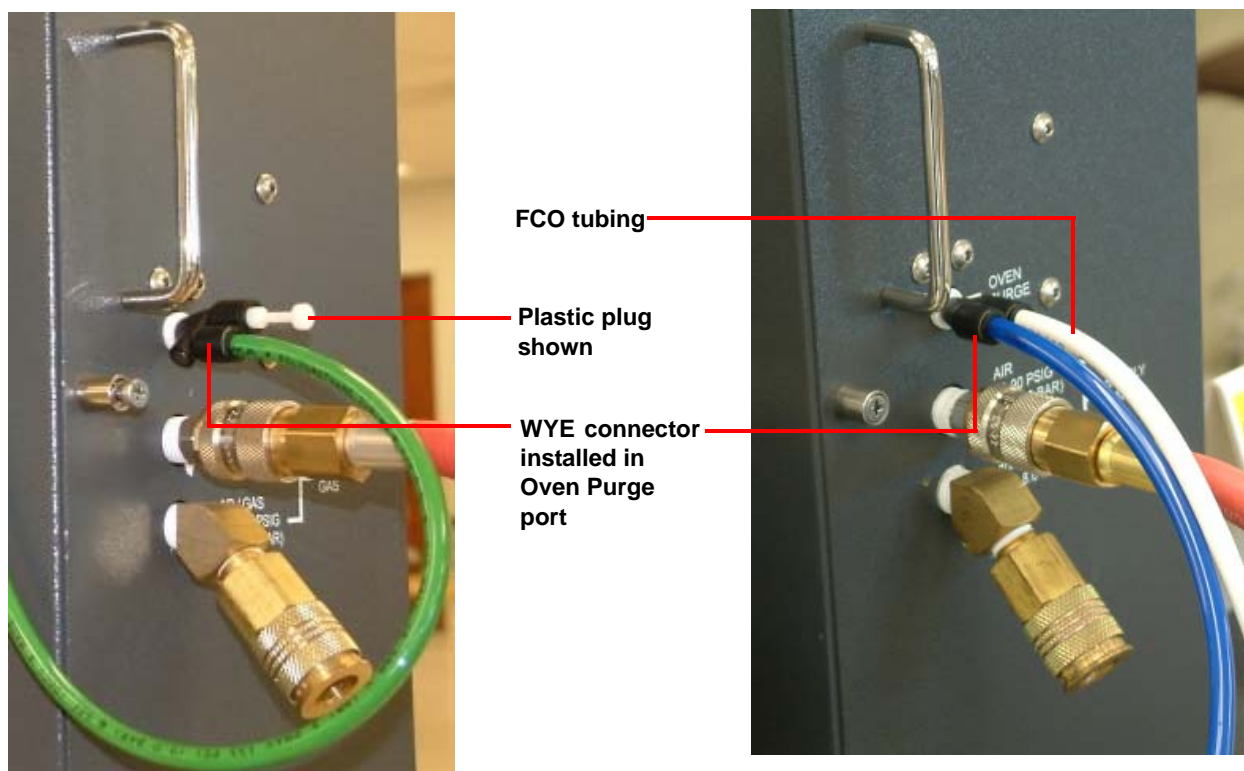
**Figure 10** Purge gas panel mounted on FCO mounting bracket rod.

- 2 Connect the short length of 1/4-inch OD plastic tubing to the outlet port at the top of the flowmeter. Then connect the tubing to the purge gas inlet port of the APS. Refer to [Figure 11](#).
- 3 Connect the long length of 1/4-inch tubing to the inlet port at the bottom of the flowmeter. Refer to [Figure 11](#).
- 4 Shut off the air supply to the test station. Ensure that the instrument power is Off.
- 5 From the rear of the test station at the oven **Oven Purge** port, remove the plastic tubing (if an FCO is equipped) or the plastic plug from the port. Then install the WYE connector (supplied in kit) into the **Oven Purge** port. Refer to [Figure 12](#).

- 6 Install the long length of tubing (from [step 3](#)) into one of the ports on the WYE connector. Then install the plastic plug (or the tubing, if an FCO is installed) into the remaining port on the WYE connector. Refer to [Figure 12](#) for the respective configurations.



**Figure 11** Purge gas panel tubing properly installed (FCO configuration shown).



**Figure 12** Configuration without an FCO (image on left); configuration with FCO (image on right).

- 7 Turn on the air supply. Check for leaks at newly-made connections.
- 8 At the flowmeter panel, set the flow for 5 L/min. This is the minimum gas flow rate required to prevent condensation from forming at sub-ambient temperature settings when using the APS. You may use lower flow rates when an inert purge is being used to prevent sample degradation or drying.

