AIR CHILLER SYSTEM
& CHILLER PANEL

Accessory for DHR Rheometer Getting Started Guide

Revision G Issued March 2023

Notice

The material contained in this manual, and in the 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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TA Instruments — Waters LLC
159 Lukens Drive
New Castle, DE 19720

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.

MISE EN GARDE: 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 the United States and Canada

CAN/CSA-C22.2 No. 61010-1-12 (R2017) Third Edition + U1;U2 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

For the European Economic Area

61010-1:2012, Third Edition + R:15Jul2015 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

For the United Kingdom

Electrical Equipment (Safety) Regulations 2016

EN 61326-1:2013 Electrical Equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General Requirements Class A.

Other

IEC 61010-1: 2010, Third Edition Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements; Corrigendum 1 2011, Corrigendum 2 2013; Issued: 2011/05/11

EN 61010-1: 2010 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements; Issued: 2010/10/01

UL 61010-1 Issued: 2012/05/11 Ed: 3 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

Electromagnetic Compatibility Standards

For Australia

EN61326-1:2013 Electrical Equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General Requirements Class A.

For Canada

ICES-001(A) Issue 5 July 2020 Interference-Causing Equipment Standard: Industrial, Scientific, and Medical Radio Frequency Generators.

For the European Economic Area

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

EN 61326-1:2013 Electrical Equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General Requirements Class A.

For the United Kingdom

Electromagnetic Compatibility Regulations 2016

EN 61326-1:2013 Electrical Equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General Requirements Class A.

Emissions

EN-61326-1-2013: Electrical equipment for measurement, control, and laboratory use. EMC Requirements.

Immunity

EN-61326-1-2013: Electrical equipment for measurement, control, and labortory use. EMC Requirements.

Supplier's Declaration of Conformity

47 CFR § 2.1077 Compliance Information

Unique Identifier:

ACS-2 Air Chiller System (220–230 VAC/60 Hz): **405001.901**

ACS-2 Air Chiller System (220–230 VAC/50 Hz): **405001.902**

ACS-3 Air Chiller System (220–230 VAC/60 Hz): **405000.901**

ACS-3 Air Chiller System (220–230 VAC/50 Hz): **405000.902**

DHR ETC and DMA 850/Q800 Combined Air Chiller Panel (for use with ACS-2 and ACS-3 Air Chiller Systems): **405400.901**

Responsible Party:

TA Instruments
159 Lukens Drive
New Castle, DE 19720
302-427-4000
www.tainstruments.com

FCC Compliance Statement:

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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: Use gloves when touching parts that have become frosted during use. MAY CAUSE FROSTBITE.

AVERTISSEMENT: Utiliser des gants pour toucher les parties qui sont devenus givrés pendant l'utilisation. Peut causer des gelures.

WARNING: Do not turn on the ACS unless the transfer hose has been connected to the DHR Rheometer temperature control system.

AVERTISSEMENT: Ne pas allumer le ACS tant que le tuyau de transfert n'a pas été connecté au système de contrôle de la température rhéomètre DHR .

Instrument Symbols

The following labels are displayed on the ACS for your protection:

Symbol	Explanation
	This symbol 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 ACS. 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 système ACS.

Please heed the warning labels and take the necessary precautions when dealing with those parts of the instrument. The *Air Chiller System (ACS) and Chiller Panel Getting Started Guide for DHR* contains cautions and warnings that must be followed for your own safety.

Table of Contents

Chapter 1:

Introducing the Air Chiller System

Overview

Air Chiller

The ACS is a unique multi-stage Air Chiller System for sub-ambient temperature control and general cooling of the DHR with the ETC Accessory. The ACS units feature CFC-free durable compressors, small footprint, and uninterrupted operation for specified temperature ranges–eliminating the recurring cost and safety concerns associated with handling and use of liquid nitrogen. The Air Chiller Systems require an air supply at pressure of 6.9 bar (100 psi), flow rate of 200 SLPM (Standard Liters Per Minute), and pressure dew point of at least -40°C (-40°F) or better, and appropriate instrument-specific Chiller Panel. Note that the dew point is to be measured at 6.9 bar.

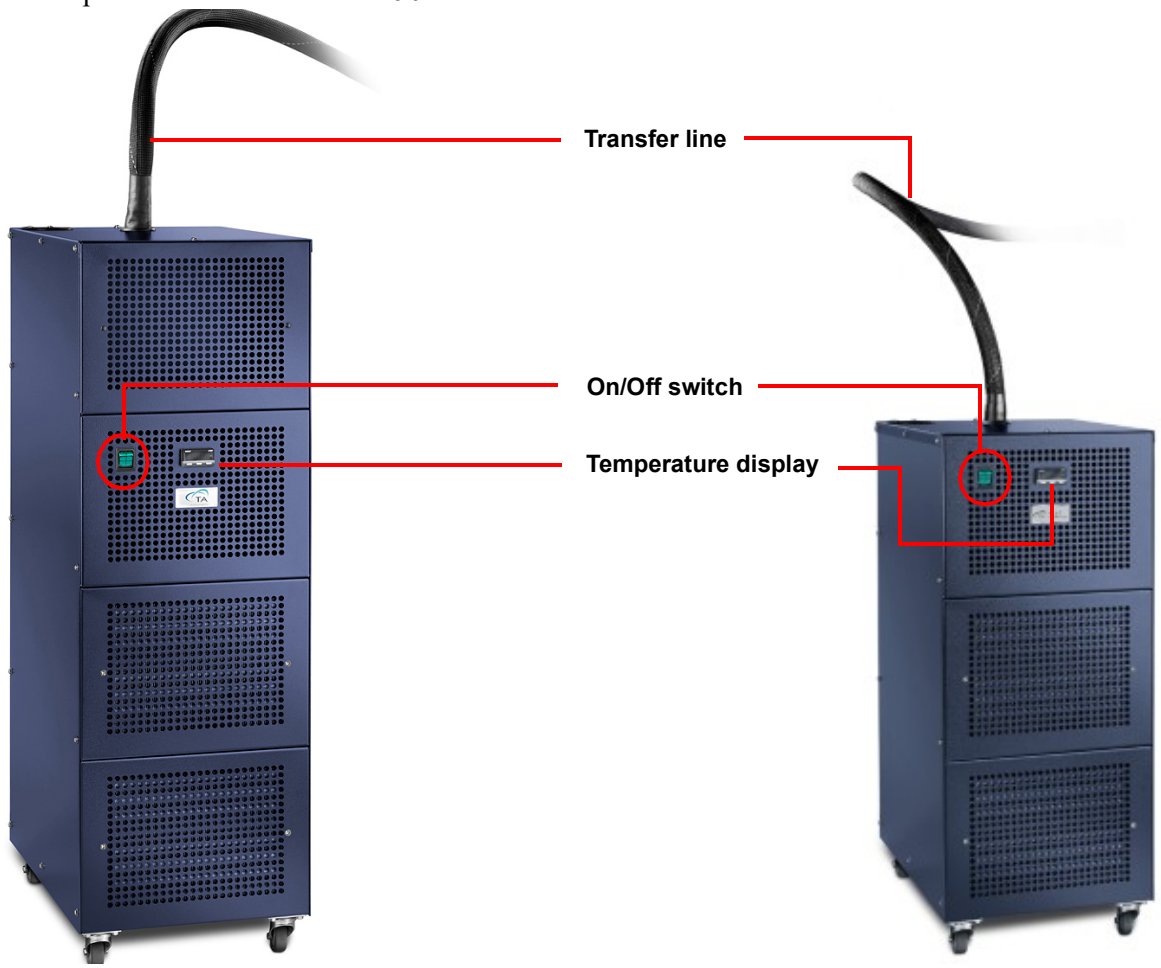

Figure 1 **Left**: ACS-3. **Right**: ACS-2

Internal Timer

The ACS contains an internal timer that keeps the purge gas solenoid valve closed until the system is fully ready. When the ACS is powered on, each Chiller stage energizes in sequence. The timer circuit begins counting after the final stage powers on. Once the final stage powers on, the timer counts approximately 30 minutes before it allows the ACS purge gas solenoid valve to open. Therefore, it will take approximately 60 minutes from when the ACS is powered on until it is ready to operate, and for cold gas to flow.

If the unit is used on a recurring daily basis, the ACS can be plugged into a power outlet that has a timer set to turn the instrument on one hour before the system is to be used.

Transfer Line

The ACS has a vacuum-insulated delivery line that carries the refrigerant to the evaporator and back. This flexible delivery line is made of corrugated stainless steel tubing.

CAUTION: Although this line is strong, it can be damaged to the point of rupture if it is repeatedly bent too sharply or twisted forcibly. This line must remain gas-tight in order to contain the refrigerant charge in the unit. The delivery line is brittle when cold. It should not be moved, bent, or disconnected when cold.

MISE EN GARDE: Bien que cette ligne est fort, il peut être endommagé au point de rupture si elle est plié trop fortement ou tordu. Cette ligne doit rester étanche aux gaz afin de contenir la charge de fluide frigorigène dans l'unité. La ligne de livraison est fragile à froid. Il ne devrait pas être déplacé, plié, ou déconnecté à froid.

Figure 2 Transfer line.

Continuous Operation

The length of time the ACS can be left running will depend on the dew point of the gas supply. The minimum temperature of the internal evaporators is maintained at -130°C on the ACS-3 and -90°C for the ACS-2. As a result, any supply with a dew point higher than this will eventually result in frost build up, reduced gas flow, and reduced performance. If the ACS is operated for extended periods under such conditions, frost accumulation may also lead to completely occluded gas transfer lines, stopping air flow and cooling. Compressors may also shut down with increased frosting, which will lead to significantly reduced cooling capacity and temperature control. If the supply has a pressure dew point lower than -130°C (ACS-3) or -90°C (ACS-2), the ACS can be operated indefinitely without interruption. When used in accordance to this guide and under normal operating conditions, the ACS should stay frost-free and be adequate for most applications during one day of testing.

