Thermo SCIENTIFIC

Dionex AutoTrace 280 SPE Instrument Operator's Manual

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Revision 02 released December 2011
Revision 03 released May 2013; new system part numbers, SolEx cartridges, Windows 7 support
Revision 04 released November 2013; new operating altitude specification

For Research Use Only. Not for use in diagnostic procedures.

Contents

1 • Introduction

1.1 Overview

The Thermo Scientific Dionex™ AutoTrace™ 280 SPE Instrument (called Dionex AutoTrace 280 for short) is an automated solid phase extraction (SPE) system designed for use with large samples (20 mL to 4 L) for the isolation of trace organics in water or aqueous matrices.

The Dionex AutoTrace 280 is available in both cartridge and disk models:

- Cartridge models use SPE devices in the cartridge format. Polymer cartridges are available in the following sizes: 1 mL, 3 mL, and 6 mL. Glass cartridges are available in one size: 6 mL.
- The disk model uses SPE devices in the disk format. Disks are available in one size: 47 mm.

Part Number	Description
072604	Dionex AutoTrace 280 for 1 mL Polymer Cartridges
072605	Dionex AutoTrace 280 for 3 mL Polymer Cartridges
071385	Dionex AutoTrace 280 for 6 mL Polymer Cartridges
072606	Dionex AutoTrace 280 for 6 mL Glass Cartridges
071386	Dionex AutoTrace 280 for 47 mm Disks

The compounds of interest are trapped on SPE adsorbents and then eluted with strong solvents to generate an extract ready for analysis.

The Dionex AutoTrace 280 saves times, solvent, and labor, ensuring high reproducibility and productivity for analytical laboratories. The instrument can process up to six samples in 2 to 3 hours with only 15 minutes of operator involvement. The Dionex AutoTrace 280 uses powerful pumps (no check valves) and proven constant flow technology to efficiently process even the most difficult samples. With the Dionex AutoTrace 280 and a Thermo Scientific Dionex Accelerated Solvent Extraction (ASE™) system, laboratories can effectively automate the solvent-extraction process for liquid and solid matrices.

The water samples are loaded or directed through the SPE cartridge or disk, using a pump. (There is a separate pump for each of the six channels.) Loading is performed in parallel, since this is the rate-limiting step of the SPE process. The analytes are eluted from the SPE material one channel at a time, using positive pressure. Positive pressure gives more uniformity when loading or eluting, leading to better reproducibility. The effluent from the SPE adsorbents can be collected in five different elution containers (16 mm x 100 mm test tubes, 17 mm x 60 mm vials, 11 mm or 1 mL GC vials, 4 mL screw cap vials, or conical bottom 15 mL centrifuge tubes).

Analytes that are extracted or removed from the water and analyzed include PAH, PCB, PCDD, PCDF, pesticides, herbicides, flame retardants, semi-volatiles, nitrosamines, and steroids.

AutoTrace software version 1.0.0 (or later) is provided with the system. Users can create software methods to automate the following SPE processes:

- Conditioning the cartridge or disk
- Loading sample onto the cartridge or disk
- Rinsing the cartridge or disk
- Drying the cartridge or disk
- Eluting the sample

The AutoTrace software must be installed on a PC running one of the following operating systems: Microsoft® Windows® 7 (32-bit or 64-bit version), Windows Vista®, or Windows XP SP3 (or later). For communication between the Dionex AutoTrace 280 and the PC, the Dionex AutoTrace 280 must be connected to a USB (Universal Serial Bus) 2.0 port on the PC.

1.2 About This Manual

The electronic version (i.e., PDF file) of the Dionex AutoTrace 280 operator's manual contains numerous hypertext links that can take you to other locations within the file. These links include:

- Table of contents entries
- Index entries
- Cross-references (underlined in blue) to sections, figures, tables, etc.

If you are not familiar with how to navigate PDF files, refer to the Adobe® Acrobat® or Adobe Reader® Help for assistance.

Chapter 1 Introduction	Introduces the Dionex AutoTrace 280; explains the conventions used in this manual, including safety-related information.
Chapter 2 Description	Describes Dionex AutoTrace 280 operating features and the extraction process.
Chapter 3 Operation and Maintenance	Provides operating instructions and routine preventive maintenance procedures.
Chapter 4 Troubleshooting	Lists error messages and how to troubleshoot them; lists operating problems and how to resolve them.
Chapter 5 Service	Provides step-by-step instructions for routine service and parts replacement procedures that the user can perform.
Appendix A Specifications	Provides specifications and installation site requirements.
Appendix B Installation	Describes how to install the Dionex AutoTrace 280.
Appendix C Reordering Information	Lists spare parts for the Dionex AutoTrace 280.
Appendix D Glossary	Defines terms used in the Dionex AutoTrace 280 operator's manual.

1.3 Safety and Regulatory Information

The Dionex AutoTrace 280 was manufactured by Thermo Fisher Scientific Inc. at the following location: 527 Lakeside Drive, Sunnyvale, CA 94088-3603 U.S.A. The Dionex AutoTrace 280 is designed to perform solid phase extraction water methods. Operation of a Dionex AutoTrace 280 in a manner not specified by Thermo Fisher Scientific may result in personal injury.

If you have a question regarding appropriate usage, contact Technical Support for Dionex products before proceeding. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

1.3.1 Safety Messages and Notes

This manual contains warnings and precautionary statements that can prevent personal injury and/or damage to the Dionex AutoTrace 280 when properly followed. Safety messages appear in bold type and are accompanied by icons, as shown below.

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in death or serious injury.

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Also used to identify a situation or practice that may seriously damage the instrument, but will not cause injury.

Indicates that the function or process of the instrument may be impaired. Operation does not constitute a hazard.

Messages d'avertissement en français

Signale une situation de danger immédiat qui, si elle n'est pas évitée, entraînera des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures graves à mortelles.

Signale une situation de danger potentiel qui, si elle n'est pas évitée, pourrait entraîner des blessures mineures à modérées. Également utilisé pour signaler une situation ou une pratique qui pourrait gravement endommager l'instrument mais qui n'entraînera pas de blessures.

Warnhinweise in Deutsch

Bedeutet unmittelbare Gefahr. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zum Tod oder schwerwiegenden Verletzungen führen.

Bedeutet eine mögliche Gefährdung. Mißachtung kann zu kleineren oder mittelschweren Verletzungen führen. Wird auch verwendet, wenn eine Situation zu schweren Schäden am Gerät führen kann, jedoch keine Verletzungsgefahr besteht.

Notes

Informational messages appear throughout this manual. These are labeled NOTE and are in bold type.

NOTE NOTES call attention to certain information. They alert the user to an unexpected result of an action, suggest how to optimize instrument performance, etc.

1.3.2 Safety Symbols

The symbols below appear on the Dionex AutoTrace 280 or on Dionex AutoTrace 280 labels.

Alternating current

Primary protective conductor terminal

Secondary protective conductor terminal

Power supply is on

Power supply is off

Hot surface

Indicates a potential hazard. Refer to the operator's manual for an explanation of the hazard and how to proceed.

1.3.3 Declaration of Conformity

The cETLus and CE marks on the Dionex AutoTrace 280 model data label (on the right-side panel) indicate that the Dionex AutoTrace 280 is in compliance with the standards below.

ThermoFisher SCIENTIFIC

Thermo Fisher Scientific
501 Mercury Drive, Sunnyvale, California 94085
Telephone: 408-737-0700
FAX: 408-739-8437

MANUFACTURERS DECLARATION OF CONFORMITY

Product Identification

Product: AutoTrace 280 SPE Instrument
Brand: Dionex
Model: AT280

Manufacturer

Dionex Corporation, a Thermo Fisher Scientific Company
1228 Titan Way
Sunnyvale, CA 94088
USA

Representative

Ajit Dastane
Dionex Corporation, a Thermo Fisher Scientific Company
1228 Titan Way
Sunnyvale, CA 94088

Function

Director, Engineering

Means of Conformity

The product is in conformity to the listed directives and standards:

Low Voltage/Safety Directive	2006/95/EC
EMC Directive	2004/108/EC
Safety Standard	EN 61010-1:2001 UL 91010-1:2004 CAN/CSA-C22.2 No. 61010.1:2004
EMC Standards	EN 61326-1:2006

Signature of Representative:

Name Ajit Dastane
Place Sunnyvale, CA USA
Date April 19, 2013

2.1 Operating Features

Figure 2-1 illustrates the main operating features on the front of the Thermo Scientific Dionex AutoTrace 280 SPE Instrument.

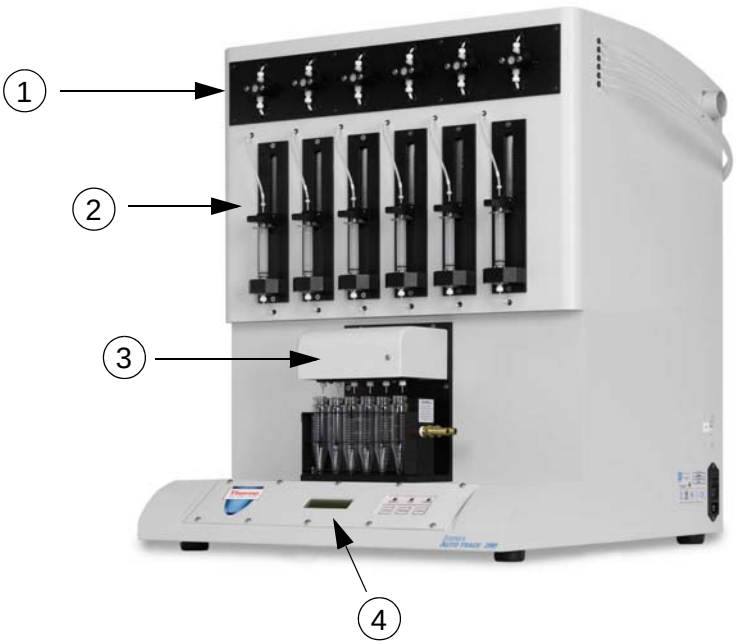

Figure 2-1. Dionex AutoTrace 280 Front View (Cartridge Model)

#	Part	Function
1	Sample Pumps	Pumps sample from sample containers to switching valves.
2	Cartridge/Disk Holders	Holds the SPE cartridges or disks (depending on the Dionex AutoTrace 280 model) for the extraction process.

#	Part	Function
3	Elution Station	Collects aqueous waste, solvent waste, or sample effluent on the elution station (see Figure 2-4).
4	Front Panel	Communicates system status to the user.

2.1.1 Front Panel Controls

Figure 2-2 illustrates the Dionex AutoTrace 280 front panel LEDs and keypad.

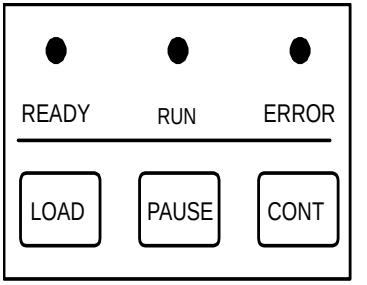

Figure 2-2. Front Panel Controls

Three LEDs indicate the system operating status:

LED State			Meaning
READY	**RUN**	**ERROR**	
On	Off	Off	The Dionex AutoTrace 280 power is on; the system is idle or has paused.
On	On	Off	A method is running.
On	Off	On	A hardware error has occurred. In most cases, the error will not interrupt operation and the method will run to completion.

The keypad offers immediate control of the most frequently used Dionex AutoTrace 280 functions:

Button	Function
LOAD	Increments the method number displayed on the front panel.
PAUSE	• Pressing **PAUSE** while the system is idle displays the **START** screen. • Pressing **PAUSE** while a method is running suspends operation (after the step in process is completed).
CONT	• Pressing **CONT** resumes operation after the user presses **PAUSE**, responds to an error condition, or performs some type of manual intervention (rinses the sample container, for example). • Pressing **CONT** once selects the method number currently displayed; pressing **CONT** a second time starts the selected method.
PAUSE + CONT	Pressing the **PAUSE** and **CONT** buttons simultaneously aborts the method currently running.

2.1.2 Front Panel Display Screen

The Dionex AutoTrace 280 front panel LCD (or screen) displays status and operating information.

When the Dionex AutoTrace 280 power is turned on, the **INITIALIZATION** screen is displayed while the firmware initializes the system. After initialization, the **SYSTEM CHECK ALERT** screen is automatically displayed. This screen will remain until the **CONT** button is pressed, which displays the **START** screen (see Figure 2-3).

Figure 2-3. Start Screen

From the **START** screen, press **LOAD** to select the required method. There are three types of methods:

- Methods 1 through 24 are operational methods that are created by the user in the AutoTrace software and then downloaded from the PC to the Dionex AutoTrace 280. For details about creating methods, refer to the AutoTrace software Help.
- Methods 25 through 31 are diagnostic methods (preprogrammed by Thermo Fisher Scientific) that can be selected and run from the Dionex AutoTrace 280 front panel. For details about when to run the diagnostic methods, see Section 4.2.
- Methods 32 through 34 are reserved for use by Thermo Fisher Scientific Manufacturing personnel.

2.1.3 Cartridges

The Dionex AutoTrace 280 uses silica-based SolEx® Solid Phase Extraction (SPE) cartridges. The cartridges are available in C8 and C18 functionalities. The C18 material is available as endcapped or unendcapped silica to provide the selectivity required by various applications.

The 1 mL cartridges contain 0.1 g of packing, the 3 mL cartridges contain 0.5 g of packing, and the 6 mL cartridges contain 1 g of packing. For a list of SolEx cartridges available for use with the Dionex AutoTrace 280, see Appendix C.

2.2 Left-Side View

Figure 2-4 illustrates the component mounting panel on the left side of the Dionex AutoTrace 280.

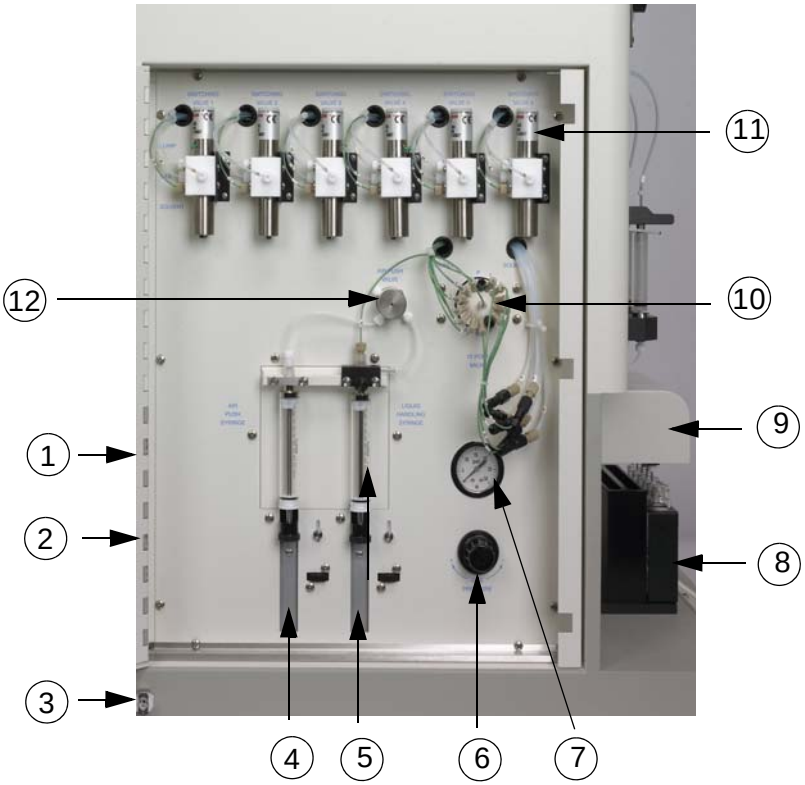

Figure 2-4. Dionex AutoTrace 280 Left-Side View

#	Part	Function
1	Solvent Ports	(Behind door, not shown) Input ports for five solvents.

#	Part	Function
2	Waste Port	(Behind door, not shown) Output port for system waste from purging solvent lines and/or washing the liquid handling syringe.
3	Gas Inlet	Input for the clean gas supply.
4	Air Push Syringe	Draws in and delivers air that follows solvent transfer (to ensure that transfer is complete).
5	Liquid Handling Syringe	Draws in and dispenses solvent through the system.
6	Gas Regulator Knob	Regulates the gas pressure in the system that is used for drying cartridges or disks and for sample concentration.
7	Gas Pressure Gauge	Indicates the gas pressure set by the knob.
8	Elution Rack	Holds tubes or vials for collection of sample effluent.
9	Elution Station	Directs effluent to one of two waste positions or collects effluent in the collection container by moving it into the appropriate position.
10	12-Port Valve	Controls the flow of solvent to whatever position is specified in the method step.
11	Switching Valves	Directs the flow of gas, solvent, or sample to the cartridge or disk holders.
12	Air Push Valve (3-Way Valve)	Draws in or vents air for the air push syringe.
	Aqueous Waste Tubing (not shown)	Routes sample and aqueous effluent to waste.
	Solvent Waste Tubing (not shown)	Routes solvent effluent to waste.