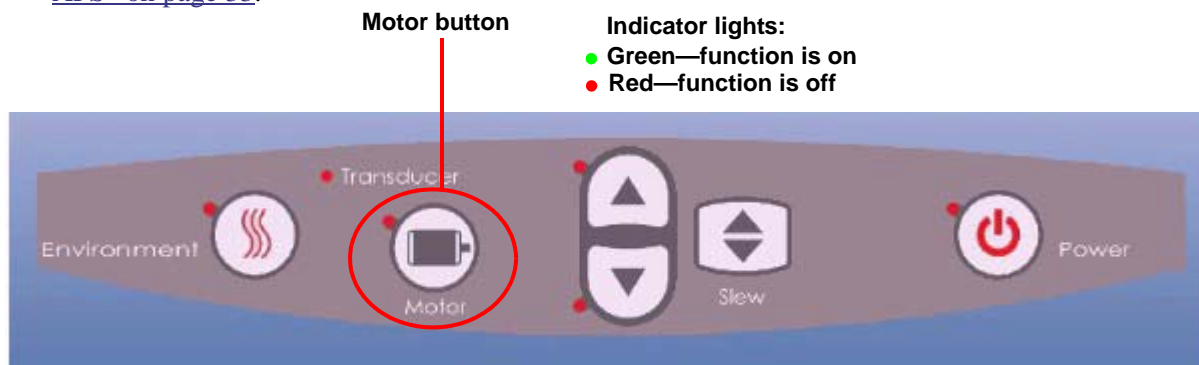
## Installing the Geometry

**CAUTION:** The APS is not intended for use with the upper geometry platinum resistance thermometer (PRT). Operating the APS with an upper geometry PRT will result in inaccurate temperature readings.

**MISE EN GARDE:** L'APS n'est pas conçu pour être utilisé avec le thermomètre à résistance de platine de la géométrie supérieure (PRT). L'utilisation de l'APS avec un PRT de la géométrie supérieure peut entraîner des relevés de température inexacts ou des températures inattendues au niveau de la plaque APS lorsqu'aucun échantillon n'est mis en place.

Follow these steps to install the geometries in the APS. If you are installing a solvent trap, refer directly to [“Installing the APS Plate Split Solvent Trap \(Optional\)” on page 23](#).

- 1 Remove the motor finger guard from the APS, if necessary.
- 2 Turn off the motor.
- 3 Position the motor anvil thumbscrew so that it is facing you as you face the instrument. Refer to [Figure 5](#) for proper orientation.
- 4 Turn on the motor.
- 5 Install the lower geometry into the bore of the APS, aligning the notch on the geometry with the scribe mark on the cover plate of the APS.
- 6 Press the geometry into the bore to compress the spring-loaded PRT.
- 7 While holding the geometry in position, tighten the thumbscrew using the supplied torque screwdriver. Continue to tighten the thumbscrew until the screwdriver makes an audible click.
- 8 Turn the motor off via the **Motor** button on the instrument keypad (circled below). Spin the lower geometry to **ensure that it spins freely**. If it does not, remove the accessory from the motor housing. Check the APS bore, APS mounting, and the motor mount for cleanliness. Refer to [“Maintaining the APS” on page 33](#).



**Figure 13** Motor button on the instrument keypad.

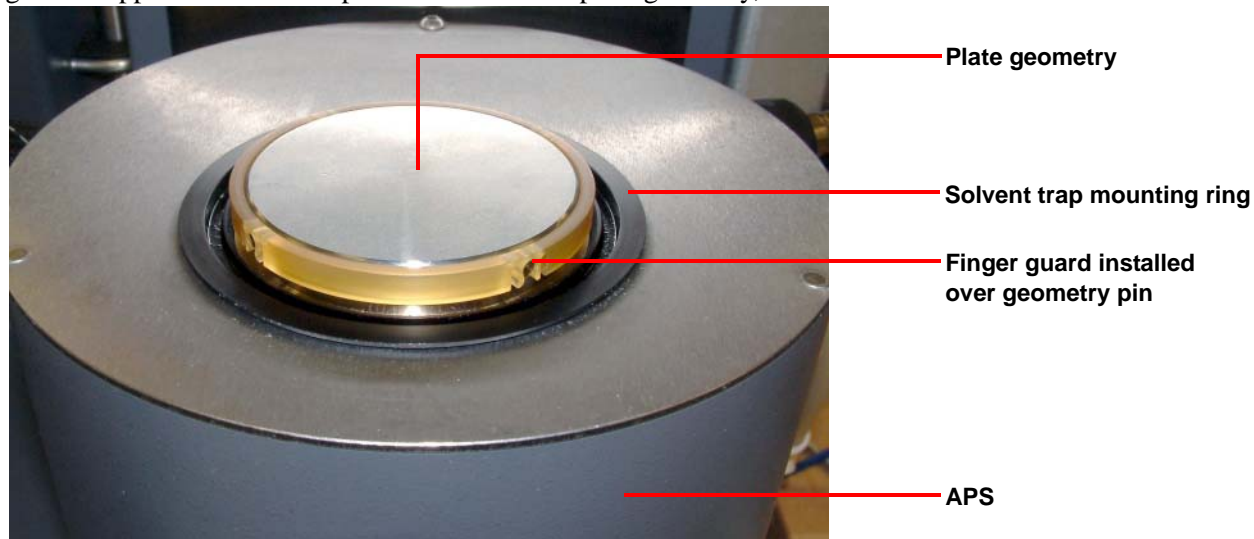
- 9 If you installed a lower plate geometry:
  - And you are **not** using a quick-change plate geometry, see [“Installing the Geometry Finger Guard” on page 22](#).
  - And you **are** using a quick-change plate geometry, see [“Installing the Bayonet Mounting Geometries \(Optional\)” on page 22](#).
- 10 Install the motor finger guard.



