AIR CHILLER SYSTEM
& CHILLER PANEL

Accessory for the Discovery DMA 850
Getting Started Guide

Revision Q Issued December 2022

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 laboratory 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**

ARES-G2, RSA-G2, & DMA FCO Air Chiller Panel (for use with ACS-2 and ACS-3 Air Chiller Systems): **404041.901**

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 DMA 850/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 DMA 850/rhéomètre.

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 DMA 850* contains cautions and warnings that must be followed for your own safety.

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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 DMA 850 with the standard furnace. 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.

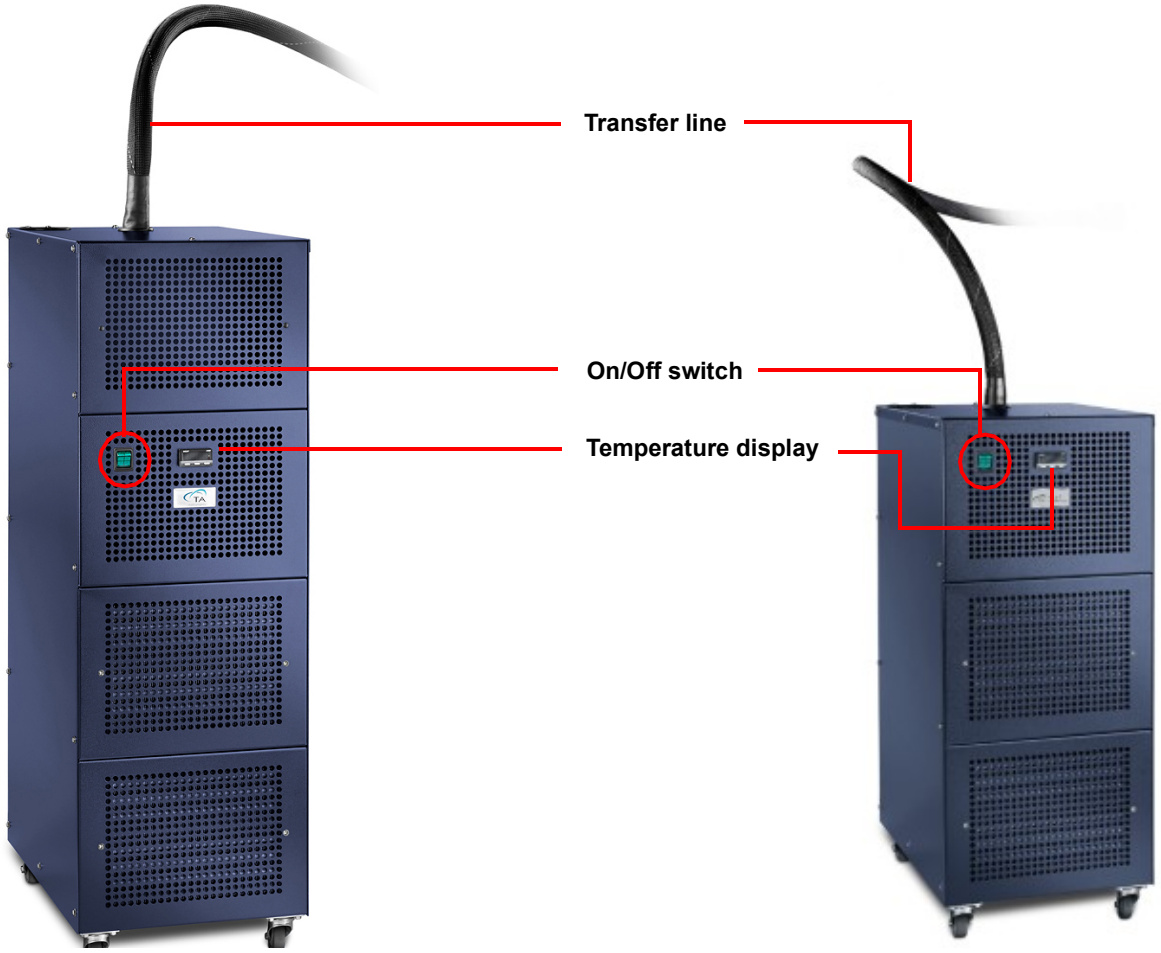

Figure 1 **Left**: ACS-3. **Right**: ACS-2

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, Purging, and Defrosting 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 panels. refer to the list below to identify the model you are using. Follow the installation instructions based on the version of the panel that you have.

- **Q800 DMA Air Chiller Panel (P/N 986300.901)**
  - Consists of filter/dryer/regulator assembly only.
  - Filter/dryer assembly is black in color.
  - Compatible with DMA 850 and Q800 DMA models only.

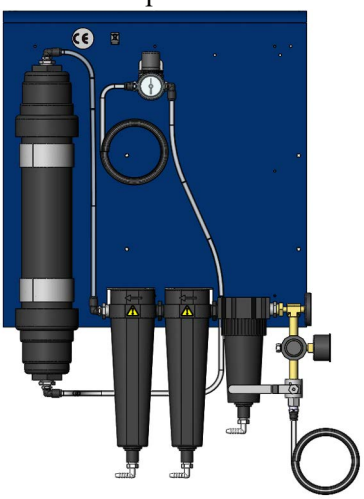

Figure 3 Q800 DMA Chiller Panel, P/N 986300.901.

- **DMA 850 & Q800 DMA Air Chiller Panel (P/N 986400.901)**
  - Consists of filter/dryer/regulator assembly and a U-shaped flow indicator.
  - Compatible with DMA 850 and Q800 DMA models.
  - Supports an optional upgrade kit that allows the panel to be used with the Discovery Hybrid Rheometers (DHR).
    - Rev A: Filter/dryer assembly is black in color.
    - Rev B: Filter/dryer assembly is silver/gray in color.

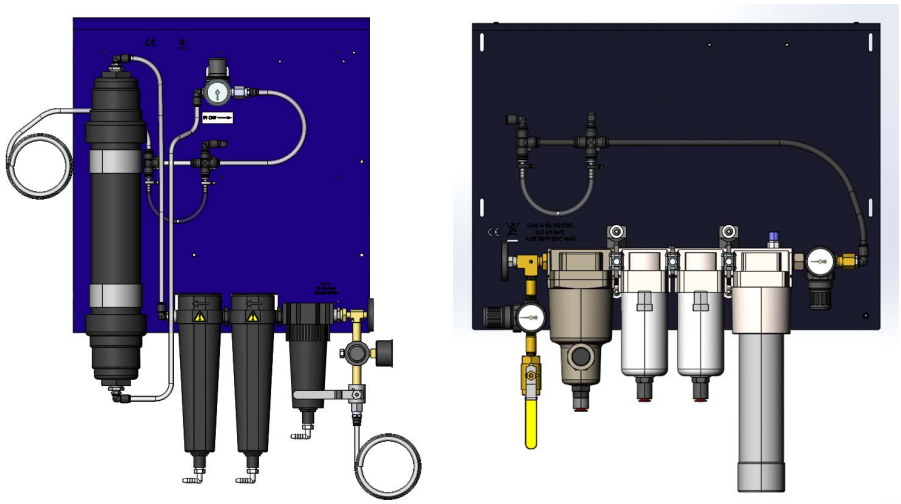

Figure 4 DMA 850 & Q800 DMA Air Chiller Panel (P/N 986400.901). **Left**: Rev A. **Right**: Rev B.

- **DHR ETC and DMA 850 & Q800 Combined Air Chiller Panel (P/N 405400.901)**
  - Consists of filter/dryer/regulator assembly and a U-shaped flow indicator.
  - Compatible with DMA 850 and Q800 DMA models.
  - Supports an optional upgrade kit that allows the panel to be used with Discovery Hybrid Rheometers (DHR).
    - Rev A: Filter/dryer assembly is black in color.
    - Rev B: Filter/dryer assembly is silver/gray in color.

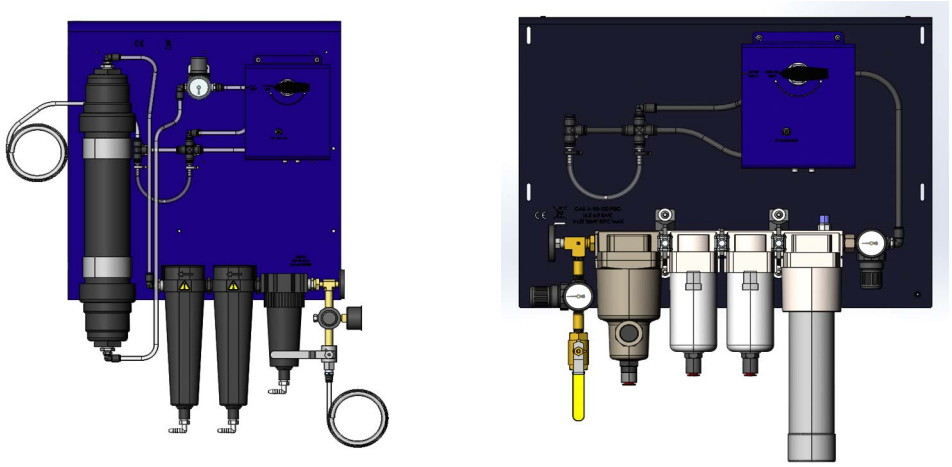

Figure 5 Combined Air Chiller Panel (P/N 405400.901). **Left**: Rev A. **Right**: Rev B.

Accessory Specifications

The tables below detail the ACS Accessory technical specifications.

Table 1A: ACS Accessory Characteristics with **DMA 850 & Q800 Air Chiller Panel (Rev. B) / 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 2A: ACS Accessory Characteristics with **Q800 Air Chiller Panel / DMA 850 & Q800 Air Chiller Panel (Rev. A) / 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 3: 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 4: 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 5: 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 6: Accessory Performance Specifications

Specification	**ACS-2**	**ACS-3**
Lowest temperature[1]	-50°C[1]	-100°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 the 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 tilt 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.

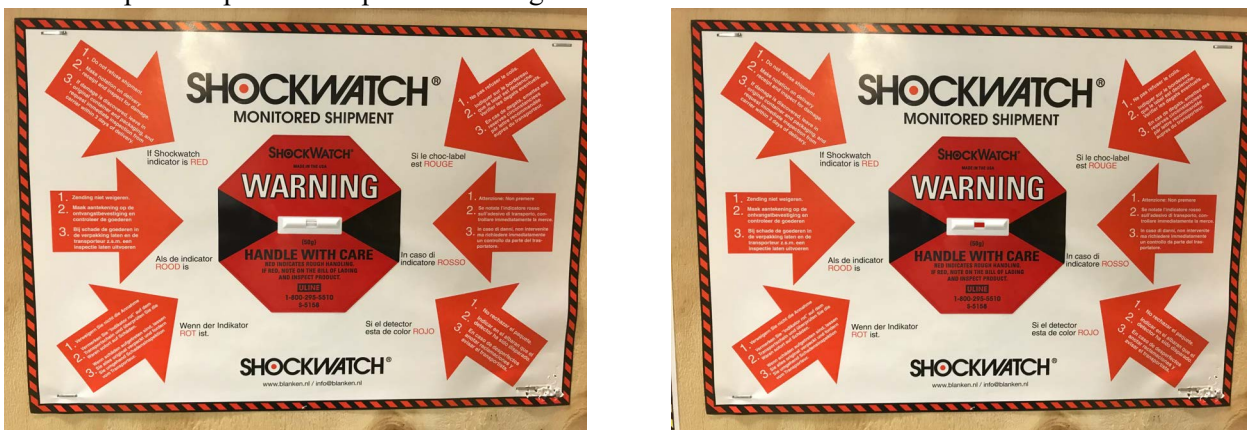

Figure 7 Shockwatch impact sensor: Red dye not visible indicates normal movement (left); Red dye visible indicates potential mishandling (right).

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 4.
- 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 DMA 850

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.