2.3 Right-Side View

Figure 2-5 illustrates the right side of the Dionex AutoTrace 280.

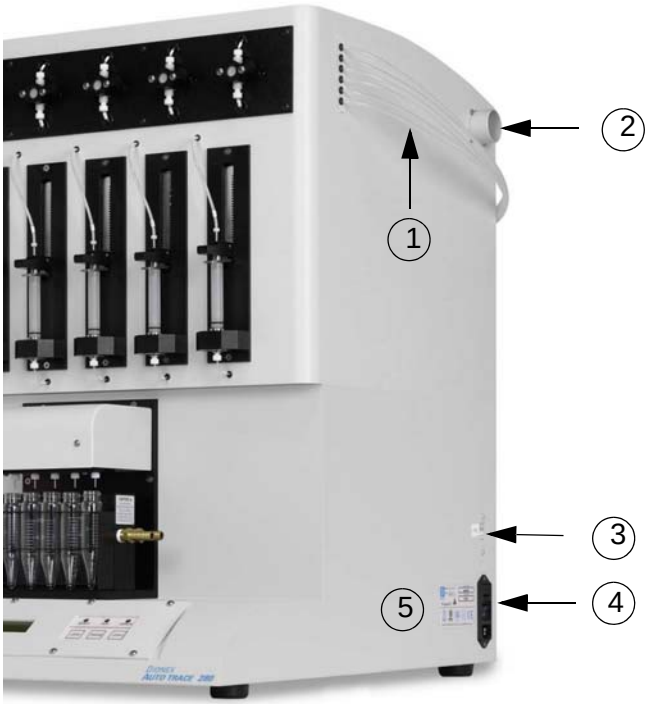

Figure 2-5. Dionex AutoTrace 280 Right-Side View (Disk Model)

#	Part	Function
1	Sample Input Lines	Connects the system to sample containers.
2	Exhaust Port	Outlet for routing solvent vapors to a suitable vent location.
3	USB Port	Connects the USB cable from the Dionex AutoTrace 280 to a USB 2.0 port on the PC on which the AutoTrace software is installed. **Note:** If you connect the USB cable to a USB 3.0 port, the system will not operate correctly.

#	Part	Function
4	Fuse Holder, Power Switch, and Power Receptacle	• The fuse holder contains two fast-blow IEC 127 fuses rated 3.15 A (P/N 954745). For instructions on how to change the fuses, see Section 5.17. • The power switch provides on/off control of power to the Dionex AutoTrace 280. • The power cord plugs into the IEC 320 three-prong receptacle.
5	Model Data Label	The model data label lists fuse and power information, as well as the Dionex AutoTrace 280 serial number. You will be asked to provide the serial number when ordering replacement parts.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the Dionex AutoTrace 280 and is easily accessible.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

2.4 Fluid Schematic

Figure 2-6 shows a simplified view of the main Dionex AutoTrace 280 components and their connections.

The dashed box shows the pump, switching valve, cartridge (or disk), and sample container for position #1 only. Refer to the flow charts and diagrams in Section 2.5 for details about the SPE process.

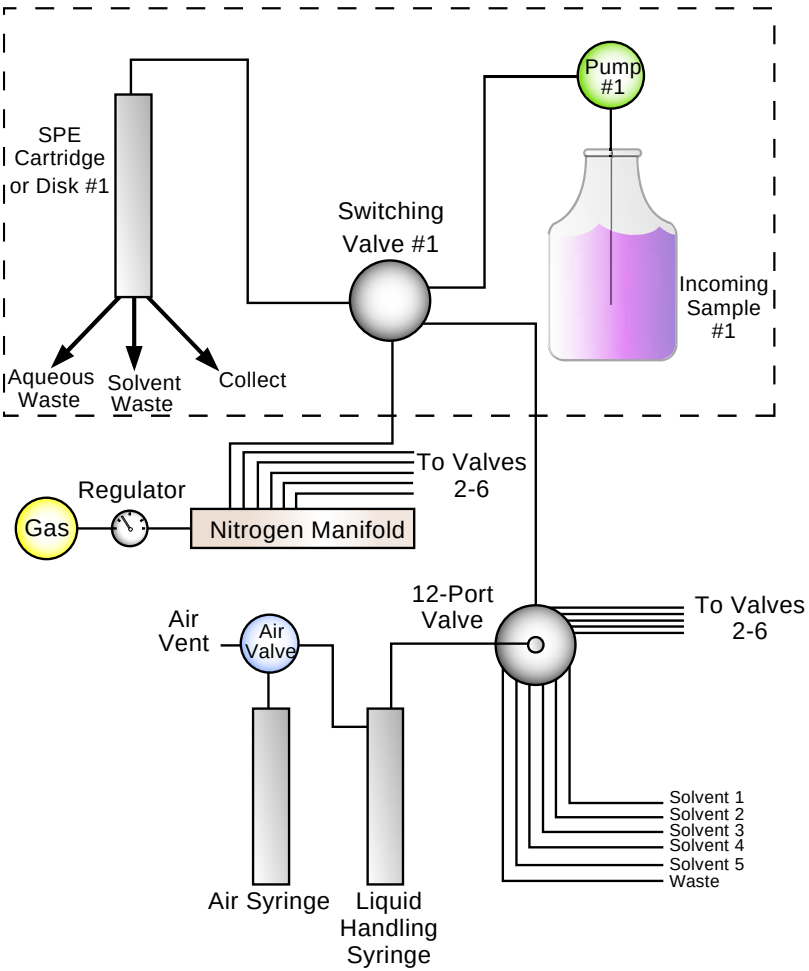

Figure 2-6. Dionex AutoTrace 280 Fluid Connections

2.5 Solid Phase Extraction Process

The flow charts and associated diagrams in this section show how the Dionex AutoTrace 280 processes a typical SPE (solid phase extraction) method.

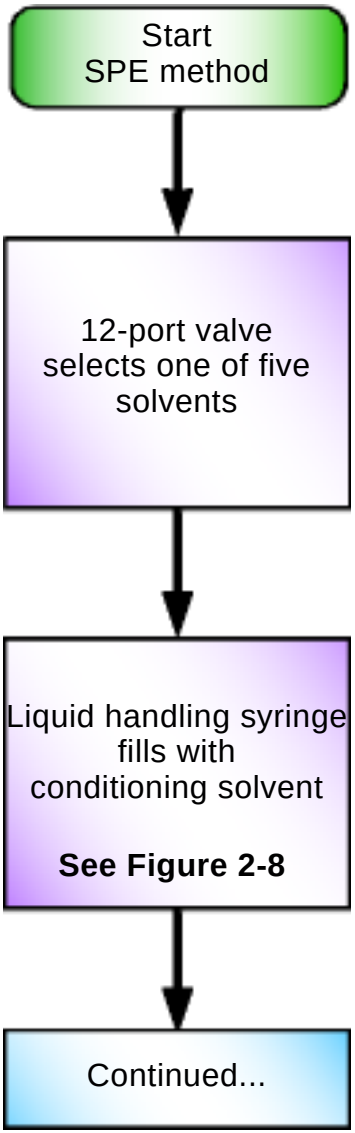

Figure 2-7. Condition Cartridge: Liquid Handling and Air Push Syringes Fill Flow Chart

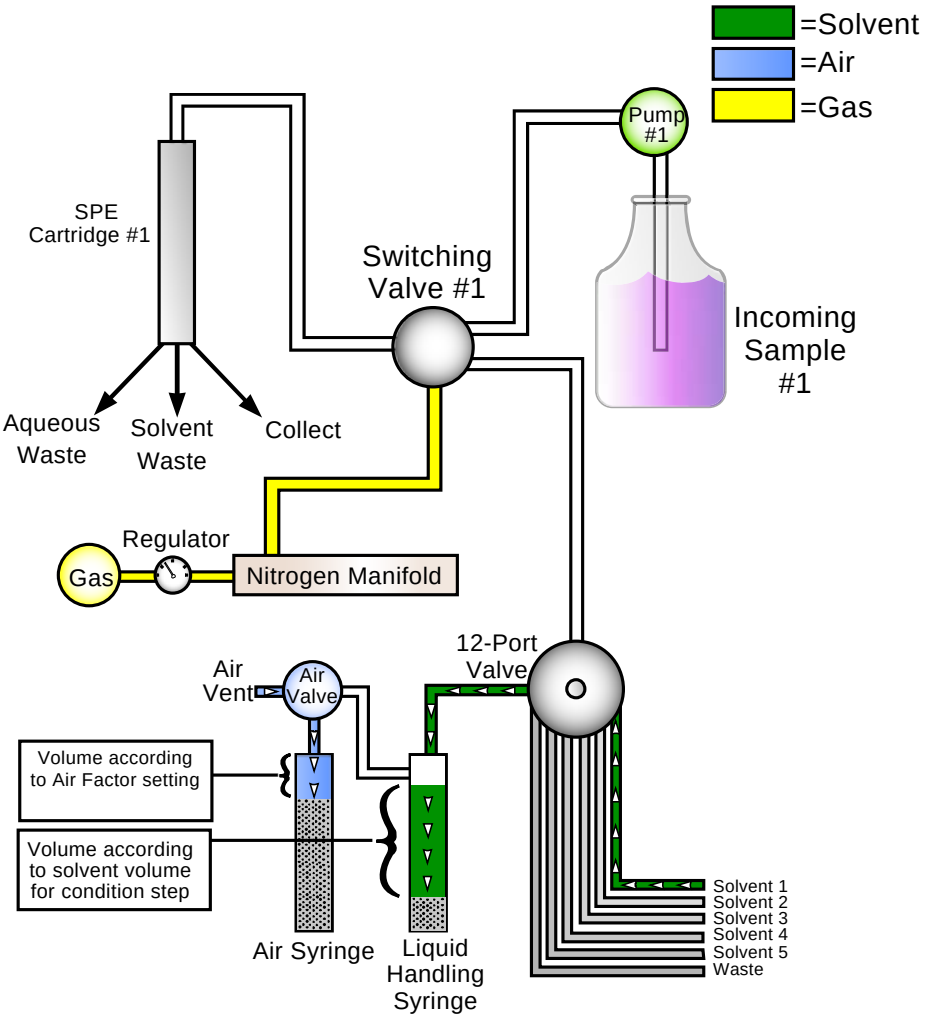

Figure 2-8. Condition Cartridge: Liquid Handling and Air Push Syringes Fill Diagram