- 11 Install the upper geometry by holding the geometry by the shaft and sliding it into the transducer opening. Tighten the knob by hand, being careful not to overtighten.

## Installing the Geometry Finger Guard

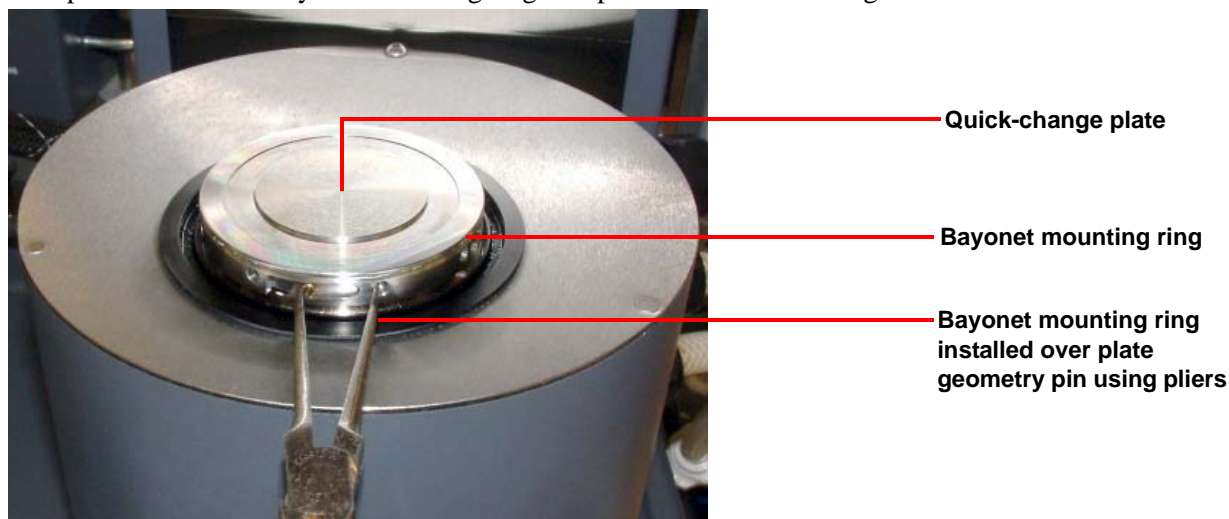
If you are using a plate geometry and **not** using a quick-change plate, be sure to have the plastic finger guard snapped onto the four pins of the standard plate geometry, as shown below.



**Figure 14** Plastic finger guard installed on plate geometry.

## Installing the Bayonet Mounting Geometries (Optional)

The plate geometry can be used as a standalone test geometry, or it can be used with interchangeable quick-change plates via the use of the bayonet mounting ring. To install a quick-change plate, simply position it on the plate geometry and install the bayonet mounting ring over the plate geometry. Use needle-nose pliers to lock the bayonet mounting ring into place. Refer to the image below.



**Figure 15** Bayonet mounting ring installed on quick-change plate.

## Installing the APS Plate Split Solvent Trap (Optional)

Use the optional plate split solvent trap to reduce drying of the sample, to prevent moisture from forming on the geometry during sub-ambient tests, when an inert atmosphere is required, or a combination of any or all of these features.

- If the plate split solvent trap is being used to reduce drying of the sample, it should be used in combination with an upper geometry that has a solvent reservoir feature.
- If the plate split solvent trap is being used to prevent moisture from forming or to maintain an inert atmosphere, then the solvent trap reservoir feature is not necessary on the upper geometry.