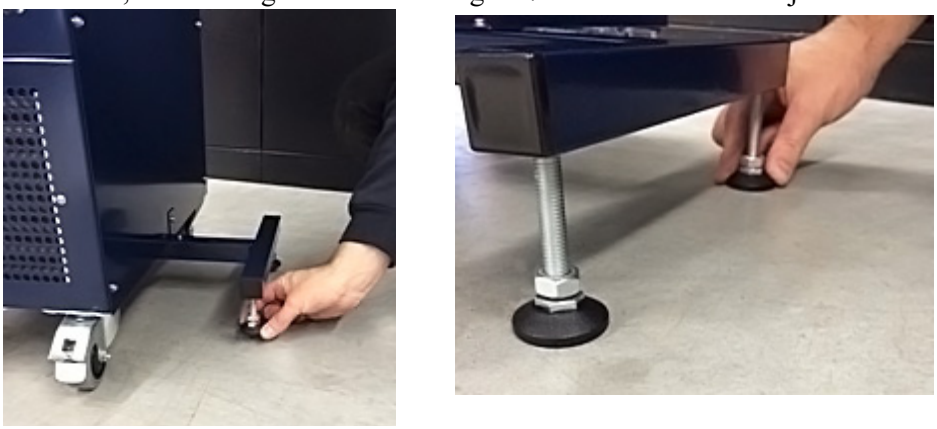

Figure 8 Adjust the feet on the anti-tilt bar.

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 Air Chiller Panel or Q800 Air Chiller Panel
- Connecting the ACS to the DMA 850
- Setting up the ACS Accessory From the DMA 850 User Interface
- Installing the ACS Clamp Screen
- Upgrading the 986400.901 DMA Air Chiller Panel for use with the Discovery Hybrid Rheometer

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.

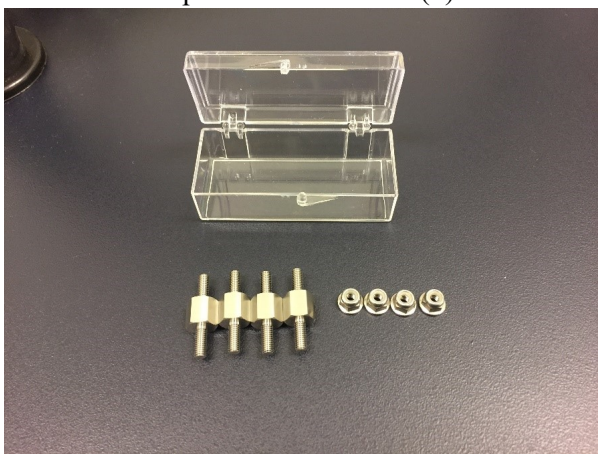

Figure 10 Standoffs and locknuts.

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.

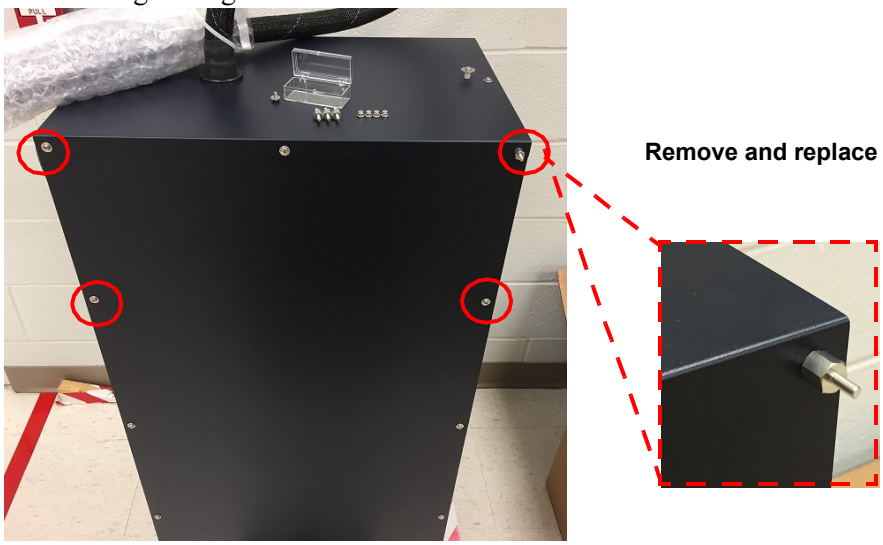

Figure 11 Remove Phillips head screws and replace with standoffs.

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.

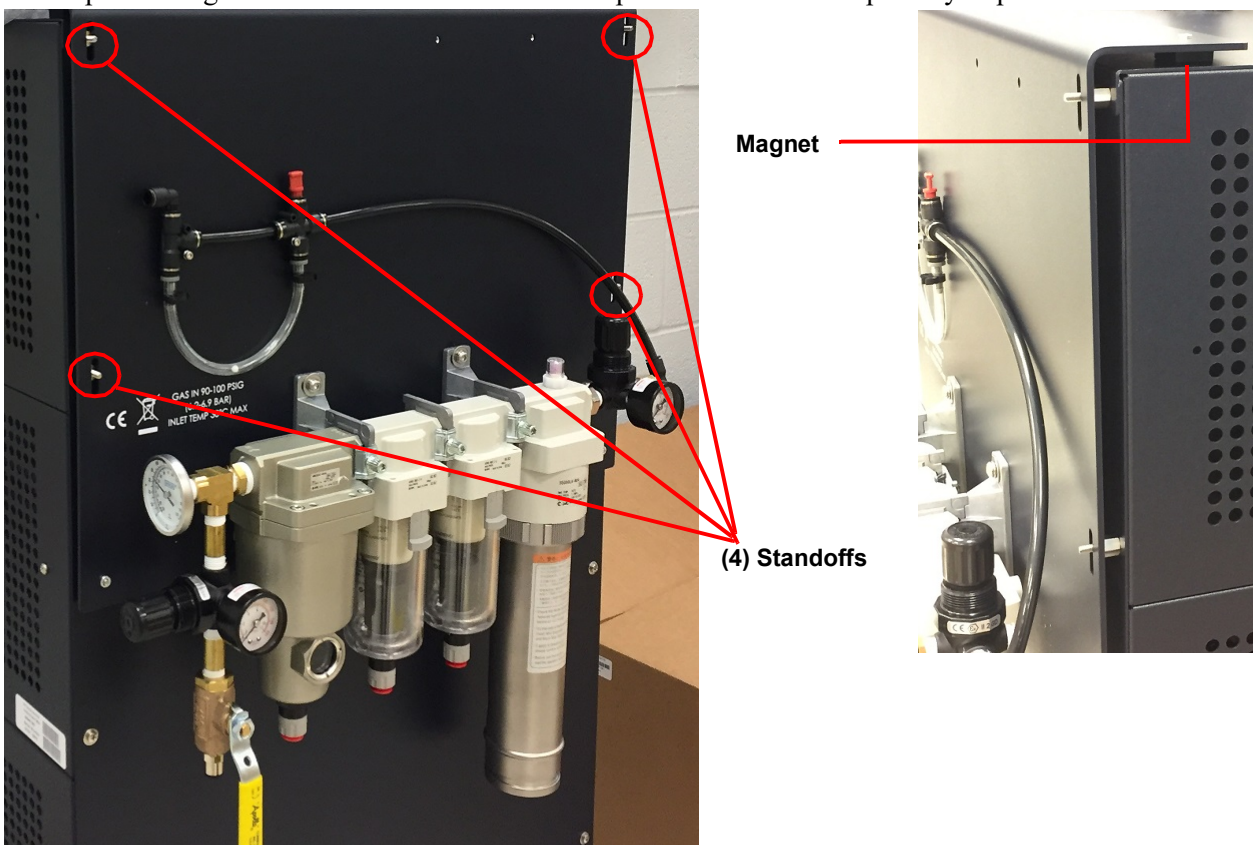

Figure 12 Position the panel.

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.

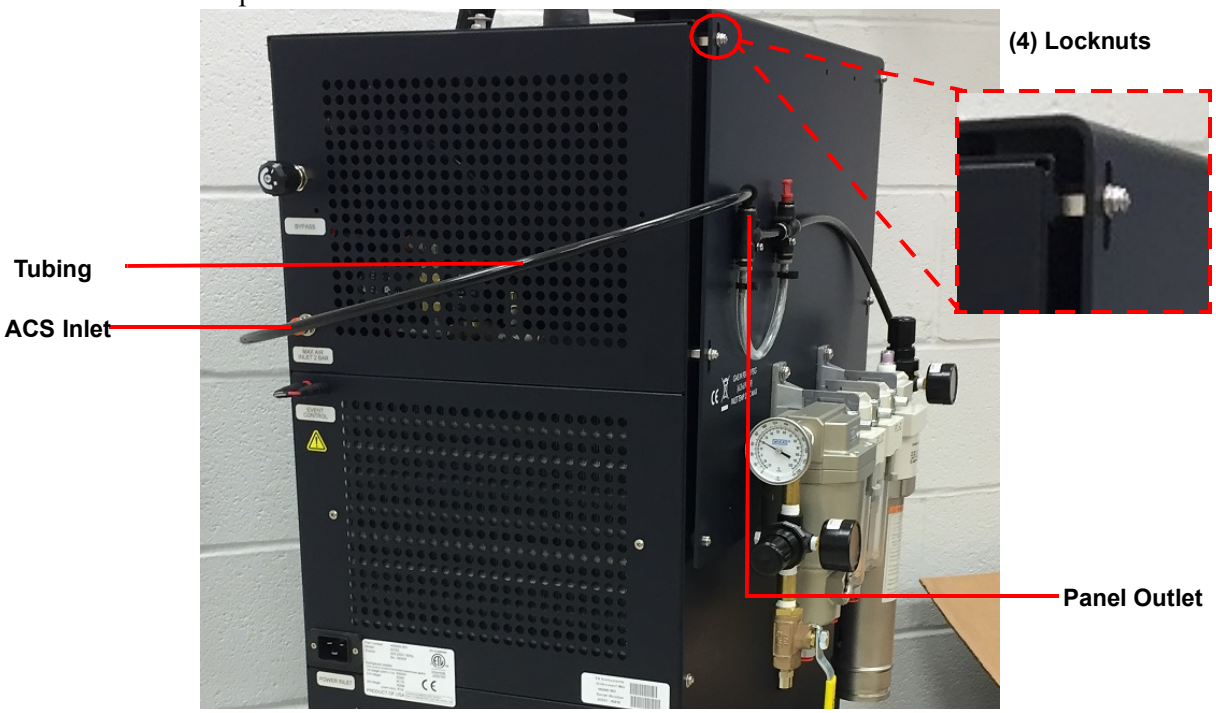

Figure 13 Secure the panel to the ACS and connect to ACS Inlet.

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.

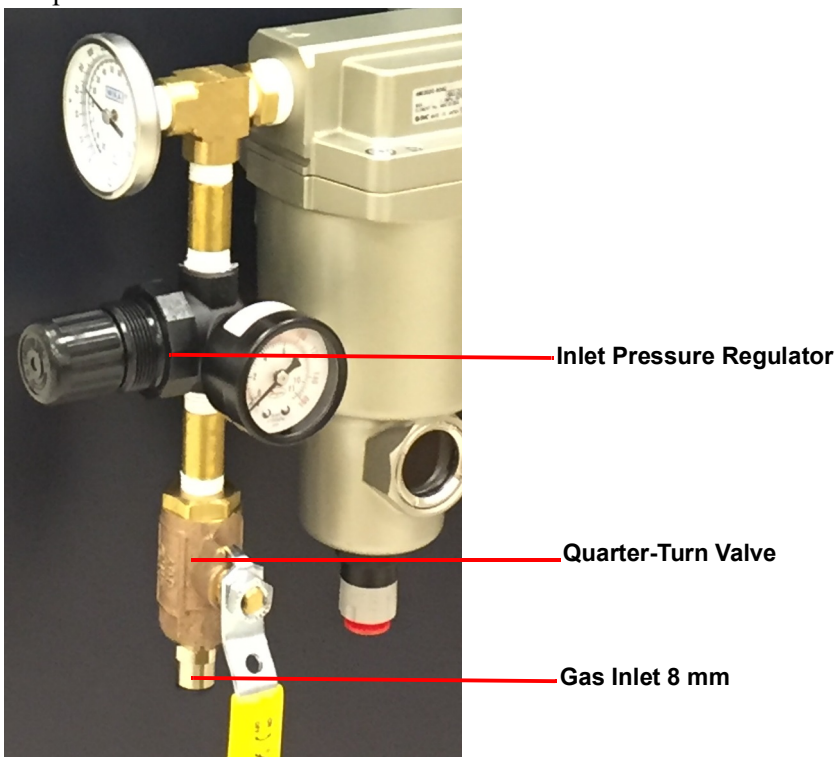

Figure 14

6 **Combined DHR/DMA Air Chiller Panel only**: Turn the instrument selection knob clockwise until the knob arrow points to the DMA 850/Q800 label.