It is recommended that the unit be shut down for drying on a daily schedule. Some users may find that longer times are permissible between drying intervals. To keep the ACS frost-free, you should leave the gas flowing through the unit after it has been powered off. See Shutting Down the ACS for more information. Extended operation without load is detrimental to the system. For this reason, it is also advised that the ACS be shut down overnight, or during other extended periods in which it will not be used actively.

Chiller Panel

The Chiller Panel is mounted to the side of the ACS. Each instrument temperature control system requires its own specific Chiller panel to interface to the ACS. The Chiller Panel assembly contains all of the pneumatic and electronic components needed to filter, regulate, and control the compressed gas (air or nitrogen) that is supplied to the temperature control systems.

There are different versions of the DMA Chiller Panel. Refer to the list below to identify the model you are using. Follow the instructions based on the version of the panel you have.

- **Stand-alone DHR Chiller Panel**
  - Consists of filter/dryer/regulator assembly and control box with flow meter.
  - Filter/dryer assembly is black in color.
  - Compatible with DHR and HR x0 rheometers only.

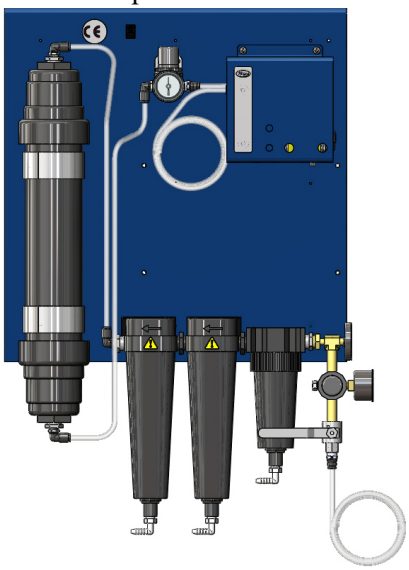

Figure 3 Stand-alone DHR Chiller Panel, P/N 404040.901

- **DHR ETC and DMA 850 Combined Chiller Panel**
  - Consists of filter/dryer/regulator assembly and control box with flow meter and a U-shaped flow indicator.
  - Compatible with DHR and HR x0 rheometers and DMA 850/Q800 DMA.
    - Rev. A: Filter/dryer assembly is black in color.
    - Rev. B: Filter/dryer assembly is silver/gray in color.

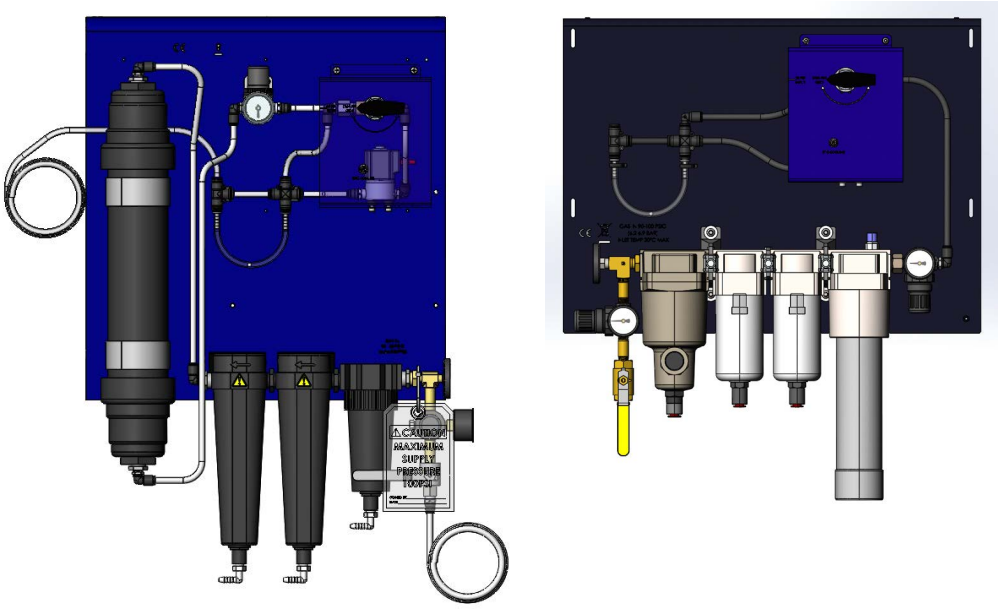

Figure 4 DHR ETC and DMA 850 Combined Chiller Panel P/N 405400.901.
Left: Rev A. **Right**: Rev B.

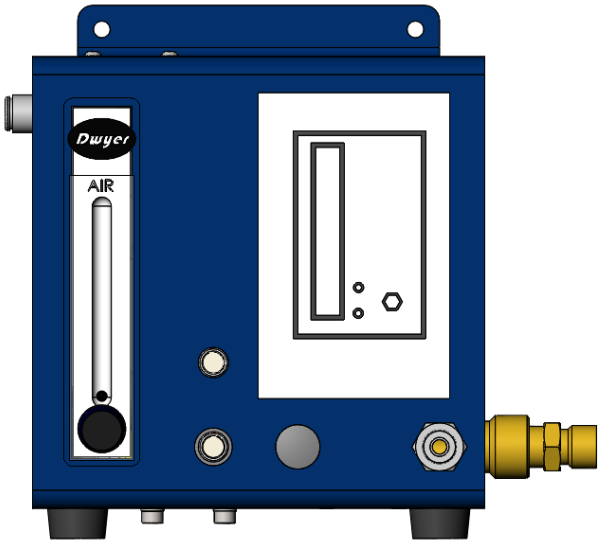

Figure 5 ETC Lo-Temp Manifold for ACS, P/N 545056.901.

The ETC manifold, P/N 545056.901, is required for operating the ACS with the DHR and is included with DHR Chiller Panel (P/N 404040.901) and the DHR ETC and DMA 850 Combined Air Chiller Panel (P/N 405400.901, Rev. A and Rev. B).

Users upgrading from the DMA 850 & Q800 DMA Air Chiller Panel must purchase this part separately.

Accessory Specifications

The tables below detail the ACS Accessory technical specifications.

Table 1A: ACS Accessory Characteristics with **DHR Air Chiller Panel / Combined Air Chiller Panel (Rev. A)**

Specifications	**ACS-2**	**ACS-3**
Dimensions of Air Chiller (H x W x D): Without Chiller Panel With Chiller Panel	 88.5 cm (35 in) x 37 cm (14.5 in) x 56 cm (22 in) 88.5 cm (35 in) x 52 cm (20.5 in) x 56 cm (22 in)	 112 cm (44 in) x 37 cm (14.5 in) x 56 cm (22 in) 112 cm (44 in) x 52 cm (20.5 in) x 56 cm (22 in)
Weight of Air Chiller Without Chiller Panel With Chiller Panel	 96 kg (211 lbs) 112 kg (247 lbs)	 121 kg (267 lbs) 137 kg (302 lbs)
Dimensions of Chiller Panel	Height: 86.4 cm (34 in) Width: 48.3 cm (19 in) Depth:38.1 cm (15 in)	Height: 86.4 cm (34 in) Width: 48.3 cm (19 in) Depth:38.1 cm (15 in)
Weight of Chiller Panel	15.8 kg (35 lbs)	15.8 kg (35 lbs)
Refrigerants	1st Stage: R404A 2nd Stage: as indicated* R290 & R508B OR R290 & R170 Each in varying amounts and substantially less than 500 g each.	1st Stage: R404A 2nd Stage: as indicated* R290 & R508B OR R290 & R170 3rd Stage: R290 & R14 Each in varying amounts and substantially less than 500 g each.

*Specific refrigerant components are indicated on the serial number tag attached to each instrument.

Table 1B: ACS Accessory Characteristics (with **Combined Air Chiller Panel (Rev. B)**

Specifications	**ACS-2**	**ACS-3**
Dimensions of Air Chiller (H x W x D): Without Chiller Panel With Chiller Panel	 88.5 cm (35 in) x 37 cm (14.5 in) x 56 cm (22 in) 88.5 cm (35 in) x 52 cm (20.5 in) x 56 cm (22 in)	 112 cm (44 in) x 37 cm (14.5 in) x 56 cm (22 in) 112 cm (44 in) x 52 cm (20.5 in) x 56 cm (22 in)
Weight of Air Chiller Without Chiller Panel With Chiller Panel	 96 kg (211 lbs) 104 kg (229 lbs)	 121 kg (267 lbs) 130 kg (285 lbs)
Dimensions of Chiller Panel	Height: 63.5 cm (25 in) Width: 55 cm (21.5in) Depth: 18 cm (7 in)	Height: 63.5 cm (25 in) Width: 55 cm (21.5 in) Depth: 18 cm (7 in)
Weight of Chiller Panel	8.2 kg (18 lbs)	8.2 kg (18 lbs)
Refrigerants	1st Stage: R404A 2nd Stage: as indicated* R290 & R508B OR R290 & R170 Each in varying amounts and substantially less than 500 g each.	1st Stage: R404A 2nd Stage: as indicated* R290 & R508B OR R290 & R170 3rd Stage: R290 & R14 Each in varying amounts and substantially less than 500 g each.

*Specific refrigerant components are indicated on the serial number tag attached to each instrument.

Table 2: Accessory Cooling Gas Requirements for ACS-2 and ACS-3

Gas	Air or nitrogen
Pressure	6.9 bar (100 psi)
Flow Rate	200 SLPM
Temperature	20–30°C
Dew Point	-40°C (-40°F) pressure dew point. NOTE: Dew point is specified at operating pressure. Supplying dryer air at a lower dew point will extend continuous operation.