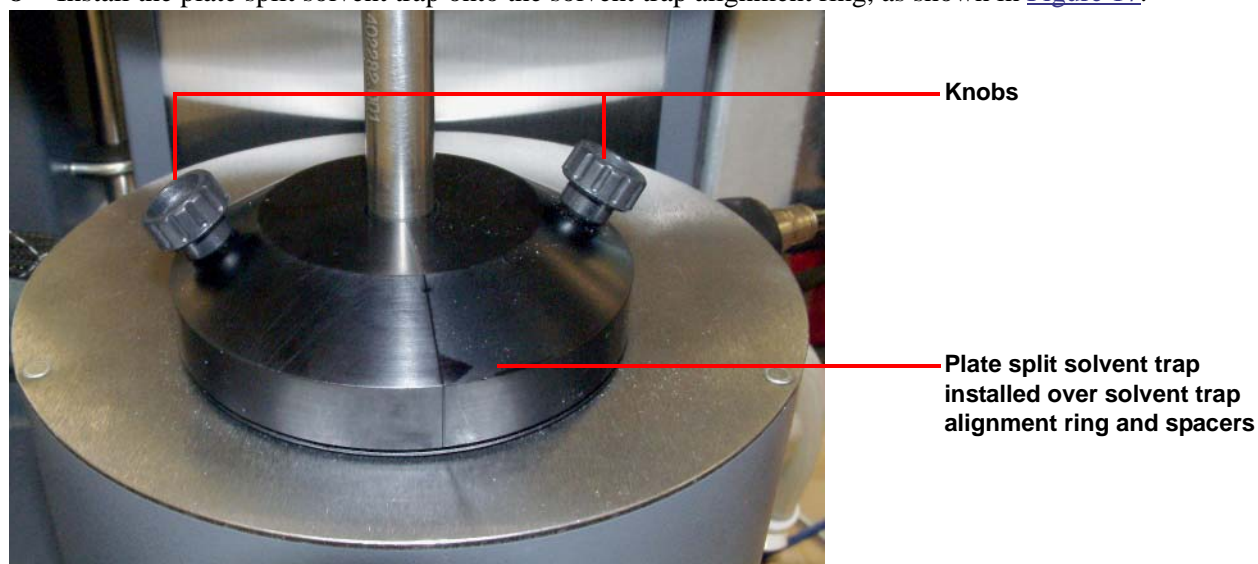
To install the plate split solvent trap:

- 1 **If you intend on using an upper geometry that has a solvent reservoir feature:** You may, if desired, fill the solvent trap alignment ring (shown in [Figure 2](#)) with solvent.
- 2 **If you intend on using a quick-change plate on the lower plate geometry:** Install the bayonet mounting ring and quick-change plate on the lower plate geometry as described in [“Installing the Bayonet Mounting Geometries \(Optional\)”](#) on page 22.
- 3 Install the ring spacer(s) over the solvent trap alignment ring. For maximum performance, use a small amount of vacuum grease on the ring spacer(s) before installing. See [“Using the Ring Spacers”](#) on page 24 for information on selecting the appropriate ring spacers for your geometry setup.
- 4 Install the upper geometry by holding the geometry by the shaft and sliding it into the transducer opening. Tighten the knob by hand, being careful not to overtighten.
- 5 Load the sample and lower the ARES-G2 stage to the applicable sample gap.
- 6 Fill the upper geometry with solvent, if applicable.
- 7 Place a light coating of vacuum grease on the outside ring of the plate split solvent trap, as shown below. Be sure that the grease is compatible with the sample and the temperature to be run.



**Figure 16** Coating the surface of the plate split solvent trap.

8 Install the plate split solvent trap onto the solvent trap alignment ring, as shown in [Figure 17](#).



**Figure 17** Plate split solvent trap installed on solvent trap alignment ring.

### *Using the Ring Spacers*

The ring spacers are required when an APS is fitted with a lower plate geometry (standard or quick-change plate) in conjunction with the plate split solvent trap. Because the distance between the upper and lower geometries varies depending upon your specific APS configuration, ring spacers are needed to compensate for the height difference and to ensure proper functionality of the solvent trap.

The plate split solvent trap ship kit includes four ring spacers: 5 mm, 2 mm, 1 mm, and 0.5 mm. The exact combination of ring spacers needed depends upon your geometry configuration. To use the ring spacers, follow these instructions:

- 1 Use Table 1 and Table 2 below to determine the height (in mm) that the spacers should total. For example, if the value is 3 mm, you will obtain the 2 mm and 1 mm spacers to achieve that height.

**Table 1: Spacers for Use with Lower Standard Flat Plate and Solvent Trap**

Upper Plate Type	Approximate Spacer Height Total (mm)
25 mm SST/SST SBL	3
25 mm PPS	3
25 mm SST Cone 1°	1
25 mm PPS Cone 1°	3
40 & 50 mm SST/SST SBL	1
40 & 50 mm PPS	3
40 & 50 mm SST Cone 2 & 4°	No spacer
40 & 50 mm PPS Cone 2 & 4°	No spacer



**Table 2: Spacers for Use with Quick-Change Lower Plate\* and Solvent Trap**

Upper Plate Type	Approximate Spacer Height Total (mm)
25 mm SST/SST SBL/CH	8
25 mm PPS	8
25 mm SST Cone 1°	8
25 mm PPS Cone 1°	8
40 & 50 mm SST/SST SBL/CH	6
40 & 50 mm PPS	8
40 & 50 mm SST Cone 2 & 4°	6
40 & 50 mm PPS Cone 2 & 4°	6

\*Includes all sizes, materials, and surfaces of quick change lower plates.