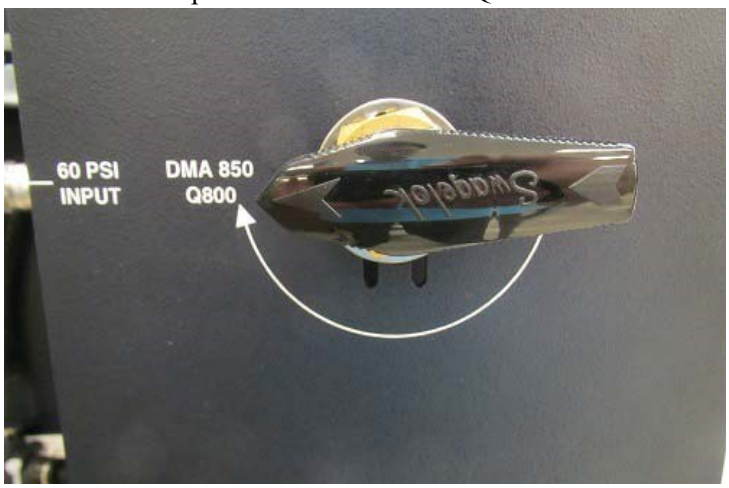

Figure 15 Instrument selection knob pointing to DMA850/Q800.

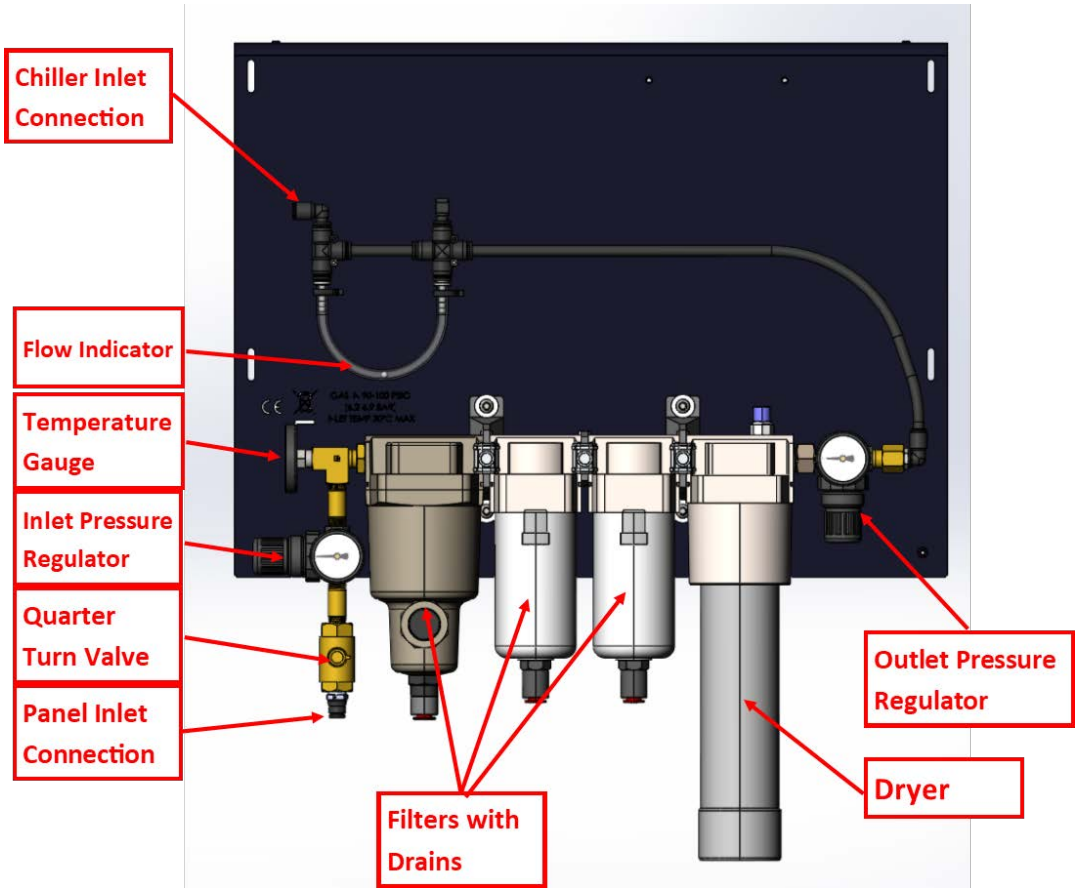

Figure 16 DMA Air Chiller Panel, P/N 986400.901, Rev. B.

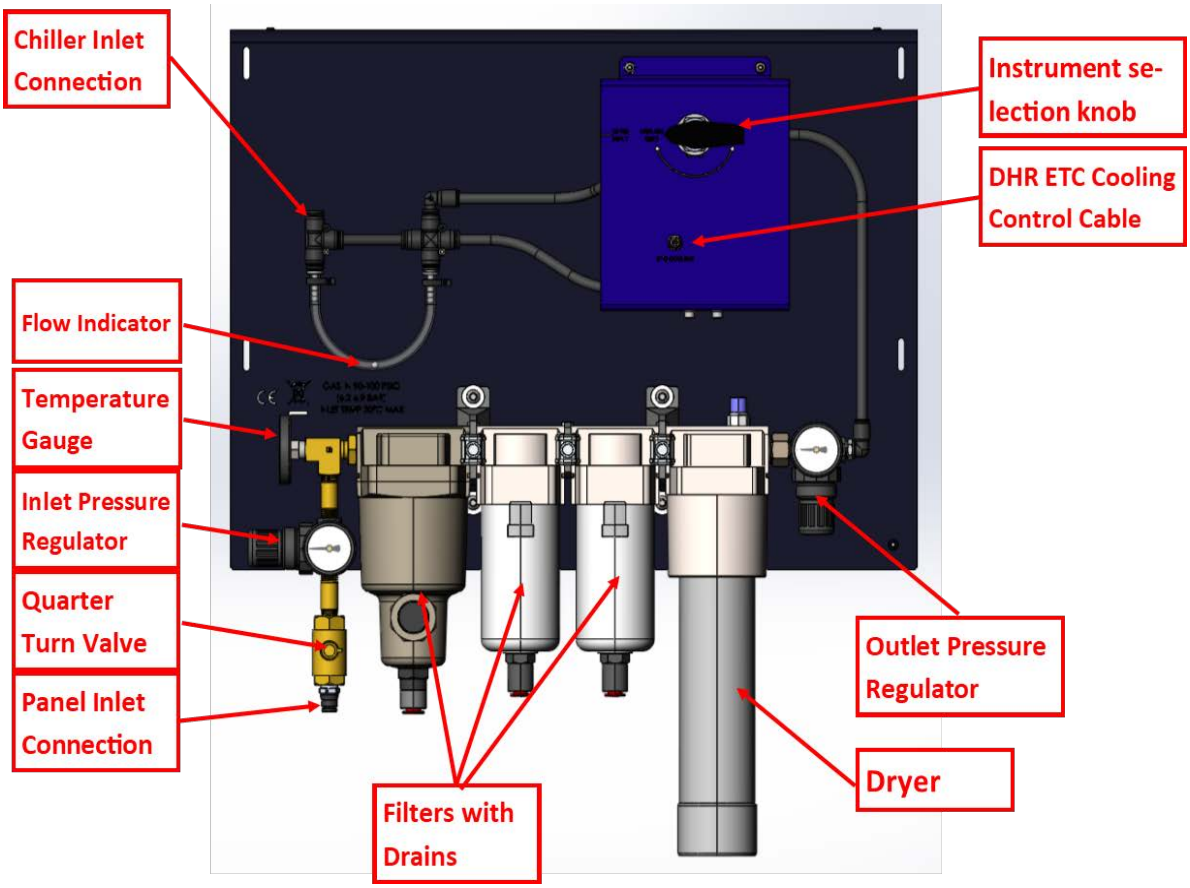

Figure 17 Combined DHR/DMA Chiller Panel, P/N 405400.901, Rev. B.

Installing the Rev A Air Chiller Panel or Q800 Air Chiller Panel

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

Figure 18 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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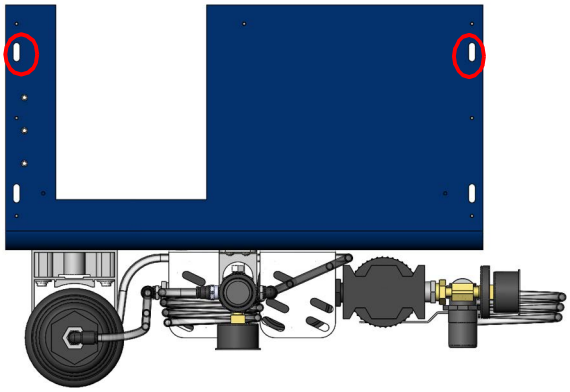

Figure 19 Attach the Chiller Panel to the top of the ACS using the two standoffs.

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.

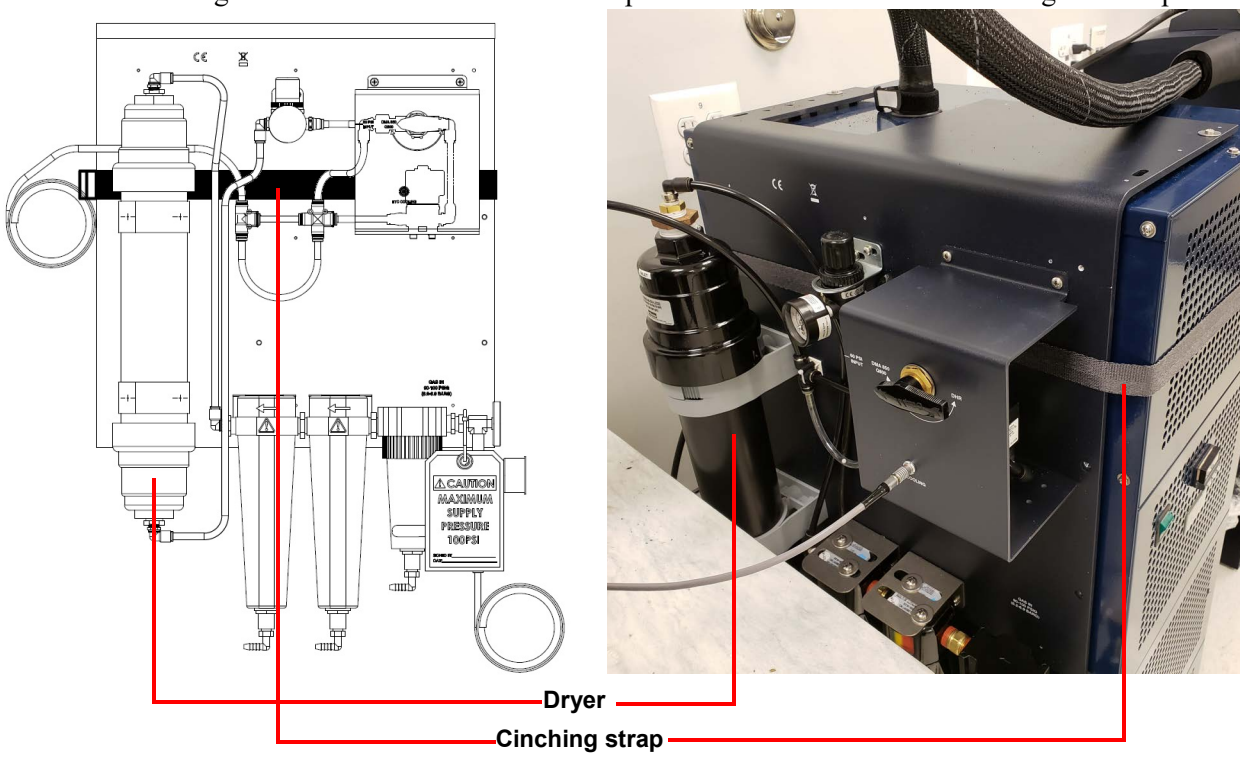

Figure 20 Cinching strap.

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.