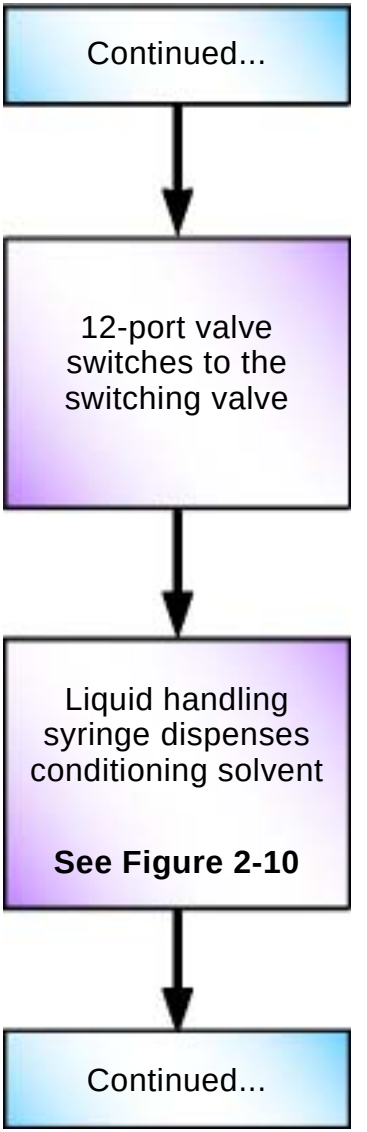

Figure 2-9. Condition Cartridge: Liquid Syringe Dispenses Solvent Flow Chart

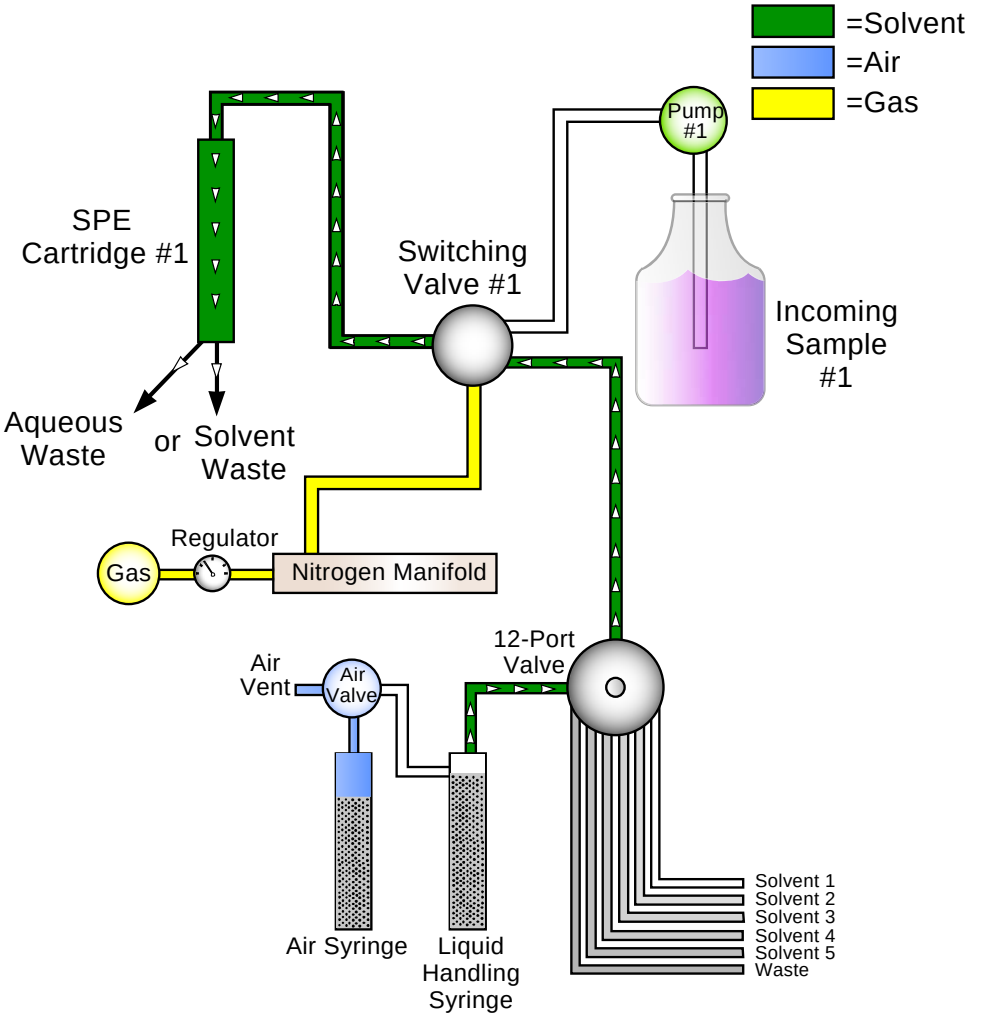

Figure 2-10. Condition Cartridge: Liquid Syringe Dispenses Solvent Diagram

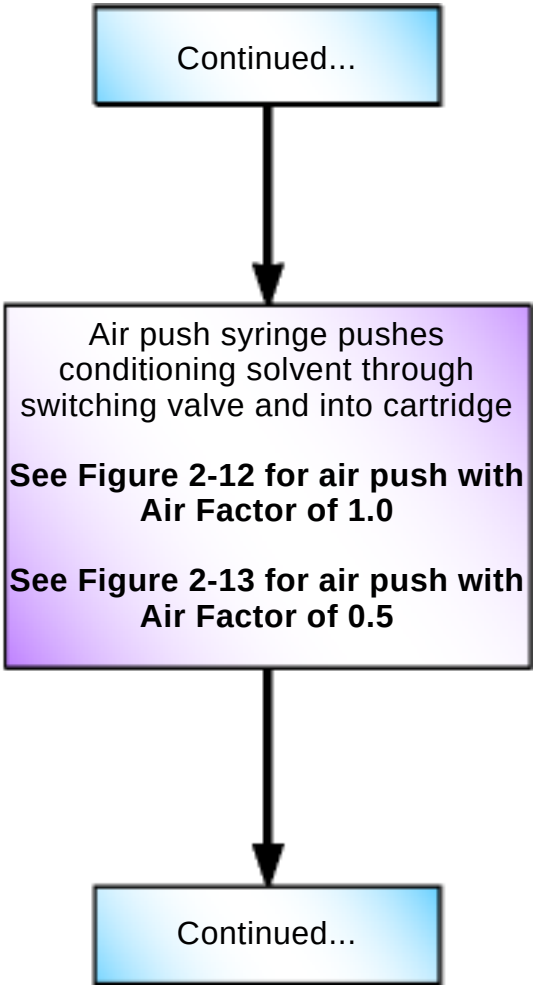

Figure 2-11. Condition Cartridge: Air Push Flow Chart

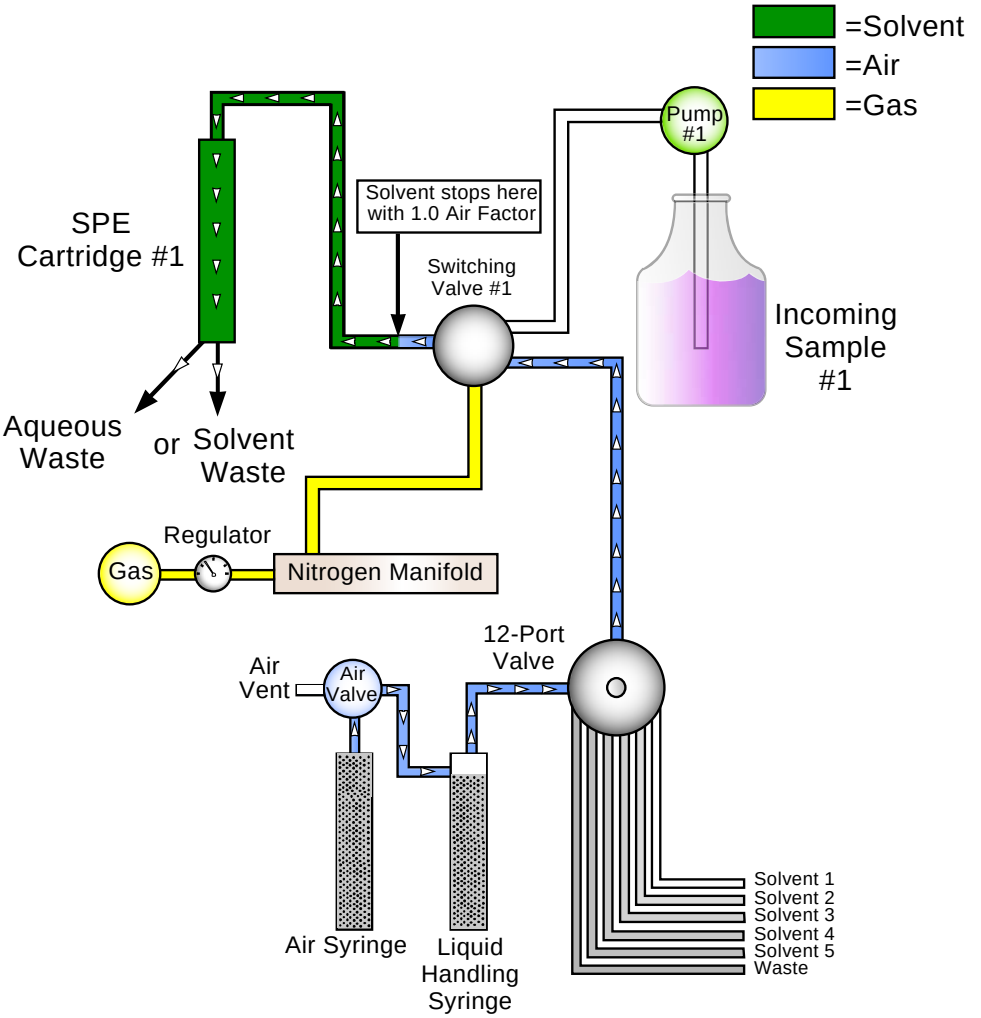

Figure 2-12. Condition Cartridge: Air Push with Air Factor of 1.0 Diagram

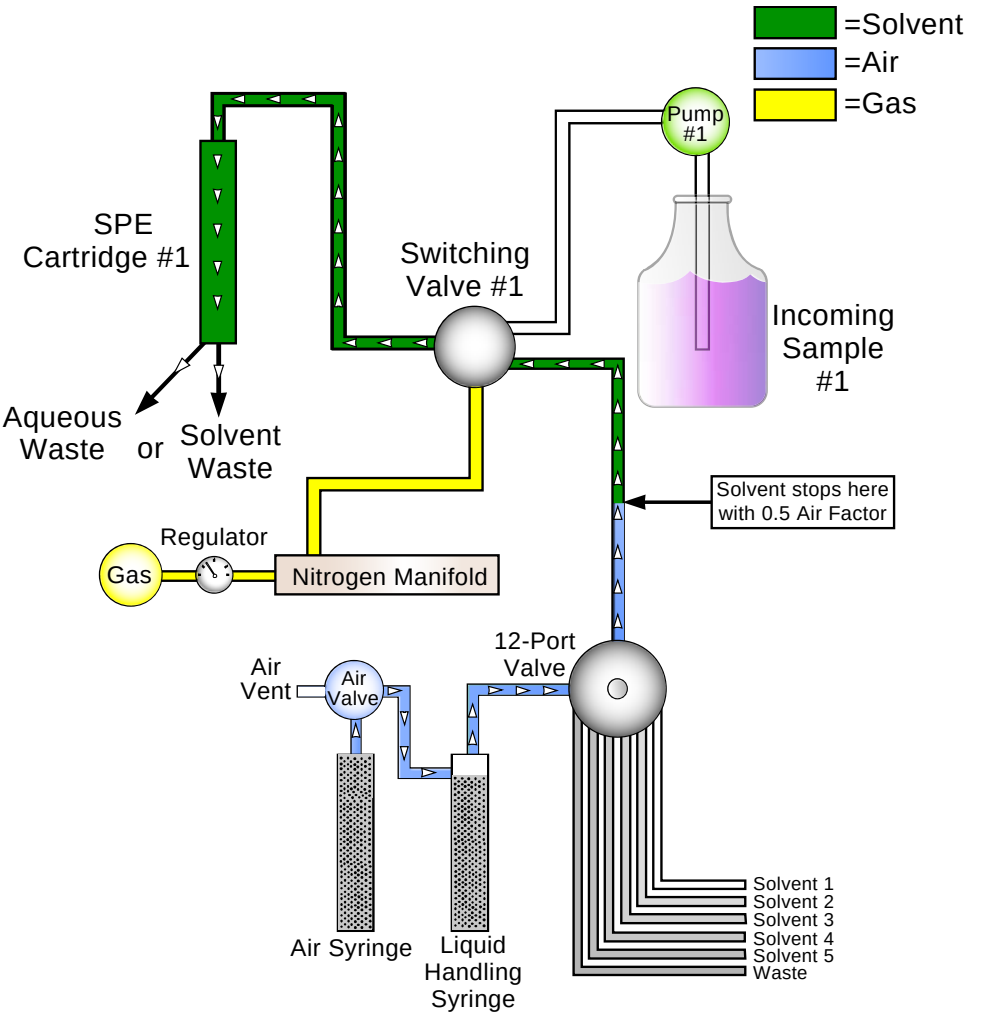

Figure 2-13. Condition Cartridge: Air Push with Air Factor of 0.5 Diagram

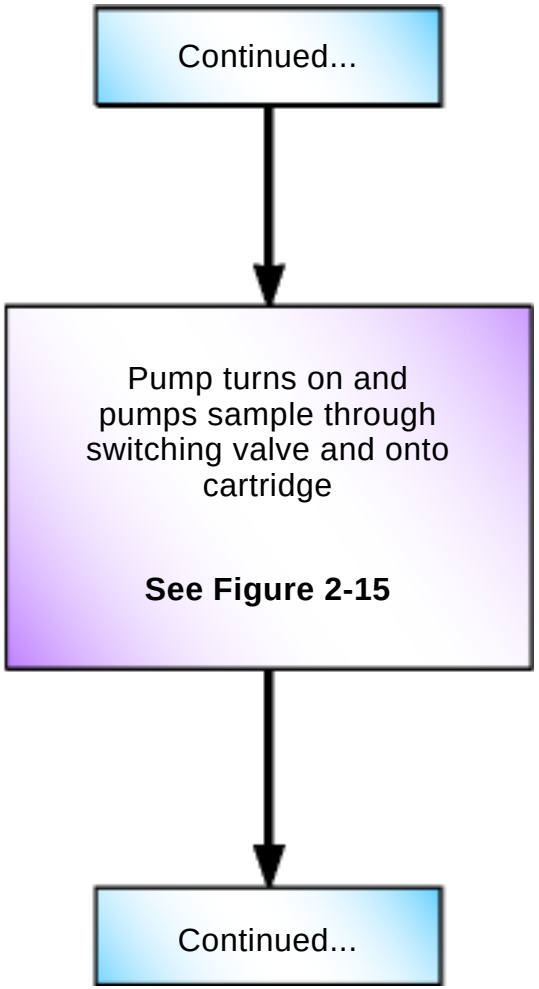

Figure 2-14. Load Sample Flow Chart

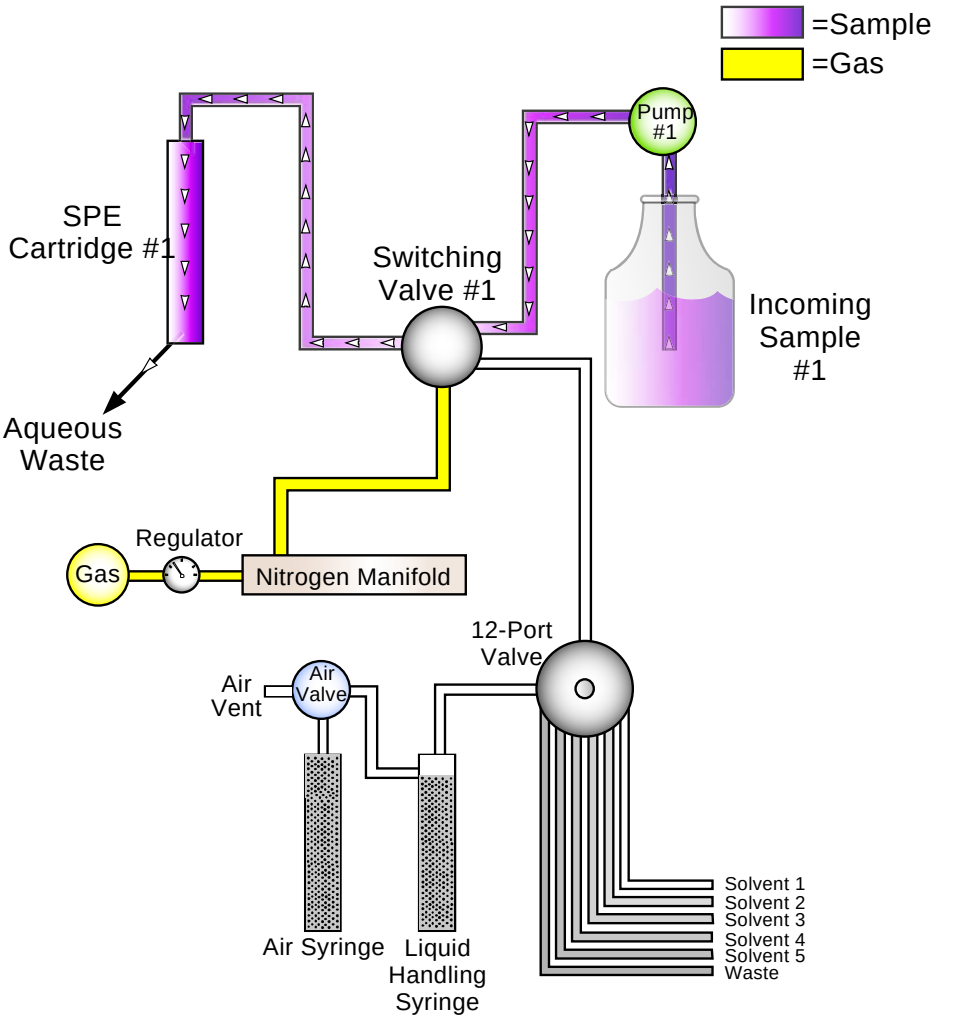

Figure 2-15. Load Sample Diagram

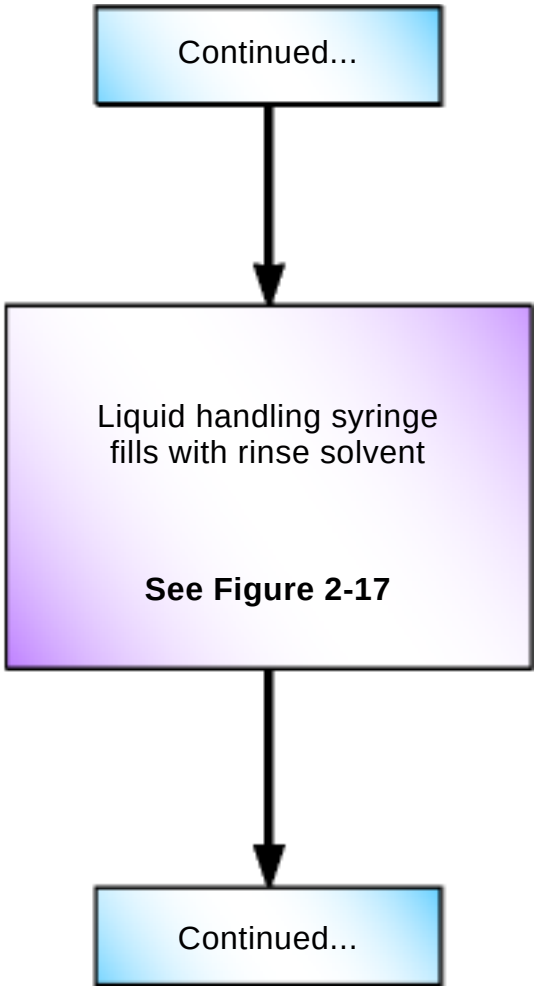

Figure 2-16. Cartridge Rinse: Liquid Handling and Air Push Syringes Fill Flow Chart