SST: stainless steel

SBL:sandblasted

PPS: polyphenylene sulfide

CH: cross-hatched

**NOTE:** Due to variances in the APS height, the spacer height values in the tables above are approximate. In some cases, the required spacer height may be less than the values supplied in the table.

- Obtain the necessary ring spacer(s) according to the above tables. For best analytical results, place a light coating of vacuum grease on the flange side of each ring spacer to be used.



Ring spacer with flange side facing up. Place a light coating of grease along this surface on each ring spacer to be used.

**Figure 18** Ring spacer flange shown.

- 3 Place the ring spacers, **flange side down**, over the solvent trap alignment ring. Refer to the figure below.



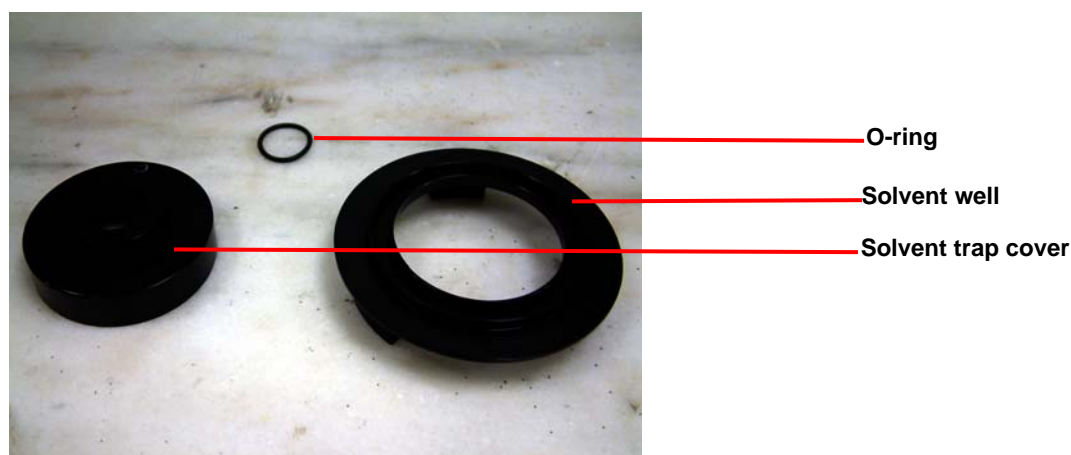
**Figure 19** Ring spacer properly installed over solvent trap alignment ring.

- 4 When finished, proceed to [step 4](#) in “[Installing the APS Plate Split Solvent Trap \(Optional\)](#)” on [page 23](#) to complete solvent trap installation.

## Installing the APS Concentric Cylinders Solvent Trap (Optional)

Use the APS concentric cylinders solvent trap to reduce drying of the sample, to prevent moisture from forming on the geometry during sub-ambient tests, when an inert atmosphere is required, or a combination of any or all of these features.

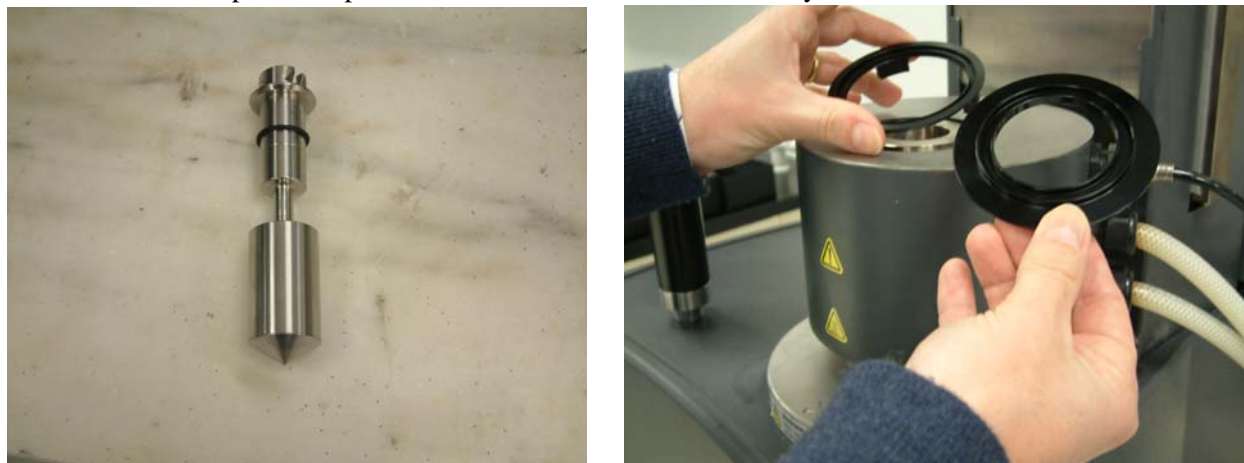
The APS concentric cylinders solvent trap kit includes o-ring, solvent well, and solvent trap cover. Refer to the image below.