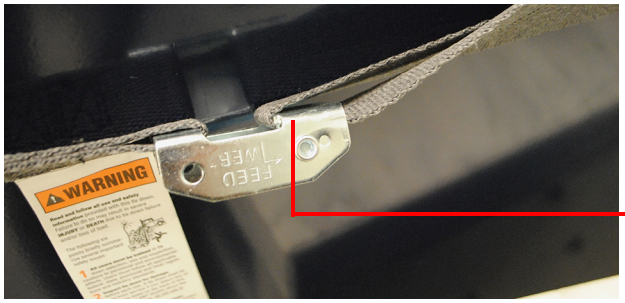

Figure 21 Cinching strap buckle.

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 on the **OFF** position.

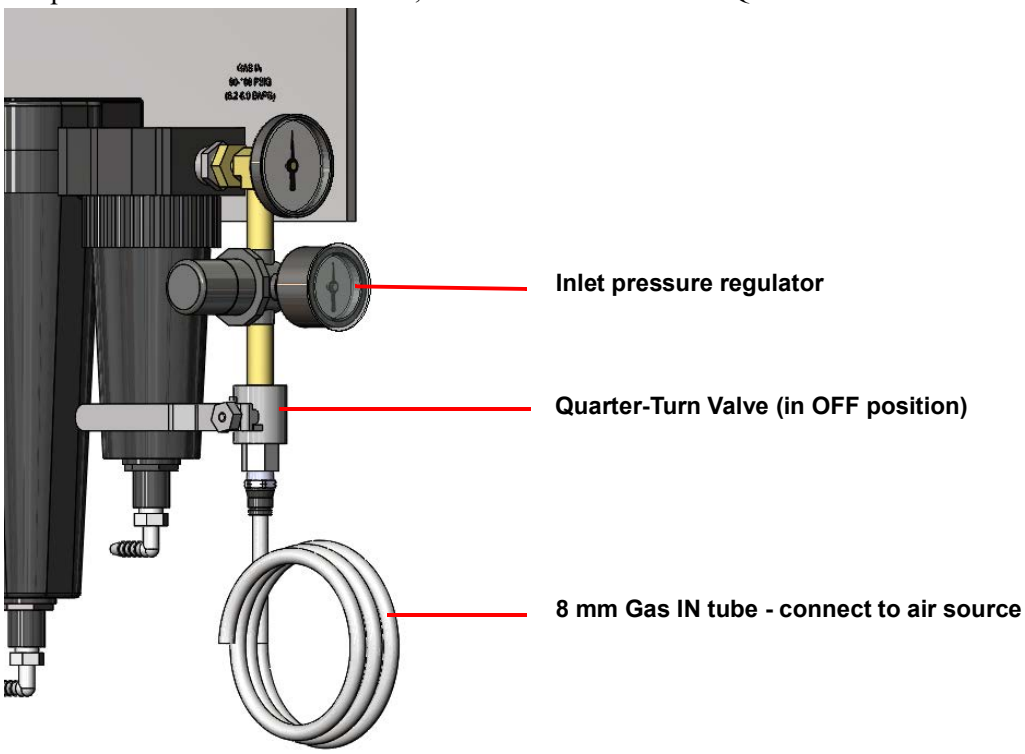

Figure 22

7 **Combined DHR/DMA Air Chiller Panel only**: Turn the instrument selection knob clockwise until the knob arrow points to the DMA 850/Q800 label.

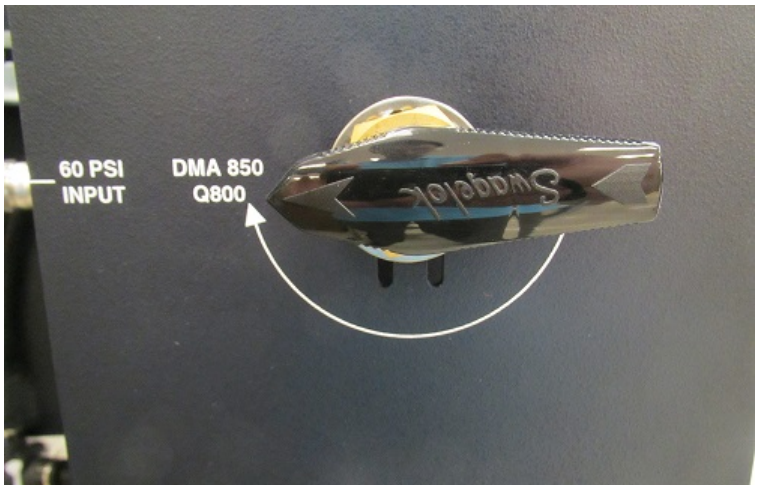

Figure 23 Instrument selection knob pointing to DMA850/Q800.

8 Connect the 8 mm Chiller Inlet tubing from the Air Chiller Panel to the Inlet on the back of the ACS unit. See Figure 24 and Figure 25.

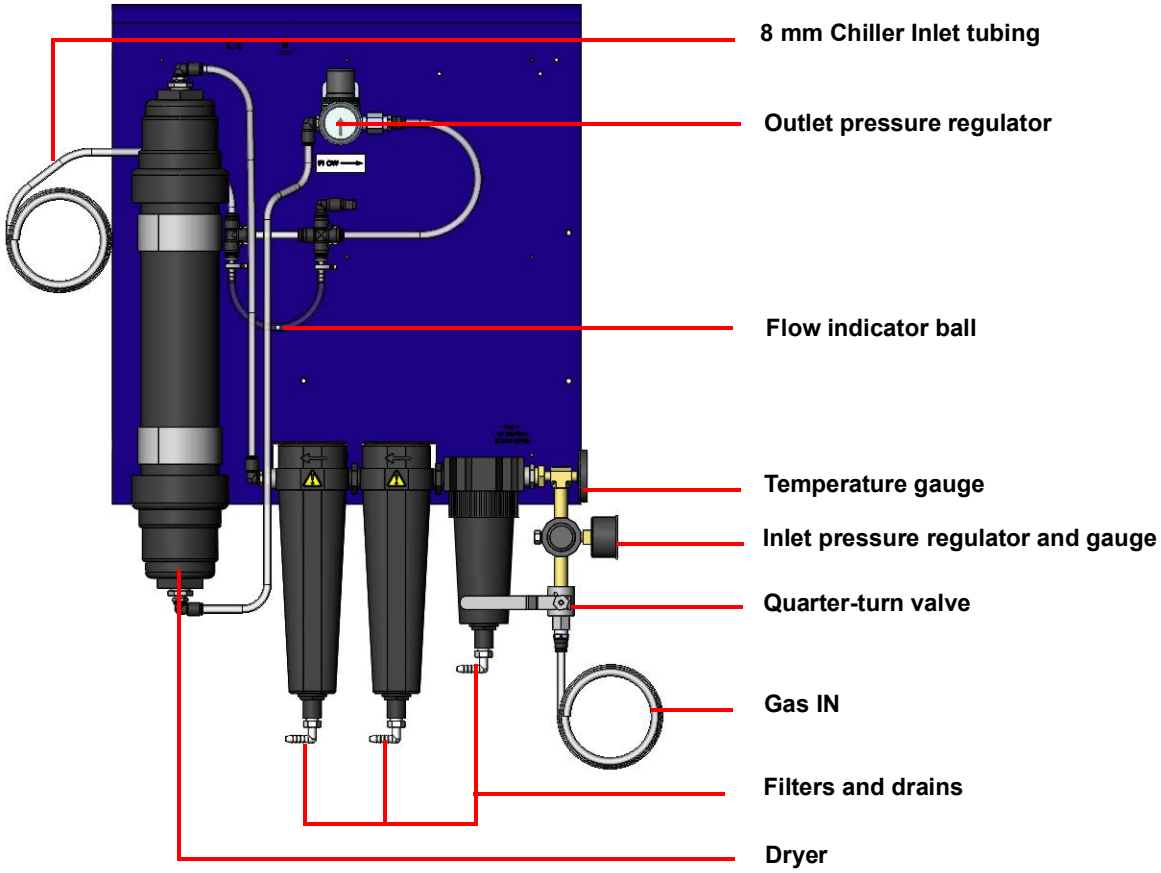

Figure 24 DMA Air Chiller Panel, P/N 986400.901 Rev. A.

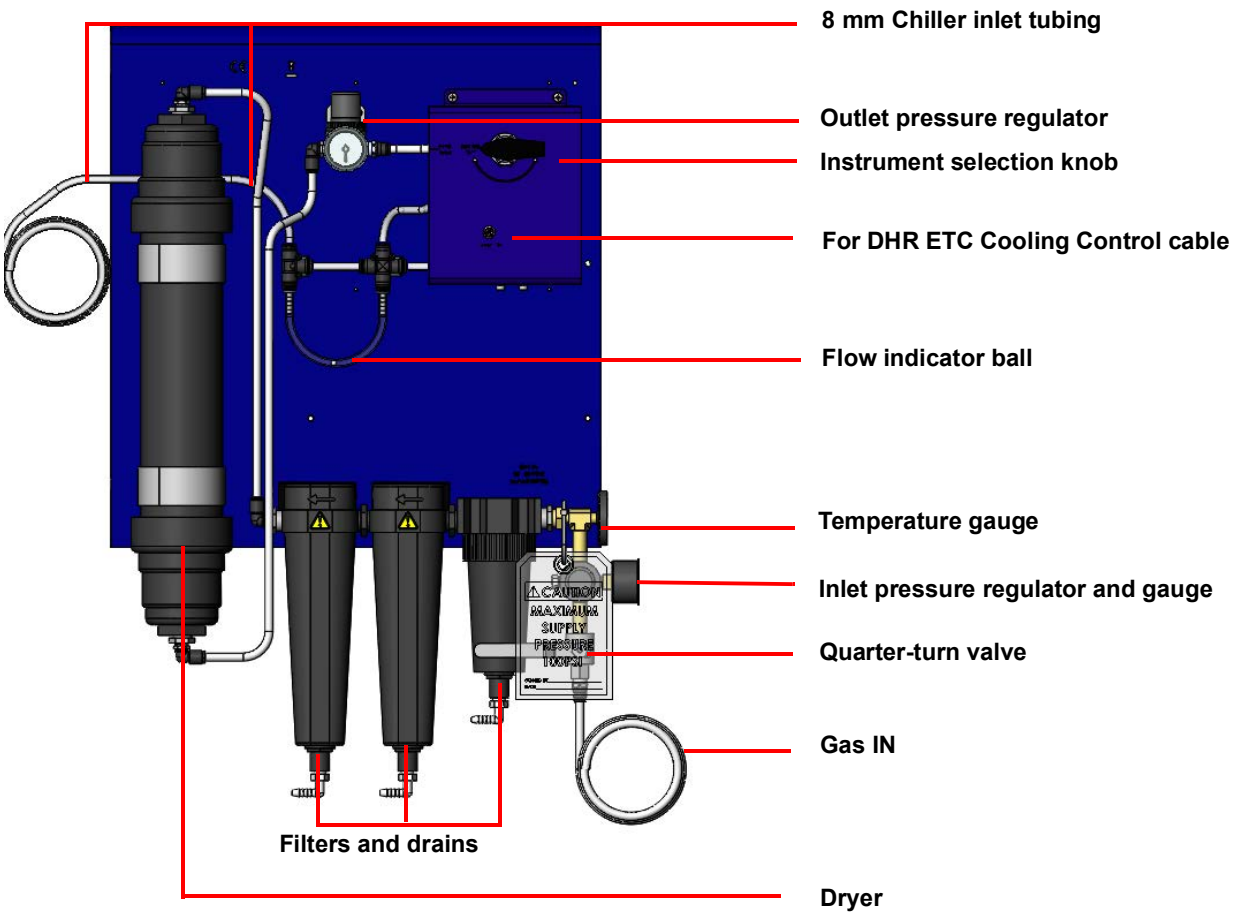

Figure 25 Combined DHR/DMA Chiller Panel, P/N 405400.901 Rev. A.

Figure 26 Air Chiller Inlet tubing connected.

Connecting the ACS to the DMA 850

To connect the ACS, access the rear panel of the DMA 850 and follow the instructions below:

1 Connect one end of the Event cable to the **Event** port on the back of the DMA 850. Connect the other end to the **Event Control** port on the back of the Chiller.

NOTE: If a jumper cable is installed in the Event Control port on the back of the Chiller (shown in Figure 27 below), remove and retain it for future use. This jumper cable is not needed for DMA 850 installation.