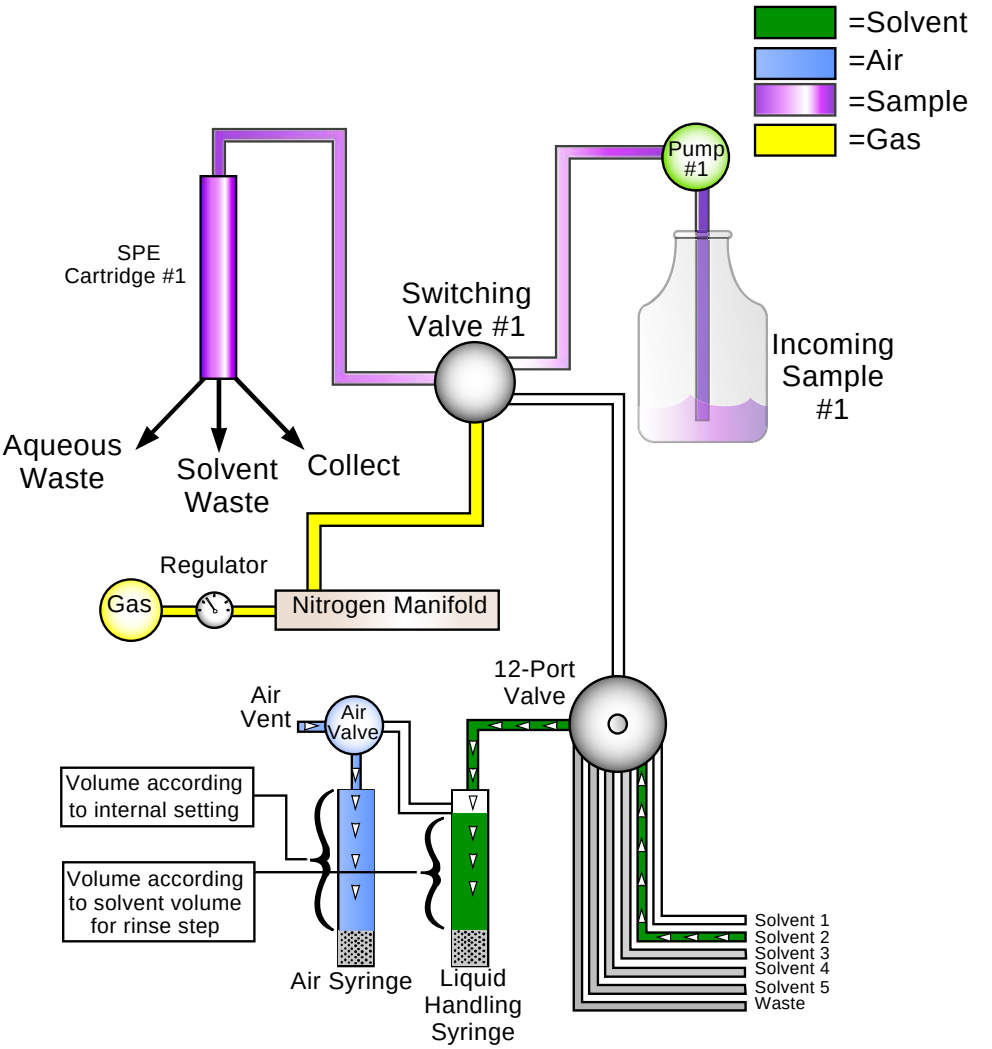

Figure 2-17. Cartridge Rinse: Liquid Handling and Air Push Syringes Fill Diagram

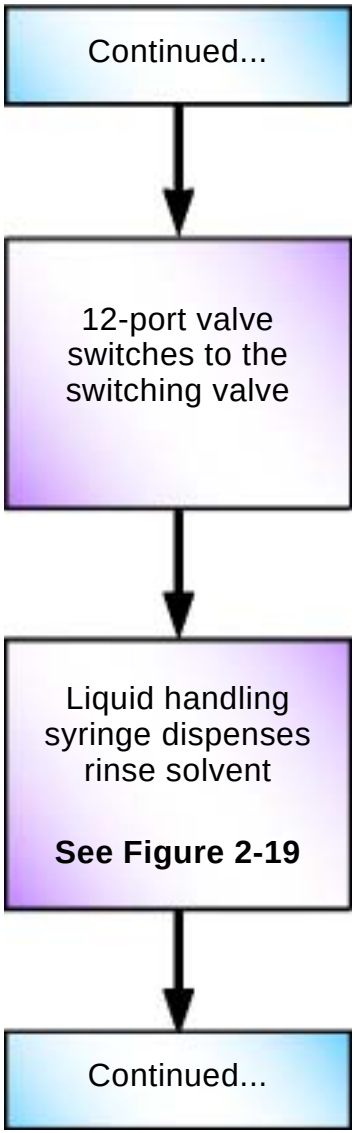

Figure 2-18. Cartridge Rinse Liquid Handling Syringe Dispenses Solvent Flow Chart

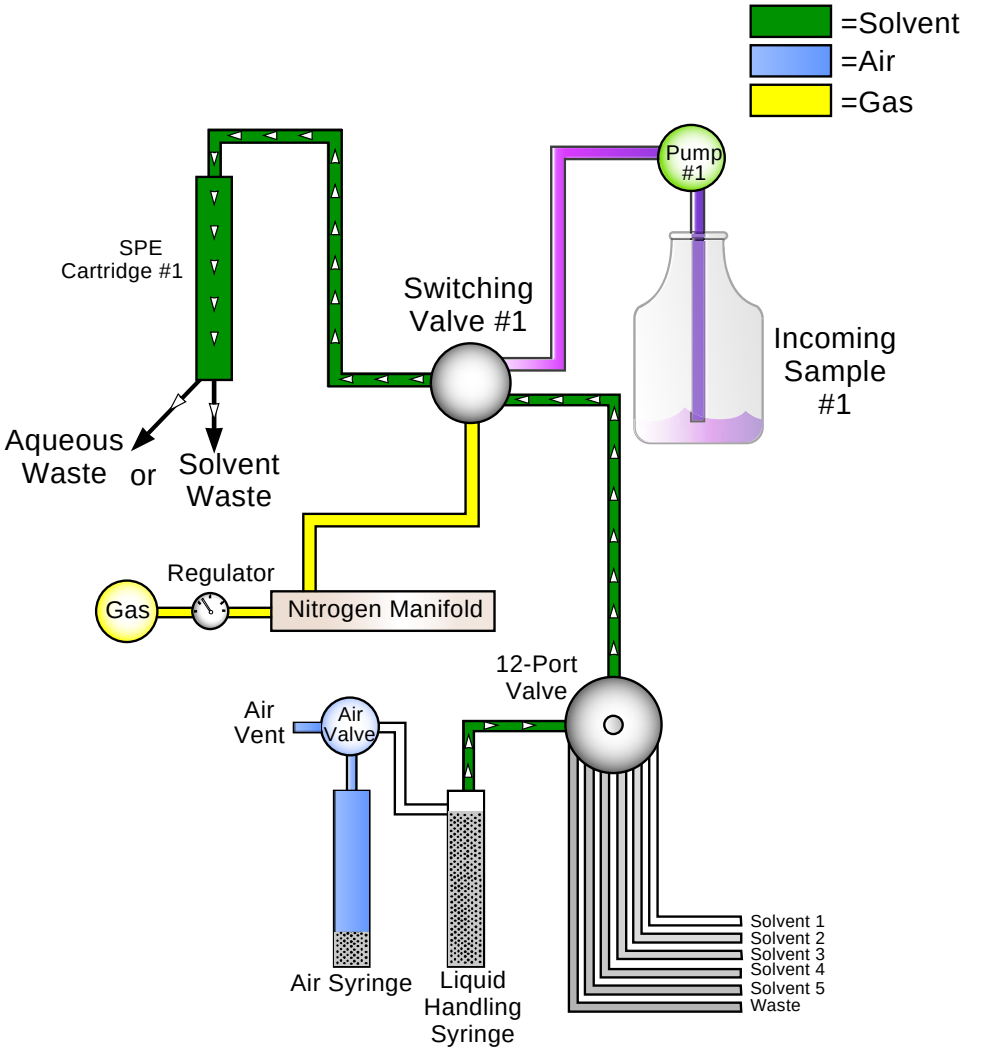

Figure 2-19. Cartridge Rinse: Liquid Handling Syringe Dispenses Solvent Diagram

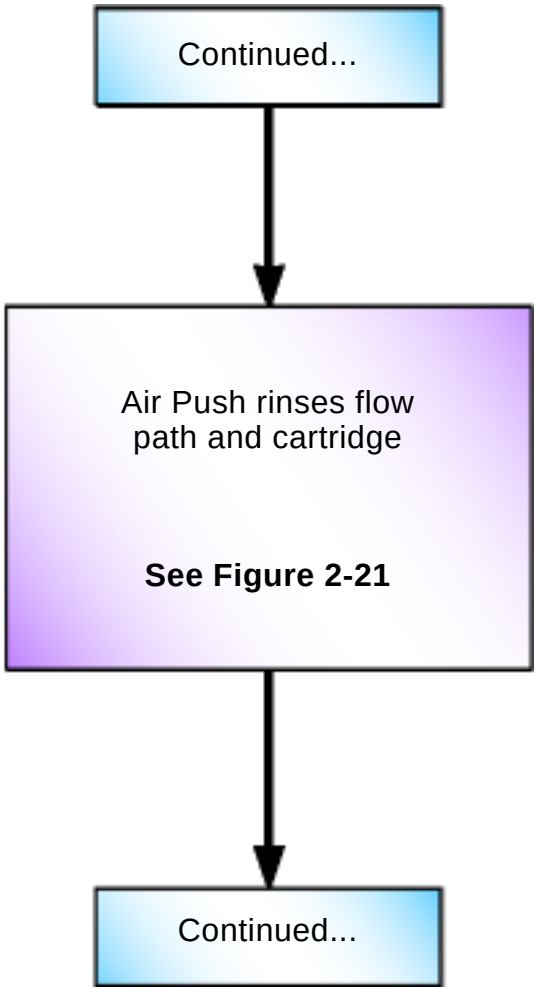

Figure 2-20. Cartridge Rinse: Air Push Flow Chart

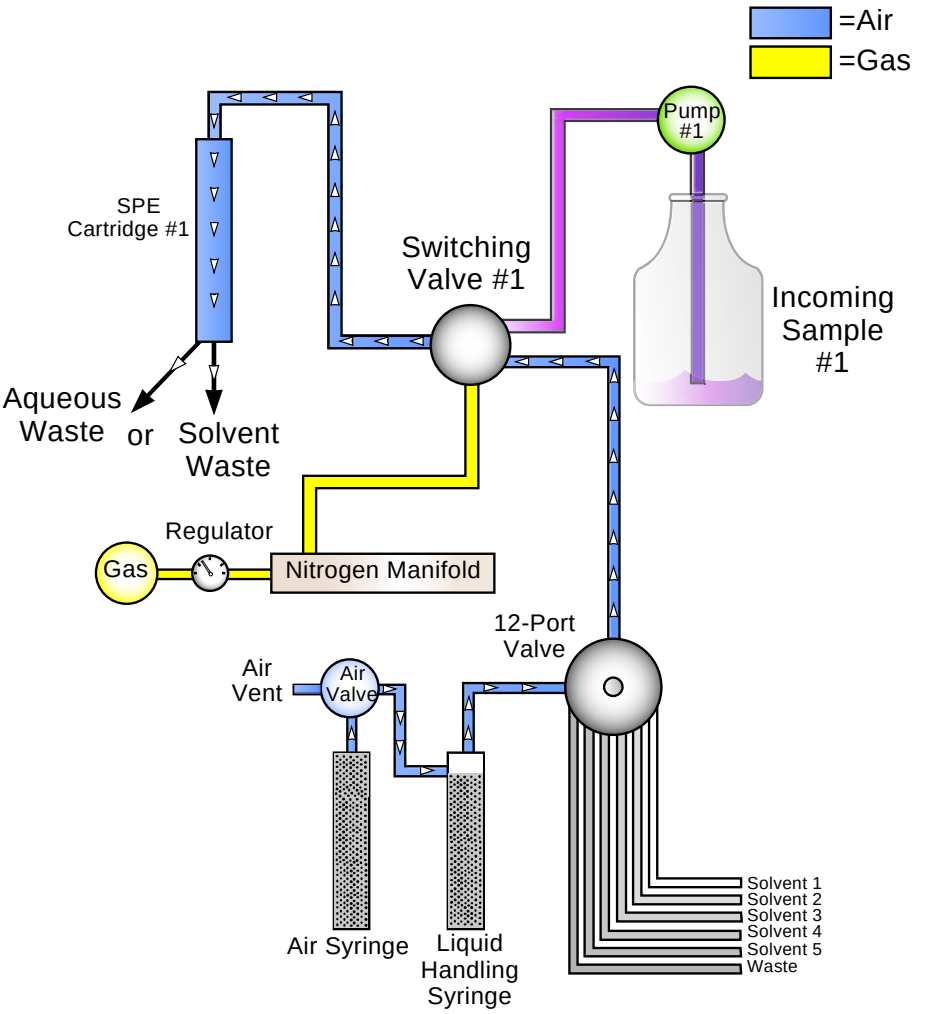

Figure 2-21. Cartridge Rinse: Air Push Diagram

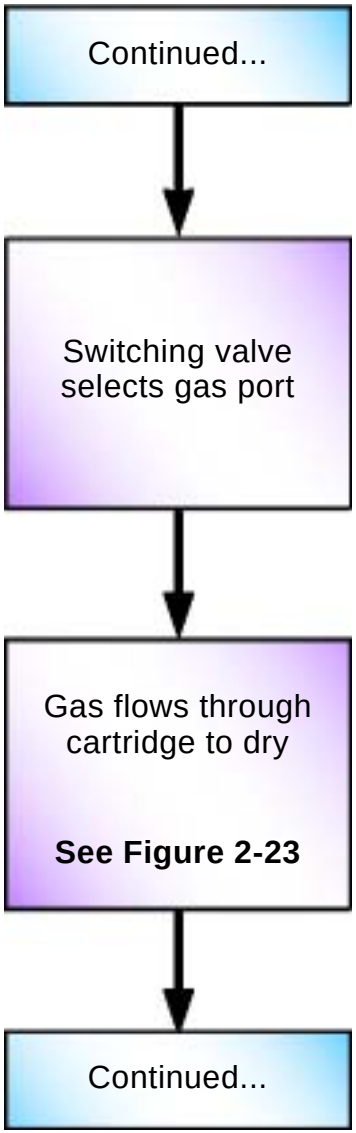

Figure 2-22. Dry with Gas Flow Chart

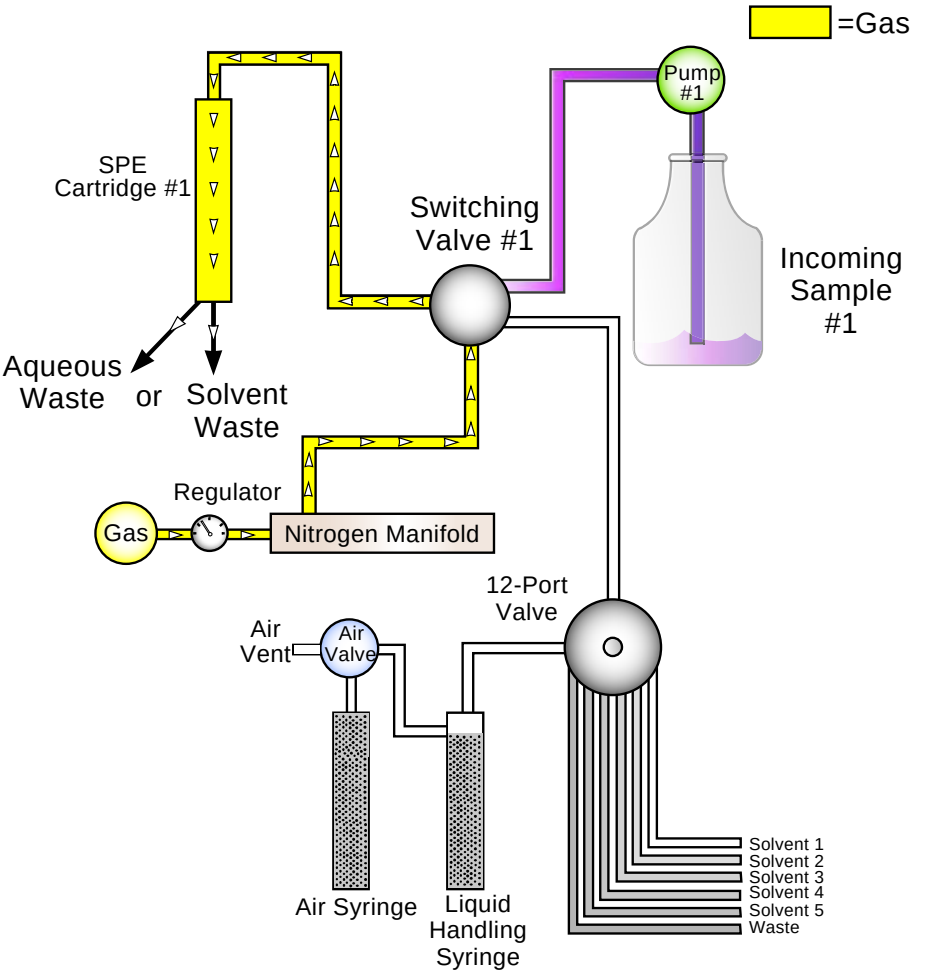

Figure 2-23. Dry with Gas Diagram

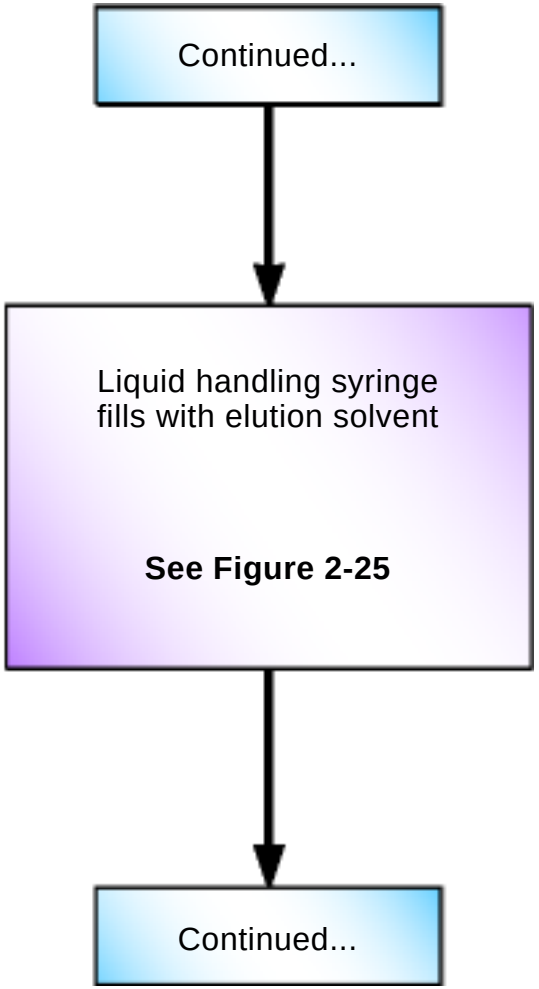

Figure 2-24. Elute to Collect: Liquid Handling and Air Push Syringes Fill Flow Chart