**Figure 20** APS concentric cylinders solvent trap kit.

- 1 Add the o-ring to the bob by sliding the o-ring from the top of the bob to below the lip. Refer to Figure 21.

- 2 On the APS, replace the plate solvent well with the concentric cylinders solvent well.



**Figure 21** O-ring placed on bob (left image); Replacing the plate well with concentric cylinders well (right image).

- 3 Install the cup and bob on the instrument.
- 4 Make sure the concentric cylinder geometry is selected in the TRIOS software. In the control software, click **Zero Fixture** to zero the gap. After zero gap routine is finished, click **Go to Geometry Gap**.
- 5 Fill the well with the desired solvent (typically water, a low viscous mineral or silicone oil, or solvent used in sample); be careful not to overflow the well.
- 6 Rest the solvent trap cover on the o-ring. Make sure the o-ring is high enough on the bob shaft so that the solvent trap cover does not touch the bottom of the solvent well.



**Figure 22** Solvent trap cover being placed over the o-ring.

- 7 Using the LCD, tare the axial force.
- 8 Slide down the solvent trap cover, along with the o-ring, on the bob shaft until the solvent trap cover lip touches the solvent in the well. This will seal the environment around the sample in the cup. Do not lower the cover all the way down so that the cover lip touches the metal at the bottom of the well.

**NOTE:** For enhanced performance, apply vacuume grease on the joint of the solvent trap cover and on the top of the o-ring.

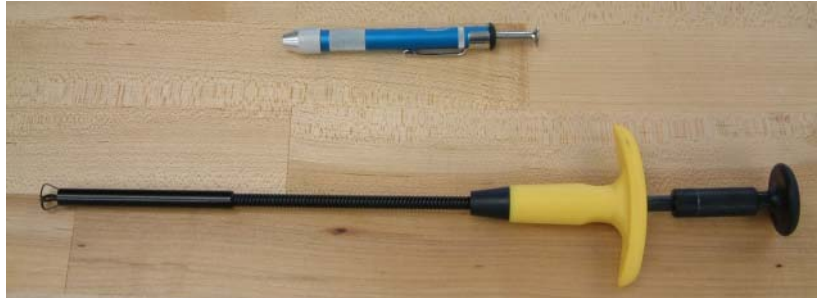
- 9 Raise the stage completely to allow for space to load the sample. Do not move the solvent trap cover from its position on the bob.
- 10 Load the desired sample, then click **Go to Geometry Gap**. Design the desired test procedure and begin the test.

## *Restore the Instrument to Operating Condition*

- 1 Power on the circulator.
- 2 Turn on the **Environment** button from the instrument keypad (refer to [Figure 6](#)).
- 3 From within TRIOS software, perform the **Check Bath Friction** test.
- 4 If the test indicates friction over 1 gm.cm (100  $\mu$ N-m), check the geometry installation and cleanliness of the mounting surfaces and geometry.

## Changing Lower Geometries in the APS

In some instances, it may be desirable to change the lower geometries (and therefore the PRT) after the APS has already been installed on the instrument. For such cases, the APS installation kit comes with a short PRT install tool and a short PRT retrieval tool (shown below). These tools allow you to remove and install the applicable PRT without having to remove the APS from the motor housing.



**Figure 23** Short PRT install tool (top) and short PRT retrieval tool (bottom).

Follow the instructions below to change lower geometries in the APS.

### Changing from a Plate to a Concentric Cylinder Geometry

If the APS is installed with a plate geometry (long PRT) and you wish to switch to a concentric cylinder geometry (short PRT), follow the instructions below:

- 1 Remove the plate geometry by loosening the thumbscrew and then lifting the geometry out of the APS bore.
- 2 Use your fingers to carefully remove the long PRT.
- 3 Install the short PRT:
  - a Use the short PRT install tool to grip the short PRT, as shown below.



**Figure 24** Gripping the short PRT using the short PRT install tool.

- b Position the PRT in the APS so that the red dot on the PRT aligns with the flat portion of the motor anvil. Rotate the PRT until it drops into the motor housing.
    - c Once the PRT is installed, push the plunger of the short PRT install tool to release the PRT.
- 4 Install the lower geometry as described in [“Installing the Geometry” on page 21](#).