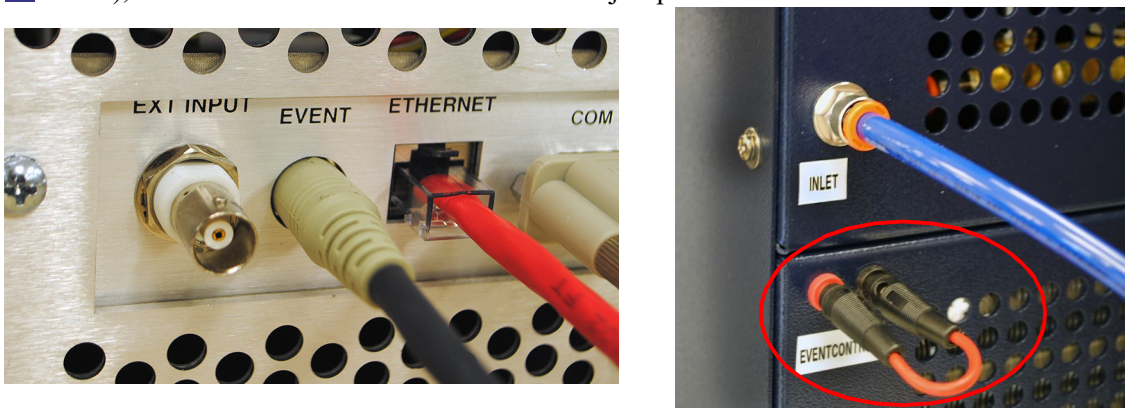

Figure 27 Event connections: DMA 850 **Event** port (left) and Air Chiller Inlet tubing connected and jumper cable in the **Event Control** port (right).

2 Disconnect the air cool line from the DMA 850, and then connect the transfer line from the Chiller to the cooling port on the DMA 850.

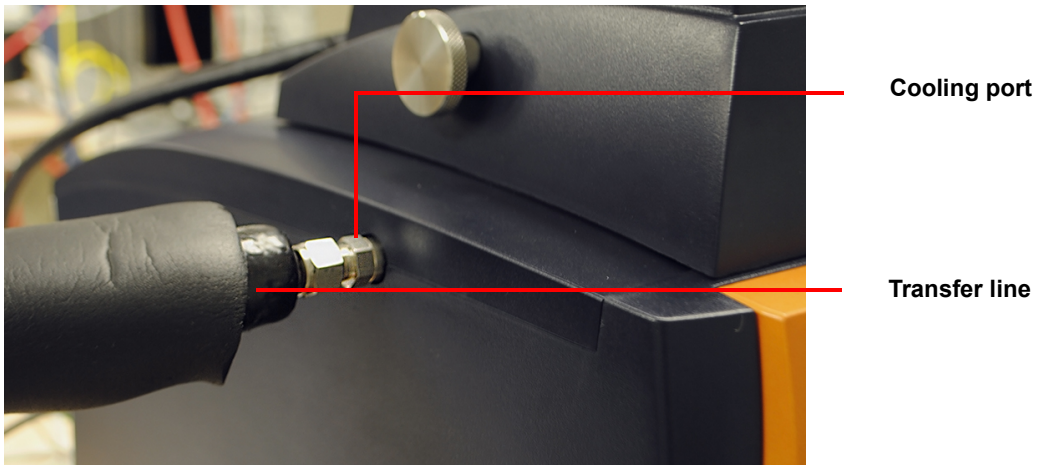

Figure 28 Connect the transfer line.

3 Install the included short piece of split insulation over the Swagelok fitting, and then slide the tube insulation piece over the cooling gas port connection.

Figure 29 Tube insulation piece covering the Cooling Gas port and Cooling Gas tube

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 52 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 52 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.

Setting up the ACS Accessory From the DMA 850 User Interface

After successfully installing the ACS Accessory, set up the accessory from the DMA 850 user interface.

1 From the Home screen, press **System**  . The System screen displays.

2 From the System screen, press **Cooling Accessories**  . The Environmental Accessory selection screen displays.

3 Press the **OFF** button for the appropriate ACS Accessory to turn the accessory on.

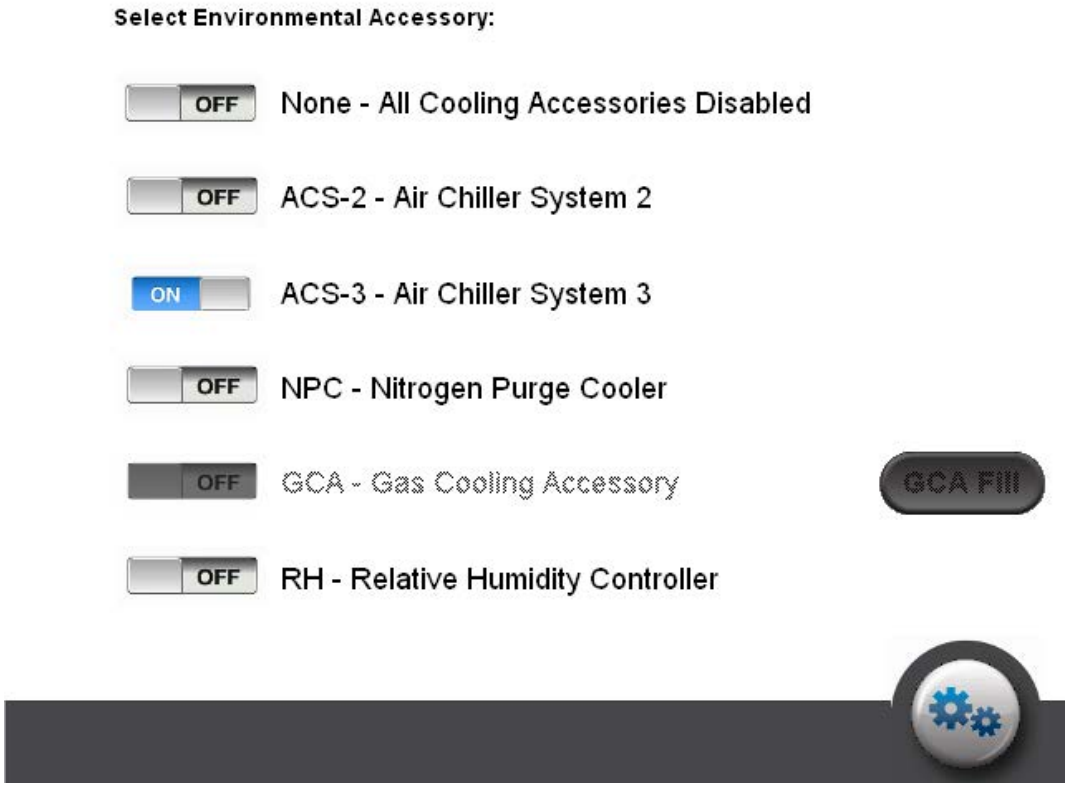

Figure 30 Turn on the accessory in the Environmental Accessory selection screen.

Installing the ACS Clamp Screen

NOTE: It is important to use the included ACS Clamp Screen found in the kit when using either the ACS-2 or ACS-3. The screen helps maintain a uniform temperature around the sample and thermocouple, allowing for more accurate temperature readings of the sample.

Figure 31 **Left**: Clamp screen for Film Tension; **Right**: Clamp screen for Cantilever and 3 Point Bending.

After mounting the sample, slide the appropriate ACS Clamp Screen over the clamp.

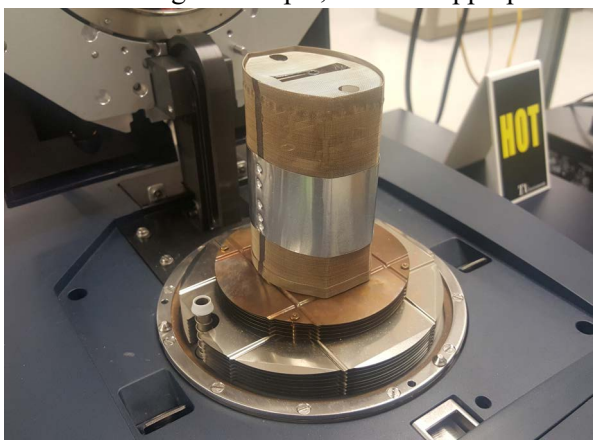

Figure 32 ACS Clamp Screen installed on the DMA 850.

WARNING: The metal band on the ACS Clamp Screen is made of aluminum. The upper temperature of the DMA 850 with ACS is limited to 400°C, and the Instrument Control Software will not allow a temperature higher than 400°C when the ACS is the chosen accessory. It is vitally important not to request a temperature higher than 400°C at any time when the ACS Clamp Screen is installed. Major damage to the DMA 850 can occur if the furnace is commanded to go above 400°C when an ACS Clamp Screen is installed.

AVERTISSEMENT: L'échangeur de chaleur de l'ACS est en aluminium. La température maximale du DMA 850 avec l'ACS est donc limitée à 400 ° C et le logiciel de contrôle d'instruments n'autorise pas une température supérieure à 400 ° C lorsque l'ACS est l'accessoire choisi. Il est extrêmement important de ne pas demander une température supérieure à 400 ° C à tout moment lorsque l'ACS est installé . Des dommages importants au DMA 850 peuvent se produire si le four est programmé pour aller au-dessus de 400 ° C quand un ACS est installé.

Upgrading the 986400.901 DMA Air Chiller Panel for use with the Discovery Hybrid Rheometer

The DMA Air Chiller Panel (P/N 986400.901 Rev. B and A; see Figure 4) can be upgraded to be a Combined DHR/DMA Air Chiller Panel for use on either DMA or DHR instruments when the Combined ACS Panel Upgrade Kit (P/N 545056.901; see Figure 38) is purchased. Instructions for the installation of this upgrade are given below.

Upgrading a Rev B Chiller Panel for use with the DHR

1 If needed, follow instructions for Shutting Down, Purging, and Defrosting the ACS and Disconnecting the ACS to Use on Another Instrument.

2 Make sure that the ACS power switch is turned off, all event cables are disconnected, and the Inlet Quarter-Turn Valve is turned to the **OFF** position and both pressure gauges show 0 psi.

3 With an adjustable wrench, disconnect the flow control orifice from the pressure regulator.

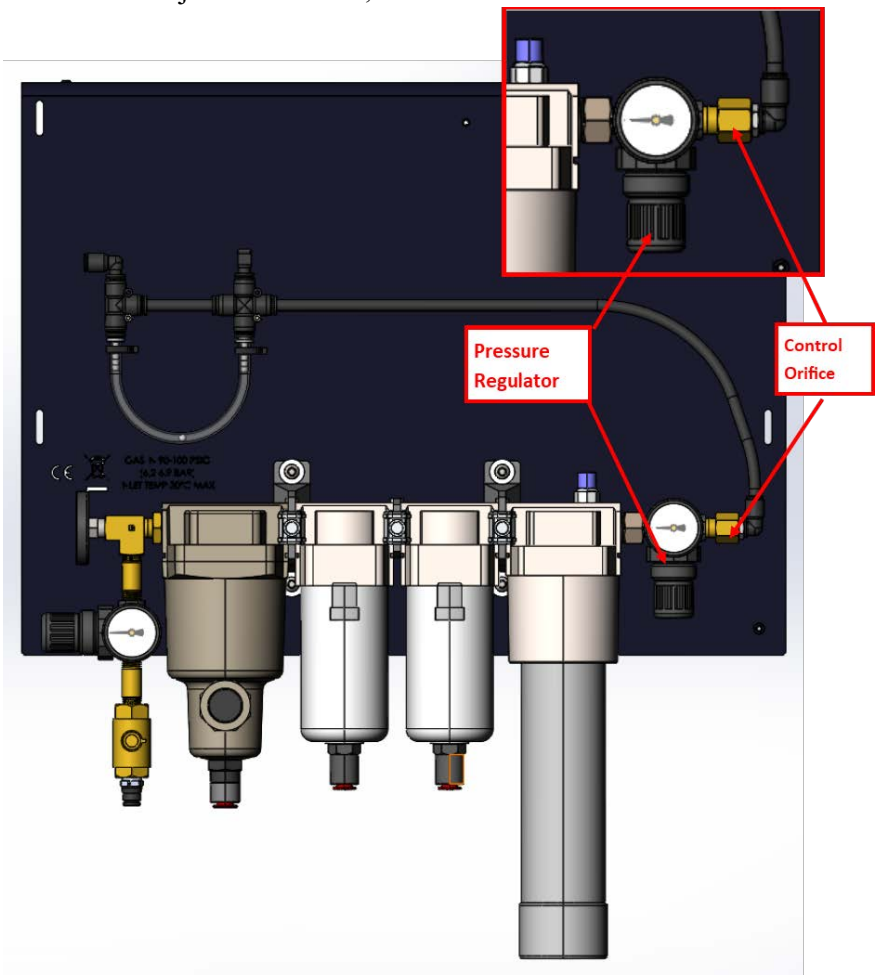

Figure 33 Disconnect flow control orifice.