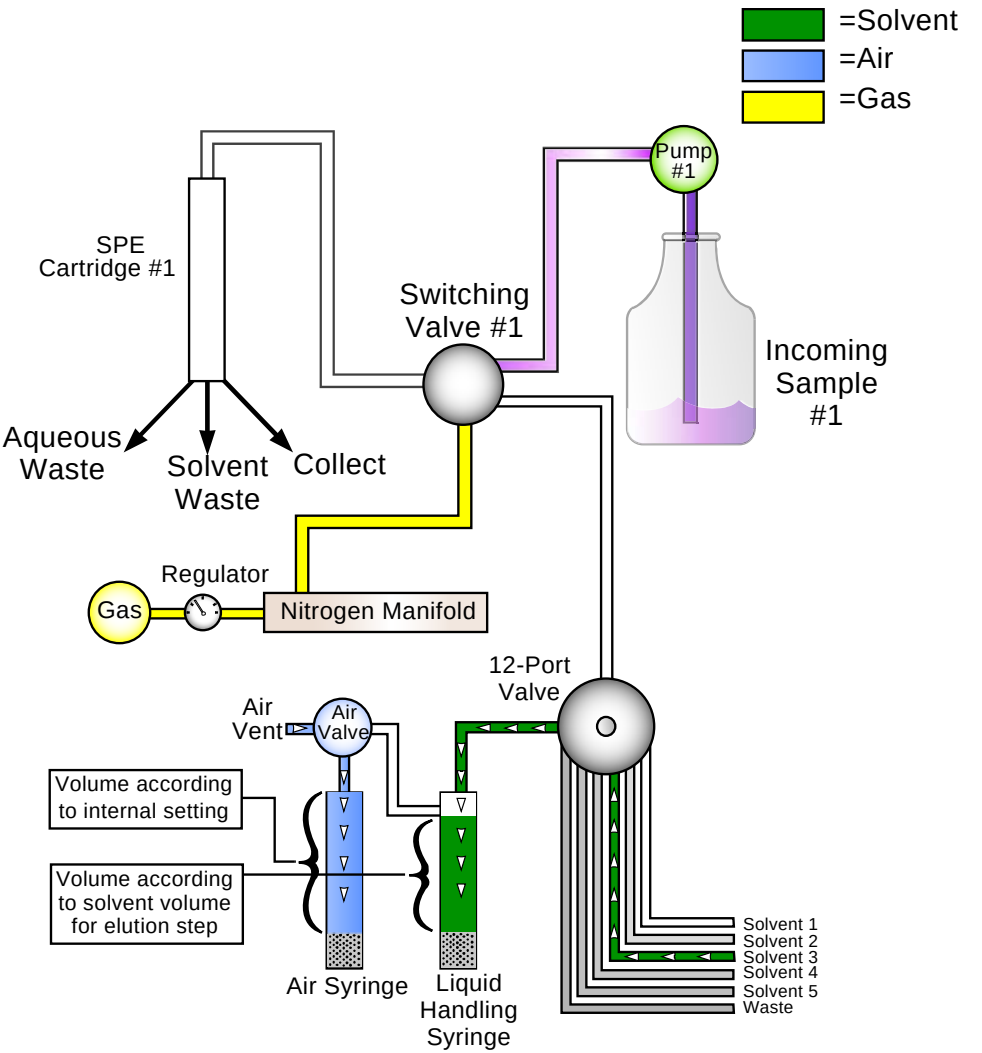

Figure 2-25. Elute to Collect: Liquid Handling and Air Push Syringes Fill Diagram

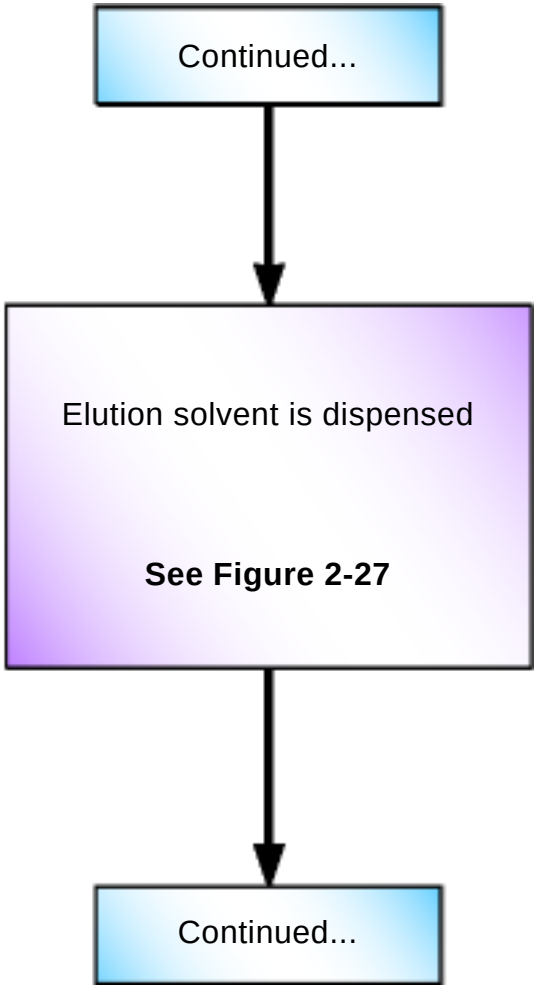

Figure 2-26. Elute to Collect: Liquid Handling Syringe Dispenses Solvent Flow Chart

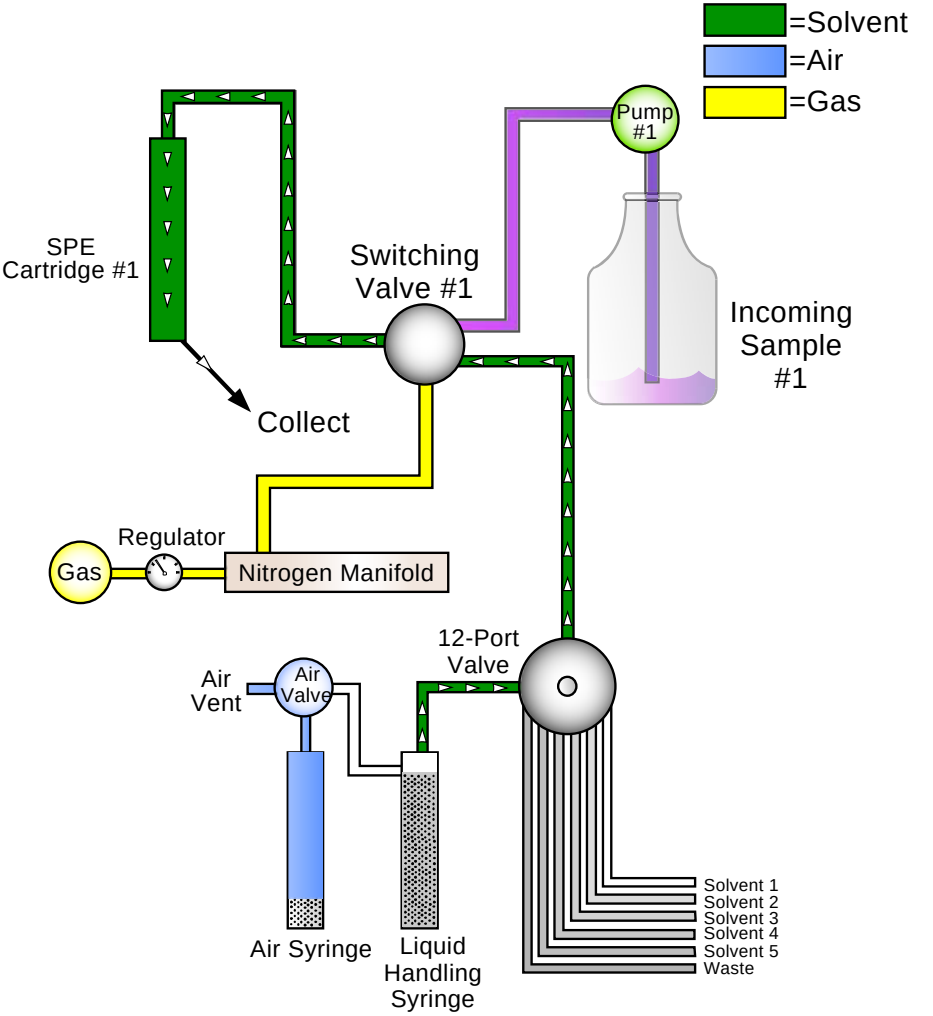

Figure 2-27. Elute to Collect: Liquid Handling Syringe Dispenses Solvent Diagram

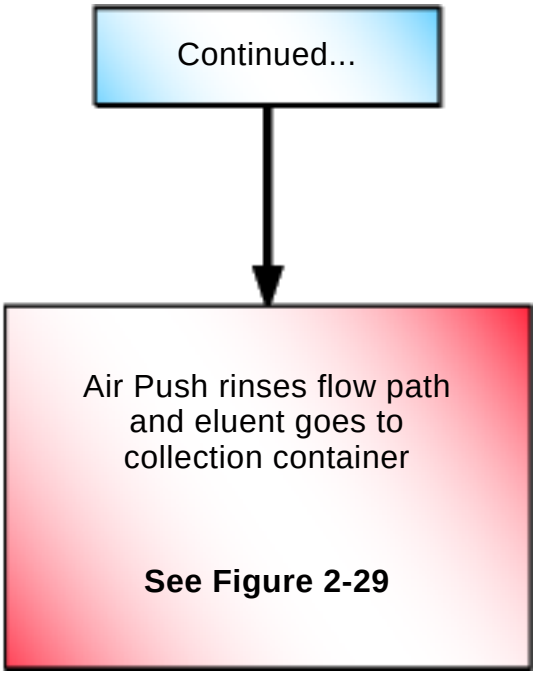

Figure 2-28. Elute to Collect: Air Push Flow Chart

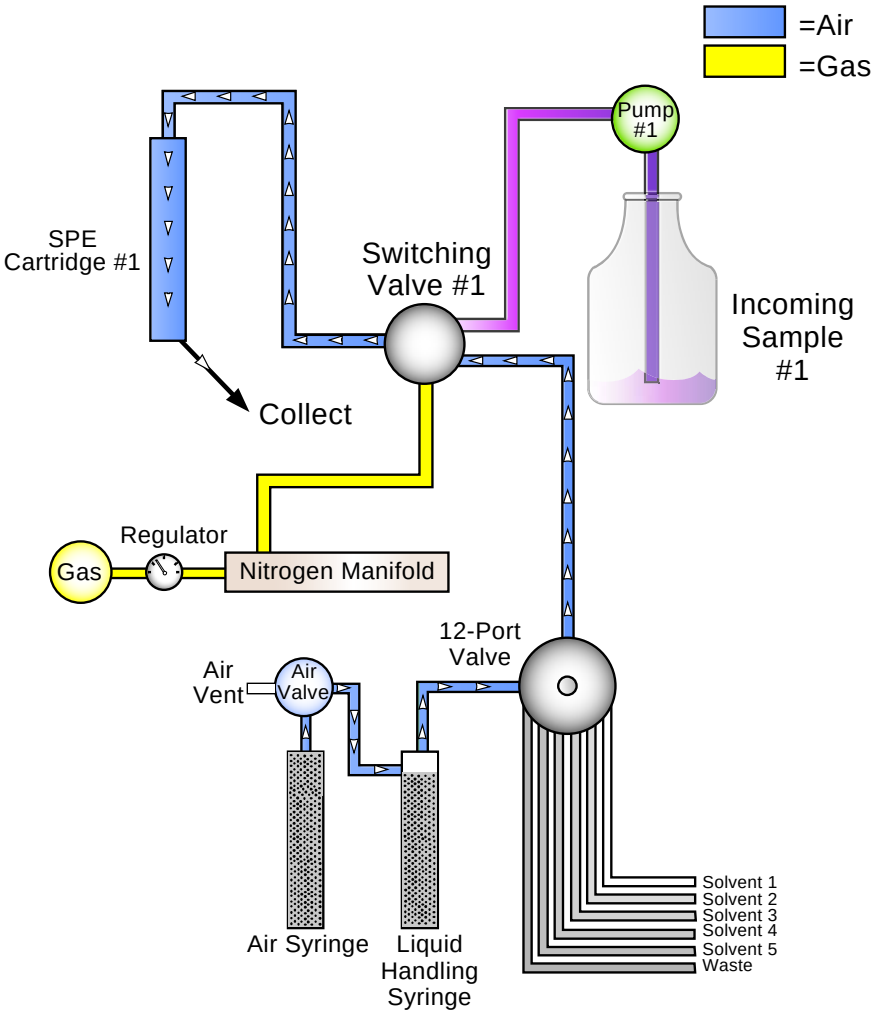

Figure 2-29. Elute to Collect: Air Push Diagram

2.6 Software Control

Use the AutoTrace software provided with the system to set operational parameters and write method steps that automate Dionex AutoTrace 280 operation. You can create and store up to 24 methods in the AutoTrace software.

Through setup parameters, the system controls the flow rates of solvent and sample in each solid phase extraction step of the method. Up to five solvents can be designated for the liquid sequences used in cartridge (or disk) precondition, sample loading, cartridge (or disk) rinsing, and elution.

The remainder of this section describes key steps that can be included in Dionex AutoTrace 280 methods. For more information, refer to the AutoTrace software Help.

2.6.1 Standard Operations

The table below describes the standard operation steps in an SPE method.

Operation	Description
Conditioning the cartridge or disk	Use **Condition Cartridge** or **Condition Disk** to pass the solvent through the cartridge or disk, respectively, and direct the effluent to waste.
Loading the sample	Use **Load Sample** to pump sample from the sample container to the cartridge or disk for extraction.
Rinsing the cartridge or disk	Use **Cartridge Rinse** or **Disk Rinse** after loading the sample path and cartridge or disk; the effluent is directed to waste.
Washing the syringe solvent	Use **Wash Syringe** to prewash the liquid handling syringe with the selected solvent. The resulting solvent waste exits through the waste port.
Eluting the sample	Use **Elute to Collect** to pass solvent through the cartridge or disk and direct the eluent into the collection container.

2.6.2 Optional Operations

The table below describes the optional operation steps that can be added to an SPE method.