Table 3: Accessory Operating Environmental Conditions for ACS-2 and ACS-3

Ambient air	21°C–24°C = Ideal NOTE: The ACS generates a significant quantity of heat when running. These operating temperatures must be maintained during system operation. Heat Generation: ACS-2 50 Hz: 1450 W ACS-2 60 Hz: 1450 W ACS-3 50 Hz: 1750 W ACS-3 60 Hz: 1600 W *Refer to the serial number plate on the rear of the unit.
Operating altitude	2000 meters maximum
Relative humidity	5% to 80% RH from 15°C to 30°C
IP Rating	The degree of protection for this instrument according to EN 60529 is IP20.

Table 4: Accessory Power Requirements for ACS-2 and ACS-3

Electrical *Refer to the serial number plate on the rear of the unit	**Part Number**	**Voltage Frequency**	**Current**
	405000.901	240V	60 Hz 9A
	405000.902	220-230V	50 Hz 11A
	405001.901	240V	60 Hz 8A
	405001.902	220-230V	50 Hz 9.1A

Table 5: Accessory Performance Specifications

Specification	**ACS-2**	**ACS-3**
Lowest temperature[1]	-50°C[1]	-85°C[1]
Cooling rate:	see below[2]	see below[2]

1. Lowest temperatures specified are achievable under ideal operating conditions. Actual temperature limits will vary with ambient and compressed air temperatures and testing conditions.
2. Ramp Rate: The maximum sustainable ramp rate will depend on a number of factors particularly the start and end temperature. To determine the maximum sustainable heating/cooling rate, perform the following test and analysis:
   a. Equilibrate to start temperature. Perform a time sweep or peak hold test with the temperature set (if possible) to a few degrees in excess of the end temperature. Set the time much longer than you expect; the test can be aborted when the temperature has reached a stable value.
   b. Plot a graph of temperature vs. time (min) and take the derivative. Inspect the derivative curve over your temperature range of interest. The maximum sustainable rate will be the lowest value on the derivative curve.

Chapter 2:

Installing the Air Chiller System

Unpacking/Repacking the ACS

Unpacking and installation of the Air Chiller System is typically performed by a TA Instruments Service Representative. Retain all of the shipping hardware and boxes from the accessory in the event you wish to repack and ship your accessory. Refer to the TA Instruments document *Unpacking the Air Chiller System* for further instructions.

Preparing the Accessory

Before shipment, the ACS is inspected so that it is ready for operation upon proper installation. Preparing te accessory for installation involves the following procedures:

- Inspecting the System for shipping damage and missing parts
- Choosing a Location
- Adjusting the Anti-Tilt Bar Feet

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 ACS 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.

Take note of the tilt sensor that is affixed to two sides of 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.

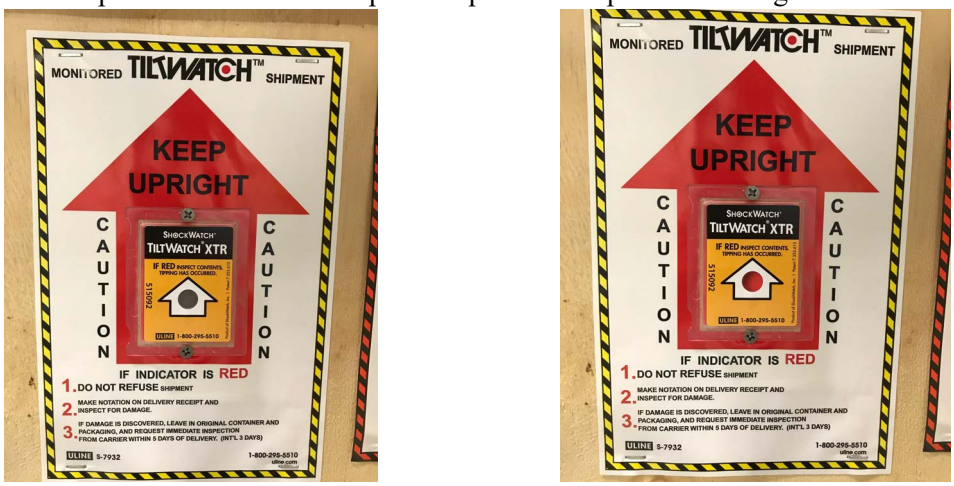

Figure 6 TiltWatch tilt sensor: Red not visible indicates normal handling (left); Red visible indicates potential mishandling (right).

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.

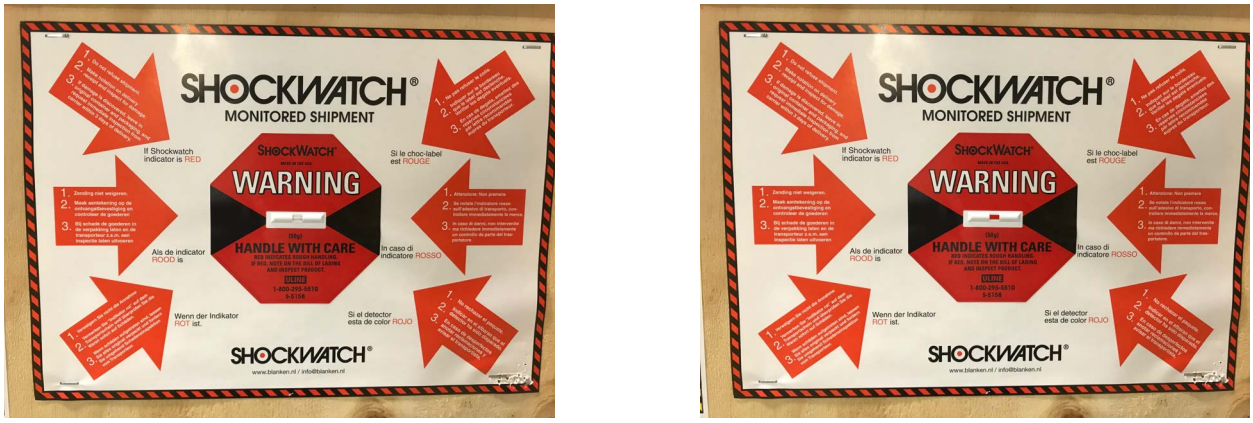

Figure 7 Shockwatch impact sensor: Red dye not visible indicates normal movement (left); Red dye visible indicates potential mishandling (right).

Choosing a Location

Choose a location for the accessory using the following guidelines. The ACS Accessory should be:

In

- A temperature-controlled area.Temperatures should be in the range specified in Table 3
- A clean environment
- An area with ample working and ventilation space. 20 cm (8 in) clearance is required at the front and back of the ACS unit to provide adequate ventilation.

On

- A level floor surface capable of safely supporting the weight of the system

Near

- Your DHR

Away from

- Dusty environments
- Exposure to direct sunlight
- Poorly ventilated areas

Adjusting the Anti-Tilt Bar Feet

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.

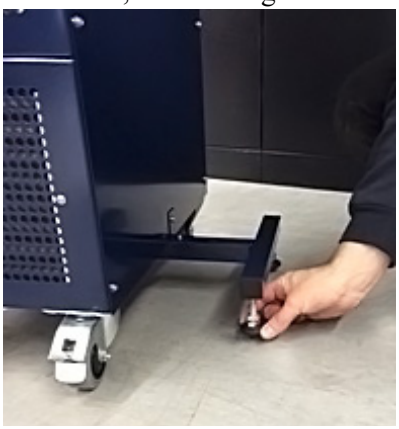

Figure 8 Adjust the feet on the anti-tilt bar.

Figure 9 Anti-tilt bar installed.

Installing the Air Chiller System

Installing the Air Chiller System involves the following procedures:

- Installing the Air Chiller Panel
  - Installing the Rev. B Air Chiller Panel
  - Installing the Rev. A Chiller Panel
- Connecting the ACS

Installing the Air Chiller Panel

Identify your chiller panel model by referring to the descriptions and figures in Chapter 1, "Chiller Panel." Follow the installation instructions based on the version of the panel that you have.

Installing the Rev. B Air Chiller Panel

1 Locate the plastic box with the (4) standoffs and (4) locknuts included.

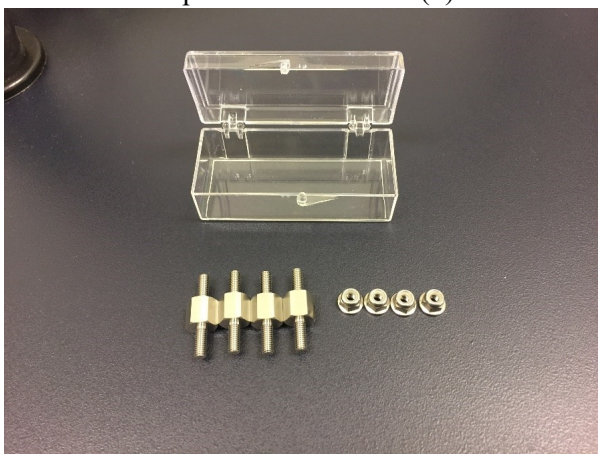

Figure 10 Standoffs and locknuts.

2 Rev. B Chiller Panels can be installed on either side of the ACS unit. Select the side on which you want to install the panel. On this side, remove and replace the (4) Phillips head screws with the (4) standoffs, hand tightening them one at a time.

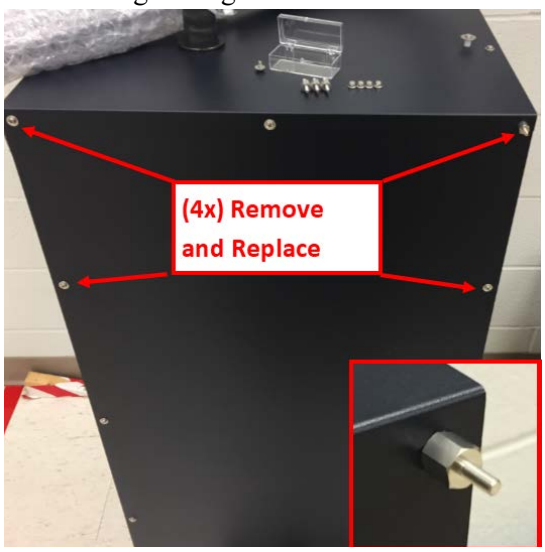

Figure 11 Remove Phillips head screws and replace with standoffs.