4 Remove the 8 mm tube from the cross connector by depressing the circumferential ring and pulling on the tubing. Apply Teflon® tape to the threads of the elbow fitting attached to the other end of the tubing and assemble the elbow fitting to the open port on the pressure regulator.

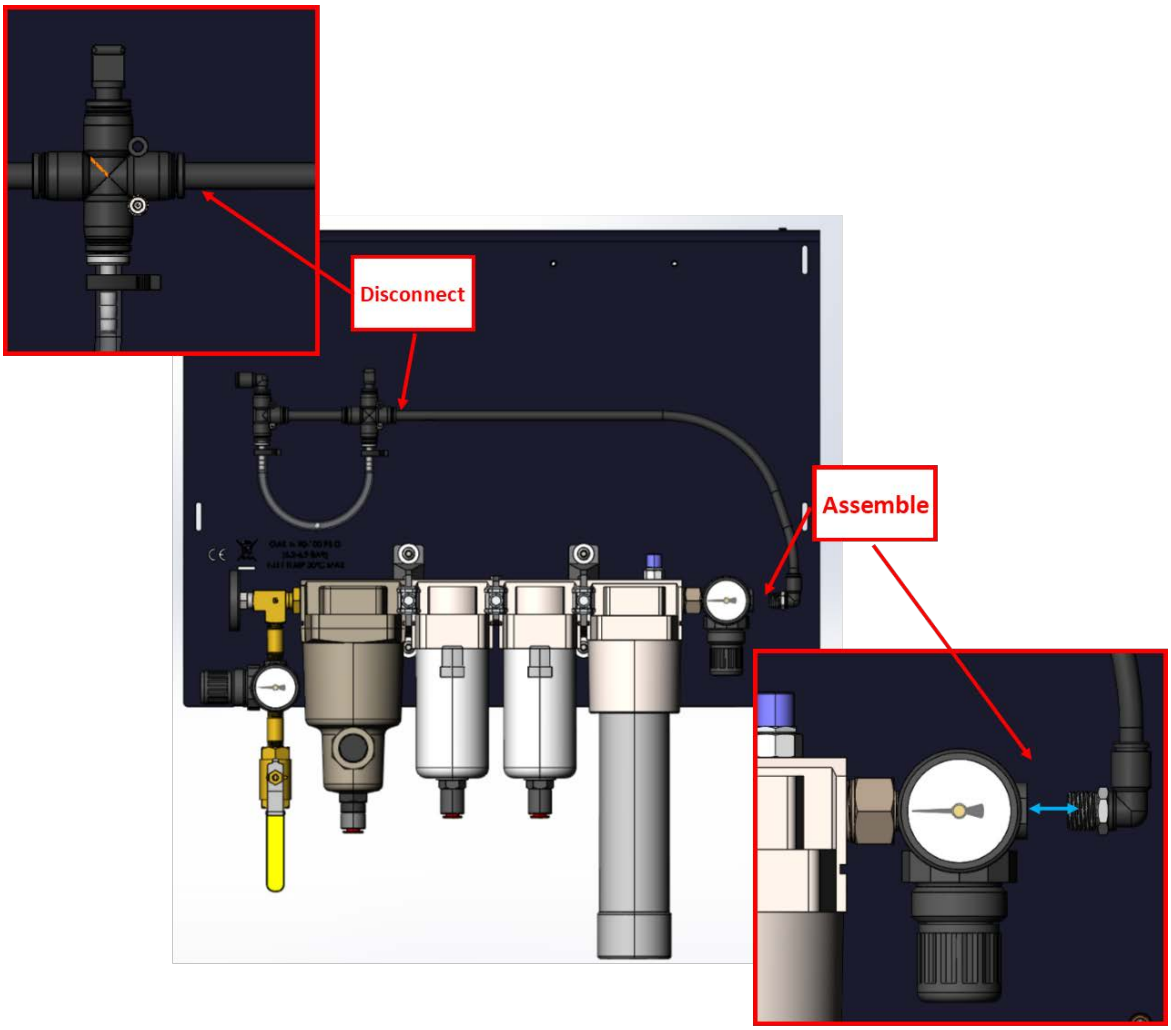

Figure 34 Remove tube & connect elbow.

5 Install the Valve and Solenoid Upgrade Assembly onto the ACS using the hardware provided. Then switch the elbow fitting from the left side of the flow indicator to the right side of the flow indicator.

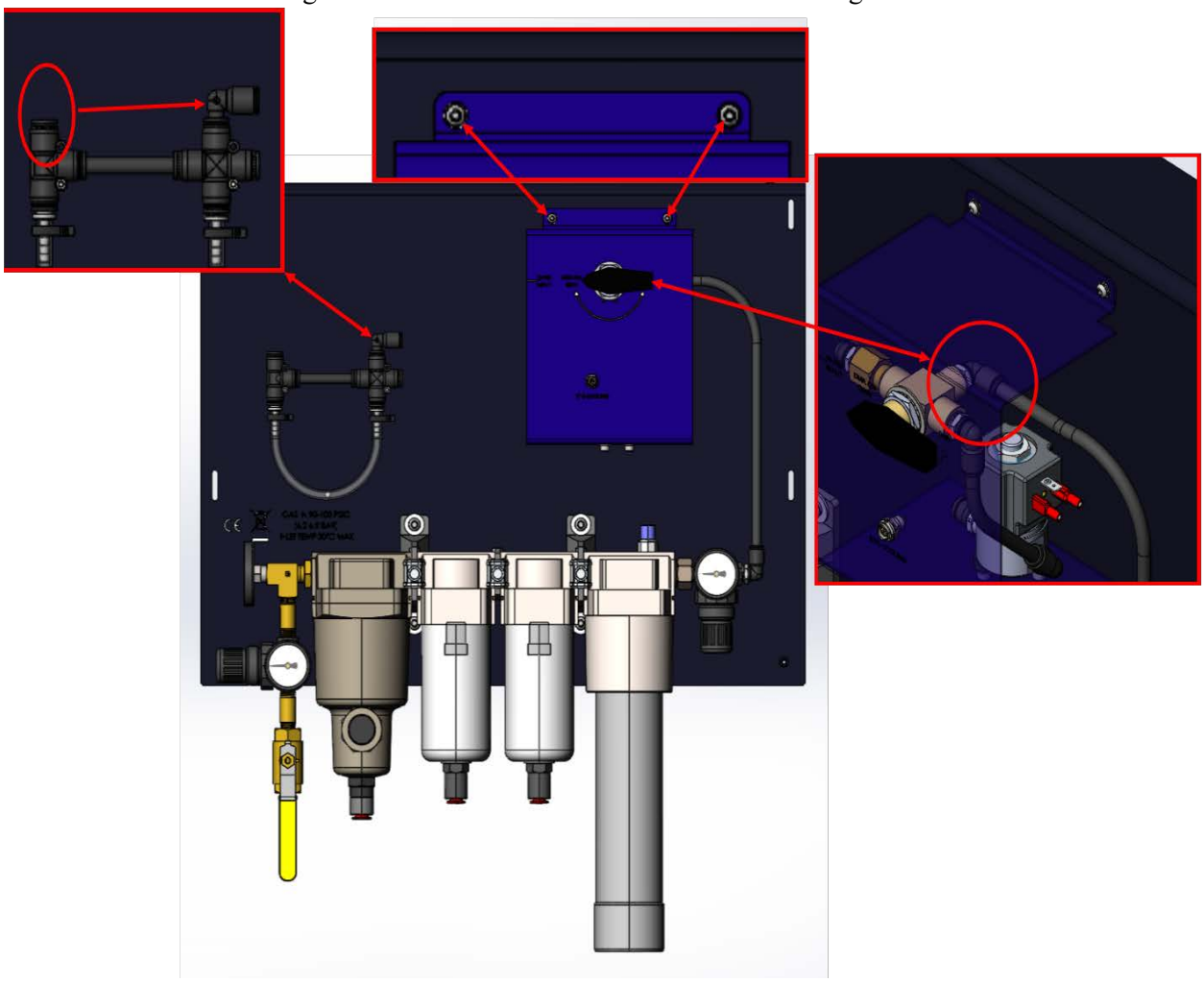

Figure 35 Valve and Solenoid Upgrade Assembly installed.

6 Connect the Valve and Solenoid Upgrade with the Flow Indicator of the Chiller Panel using the supplied 8mm tubing.

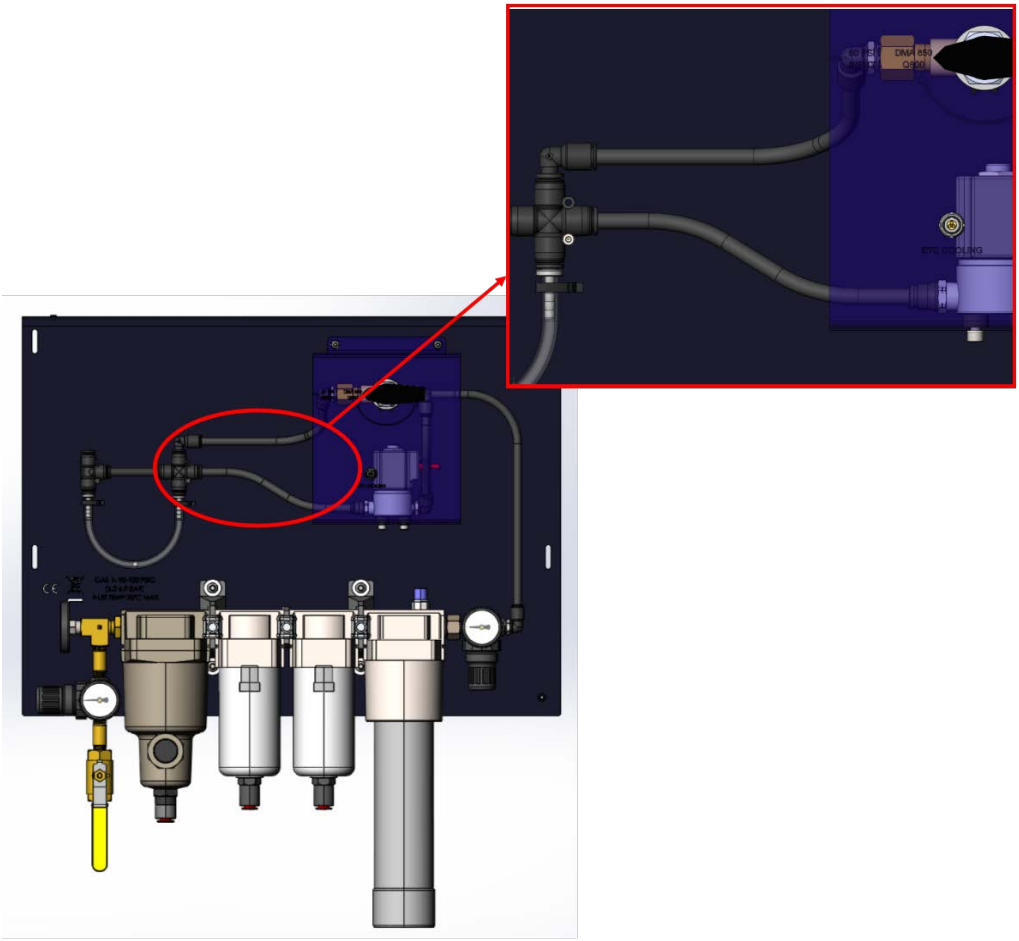

Figure 36 Install tube connection.

The panel is now upgraded to a Combined DHR/DMA Air Chiller Panel (P/N 405400.901 Rev. B; see Figure 37); it allows the ACS to be used on a DMA following the *ACS for DMA Getting Started Guide* or on a DHR following the *ACS for DHR Getting Started Guide*. Follow instructions for Combined DHR/DMA Air Chiller Panel.

Figure 37 Upgraded Combined DHR/DMA Air Chiller Panel (P/N 405400.901 new design)

NOTE: The remaining items in the Combined ACS Panel Upgrade Kit are used with the DHR only. Instructions are in the *ACS for DHR Getting Started Guide*.