Operation	Description
Rinsing the sample container	Use **Rinse Sample Container** to manually add solvent and swirl to rinse the sample container walls before continuing.
Drying with gas	Use **Dry with Gas** to flow gas through the cartridge or disk, clearing the path of residual water.
Pausing operation	Use **Pausing Operation** to delay operation or to stop operation and signal manual intervention.
Increasing absorption time	Use **Elute to Soak** before an **Elute to Collect** step to allow solvent to soak the cartridge or disk.
Cleaning the sample path	Use **Clean Sample Path** method steps between sample batches to prevent cross-contamination.
Concentrating the sample	Use **Concentrate Sample** for automated concentration of the eluent.

3 • Operation and Maintenance

This section describes the steps involved in operating the Thermo Scientific Dionex AutoTrace 280 SPE Instrument:

- Selecting the Dionex AutoTrace 280 method type (see Section 3.1)
- Creating a method (see Section 3.2 and Section 3.3)
- Loading a method (see Section 3.4)
- Preparing the Dionex AutoTrace 280 for operation (see Section 3.5)
- Running a method (see Section 3.6)
- Post-run activities (see Section 3.7)

3.1 Selecting the Method Type

Before creating a method, you must select the method type that corresponds to the type of Dionex AutoTrace 280 (cartridge or disk model) on which the method will run. Typically, you select the method type to match the model type set at the factory. However, it is possible to create a method for either type of model.

Notes:

- The commands and parameters available in the Set Up Methods window in the AutoTrace software vary, depending on the selected method type.
- To prevent changing the type of an existing method, the **Set Up Method Type** command is not available if the Set Up Method window is open.

To set up the method type:

1. On the AutoTrace software menu, click **Data** and select **Set Up Method Type**. A dialog box opens.

   –or–

   On the toolbar, click the down arrow next to **Data** and select **Set Up Method Type**.

2. Select **Cartridge Version** or **Disk Version** and click **OK**.

3.2 Creating a Method

3.2.1 Creating an Operational Method

1. In the AutoTrace software main window, click **Methods**. The Set Up Methods window opens.
2. On the Set Up Methods window toolbar, click **New**.

   This creates a new method with two default steps. Step 1 is an introductory comment that indicates the number of samples the method will run. Step 2 designates the end of the method. These two steps are always the first and last steps in a method. They cannot be deleted.
3. In the **Name** box, enter a name for the method.
4. In the **Samples** box, enter the number of samples you want to process when the method runs. This information is used only for estimating the time needed to run the method.
5. Click the down arrow next to the **Solvent Set** box and select the predefined set of solvents that will be used for this method.
6. To add a new step, double-click the desired command in the list in the left pane of the window. For details, see the "Method Command Descriptions" topic in the AutoTrace software Help.
7. Specify any parameters for the selected command (**Volume**, **Time**, **Waste Position**, **Solvents**). For guidelines for the selection of method parameters, see the application tips in Section 3.3.
8. Continue adding new steps in the order in which they should be performed when the method is run. New steps are added after the row indicated by the left arrow in the table. A method can contain a maximum of 45 lines.
9. To edit the Dionex AutoTrace 280 operating parameters that will be in effect when the method is run, click **Params** on the toolbar. For details, see the "Set Up Method Operating Parameters" topic in the AutoTrace software Help.
10. To save the method, click **Save** on the toolbar.

3.2.2 Creating a Method to Clean the Sample Lines

Before beginning routine operation with the Dionex AutoTrace 280, a method is needed for cleaning the sample lines. If the method for your application does not end with **Clean Sample Path** steps (see Section 2.6.2), run this method between sample runs to clean the lines.

Also, whenever the Dionex AutoTrace 280 is idle for a period of time, run this method to clean the lines and leave them filled with deionized water.

1. Repeat Step 1 and Step 2 in Section 3.2.1.
2. In the **Name** box, enter a name for the method (for example, "Clean Sample Path–Solvent & Water").
3. In the **Samples** box, enter the number of samples you want to process when the method runs.
4. Choose **Clean Sample Path**. Specify a **Volume** of 25.0 mL and select **Solvent Waste** as the **Waste Position**.
5. If the solvent used for the first **Clean Sample Path** step is immiscible in water: Repeat the **Clean Sample Path** selection. Specify a **Volume** of 25.0 mL and choose **Solvent Waste** as the **Waste Position**.

   If the solvent is not immiscible in water: Go directly to Step 6.
6. Repeat the **Clean Sample Path** selection. Specify a **Volume** of 25.0 mL and choose **Aqueous Waste** as the **Waste Position**.

   For each **Clean Sample Path** step, the system pauses for the sample lines to be placed in a beaker of:

   - Solvent for the first step
   - Intermediate solvent for the second step, if necessary
   - Water for the last step
7. Choose **Dry with Gas** and specify a time of 0.5 minutes to remove the water from the solvent path. This step removes the water between the switching valve and the cartridge or disk.

IMPORTANT **Only inert gases such as nitrogen, argon, or compressed air (free from oil) should be used for the Dry with Gas step.**

8. To save the method, click **Save** on the toolbar.

3.3 Application Tips

After writing a Dionex AutoTrace 280 method, you may need to fine-tune the method to optimize sample recovery and/or sample throughput. The need for changes may be evident when first running the method or when examining the recovery data from the sample run. If the recovery data looks good, test higher flow rates, shorter times, etc., to achieve a higher sample throughput.

When making changes to optimize the method, make them one at a time to evaluate the effect of each change. The remainder of this section discusses various ways in which methods can be optimized.

3.3.1 Sample Recovery

Table 3-1 describes three areas that can cause unacceptable recovery and should be investigated when optimizing sample recovery.

Breakthrough[a]	Elution[b]	Internal Loss[c]
Conditioning steps	Solvent type	Sample path
Conditioning flow and air push rates	Solvent miscibility	Sample container
Solvent type	Solvent volume	
Solvent volume	Elution flow and air push rates	
Loading rate		

Table 3-1. Sample Recovery Optimization

a. Can be determined by collecting aqueous waste and manually analyzing it for target compounds.
b. Sample retention; still on cartridge or disk.
c. Sample adsorption.

3.3.2 Setup Parameters

Table 3-2 lists some considerations for setting method parameters.

If...	Then...
you need to improve recovery	decrease the flow rate(s)
you need to improve throughput	increase the flow rate(s)
the liquid handling syringe stalls	decrease the flow rate(s)
you are using viscous liquids	adjust the **Push Delay**
you need to decrease the amount of air between multiple conditioning steps	reduce the **Air Factor**[a]

Table 3-2. Setup Parameters

a. When using an **Air Factor** of less than 1, always perform a **Cartridge Rinse** (or **Disk Rinse**) after loading the sample.

3.3.3 Method Steps

Table 3-3 lists some considerations for designating the steps in the method.

If...	Then...
the sample contains volatile compounds	introduce samples to the system only when ready for them by placing a **Pause and Alert** step between conditioning and loading steps
the manual method requires a “rinse with water” step without allowing the water to leave the cartridge or disk	use a **Condition Cartridge** (or **Condition Disk**) step rather than a **Cartridge Rinse** (or **Disk Rinse**) step, so that a smaller air push is used
you need an extended contact time between solvent and packing material	introduce a **Timed Pause** step

Table 3-3. Method Step Considerations

the sample contains a large amount of solids	add 5% to 7% to your volume entry for the **Load Sample** step –or– filter the sample, collect the filtrate, and place this in the sample container
you are going between immiscible solvents in the method	perform a **Wash Syringe** step with an intermediate solvent before performing the next step (even if **Autowash** is being used)
you need syringe washing to appear in your method printout for auditing purposes	disable **Autowash** and use **Wash Syringe** method steps where needed
you are running with the **Air Factor** parameter set to less than one	you must perform a **Cartridge Rinse** (or **Disk Rinse**) step between sample loading and elution
the elution solvent is immiscible in water	eliminate channeling by performing a **Dry with Gas** step to remove all water from the cartridges
you are not drying the cartridge or disk after loading sample	you must perform a **Cartridge Rinse** (or **Disk Rinse**) step before elution
there is water in your extract	increase the pressure and/or time of the **Dry with Gas** step
the elution solvent is not reaching the packing material in the first **Elute to Soak** step	use a volume of 3 mL or greater in the elution step
you need to increase the contact time between solvent and packing material for extraction of analytes	use an **Elute to Soak** step before **Elute to Collect**
you need to minimize the amount of air introduced between multiple elution steps	use an **Elute to Soak** step before **Elute to Collect**
you need to collect more than the maximum elution volume of your collection container	use an **Elute to Collect, 2nd Tube** step to double the collection volume

Table 3-3. Method Step Considerations (Continued)

you need to improve throughput	decrease times wherever possible
you need to improve recovery	refer to Table 3-1
you need to run a solvent through the sample path (from sinkers, through the sample lines, sample pumps, switching valves, and cartridges or disks, to a designated collection position) For example, in a conditioning step requiring 40 mL of water, rather than using four **Condition Cartridge** (or **Condition Disk**) steps of 10 mL, you can save time by using a single 40 mL **Clean Sample Path** step to aqueous waste. Follow with a **Pause and Alert** step for moving the lines from the water container to the sample containers.	use a **Clean Sample Path** step to designate either of the waste positions – or –- use a **Rinse Sample Container** step to designate either of the waste positions or the collection container position

Table 3-3. Method Step Considerations (Continued)

3.4 Loading a Method

1. In the AutoTrace software main window, click **Methods**. The Set Up Methods window opens.
2. On the Set Up Methods window toolbar, click **Load**. The Find Method window opens. This window lists all of the methods that were previously defined and saved.
3. Double-click the name of the method or click the blank cell in the leftmost column.
4. Click **Close** to return to the Set Up Methods window. The settings for the selected method are loaded into the right pane of the Set Up Methods window.

3.5 Preparing the Dionex AutoTrace 280

1. Turn on the system, using the power switch located on the right side of the Dionex AutoTrace 280. After power-up, the system goes through a brief initialization.

   NOTE Thermo Fisher Scientific recommends that you leave the system power on continuously unless the Dionex AutoTrace 280 will be idle for more than 14 days.

2. To perform a **Dry with Gas** or **Concentrate Sample** method step, turn on the gas supply. Set the pressure to no more than 0.69 MPa (100 psi). The gas supply should have sufficient reserve for the sample run.
3. Adjust the system's output gas pressure to the proper setting for running the method. The recommended operating setting is 0.07 MPa (10 psi). Adjust the gas pressure, using the regulator knob on the left side of the Dionex AutoTrace 280 (see Figure 2-4).
4. Check that the solvent reservoirs are full and the tubing is fully submerged in reservoirs. (Use the tubing weights and fittings provided in the Tubing Weight Kit (P/N 072580). For installation instructions, see Section B.3.1.)
5. Check that all waste containers (left-side port, elution station solvent, and elution station aqueous waste) are empty.
6. Select the Prime Solvents diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 29.
   c. Press **CONT** once to select method 29.
7. Press **CONT** to run the method. The method draws enough solvent from each port to prime the liquid lines.
8. Place a collection container in each elution rack position. Install the elution rack onto the two pins on the front of the elution station.

   NOTE The elution rack is symmetrical and can be positioned either way.

9. **Optional:** When using the Dionex AutoTrace 280 cartridge model, manually rinse the cartridges with MeCl or water. This prevents leakage around the cartridge holder O-ring due to the presence of packing debris on the inside walls of the SPE cartridge.

10. **For the Dionex AutoTrace 280 cartridge model:** Place cartridges in each holder to be used by sliding a cartridge upward onto the bottom of the cartridge holder's plunger. Push down on the lever until the assembly “clicks” into place and the holder's LED comes on (see Figure 3-1).

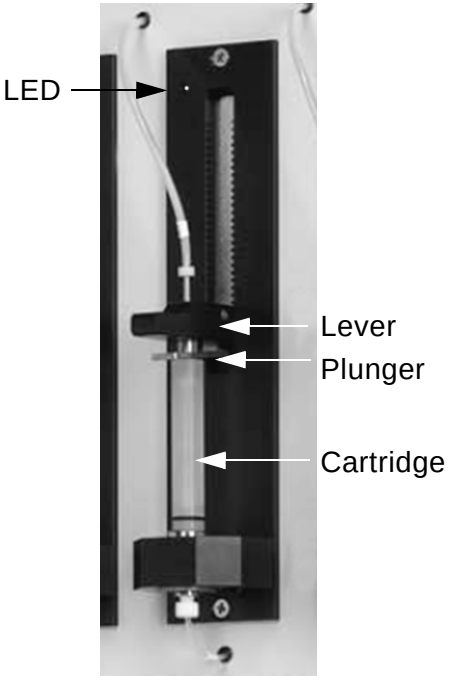

Figure 3-1. Cartridge Holder Front View

For the Dionex AutoTrace 280 disk model: Place disks in each holder to be used by opening the disk holder (by unscrewing the locking collar), squeezing the clip and moving it up toward the lever, and sliding the holder up (see Figure 3-2).

Place the SPE disk on top of the flow dispersing disk. Check that both disks are centered, and then push down on the lever until the assembly "clicks" into place and the holder's LED comes on (see Figure 3-2). Tighten the locking collar by screwing it as far as allowed.

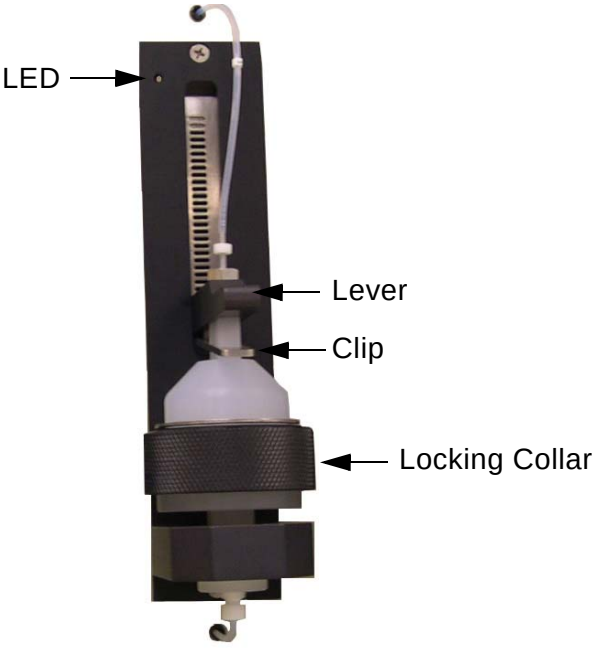

Figure 3-2. Disk Holder Front View

11. Place the 6-position sample rack (P/N 071333) (see Figure 3-3) to the right of the Dionex AutoTrace 280. (The sample rack must be ordered separately from the Dionex AutoTrace 280.)

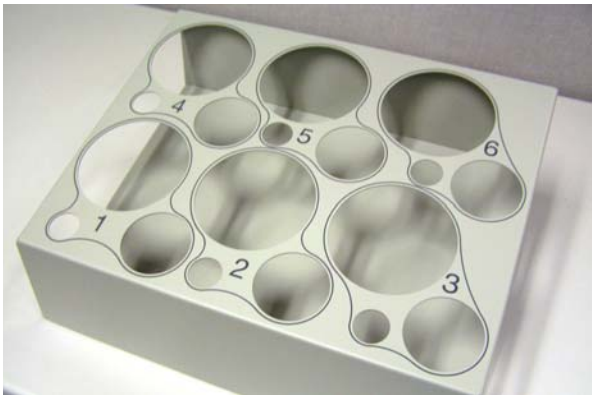

Figure 3-3. Dionex AutoTrace 280 Sample Rack

The sample rack accommodates a variety of sample containers: 60 mL vials (P/N 048784), 250 mL reservoirs (P/N 056284), and 1 liter reservoirs (P/N 045900).

12. Place a sample container in each rack position to be used and insert the sample line with tubing weight into the appropriate container. Each sample line and each rack position is numbered to correspond to the numbered sample inlet ports on the right side of the Dionex AutoTrace 280 (see Figure 3-4).