3 Position the panel onto the ACS unit and slide the panel over the (4) standoffs installed in the previous step. The magnets installed at the bottom of the panel will hold it temporarily in place.

Figure 12 Position the panel.

4 Use the (4) locknuts to secure the panel to the ACS. Then use an appropriate length of tubing (supplied) and connect the panel Outlet to the ACS Inlet.

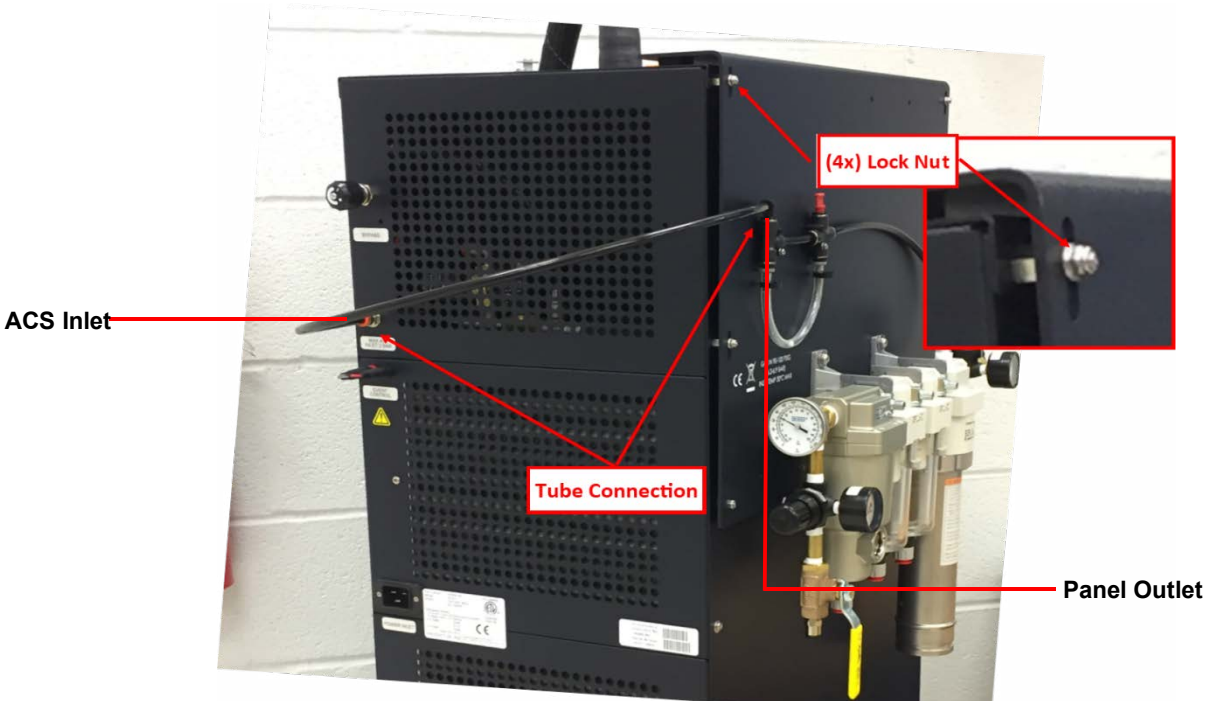

Figure 13 Secure the panel to the ACS and connect to ACS Inlet.

5 Use 8 mm tubing (supplied) to connect the Chiller Panel Gas IN to your air source. An additional 8 mm fitting is provided with the Chiller Panel, if needed. Ensure that the Quarter-Turn Valve is in the **OFF** position.

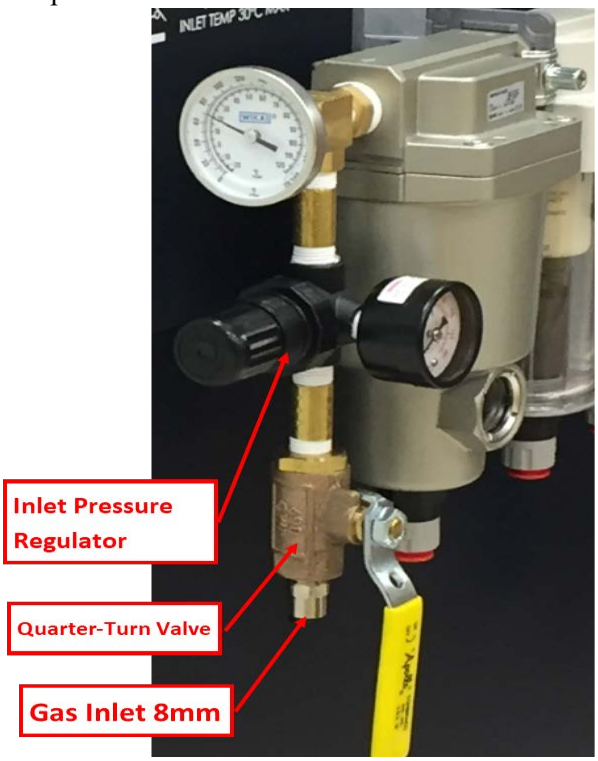

Figure 14

6 **Combined DHR/DMA Air Chiller Panel only**: Turn the instrument selection knob clockwise until the knob arrow points to the DHR label.

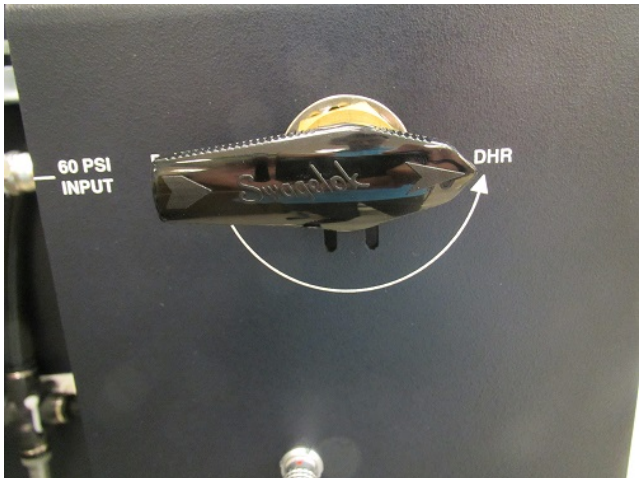

Figure 15 Instrument selection knob pointing to DHR.

Installing the Rev. A Chiller Panel

1 Unscrew and remove the two (2) standoffs located on top of the Air Chiller.

Figure 16 Standoff.

2 Place the Chiller Panel on top of the Chiller, aligning the slots on the panel with the standoff holes.

WARNING: The Chiller Panel is too heavy for one person to install safely.

AVERTISSEMENT: Le panneau de refroidissement est trop lourd pour une personne à installer en toute sécurité.

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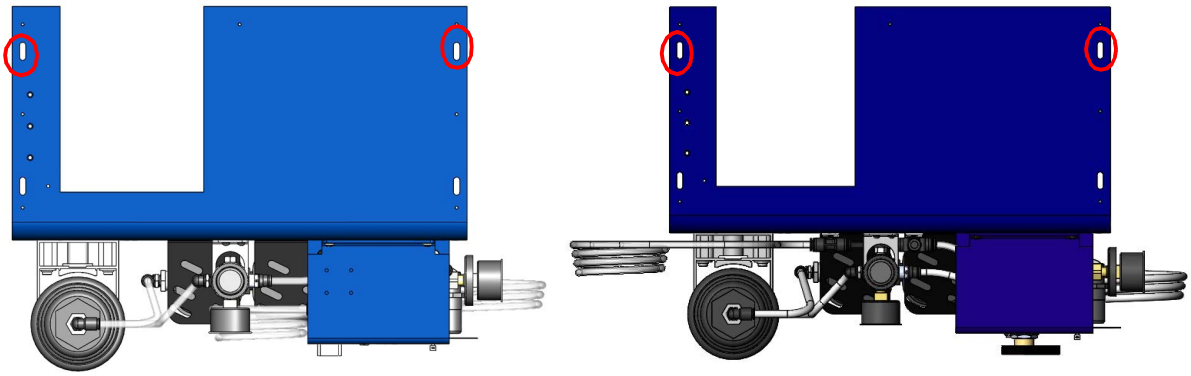

Figure 17 **Left:** Top of the DHR Chiller Panel. **Right:** Top of the DMA/DHR Chiller Panel.

3 Replace the standoffs so that the Chiller Panel is secured to the Air Chiller.

4 Fit the cinching wrap around the Chiller. Thread the strap under the dryer and pressure line tubing as shown in the figure below. Make sure that the strap is not twisted and that it lies flat against the panel.