Upgrading a Rev A Chiller Panel for use with the DHR

If needed, follow instructions for Shutting Down, Purging, and Defrosting the ACS and Disconnecting the ACS to Use on Another Instrument.

1 Make sure that the ACS power switch is turned off, all event cables are disconnected, and the Inlet Quarter-Turn Valve is turned to the **OFF** position and both pressure gauges show 0 psi.

2 With an adjustable wrench, disconnect the flow control orifice from the pressure regulator.

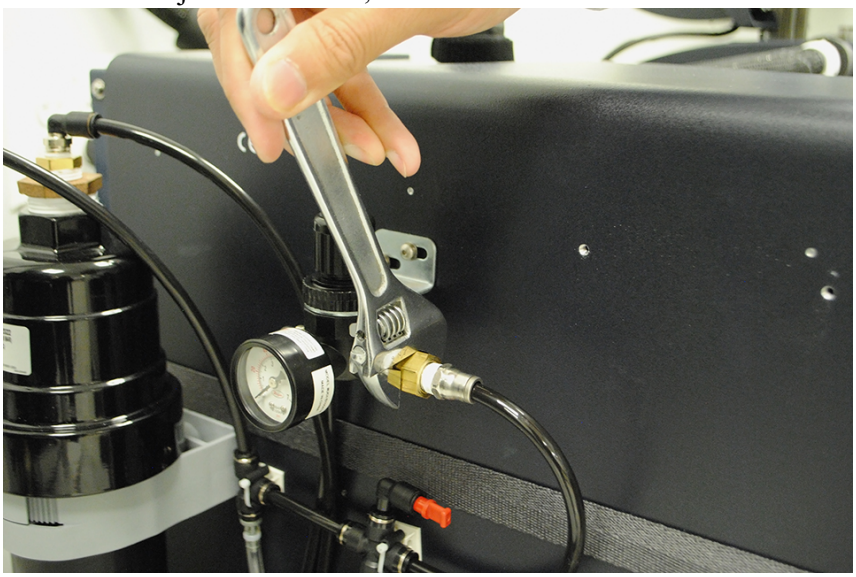

Figure 38 Disconnect flow control orifice.

3 Remove the 8 mm tube from the cross connector by depressing the circumferential ring and pulling on the tubing.

Figure 39 Remove tube.

4 Remove the 8 mm plug from the elbow on top of the cross connector by depressing the circumferential ring and pulling on the plug.

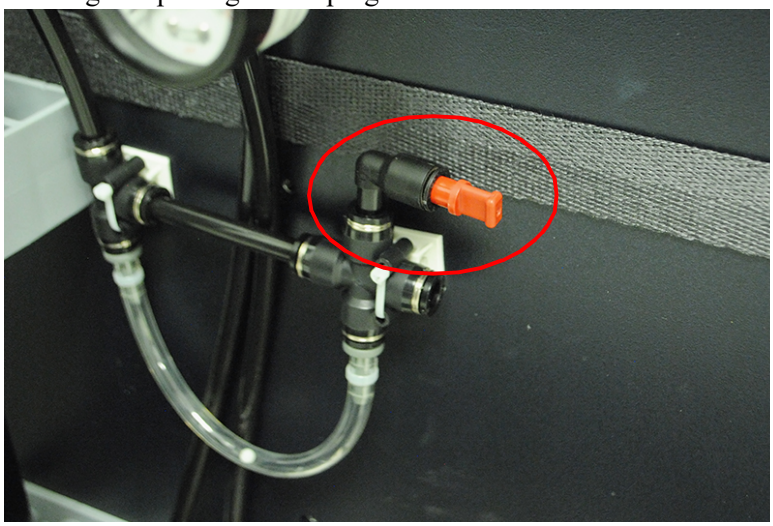

Figure 40 Plug.

5 Install the Valve and Solenoid Upgrade Assembly onto the ACS using the (2) screws provided. .

Figure 41 Valve and Solenoid Upgrade Assembly installed.

6 Install the included 8 mm push-to-connect fitting into 1/4” NPT thread on the right side of the pressure regulator.

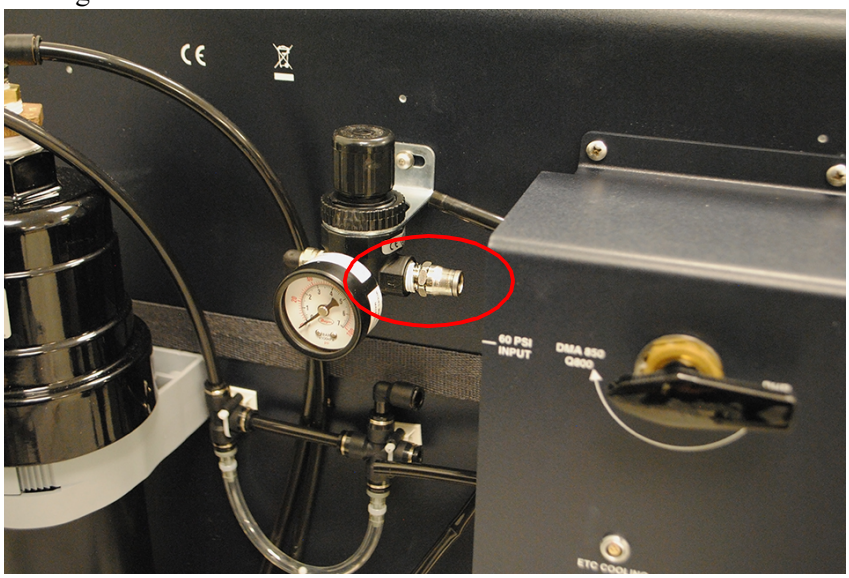

Figure 42 Install push-to-connect fitting.

7 Connect the tubing as follows:

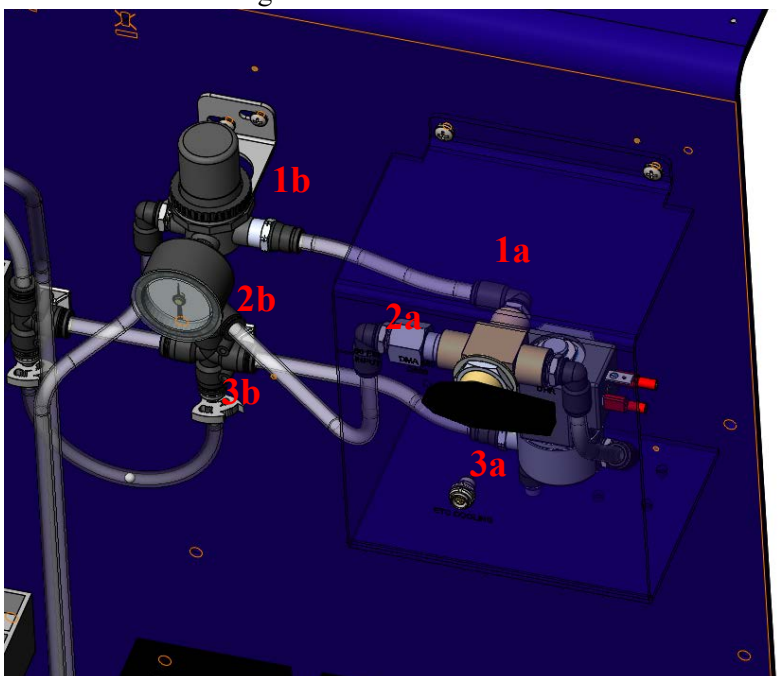

Figure 43 Connect tubing.

a Take the free end of the top tube in position #**1a** and connect it to the push-to-connect fitting on the regulator (position #**1b**) (Figure 43).

b Take the free end of the center tube in position #**2a** and connect it to the elbow on top of the cross connector (position #**2b)** (Figure 43).

c Take the free end of the bottom tube in position #**3a** and connect it to the right side of the cross connector (position #**3b)** (Figure 43).

NOTE: Make sure that both ends of all tubing are fully seated into the push-to-connect fittings. Tubing may need to be cut to ensure proper fit. Figure 44 shows the push-to-connect fitting and all tubing connected.

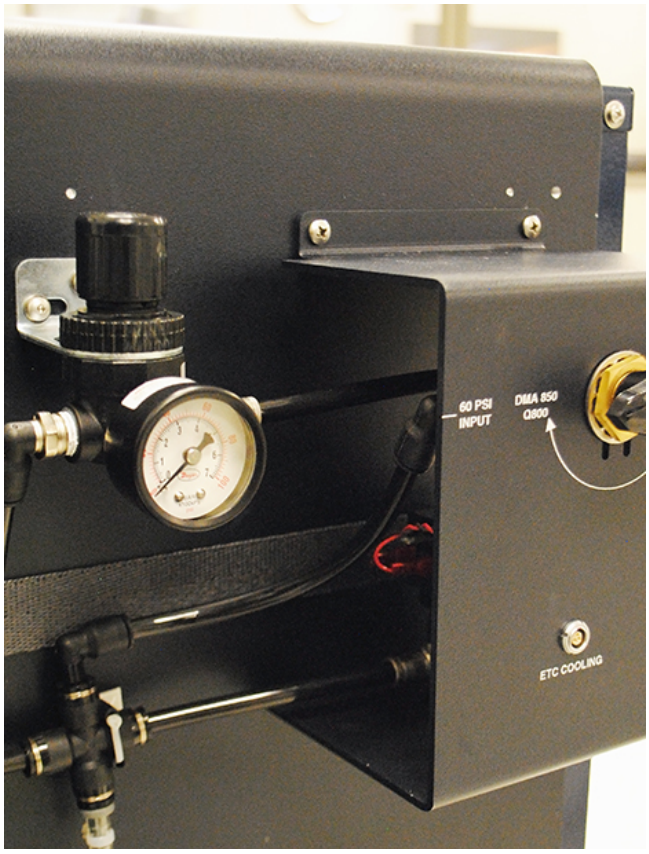

Figure 44 Tubing connected.

The panel is now upgraded to a Combined DHR/DMA Air Chiller Panel (P/N 405400.901 Rev A; see Figure 45); it allows the ACS to be used on a DMA following the *ACS for DMA Getting Started Guide* or on a DHR following the *ACS for DHR Getting Started Guide*. Follow instructions for Combined DHR/ DMA Air Chiller Panel.

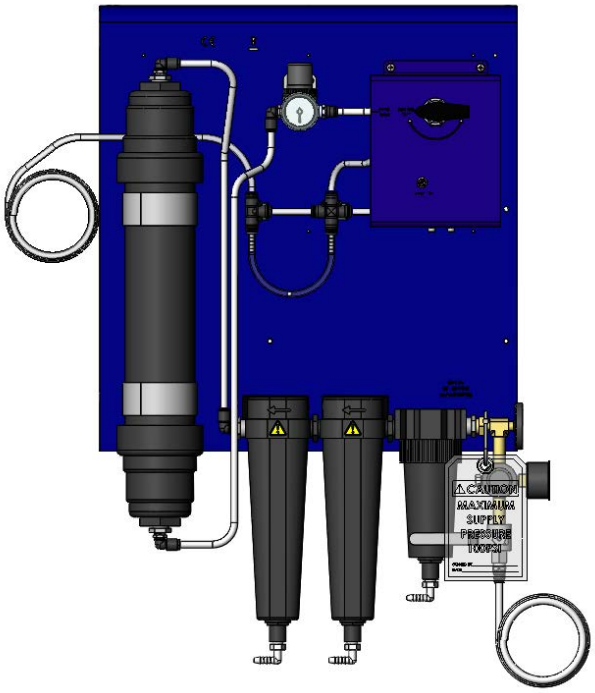

Figure 45 Upgraded Combined DHR/DMA Air Chiller Panel (P/N 405400.901).

NOTE: The remaining items in the Combined ACS Panel Upgrade Kit are used with the DHR only. Instructions are in the *ACS for DHR Getting Started Guide.*

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 online 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
- Powered on the instrument
- Specified the ACS in the instrument control software, if required (see Chapter 2)
- 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 Adjust the Bypass valve flow: Open the valve by turning the manual knob on the back of the ACS to allow air flow to dry out the line. Noise level will increase with increased flow rate. 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 46 Bypass valve.

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, Purging, and Defrosting the ACS for more information.

4 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 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.