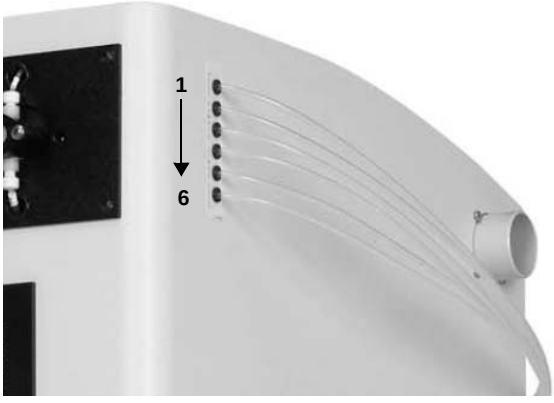

Figure 3-4. Dionex AutoTrace 280 Sample Inlet Ports

3.6 Running a Method

To run a Dionex AutoTrace 280 method:

1. Press **LOAD** until the required method number is displayed.
2. Press **CONT** to select the displayed method.
3. Press **CONT** again to start running the selected method.

While the method runs, the Dionex AutoTrace 280 front panel reports each step as it is performed, as well as the time left until the step is completed, if applicable. For example, while a sample is being loaded (pumped) onto the cartridge, the front panel displays:

LOADING SAMPLES
ONTO CARTRIDGE
@ 10 MLS/MIN
5.0 Minutes Left

NOTE If the system is the Dionex AutoTrace 280 disk model, "Disk" replaces "Cartridge" in all messages displayed on the front panel.

The display also reports when manual intervention is required and when the sample run is finished.

Some method steps cause the system to pause operation and wait for manual intervention. When this happens, the system beeps (if the **Beeper On** check box in the Setup Parameters dialog box is selected) and the front panel displays a message indicating the required action. Table 3-1 lists these front panel messages.

Method Step	Front Panel Display
Rinse Sample Container	RINSE SAMPLE CONTAINER WITH xx ML OF SOLVENT PRESS CONT TO RESUME
Elute to Collect, 2nd Tube	SECOND ELUTION STEP REPLACE TUBES WITH NEW TUBES PRESS CONT TO RESUME

Table 3-1. Front Panel Messages

Method Step	Front Panel Display
Concentrate Sample	CONCENTRATION STEP PLACE EMPTY CARTRIDGES IN THE HOLDERS PRESS CONT TO RESUME
Clean Sample Path	TO CLEAN SAMPLE PATH PLACE SAMPLE INPUT LINES INTO A BREAKER PRESS CONT TO RESUME
Pause and Alert	SYSTEM PAUSED PRESS CONT TO RESUME

Table 3-1. Front Panel Messages (Continued)

When you complete the manual steps, press **CONT** to have the system continue running the method.

3.6.1 Pausing a Run

To suspend operation at any time, press **PAUSE**. The system will complete the function in process when **PAUSE** was pressed and then stop.

3.6.2 Resuming a Run

To resume the method at the point at which you pressed **PAUSE**, press **CONT**.

NOTE **Be careful when using the CONT button to restart a method. If all method steps have not run yet (because the PAUSE button was pressed), pressing CONT resumes operation at the point when processing was interrupted, not at step #1 of the method.**

3.6.3 Stopping a Run

To stop a run before the end of the method, press the **PAUSE** and **CONT** buttons at the same time. The system will start the abort process without further warning and display a screen with the following options:

- Press **PAUSE** to return the Dionex AutoTrace 280 to an idle state.
- Press **CONT** to rinse all sample lines and clear solvent lines of any remaining solvent before the Dionex AutoTrace 280 returns to an idle state.

3.7 Post-Run Activities

After running a method:

- Make any necessary procedural changes (during method development)
- Test the changes
- Remove the used cartridges or disks
- Prepare to run the next batch of samples
- Clean up, if done for the day

3.7.1 Determining the Required Changes

Based on the recovery data and operation observations during method development, you may need to modify the Dionex AutoTrace 280 method. The **Elute Flow** and **Load Flow** parameters are usually the most critical settings.

For additional assistance, see the method development guide published by the manufacturer of your SPE cartridges or disks, the application tips in Section 3.3, and the AutoTrace software Help.

NOTE **When attempting to optimize a method, making changes one at a time is the best way to evaluate the effect of a change.**

3.7.2 Making the Necessary Changes

1. Load the method into the Set Up Methods window (see Section 3.4).
2. On the toolbar, click **Edit**.
3. If you want to save the edited method to a new method, enter a new name into the **Name** box, click the down arrow next to **Save**, and select **Save as new Method**. Click **Edit** to return to editing mode.
4. To edit the settings of an existing step:
   - In the method step table in the bottom right section of the window, select the step to be edited. The current settings for the step are displayed above the table.
   - Change the settings as required.
5. To delete a step, double-click its entry in the method step table.
6. To add a step:
   - In the method step table, click the step *above* where you want to add the new step.
   - In the command list in the left pane of the window, double-click the command. The command is added to the table below the selected step. For details, see the "Method Command Descriptions" topic in the AutoTrace software Help.

     NOTE A method can have no more than 45 steps.

7. To edit the Dionex AutoTrace 280 operating parameters that will be in effect when the method is run, click **Params** on the toolbar. For details, see the "Set Up Method Operating Parameters" topic in the AutoTrace software Help.
8. To undo changes and recall the previous entries, click **Undo** on the toolbar.
9. When changes are complete, click **Save** on the toolbar.

3.7.3 Testing the Changes

Run the method to evaluate the outcome of the changes.

3.7.4 Removing Used Cartridges

Remove the used cartridges (see Figure 3-5) by squeezing the holder's lever and clip together to release the cartridge from the holder.

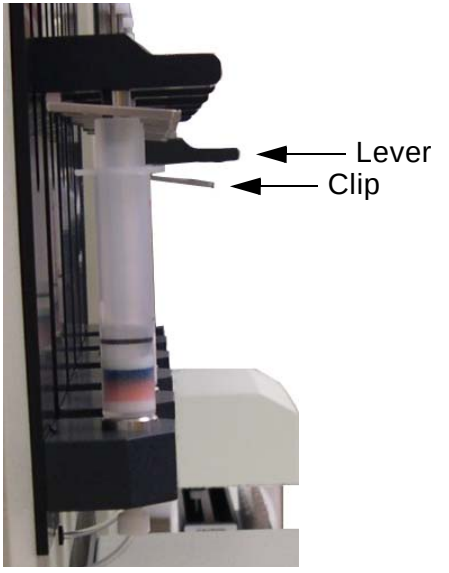

Figure 3-5. Cartridge Holder–Side View

IMPORTANT **Never leave the cartridge holders in the down position without the cartridges in place; this can deform the O-ring.**

3.7.5 Removing Used Disks

Remove the used disks by unscrewing the locking collar (see Figure 3-6), squeezing the clip and moving it up toward the lever, and sliding the holder up.

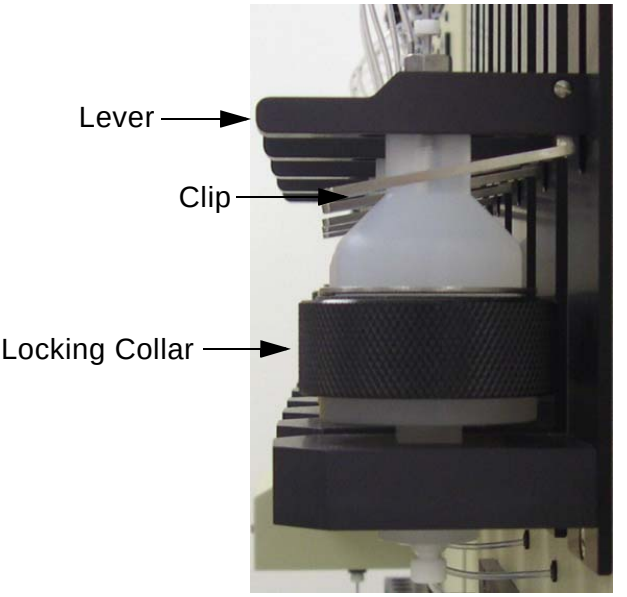

Figure 3-6. Disk Holder–Side View

3.7.6 Preparing the Next Sample Batch

Unless the last steps of the method were **Clean Sample Path** steps, you need to clean the sample lines between batches of samples.

1. Place an empty cartridge in each holder and make sure each holder is in the fully down position, with the holder LED on. (There is no need to place an empty disk in each holder.)
2. Load the **Clean Sample Path** method created in Section 3.2.2. Start running the method.
3. When the system pauses the first time, insert the sample lines into a clean container filled with a solvent.

IMPORTANT **Do not use acetone as a solvent to clean the sample path; it is harmful to the sample pumps.**

4. If the solvent used in Step 3 is immiscible in water: When the system pauses the second time, remove the sample lines and insert them into a clean container filled with an intermediate solvent. Press **CONT** when ready.

   If the solvent is not immiscible in water: Go directly to Step 5.

5. When the system pauses the last time, remove the sample lines and insert them into a clean container filled with deionized water. Press **CONT** when ready.

3.7.7 Flushing the Solvent Lines

When using samples that tend to crystallize, or corrosive solvents that could attack valves or other Dionex AutoTrace 280 parts over time, flush the solvent and sample lines with water or an inert, soluble solution whenever the system will not be processing samples.

The Prime Solvents diagnostic method (#29) is typically used for this purpose. The diagnostic method flushes all five solvent lines. If you prefer, you can create a customized method that primes fewer than five solvent lines. For details, refer to Section 3.2.2.

To flush the solvent lines:

1. Fill the solvent reservoirs with the solvent of choice for flushing and fully submerge the tubing.
2. Swirl the solvent in the containers to rinse the outside surface of the tubing and weights.
3. Select the Prime Solvents diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 29.
   c. Press **CONT** once to select method 29.

NOTE When using a customized priming method, substitute that the number of that method in the instructions above.

4. Press **CONT** to run the method. The method draws enough solvent from each port to prime the liquid lines.
5. When the system pauses, press **CONT**.

3.7.8 Flushing the Sample Lines

To flush the sample lines, refer to "Preparing the Next Sample Batch" on page 59.

3.8 Method Development Checklist

3.8.1 Specifying Your Method

- Run the AutoTrace software.
- Specify the parameter and solvent information.
- Write the method.
- Save and print the method.

3.8.2 Preparing the System

- Turn on the system.
- Turn on and check the gas supply and set the gauge (if applicable).
- Check the solvent reservoirs.
- Check/empty the waste containers.
- Prime the solvent lines.
- Load the elution rack.
- (Optional) Clean the SPE cartridges or disks.
- Load the SPE cartridges or disks.
- Load the sample container rack.

3.8.3 Running the Method

- Load the method.
- Observe operation.
- Press **CONT** to silence the end-of-run alarm.

3.8.4 After Running the Method

- Based on recovery data and observations during operation, make any necessary procedural changes, using the **METHODS** program option.
- Remove the used cartridges or disks.
- Prepare to run the next batch of samples by cleaning the sample lines (see Section 3.7.6).
- If you are done for the day, clean up by emptying the waste reservoirs and flushing the solvent and sample lines.

3.9 Daily Operation Checklist

This section presents an overview of key elements in routine operation. For details, refer to the remaining sections of this chapter.

3.9.1 Preparing the System

- Turn on the system.
- Turn on and check the gas supply and set the gauge (if applicable).
- Check the solvent reservoirs.
- Check/empty the waste containers.
- Prime the solvent lines.
- Load the elution rack.
- (Optional) Clean the SPE cartridges or disks.
- Load the SPE cartridges or disks.
- Load the sample container rack.

3.9.2 Running Your Method

- Load the method.
- Intervene as required.
- Press **CONT** to silence the end-of-run alarm.

3.9.3 After Running the Method

- Remove the used cartridges or disks.
- Prepare to run the next batch of samples by cleaning the sample lines (see Section 3.7.6).
- If done for the day, clean up by emptying the waste reservoirs and flushing the solvent and sample lines.

3.10 Performing Routine Maintenance

This section describes routine maintenance procedures that the user can perform. All other Dionex AutoTrace 280 maintenance procedures must be performed by qualified Thermo Fisher Scientific personnel.

In order to test, adjust, or replace components not covered in this section, run the Dionex AutoTrace 280 diagnostic methods. For details, see Section 4.2.

3.10.1 Daily Maintenance

- Empty the waste reservoirs.
- Flush the solvent lines (see Section 3.7.7).
- Flush the sample lines (see Section 3.7.8).

IMPORTANT **Acetone is harmful to the sample pumps and should never be used to clean the sample path or rinse the sample container.**

Do not run pumps dry. Always leave deionized water in the sample lines when the system is not in use.

3.10.2 Periodic Maintenance

- Check for tubing and syringe leaks. If a tubing leak is found, replace the tubing as necessary (see Section 5.1). If liquid is below the plunger-tip level inside any syringe, replace the syringe (see Section 5.5).

IMPORTANT **The replacement tubing must have the same length and ID as the original tubing. This maintains the accuracy of the Dionex AutoTrace 280 liquid and air push operations.**

- Clean cartridge or disk holders, racks, and other system surfaces with warm, soapy water.
- If the Dionex AutoTrace 280 will be idle for more than 14 days, flush the solvent lines (see Section 3.7.7) and the sample lines (see Section 3.7.8).
- Check that all syringe and valve fittings are fingertight.
- Check the O-rings at the bottom of the cartridge holder for cracking or wear, and replace any O-rings as required (see Section 5.3).
- Check the overall system performance by running the Benchmark Test diagnostic method (see Section 5.16). The Benchmark Test checks the operation of the front panel, elution station, syringes, pumps, and valves.

3.10.3 Annual Maintenance

Thermo Fisher Scientific recommends performing preventive maintenance annually. A Dionex AutoTrace 280 Preventive Maintenance Kit (P/N 072598) is available.

3.11 System Shutdown

It is not necessary to turn off the Dionex AutoTrace 280 power at the end of daily use. Thermo Fisher Scientific recommends that you leave the power on unless the system will be idle for more than 14 days.

4 • Troubleshooting

This chapter is a guide to troubleshooting minor problems that may occur while operating the Thermo Scientific Dionex AutoTrace 280 SPE Instrument.

- Section 4.1 describes error messages and how to troubleshoot them.
- Section 4.2 describes the Dionex AutoTrace 280 diagnostic methods.
- The remaining sections in this chapter describe routine operating problems and how to resolve them.

If you are unable to resolve a problem by following the instructions here, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office. Please have this chapter at hand when talking with Technical Support personnel.

4.1 Error Messages

The Dionex AutoTrace 280 can identify several potential operating problems. If one of these problems occurs, an error message is displayed on the front panel screen. The message remains until you press any button to clear it or until another error message appears.

This section lists the error messages and explains how to respond if an error occurs. Most problems can be resolved by the user.

Elution Station Errors

	Elution station cannot find home **Elution station motor stalled**
Cause:	An obstruction is blocking movement of the elution station.
Action:	Find and remove the obstruction.
Cause:	Malfunction of the home sensor, motor drive, and/or electronics.
Action:	Contact Technical Support for Dionex products.

Pump Errors

	Pump x stalled
Cause:	Flow rate is too high for the cartridge or disk installed.
Action:	Reduce the flow rate of the sample pump.
Cause:	Sample may contain particles that are clogging the cartridge or disk.
Action:	Filter the sample as required. Be careful not to lose analytes that would affect recovery. For tips on optimizing sample recovery, see Section 3.3.1.
Cause:	High backpressure due to a tubing blockage.
Action:	Replace blocked tubing with tubing of the same length and ID. For instructions, see Section 5.1.
Cause:	Loose connection between the pump motor and the sensor connector.
Action:	Reseat the pump connector.
Cause:	The pump motor or sensor has failed.
Action:	Replace the pump (P/N 071529 for the cartridge model; P/N 071530 for the disk model). For instructions, see Section 5.10.
Action:	If the error message appears again, contact Technical Support for Dionex products.

Syringe Errors

	Air syringe cannot find home **Air syringe motor stalled** **Liquid syringe cannot find home** **Liquid syringe motor stalled**
Cause:	Syringe home position not calibrated properly.
Action:	Run the appropriate diagnostic method (Adjust Air Syringe or Adjust Liq Syringe) (see Section 4.2).
Cause:	A 12-port valve error has occurred.