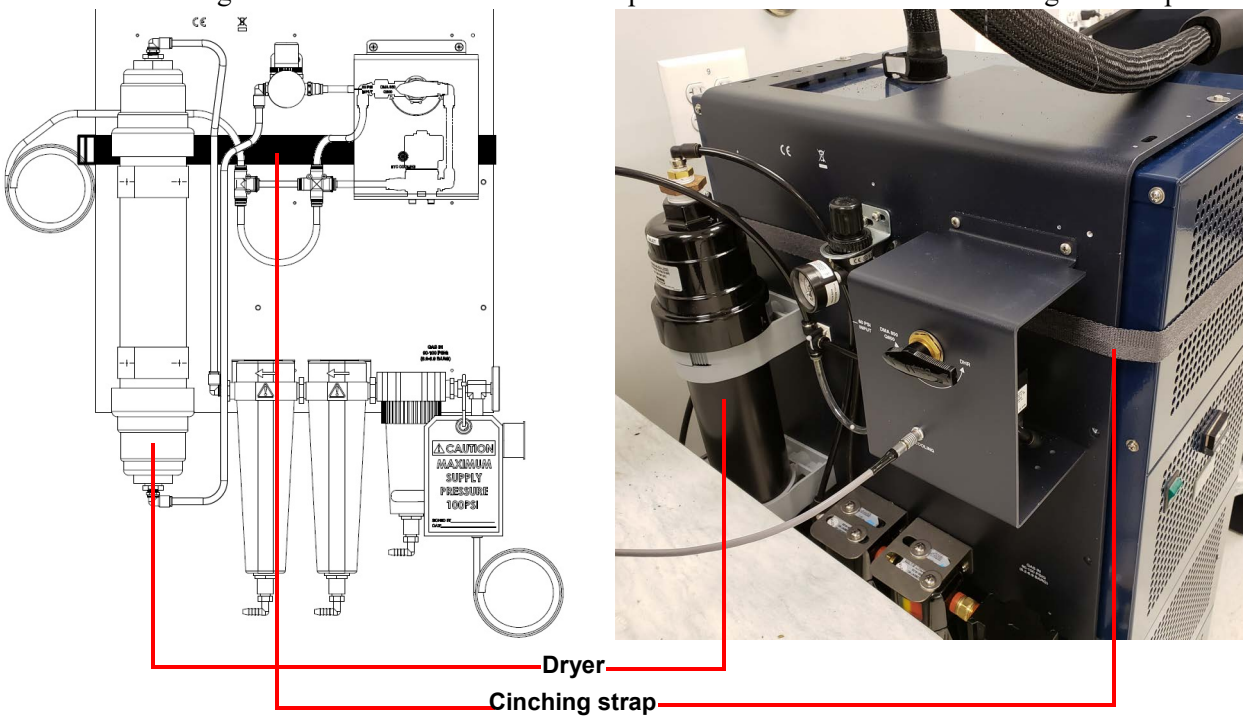

Figure 18 Cinching strap.

5 Insert the loose end of the strap into the opening on the underside of the buckle by holding the clamp open and feeding the strap through. See the figure below. Pull the cinching strap taut to secure the Chiller Panel.

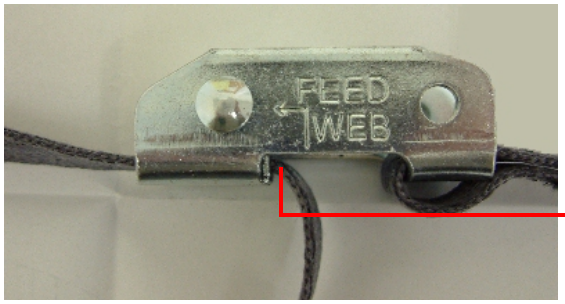

Figure 19 Cinching strap buckle.

6 Connect the 8 mm Gas **IN** tube from the Chiller Panel to the air source. An additional 8 mm fitting is provided with the Chiller Panel, if needed. Ensure that the Quarter-Turn Valve is in the **OFF** position.

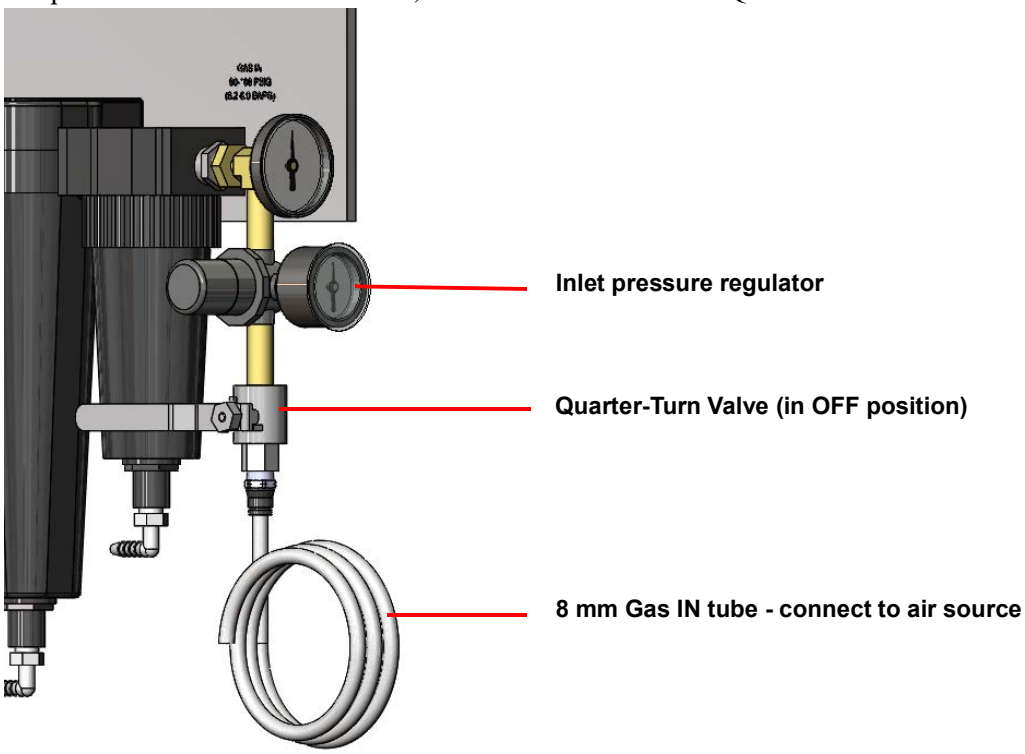

Figure 20

7 **Combined DHR/DMA Chiller Panel only**: Turn the instrument selection knob counter-clockwise until the knob arrow points to the DHR label.

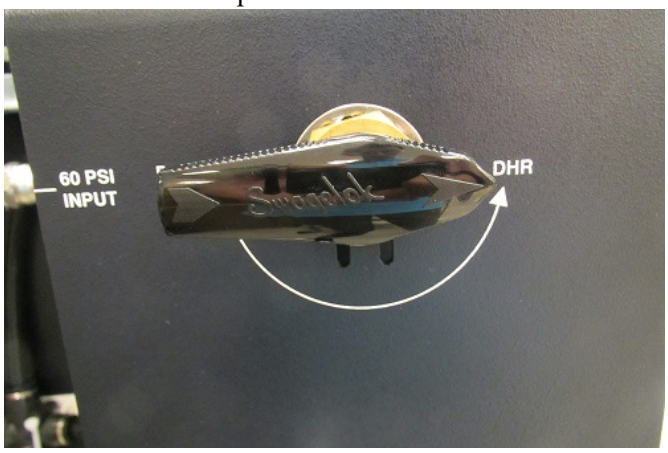

Figure 21 Instrument selection knob pointing to DHR.

Connecting the ACS

To connect the ACS, access the rear panel of the DHR and follow the instructions below:

NOTE: The ETC must already be installed on the DHR. For installation instructions, refer to the ETC Getting Started Guide, which can be found in TRIOS Help.

1 If the Air Chiller with Chiller Panel is connected to another instrument, disconnect it following the instructions in the instrument's Getting Started Guide before proceeding. Ensure the instrument selection knob is rotated to point toward DHR.

2 Place the Air Chiller with attached Chiller Panel next to the DHR.

NOTE: If a DMA event cable is connected to the Event Control port, disconnect and store the cable for future use prior to connecting the jumper cable. The DMA event cable is not used for the DHR.

3 If previously removed, plug the jumper cable into the **Event Control** port on the back of the Chiller. See Figure 22.

4 Connect the 8 mm Chiller Inlet tubing from the Air Chiller Panel to the **Inlet** on the back of the ACS unit.

Figure 22 **INLET** port with Inlet tubing connected and Event Control port with jumper cable.

5 Connect the 3 pin event cable from the Chiller Panel to the ETC manifold.

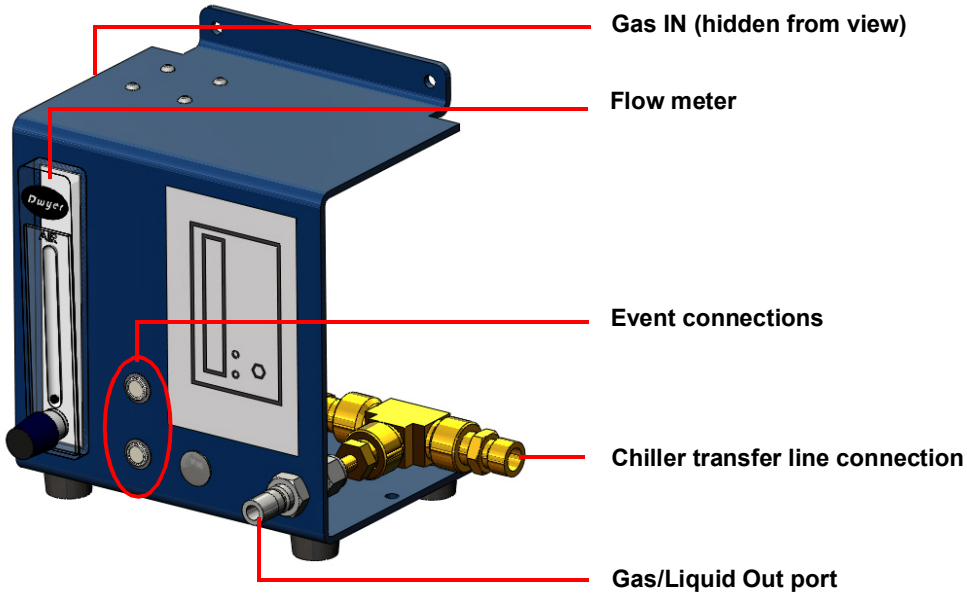

Figure 23 ETC manifold.