5 After mounting the sample, slide the appropriate ACS Clamp Screen over the clamp. See Figure 31 and Figure 32.

6 Close the DMA 850 furnace and set a temperature of 25°C from the touchscreen. Ensure that ACS is selected as the cooling accessory. Cool gas will start flowing through the furnace as soon as the internal timer condition is satisfied.

7 **DMA Air Chiller Panel (P/N 986400.901 Rev. A and Rev. B)** and **Combined DHR/DMA Air Chiller Panel (P/N 405400.901 Rev. A and Rev. B)**: When cool gas begins to flow through the furnace, the flow indicator ball will move to the upper left of the tube. Verify the movement of the ball.

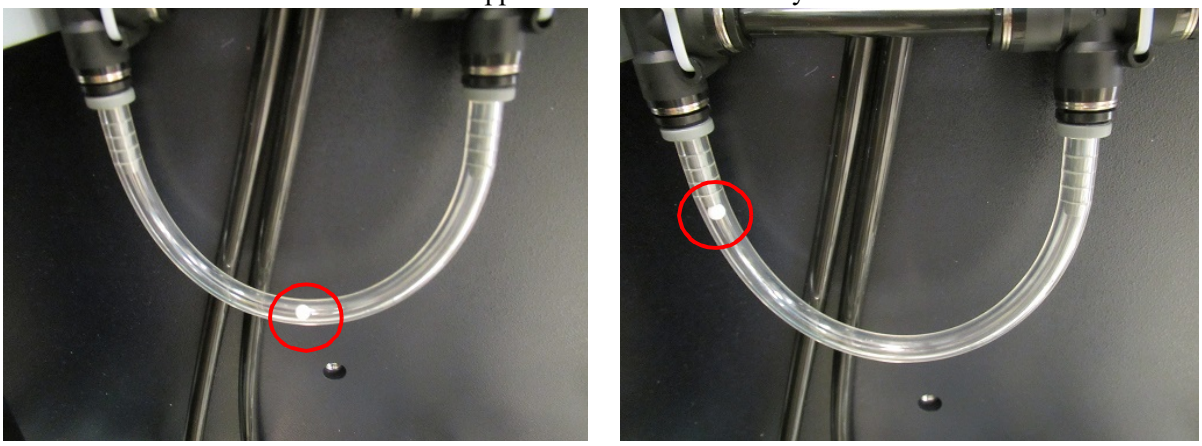

Figure 47 DMA Air Chiller Panel and Combined DHR/DMA Air Chiller Panel only: Flow indicator ball indicating no air flow (left) and air flow (right). **NOTE**: Any movement of the ball indicates flow. The ball does not need to move to the top of the tube as shown.

NOTE: Make sure cool gas is flowing through the furnace before adjusting the Outlet Pressure Regulator in the next step.

8 Setting the correct air pressure:

- **DMA Air Chiller Panel and Combined DHR/DMA Air Chiller Panel (Rev. A. and Rev. B)**: The Outlet Pressure Regulator is factory set to 60 psi and does not need to be readjusted. Verify that the indicator is reading 60 psi. See Figure 33.

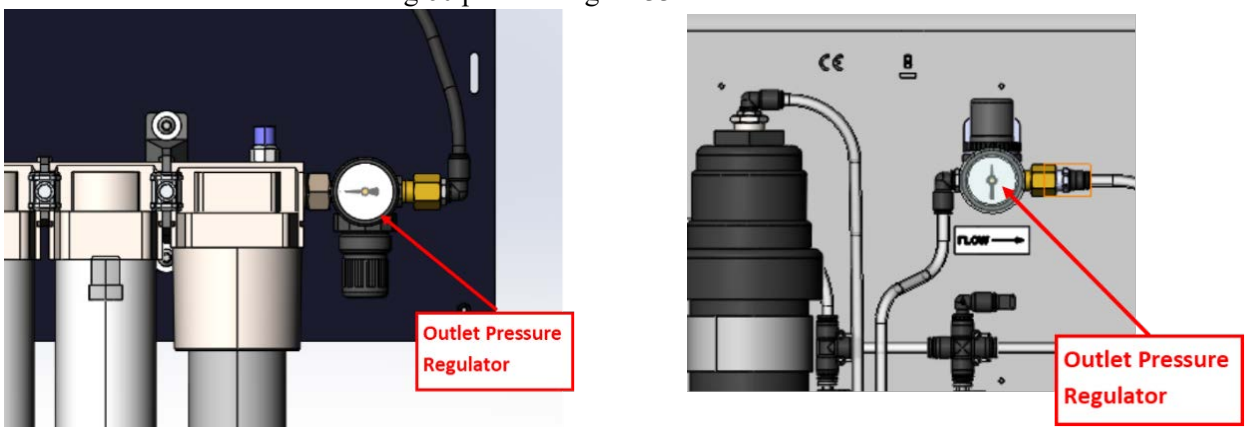

Figure 48 DMA Chiller Panel and Combined DHR/DMA Air Chiller Panel Outlet Pressure Regulator set to 60 psi. Flow is from left to right as indicated by the arrow.
Left: Rev. B. **Right**: Rev. A.

- **Q800 DMA Air Chiller Panel**: Set the Outlet Pressure Regulator to 30 psi. See Figure 49.
  See Figure 49.

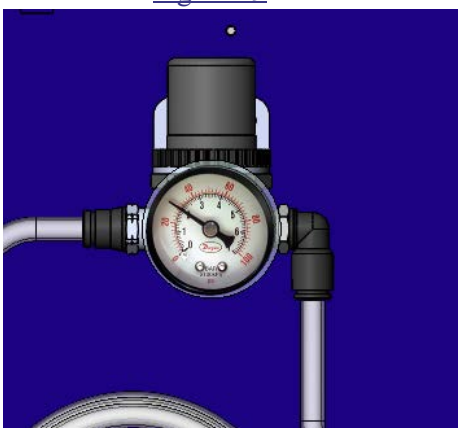

Figure 49 Q800 DMA Air Chiller Panel Outlet Pressure Regulator showing 30 psi. Flow is from right to left.

NOTE: The Chiller Panel's pressure regulator is pre-set at the factory to the value appropriate for each panel.

- **DMA Air Chiller Panel (P/N 986400.901 Rev. B)** and **Combined DHR/DMA Air Chiller Panel (P/N 405400.901 Rev. B)**: The Membrane Dryer is equipped with an Indicator which 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.

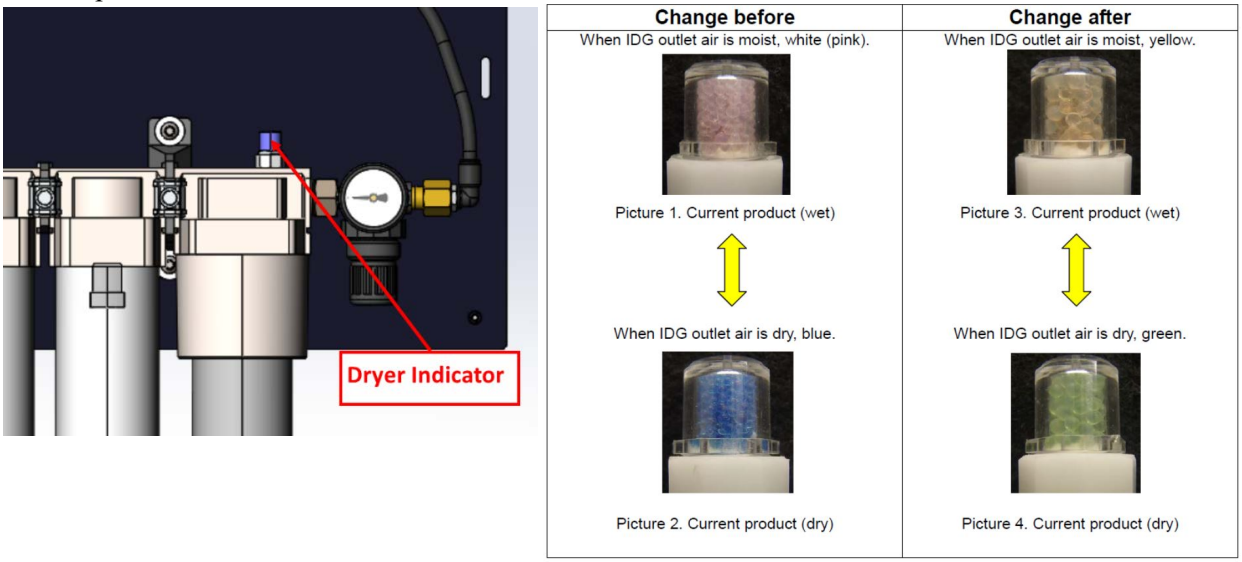

Figure 50

NOTE: Power on the ACS at least 60 minutes before the start of your first test. 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 52 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 52 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, Purging, and Defrosting the ACS

1 Close the DMA 850 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 equipped 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 leave the purge gas on 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.

CAUTION: Do not move the flexible line when it is cold, always warm the system to ambient (+20°C) before making any adjustments to the placement of the delivery line.

MISE EN GARDE: Ne pas déplacer la ligne flexible quand il fait froid, toujours réchauffer le système à la température ambiante (20°C) avant de faire des ajustements à la placement de la ligne de livraison.

Disconnecting the ACS to Use on Another Instrument

1 Follow the instructions above for Shutting Down, Purging, and Defrosting the ACS.

2 Allow the ACS to reach room temperature and dry overnight.

3 Make sure that the ACS and DMA 850 are shut down and not powered on.

4 Turn the Inlet Quarter-Turn Valve to **OFF** (perpendicular to the line).

5 Disconnect the event cable from the DMA 850 and ACS and replace with the jumper cable (see Figure 27). Store the event cable for future use.

6 Carefully disconnect the insulated hose from the DMA 850.

Relocating the ACS

1 Follow the instructions above for Shutting Down, Purging, and Defrosting 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 DMA 850.

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

4 Disconnect the Event cable from the ACS and replace it with the jumper cable. See Figure 27. Store the Event cable for future use.

5 Carefully disconnect the insulated hose from the DMA 850.

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

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

8 Carefully move the ACS to its final location.

9 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 16 and Figure 17.

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 when the locknuts are removed. See Figure 12.

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 from the source. **NOTE**: The line may be pressurized.

2 Disconnect the 8 mm Chiller Inlet Tubing from the ACS. See Figure 24, Figure 25, and Figure 26.

3 Remove the Cinching Strap. See Figure 20.

4 Remove the standoffs as shown in Figure 18 and Figure 19

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 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*. The Q800 panel cannot be used on the DHR.

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.

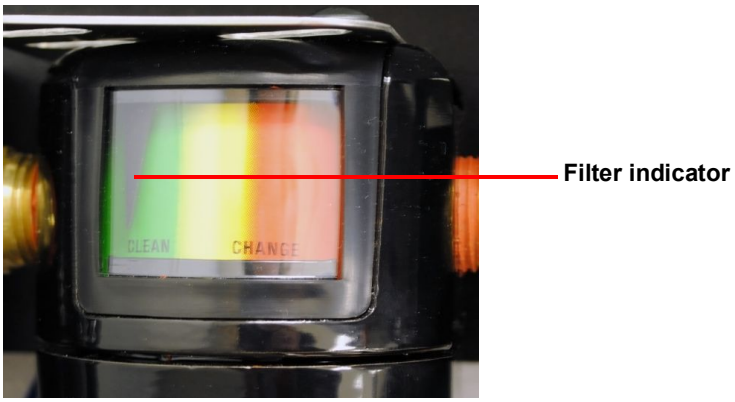

Figure 51 Filter indicator showing CLEAN.

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.

NOTE: Turn the unit off by using the On/Off switch, not the Event control. The Event control only turns off the airflow and will not allow the system to defrost.

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 52) 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 47).
	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 7: DMA 850 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
545056.901	Combined ACS Panel Upgrade Kit
405400.901 404040.90	Combined DHR/DMA Air Chiller Panel DHR Chiller Panel

Table 8: DMA 850 Chiller and Chiller Panel Replacement Parts – Rev. A

613.06190	Air Regulator Type R07
200750.001	Cinching strap 8 ft. long
578056.001	Black Nylon Tubing 8 mm OD x 6 mm ID
986301.901	Chiller Panel Filter Replacement Pack (BX filter, DX filter, Element filter)
985730.901	Clamp Screen Kit DMA ACS
545056.901	Combined ACS Panel Upgrade Kit
405400.901 986400.901	Combined DHR/DMA Air Chiller Panel DMA Air Chiller Panel