## Changing from a Concentric Cylinder to a Plate Geometry

If the APS is installed with a concentric cylinder geometry (short PRT) and you wish to switch to a plate geometry (long PRT), follow the instructions below:

- 1 Remove the concentric cylinder geometry by loosening the thumbscrew and then lifting the geometry out of the APS bore.
- 2 Depress the plunger on the end of the short PRT retrieval tool to actuate the jaws to the open position, and insert the short PRT retrieval tool into the bore of the APS, as shown below.



**Figure 25** Inserting the short PRT retrieval tool into the APS bore.

- 3 While continuously pressing the plunger, position the open jaws over the short PRT, and release the plunger to grab the PRT.
- 4 Pull the short PRT out of the APS.



**Figure 26** Pulling the short PRT out of the APS bore using the short PRT retrieval tool.

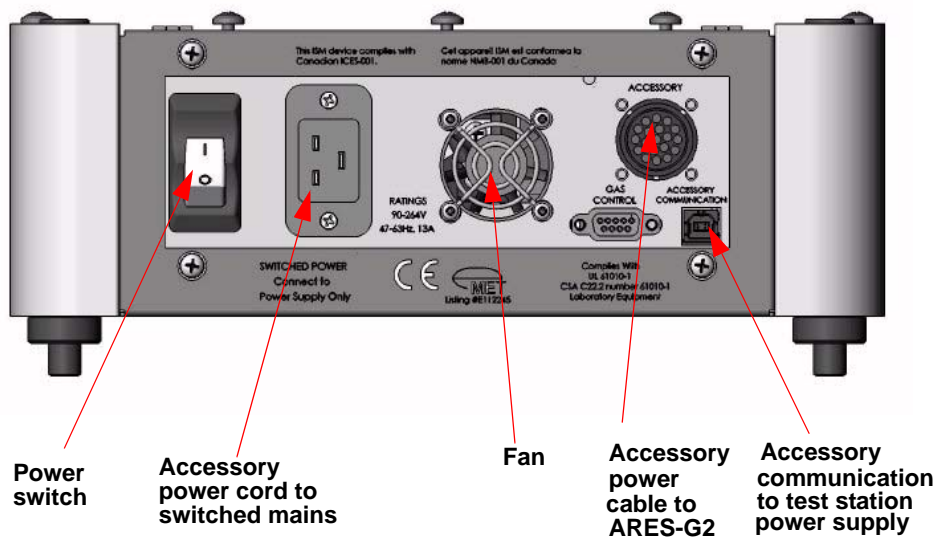
- 5 Install the long PRT into the APS housing, making sure to align the red dot on the PRT with the flat portion of the motor anvil. Rotate the PRT until it drops into the motor housing.
- 6 Install the lower geometry as described in [“Installing the Geometry” on page 21](#).



## Connecting the Environmental Controller

**CAUTION:** Make sure there is no power going to the environmental controller while making the connections described here. Turn the power switch to the off (O) position.

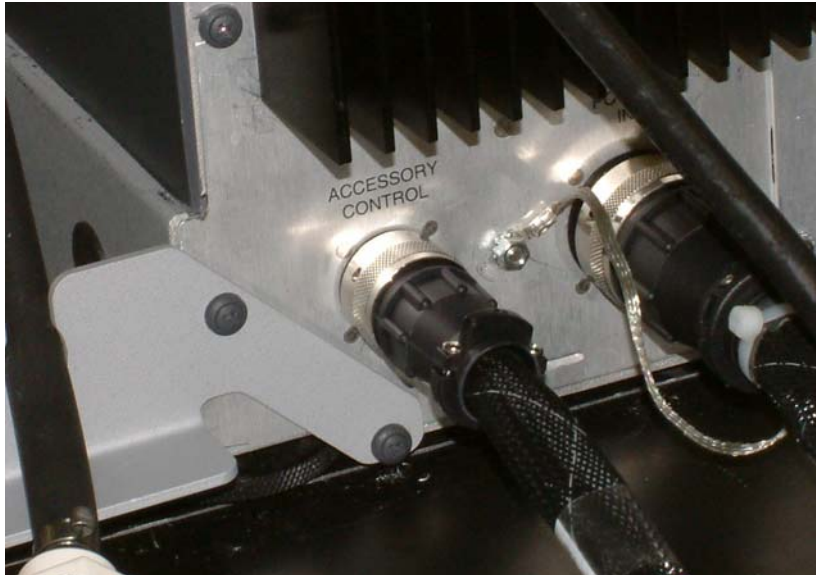
**MISE EN GARDE:** Assurez-vous que le contrôleur environnemental n'est pas alimenté en courant pendant le réglage des connexions décrites ici. Placez l'interrupteur d'alimentation sur la position d'arrêt (O).



**Figure 27** Environmental controller rear panel.

- 1 Place the environmental controller on top of the lower test station power supply or on top of a previously-installed FCO controller, within the limit of the cable length. Make sure you have access to the rear of the environmental controller and the ARES-G2.
- 2 Obtain the power cable from the accessory kit. Connect the cable to any of the four accessory power connections on the rear of the lower test station power supply, and connect the other end to the accessory power port on the environmental controller.