6 Connect the 5 pin event cable from the ETC manifold to Event A on the rear of the Rheometer.

7 Connect the Chiller transfer hose to the ETC manifold Chiller transfer line connection. The ETC manifold is fitted with a straight 3/8" Swagelock fitting, but this can be replaced with an elbow (supplied with the accessory) if this aids in positioning the Chiller.

NOTE: The Chiller transfer line must be positioned horizontally to the ETC manifold, as shown in the image below.

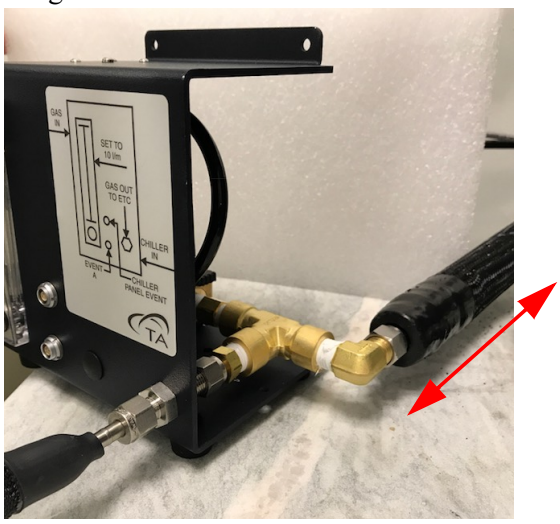

Figure 24 Transfer line positioned horizontally.

8 Connect the short black insulated hose from the **Gas/Liquid Out** port on the ETC manifold to the **Purge Gas** port on the ETC.

Figure 25 ETC Purge Gas port.

9 Connect a gas feed to the **Gas IN** port of the ETC manifold using 8 mm tubing. If the main air supply is used as the feed gas, the line should be split upstream of the flow meter assembly and rheometer filter/ regulator. An 8 mm 'Y'-piece is provided.

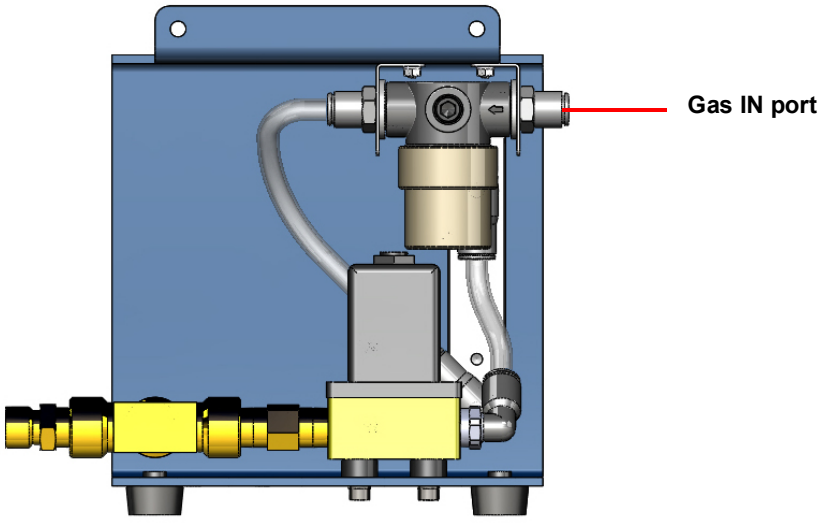

Figure 26 Rear view of ETC manifold.

10 Make sure the oven is closed and **Purge Gas only** is selected in the TRIOS control panel.

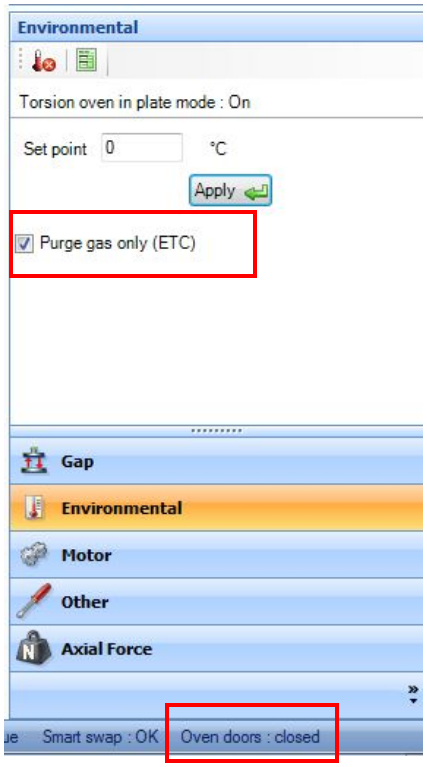

Figure 27 Environmental pane of the Control panel in TRIOS.

11 Set a flow rate of 10 L/min on the ETC manifold's flow meter assembly. Once set, uncheck **Purge Gas only**.

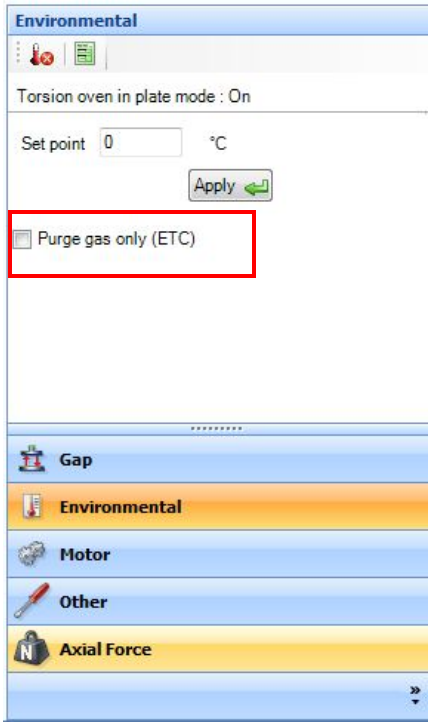

Figure 28 Environmental pane of the Control panel in TRIOS.

12 Turn the Quarter-Turn Valve on the ACS panel to the **ON** position.

13 Set the Inlet Pressure Regulator to 90–100 psi.

14 Insulate all exposed cold connections to minimize heat gains and frosting.

15 Insert the power cable into the power port on the back of the Chiller. Plug the cord into a wall outlet rated for the Chiller.

NOTE: External frosting only occurs when cold gas is flowing. If very lengthy experiments are being run, consider melting water that could become an issue once the test has been completed. A conditioning end of test step setting the temperature to ambient and a conditioning options step to set **Purge Gas Only** is good practice for minimizing external frosting.

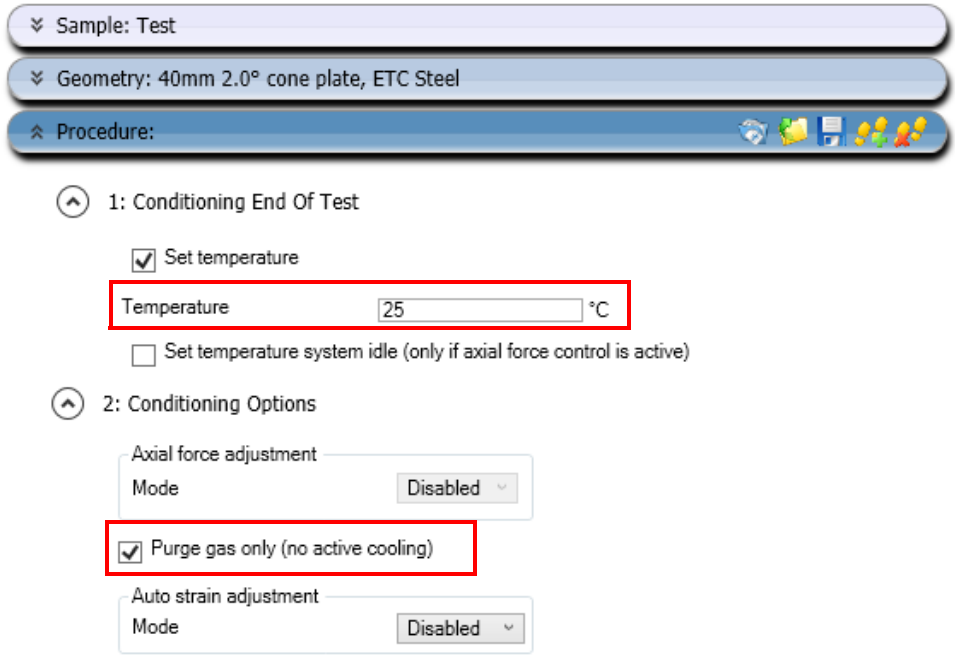

Figure 29 Conditioning End of Test and Conditioning Options. .

WARNING: It is always important to keep the end of the transfer line horizontal. Do not allow the end of the transfer line to droop or hang downward, especially while the Chiller is running or when the transfer line is cold. This could allow coolant to clog the capillary tube, damaging the system. If it is suspected the capillary tube may be clogged due to mishandling, follow the instructions for Shutting Down the ACS found on page 36 of this document. The line may then be supported vertically for several hours to allow coolant to redistribute throughout the system.

AVERTISSEMENT: AVERTISSEMENT: Il est toujours important de garder la fin de la ligne horizontale de transfert. Ne laissez pas la fin de la ligne de transfert à se faner ou accrocher vers le bas, en particulier alors que le refroidisseur est en cours d'exécution ou lorsque la ligne de transfert est froid. Cela pourrait permettre à du liquide de refroidissement à obstruer le tube capillaire, d'endommager le système. Si l'on soupçonne le tube capillaire peut être obstrué en raison de la mauvaise gestion, suivez les instructions pour arrêter l'ACS trouvé à la page 36 de ce document. La ligne peut alors être pris en charge à la verticale pendant plusieurs heures pour permettre réfrigérant de redistribuer througout le système.