- 3 Connect the accessory control cable to the **ACCESSORY** port on the environmental controller and the other end of the cable to the **ACCESSORY CONTROL** port on the back of the ARES-G2, as shown below.



**Figure 28** Accessory Control connection to make on rear panel of ARES-G2.

- 4 Obtain the accessory communication cable from the accessory kit. Connect one end of the cable to the accessory communication port on the environmental controller. Connect the other end of the cable into the accessory communication port on the lower test station power supply.
- 5 Turn on the environmental controller using on/off switch located on the back of the controller.



# Chapter 3:

## Operating and Maintaining the APS

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This chapter briefly describes the operation and maintenance of the APS.

### *Operating the APS*

Once installed properly, the APS is ready for use with the ARES-G2 Rheometer. There are no specific operation instructions related to the APS. For information on operating the ARES-G2, refer to the *ARES-G2 Getting Started Guide* or TRIOS Help.



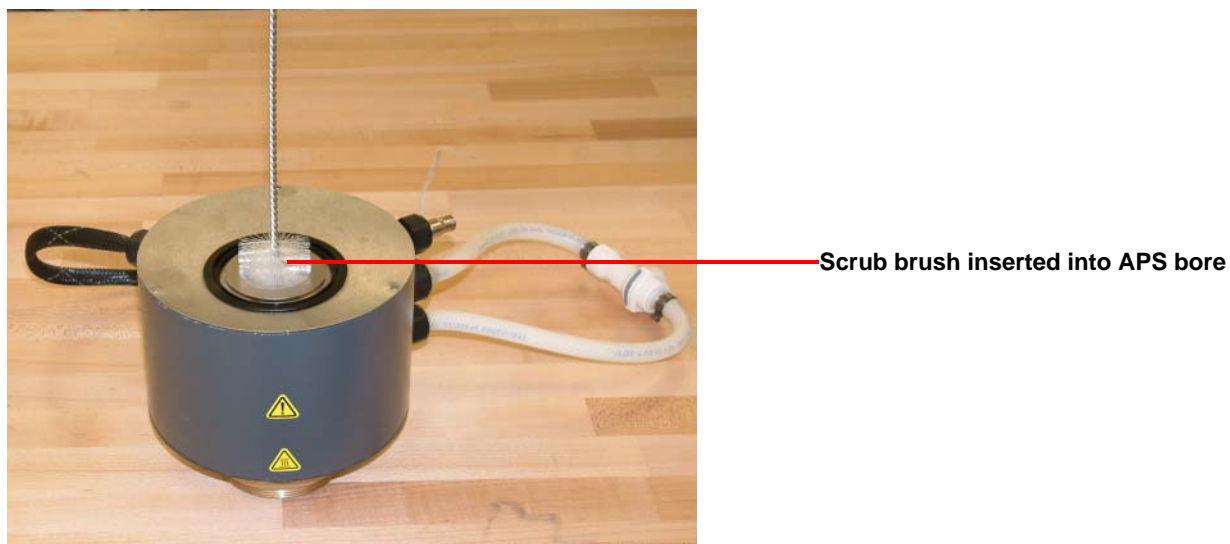
**DANGER:** Depending on the circulating fluid used, the temperature range of the APS is  $-10$  to  $150^{\circ}\text{C}$ . To prevent injury, do not touch the APS or geometry while it is in operation.

**DANGER:** En fonction du fluide de circulation utilisé, la plage de température de l'APS est comprise entre  $-10$  et  $150^{\circ}\text{C}$ . Pour éviter des blessures, ne touchez pas l'APS ou la géométrie lorsqu'il est en fonctionnement.

### *Maintaining the APS*

If the lower geometry does not spin freely once installed into the APS, there may be an obstruction in the APS bore. To clean the APS bore:

- 1 Shut down the circulator, if necessary.
- 2 Disconnect circulator hoses, air lines, and the Smart Swap™ plug.
- 3 Remove the APS from the motor mount.
- 4 Use the scrub brush (included with kit) to clean out the APS bore. Refer to the figure below.



**Figure 29** Cleaning the APS bore.

## *Replacement Parts*

**Table 3: APS Replacement Parts**

Part Number	Description
201248.001	Torque screwdriver, 10 in-lbs fixed
201249.001	Universal bit holder, 1/4 hex
201250.001	SLTD screwdriver insert bit
201251.001	Pliers, long nose with cush handle
201253.001	Wrench stubby ratchet 7/16 in
201254.001	Hygienic scrub brush
201268.001	Lighted mech pick-up tool 12 in flex shaft
201269.001	SPR rtrac tool pocket style
402503.901	Safety guard assembly
402514.901	APS plate PRT assy
402514.902	APS cup PRT assy
402537.901	Lock nut spanner wrench

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