Chapter 3:

Use and Maintenance

Using the Air Chiller System Accessory

All of your ACS Accessory experiments will follow the same general outline. In some cases, not all of these steps will be performed. The majority of these steps are performed using the instrument control software. See the instrument control Help for instructions on performing these actions.

- Selecting and preparing the sample
- Creating or choosing a test procedure and entering experiment information through the TA Instruments instrument control software
- Loading the prepared sample
- Starting the experiment

Before You Begin

Before using the ACS Accessory, ensure that the instrument is installed properly. Also make sure you have:

- Connected the ACS
- Connected the ETC manifold
- Powered on the instrument
- Become familiar with controller operations

Starting the ACS

NOTE: Do not turn off the unit and immediately turn it back on. After the compressor has shut down, allow 45 minutes for the internal pressures to equalize before restarting the unit.

1 Turn the Quarter-Turn Valve to the **ON** position (parallel to the line).

2 Adjust the Inlet Pressure Regulator to 100 psi.

3 Close the ETC and set the temperature to 0°C in the TRIOS Control panel.

NOTE: Verify that the **Purge Gas Only** option in the TRIOS Control panel is unchecked. Refer to Figure 28.

4 Adjust the Bypass valve flow rate: Open the valve by turning the manual knob on the back of the ACS to allow air flow to dry out the line; opening the valve fully increases the noise level. Allow the dry gas to purge through the ACS for 10–15 minutes before powering on the ACS. This will ensure that the ACS internal tubing is free of moisture, which, if present, could freeze when the ACS is turned on.

Figure 30 Bypass valve.

5 **NOTE**: This is only for drying the internal tubing of the ACS before and after use. The bypass purge will be turned off automatically when the ACS is powered on and will turn on automatically when the ACS is powered off. See Shutting Down the ACS for more information. Cool gas will start flowing through the oven as soon as the internal timer condition is satisfied.

6 Turn the power switch on the front of the Air Chiller to the **On** position. Wait 60 minutes before operating the system. The built-in timer will not allow flow through the ACS until all of the stages have started. See Internal Timer for more information.

NOTE: Before turning the unit on for the first time, make sure the full length of the transfer hose has been above the top of the ACS unit for more than 24 hours.

7 Once flow has started, verify that the Outlet Pressure Regulator is set for 60 psi.

8 **Standalone DHR Panel:** Verify that the flow rate is approximately 60 L/min.
Combined DHR/DMA Air Chiller Panel: Verify that the flow indicator ball has moved up from the bottom of the U, indicating flow is occurring.

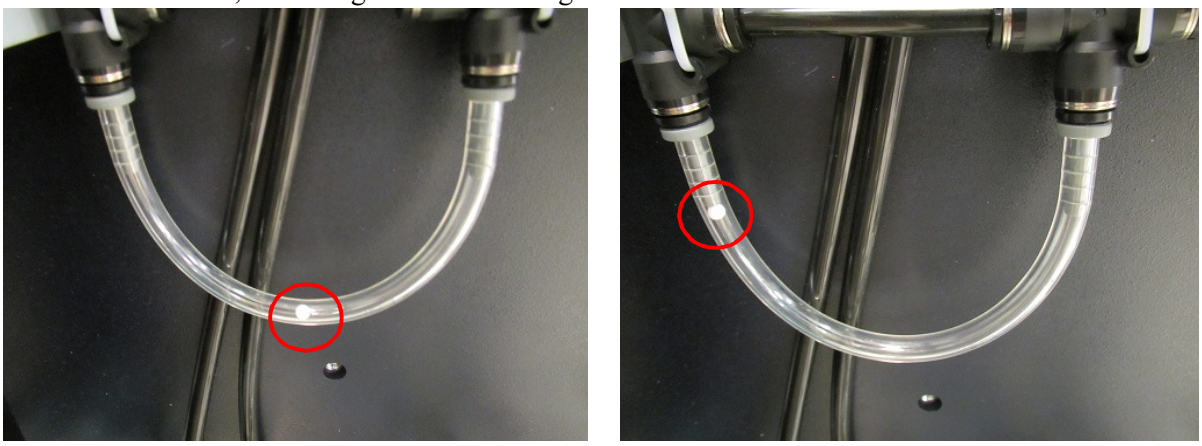

Figure 31 Combined DHR/DMA Air Chiller Panel only: Flow indicator ball indicating no air flow (left) and air flow (right). **NOTE**: Any movement of the ball indicates flow. The ball does not need to move to the top of the tube as shown.

NOTE: The pressure regulator is set to 60 psi at the factory to provide the appropriate air flow. After the flow has started, verify the regulator is at 60 psi. Further adjustments will not be required.

9 **Combined DHR/DMA Air Chiller Panel (P/N 405400.901 Rev. B)**: The Membrane Dryer is equipped with an Indicator that will turn color when it is ready and suppling dry air/nitrogen. The color will either change from off white/pink to blue OR from yellow to green within 20 minutes of continuous air/nitrogen flow through the dryer. If the Indicator color is not changing ,please inspect your air/nitrogen source and the panel filters.

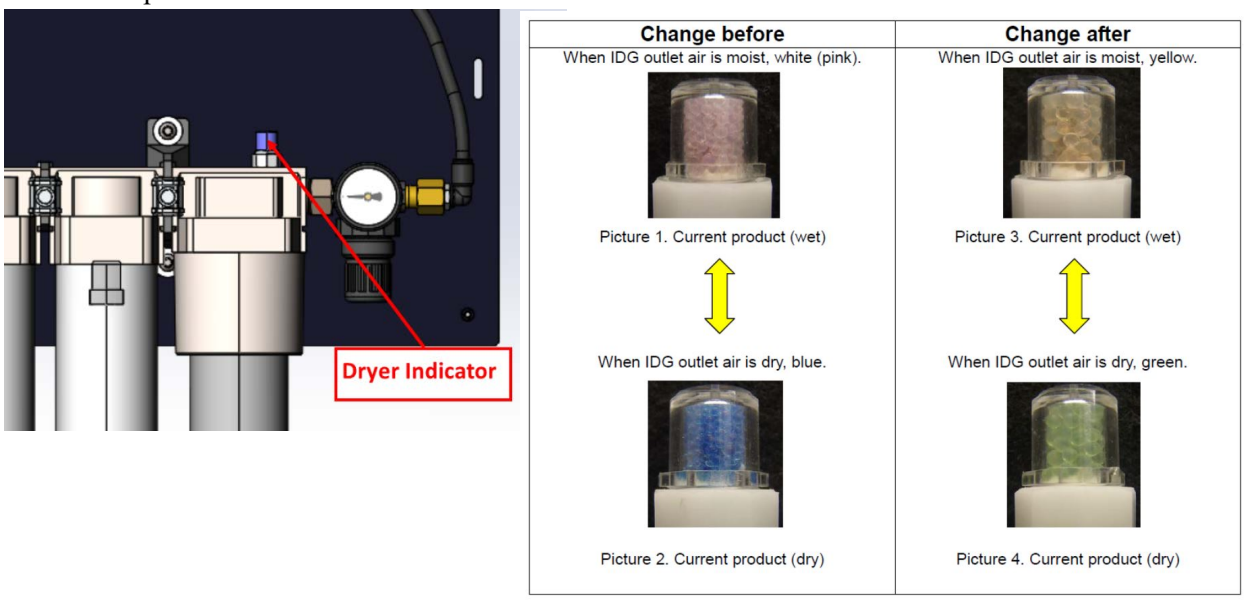

Figure 32

NOTE: Run the ACS for 60 minutes before beginning your experiment. The built-in timer will not allow flow through the ACS until all the stages have started. See Internal Timer for more information.

NOTE: It is important to power off the ACS regularly and purge with dry gas for a period of time, typically over-night. This prevents build-up of frost inside the ACS, which can slowly degrade the performance of the Chiller or even stop operation entirely. It is recommended to power off the Chiller daily when the ACS is used continually. Some users with exceptionally dry supply air will find that less frequent drying intervals are acceptable, possibly allowing up to a week to pass between drying cycles.

WARNING: It is always important to keep the end of the transfer line horizontal. Do not allow the end of the transfer line to droop or hang downward, especially while the Chiller is running or when the transfer line is cold. This could allow coolant to clog the capillary tube, damaging the system. If it is suspected the capillary tube may be clogged due to mishandling, follow the instructions for Shutting Down the ACS found on page 36 of this document. The line may then be supported vertically for several hours to allow coolant to redistribute throughout the system.

AVERTISSEMENT: AVERTISSEMENT: Il est toujours important de garder la fin de la ligne horizontale de transfert. Ne laissez pas la fin de la ligne de transfert à se faner ou accrocher vers le bas, en particulier alors que le refroidisseur est en cours d'exécution ou lorsque la ligne de transfert est froid. Cela pourrait permettre à du liquide de refroidissement à obstruer le tube capillaire, d'endommager le système. Si l'on soupçonne le tube capillaire peut être obstrué en raison de la mauvaise gestion, suivez les instructions pour arrêter l'ACS trouvé à la page 36 de ce document. La ligne peut alors être pris en charge à la verticale pendant plusieurs heures pour permettre réfrigérant de redistribuer througout le système.

Shutting Down the ACS

1 Close the ETC furnace.

2 Turn the power switch on the front of the Air Chiller to the **Off** position.

NOTE: It is important to power off the ACS regularly and purge with dry gas for a period of time, typically over-night. This prevents build-up of frost inside the ACS, which can slowly degrade the performance of the Chiller or even stop operation entirely. It is recommended to power off the Chiller daily when the ACS is used continually. Some users with exceptionally dry supply air will find that less frequent drying intervals are acceptable, possibly allowing up to a week to pass between drying cycles.

NOTE: The ACS is quipped with a normally open solenoid valve that purges the Chiller with dry gas when turned off. This is to help prevent frosting within the ACS while it is still cold. It is best to purge for a minimum of 2 hours to allow the ACS to come up to room temperature. An overnight purge of the ACS with dry air is recommended for optimum operation.

NOTE: Do not turn off the unit and immediately turn it back on. After the compressor has shut down, allow 45 minutes for the internal pressures to equalize before restarting the unit.

3 Enter a temperature of 0°C in TRIOS software and leave the oven closed to ensure a flow of dry gas through the system until the unit warms to prevent internal frosting. Check the flow meter or flow indicator on the Chiller Panel to ensure there is flow through the system. The oven doors can be opened and the gas turned off when the measured temperature reaches ambient. It is recommended that the gas be left flowing, if possible, so that any built-up moisture can be forced out through the flexible line.

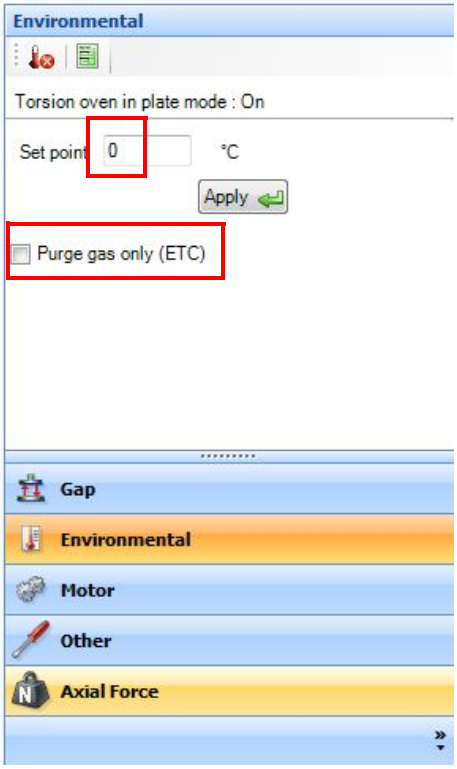

Figure 33 Enter 0°C in TRIOS Control panel.

Disconnecting the ACS to Use on Another Instrument

1 Follow the instructions above for Shutting Down the ACS. Make sure the ACS is shut down and not powered on.

2 Allow the ACS coils to warm up to room temperature. This can be determined by monitoring the temperature of the air from the ACS in the ETC.

3 Turn the inlet Quarter-Turn Valve to **OFF** (perpendicular to the line).

4 Turn-off source air and disconnect the 8mm Gas In tubing on the ACS and the ETC manifold from the source. **NOTE**: The line may be pressurized.

5 Disconnect the 3-pin event cable between the Chiller Panel and the ETC manifold.

6 Carefully disconnect the insulated hose from the ETC manifold.

7 Disconnect the 5-pin Event cable between the ETC manifold and the DHR.

8 Disconnect the short black insulated hose from the **Gas/Liquid Out** port on the manifold to the P**urge Gas** port on the ETC.

Relocating the ACS

1 Adjust the Anti-Tilt Bar Feet so they do not touch the floor. See Figure 8 and Figure 9.

2 Carefully move the ACS to its final location.

3 Promptly readjust the Anti-Tilt Bar Feet to touch the floor after relocation.

Removing the ACS Chiller Panel – Rev. B

1 Turn off the source air and disconnect the 8 mm Gas In tubing from the source. **NOTE**: The line may be pressurized.

2 Disconnect the 8 mm Chiller Inlet Tubing from the ACS. See Figure 13, Figure 14, and Figure 15.

3 Remove the (4) lock nuts and lift the Chiller Panel off of the ACS unit. Note that the Panel mounting magnets will temporarily hold the Panel in place while the locknuts are being removed. See Figure 17.

NOTE: If you are connecting the ACS to a DHR instrument using the Combined DHR/DMA Air Chiller Panel, follow the instructions in the *Air Chiller System (ACS) and Chiller Panel Getting Started Guide for the DHR*.

Removing the ACS Chiller Panel – Rev. A

1 Turn off the source air and disconnect the 8 mm Gas In tubing on the ACS and the ETC manifold from the source. **NOTE**: The line may be pressurized.

2 Disconnect the 8 mm Chiller Inlet Tubing from the ACS. See Figure 22.

3 Remove the Cinching Strap. See Figure 18.

4 Remove the standoffs as shown in Figure 16 and Figure 17

WARNING: The Chiller Panel is too heavy for one person to install safely.

AVERTISSEMENT: Le panneau de refroidissement est trop lourd pour une personne à installer en toute sécurité.

NOTE: If you are connecting the ACS to a DMA instrument using the Combined DHR/DMA Air Chiller Panel, follow the instructions in the *Air Chiller System (ACS) and Chiller Panel Getting Started Guide for the DMA*. The Stand-alone DHR panel cannot be used on the DMA.

Maintaining the Accessory

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.

Changing the Filter Cartridges – Rev. B

The cartridges in each filter should be replaced every 12 months or when there is excessive dirt or liquid visibly built up in the filter bowls.

Changing the Filter Cartridges – Rev. A

The cartridges in each filter should be replaced every 12 months or when the pointer in the central filter is in the red CHANGE section- whichever occurs first.

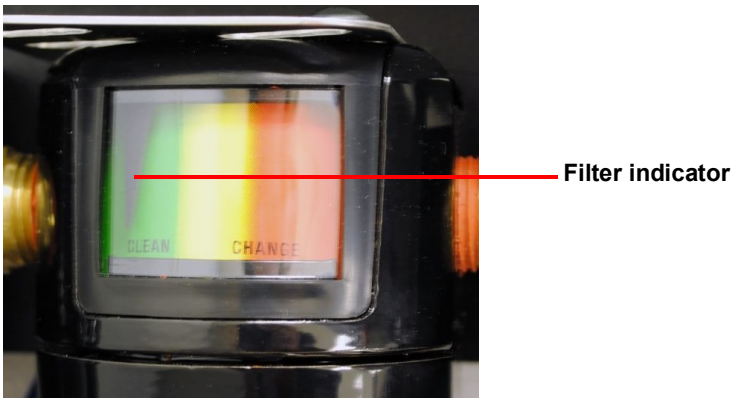

Figure 34 Filter indicator showing CLEAN.

Cleaning the Accessory

To clean the ACS Accessory, wipe down the exterior of the Chiller with a damp, soft cloth.

CAUTION: Do not use harsh chemicals, abrasive cleansers, steel wool, or any rough materials to clean the cabinet, as you may scratch the surface and degrade its properties.

MISE EN GARDE: N'utilisez pas de produits chimiques agressifs, de nettoyants abrasifs, de la laine d'acier ou tout autre matériau rugueux pour nettoyer l'armoire [écran tactile], car vous pourriez égratigner sa surface et dégrader ses propriétés.

NOTE: It is important to power off the ACS regularly and purge with dry gas for a period of time, typically over-night. This prevents build-up of frost inside the ACS, which can slowly degrade the performance of the Chiller or even stop operation entirely. It is recommended to power off the Chiller daily when the ACS is used continually. Some users with exceptionally dry supply air will find that less frequent drying intervals are acceptable, possibly allowing up to a week to pass between drying cycles.

NOTE: Extended operation without load is detrimental to the system. For this reason, it is also advised that the ACS be shut down overnight, or during other extended periods in which it will not be used actively.

Troubleshooting

Issue	Reason	Action
Compressor shuts OFF and then turns itself back on in 3-4 minutes	Low voltage	Check the voltage on the unit while it is under-load. The voltage must be within 5% of the voltage listed on the serial tag on the back of the unit.
	High ambient temperature	Check room temperature and compare with the Ambient Air Requirement listed in Installation. Take steps to reduce this temperature if it is too high.
	Dirty or blocked condenser fins	Clean condenser
	Fan out of order	Check for operation of fan (you can feel the air being drawn across the condenser). If it isn't working, contact TA Instruments.
Compressor fails to restart after it has been shut off	High pressure/temperature in the refrigeration system	Wait 45 minutes and try starting the unit again.
Gradual loss of temperature	Frost build-up inside ACS	Power down the ACS (see page 36) and purge with dry gas overnight. If using the Combined DHR/DMA Air Chiller Panel, check the flow indicator ball. If the ball is at the bottom of the U, the flow is restricted (see Figure 31).
	Dirty or blocked condenser fins	Clean the condenser fins.
	High ambient temperature	Check room temperature and compare with the Ambient Air Requirement listed in installation. Take steps to reduce this temperature if it is too high.
	Loss of refrigerants	Call TA Instruments.

Replacement Parts

Table 6: DHR Chiller and Chiller Panel Replacement Parts – Rev. B

613.06190	Air Regulator Type R07
404146.001	ACS Dryer Panel Standoff
203928.001	Locknut M4 with flange
578056.001	Black Nylon Tubing 8 mm OD x 6 mm ID
203929.901	Chiller Panel Filter Replacement Pack (filter elements for water seperator, mist filter, and micro mist filter)
203920.001	Dryer Membrane Replacement (does NOT need to be replaced on a 12 month schedule)
985730.901	Clamp Screen Kit DMA ACS
405400.901 404040.901	Combined DHR/DMA Air Chiller Panel DHR Air Chiller Panel

Table 7: DHR Chiller and Chiller Panel Replacement Parts – Rev. A

552796.001	3 Pin Liquid Cable
552795.001	5 Pin Event A
578036.001	Small insulated line
613.04787	1/4 turn ball valve
613.06190	Air Regulator Type R07
200750.001	Cinching strap 8 ft. long
578056.001	Tubing 8 mm OD x 6 mm ID
986301.901	Chiller Panel Filter Replacement Pack (BX filter, DX filter, Element filter)
545056.901	ETC Lo-Temp Manifold for ACS
404040.901 405400.901	DHR Chiller Panel DMA 850/DHR Chiller Panel