Action:	Follow the instructions in "Valve Errors" on page 67.
Cause:	Flow rate is too high for the cartridge or disk installed.
Action:	Reduce the flow rate of the liquid syringe.
Cause:	An obstruction in the tubing is blocking movement of the syringe.
Action:	Starting with the tubing to the cartridge or disk, work backward to the syringe and remove the blockage.
Cause:	An obstruction is blocking movement of the syringe.
Action:	Find and remove the obstruction.
Cause:	Loose connection between the syringe and the Valve Distribution PC board.
Action:	Reseat the connector.
Cause:	Malfunction of the home sensor, motor drive, and/or electronics.
Action:	Contact Technical Support for Dionex products.

Valve Errors

	12-port valve cannot find home **12-port valve cannot find position**
Cause:	Loose connection between the valve and the Valve Distribution PC board.
Action:	Reseat the valve connector.
Cause:	Valve rotor is binding
Action:	Replace the rotor and stator. For instructions, see Section 5.11 and Section 5.12.
Cause:	Malfunction of the motor drive and/or electronics.
Action:	Contact Technical Support for Dionex products.

4.2 Dionex AutoTrace 280 Diagnostic Methods

The Dionex AutoTrace 280 includes several diagnostic methods. Table 4-1 lists the diagnostic methods and explains when to run them.

To run a diagnostic method:

1. Press **LOAD** to display the **LOADING METHOD** screen.
2. Press **LOAD** to increment the displayed method to the required number; for example, the number of the Prime Solvents diagnostic method is 29.
3. Press **CONT** once to select the method number currently displayed.
4. Press **CONT** to run the method.

	When you want to...	Run this diagnostic method...
Initialization	Initialize Dionex AutoTrace 280 components (send syringes to the home position, etc.) or diagnose the reason the system failed to initialize properly	#25: Initialization
Syringes	Check the integrity of the liquid handling syringe drive mechanism or calibrate the syringe home position	#26: Adjust Liq Syringe
	Check the integrity of the air push syringe drive mechanism or calibrate the syringe home position	#27: Adjust Air Syringe
Valves	Confirm the positioning integrity of the 12-port valve	#28: 12-Port Valve Test **NOTE:** Do not run the 12-Port Valve Test if the solvent lines have not yet been primed.
	Prime the solvent lines[a]	#29: Prime Solvents

Table 4-1. Dionex AutoTrace 280 Diagnostic Methods

	When you want to...	Run this diagnostic method...
General operation	Investigate an indication of trouble with the system –or–- After replacement of any of the following system components: tubing, syringe, valve, cartridge holder, keypad, or PC board	#30: Benchmark Test
Pump	Check sample pump flow accuracy or calibrate the pump	#31: Calibrate Pump

Table 4-1. Dionex AutoTrace 280 Diagnostic Methods (Continued)

a. When using fewer than five solvents, writing your own priming method will prime solvent lines more quickly and will conserve solvent.

4.3 General Operation Troubleshooting

Symptom	Probable Cause	Solution
1. **READY** LED is not on.	1a. Power switch is off.	1a. Turn on the Dionex AutoTrace 280 power switch.
	1b. AC power cord is unplugged.	1b. Connect the AC power cord (see Section B.3.9).
	1c. Fuse is blown.	1c. Replace the fuse (see Section 5.17).
	1d. No voltage at power outlet.	1d. Check the outlet voltage with another component, such as a desk lamp.
2. **ERROR** LED is on.	2. One of the errors detailed in Section 4.1 has occurred.	2. Check the Dionex AutoTrace 280 front panel for error messages; follow the recommended corrective action in Section 4.1.

Symptom	Probable Cause	Solution
3. **RUN** LED fails to turn on after **LOAD** is pressed, or the method does not run.	3. Cartridge or disk holder not fully down; holder's green LED is off.	3. Push down on the holder lever until it "clicks" and the holder's green LED comes on. Run the method.
4. Unable to download a method.	4. Communication error.	4a. Check that the power is on and the system is not in an abort state or a user intervention state. 4b. Check that the USB cable is connected correctly between the Dionex AutoTrace 280 and the PC (see Section B.3.8).
5. Nitrogen consumption is abnormally high.	5. Switching valve is not turning off completely.	5. Adjust the nitrogen regulator until the pressure is 0.14 MPa (20 psi). Verify that no method is running. Remove the tubing from each cartridge (or disk) inlet. Place the free end of the tubing in a beaker of water. Check for gas bubbles exiting the tubing: • If there are bubbles, replace the switching valve for the channel (see Section 5.15). • If there are no bubbles, tighten the nitrogen manifold fittings (see Section 5.2).

4.4 Liquid Handling Troubleshooting

Symptom	Probable Cause	Solution
1. Syringe makes a clicking sound while moving.	1a. Syringe is not calibrated.	1a. Run the Adjust Liq Syringe diagnostic method (see Section 4.2).
	1b. Syringe speed is too fast.	1b. Adjust the flow rates.
	1c. Syringe is not securely mounted.	1c. Check the syringe mounting.
	1d. Defective syringe.	1d. Replace the syringe (see Section 5.5).
	1e. Fluid path blocked at valve, cartridge or disk, or tubing.	1e. Inspect the fluid path and correct the problem.
2. Incorrect solvent dispensed.	2. Solvent lines placed in wrong reservoirs.	2. Reinsert solvent lines into the appropriate reservoirs and prime the lines.
3. Syringe stalls.	3a. Flow rate is too high.	3a. Adjust the flow rate.
	3b. Bad cartridge or disk.	3b. Replace the cartridge or disk.
	3c. 12-port valve problem.	3c. Run the 12-Port Valve Test diagnostic method (see Section 4.2). If the problem continues, contact Technical Support for Dionex products. **NOTE:** Do not run the 12-Port Valve Test until all solvent lines have been primed.
4. Valves leak.	4a. Flow rate is too high.	4a. Adjust the flow rate.
	4b. Valve fitting is loose.	4b. Make sure valve fittings are securely fingertight. If tightening a fitting does not stop a leak, replace the fitting (see Section 5.1).
5. Liquid volumes delivered are incorrect.	5a. Flow rates are too high, causing gas bubbles to form.	5a. Reduce the flow rates.

Symptom	Probable Cause	Solution
	5b. Solvent inlet tubing is restricted or leaking.	5b. Inspect tubing for kinks or cracks. If necessary, replace the tubing (see Section 5.1).
	5c. Solvent outgassing.	5c. Degas or sparge reagents with helium before use.
	5d. Valve fitting is loose.	5d. Make sure valve fittings are securely fingertight. If tightening a fitting does not stop a leak, replace the fitting (see Section 5.1).
	5e. Syringe is leaking.	5e. Run the Adjust Liq Syringe diagnostic method (see Section 4.2). If necessary, replace the syringe (see Section 5.5).
	5f. 12-port valve is partially blocked or out of alignment.	5f. Run the 12-Port Valve Test diagnostic method (see Section 4.2). If the problem continues, contact Technical Support for Dionex products. **NOTE:** Do not run the 12-Port Valve Test until all solvent lines have been primed.
	5g. Steps using immiscible solvents.	5g. Perform a **Wash Syringe** step with an intermediate solvent between steps.
6. Liquid buildup in air push syringe.	6a. Excessive pressure built up in system due to a blocked line, or excessive solids in cartridge or disk.	6a. Inspect and correct the problem.
	6b. Syringe speed too fast.	6b. Adjust the flow rates.
	6c. Air push valve leaking.	6c. The valve needs replacement (see Section 5.14).

Symptom	Probable Cause	Solution
7. Incorrect volume removed from the sample container.	7a. Samples with large amounts of suspended solids.	7a. Increase the sample volume specified in the **Load Sample** step by 5% to 7%. For example, specify 1050 mL instead of 1000 mL. –or– Filter the sample, collect the filtrate, and place this in the sample container.
	7b. Sample pump is out of calibration.	7b. Perform a **Clean Sample Path** step with deionized water, and then run the Calibrate Pump diagnostic method (see Section 4.2).
	7c. Fittings are loose at the sample pump.	7c. Tighten the fittings.
	7d. Sample pump is leaking.	7d. Clean the pump cylinder and piston (see Section 5.8).
8. Uneven volumes in elution containers. For example, 10 mL is expected, but one container has 8 mL and the other has 12 mL.	8. Loose fitting at 12-port valve or switching valve.	8. Make sure valve fittings are securely fingertight. If tightening a fitting does not stop a leak, replace the fitting (see Section 5.1).

4.5 Solid Phase Extraction Troubleshooting

Symptom	Probable Cause	Solution
1. LED on cartridge or disk holder fails to light.	1a. Cartridge or disk deformed or size is incorrect.	1a. Discard and replace the cartridge or disk.
	1b. Defective cartridge or disk holder.	1b. Contact Technical Support for Dionex products.
	1c. Cartridge or disk is missing.	1c. Install the cartridge or disk.
2. Leakage around the cartridge or disk holder O-ring.	2a. Packing material debris may exist on inside walls of the cartridge or disk, causing a poor seal.	2a. Clean cartridges or disks before use (see "Preparing the Dionex AutoTrace 280" on page 50).
	2b. Dirty O-ring.	2b. Clean the O-ring with a lint-free laboratory tissue and solvent.
	2c. Cracked O-ring.	2c. Replace the cartridge holder O-ring (see Section 5.3) or disk holder O-ring (see Section 5.4).
3. Low recovery of volatile compounds.	3a. Sample evaporates while cartridge or disk conditioning occurs.	3a. Use a **Pause and Alert** step to introduce sample when needed by the method.
	3b. Gas pressure is set too high.	3b. Decrease the gas pressure.
4. Low recovery.	4. Various causes.	4. Refer to Section 3.3.1 for tips on how to optimize sample recovery.

Symptom	Probable Cause	Solution
5. Water coming off with eluent.	5a. Method is missing a step to clear the lines.	5a. Add a **Cartridge Rinse** (or **Disk Rinse**) or **Dry with Gas** step before elution.
	5b. Gas pressure is too low.	5b. Increase the gas pressure.
	5c. Drying time is too short.	5c. Increase the dry time specified in the **Dry with Gas** step.
	5d. None of the above.	5d. Run eluent through a drying cartridge or disk before analysis.
6. Cross-contamination.	6. Sample path was not cleaned between sample passes.	6. Between each batch of samples, run a method that cleans the sample lines with solvent and deionized water (see Section 3.2.2).
7. Incorrect volume removed from sample container.	7a. Samples with large amounts of suspended solids.	7a. Increase the sample volume specified in the **Load Sample** step by 5% to 7%. For example, specify 1050 mL instead of 1000 mL.
	7b. Sample pump is out of calibration.	7b. Perform a **Clean Sample Path** step with deionized water, and then run the Calibrate Pump diagnostic method (see Section 4.2).
8. Sample pump fails to start.	8. Bad electronics board or pump.	8. Contact Technical Support for Dionex products to determine the faulty part and have it replaced.
9. Nothing exits an elution manifold nozzle.	9. Clogged nozzle.	9. Clean the nozzle with a fine piece of wire. If the problem persists, contact Technical Support for Dionex products to have the manifold replaced.
10. Elution station does not move into the correct position.	10. Bad stepper motor or loose connection on control board.	10. Run the Benchmark Test diagnostic method (see Section 5.16) and contact Technical Support for Dionex products.

5 • Service

This chapter describes Thermo Scientific Dionex AutoTrace 280 SPE Instrument service and repair procedures that users can perform. All procedures not included here, including electronics-related repair procedures, must be performed by Thermo Fisher Scientific personnel. For assistance, contact Technical Support for Dionex products. In the U.S. and Canada, call 1-800-346-6390. Outside the U.S. and Canada, call the nearest Thermo Fisher Scientific office.

Before calling, have the following information available for the Technical Support Representative:

- Dionex AutoTrace 280 serial number (printed on the model data label)
- AutoTrace software version (select **Help > About** to display the version)

Before replacing any part, refer to the troubleshooting information in Chapter 4 to correctly identify the cause of the problem.

IMPORTANT **Substituting non-Dionex/Thermo Fisher Scientific parts may impair the performance of the Dionex AutoTrace 280, thereby voiding the product warranty. For details, see the warranty statement in the Dionex Terms and Conditions.**

5.1 Replacing Tubing

Replace tubing assemblies whenever the tubing becomes kinked or develops a blockage that prevents flow. If tightening a fitting that is leaking does not resolve the problem, the fitting or the entire tubing assembly should be replaced.

Parts and Tools Required

The following parts and tools are required to complete this procedure:

- #2 Phillips screwdriver
- Replacement tubing (see Table 5-1)
- (Optional) Emery cloth or fine sandpaper
- (Optional) Latex gloves

Locate the tubing that needs to be replaced. Refer to Table 5-1 to identify the kit that contains the replacement tubing.

Name of Kit	Description
Solvent Tubing Kit (P/N 072599)	Tubing, fittings, couplers, and weights for three solvent input lines
Sample Tubing Kit (P/N 070268)	Tubing, fittings, couplers, and weights for three sample input lines
PTFE Tubing Kit (P/N 071088)	Tubing and fittings for 1.40-mm (0.055-in) ID PTFE tubing (other than sample and waste lines)
PEEK Tubing Kit (P/N 072600)	PEEK tubing and fittings for connections to 12-port valve
Waste Tubing Kit (P/N 071089)	Tubing and brass fittings for two waste lines
Tubing Fittings Kit (P/N 072608)	Fittings for 10 lengths of 1.40-mm (0.055-in) ID PTFE tubing (other than sample and waste lines)

Table 5-1. Dionex AutoTrace 280 Tubing Kits

IMPORTANT **The replacement tubing must have the same length and ID as the original tubing. This maintains the accuracy of the Dionex AutoTrace 280 liquid and air push operations.**

For your reference, the Dionex AutoTrace 280 is plumbed with the tubing listed in Table 5-2.

Tubing from	Tubing to	Tubing Length	Volume
12-port valve	Solvent waste	2.2 m (7 ft)	3.44 mL
	Solvent #1	2.2 m (7 ft)	3.44 mL
	Solvent #2	2.2 m (7 ft)	3.44 mL
	Solvent #3	2.2 m (7 ft)	3.44 mL
	Solvent #4	2.2 m (7 ft)	3.44 mL
	Solvent #5	2.2 m (7 ft)	3.44 mL
	Switching valve #6	51 cm (20 in)	0.023 mL
	Switching valve #5	51 cm (20 in)	0.023 mL

Table 5-2. Dionex AutoTrace 280 Tubing Connections

Tubing from	Tubing to	Tubing Length	Volume
	Switching valve #4	51 cm (20 in)	0.023 mL
	Switching valve #3	51 cm (20 in)	0.023 mL
	Switching valve #2	51 cm (20 in)	0.023 mL
	Switching valve #1	51 cm (20 in)	0.023 mL
Air push syringe	Air push valve (com)	13 cm (5 in)	0.2 mL
Liquid handling syringe (top)	12-port valve (com)	25.4 cm (10 in)	0.12 mL
Liquid handling syringe (side)	Air push valve (NC)	8.3 cm (3.25 in)	0.13 mL
Gas manifold	Switching valve	25.4 cm (10 in)	0.24 mL
Switching valve	Pump	86 cm (34 in)	1.36 mL
	SPE cartridge	97 cm (38 in)	1.52 mL
SPE cartridge	Elution station or elution manifold	61 cm (24 in)	0.96 mL
Pumps	Sample containers	137 cm (54 in)	2.16 mL

Table 5-2. Dionex AutoTrace 280 Tubing Connections (Continued)

Tubing Replacement Procedure

1. Access to tubing assemblies usually requires removal of the Dionex AutoTrace 280 rear panel. Before removing the rear panel, first turn off the Dionex AutoTrace 280 power switch and then disconnect the power cord from its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

2. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.

3. Remove the fittings at both ends of the tubing assembly to be replaced. As you do, note the order and orientation of the fitting components. Also note the tubing markers at each end of the tubing assembly.
4. **Optional:** If the tubing assembly is connected to a switching valve, remove the switching valve from the left-side panel to improve access to the fittings.
5. Remove the tubing assembly from any tubing clips.
6. Route the new tubing assembly through the same clips as the old tubing assembly.
7. Install the new fittings and tubing markers in the same order and orientation as the parts they are replacing. **Tip:** When installing the fittings, you may want to use a small piece of emery cloth or fine sandpaper to hold the tubing in place.
8. Install the fittings into the ports of the component. Reinstall the component, if it was removed for easier access. Tighten fittings securely to prevent leaks. **Tip:** If necessary, use latex gloves to obtain a tight grip.
9. If you removed the Dionex AutoTrace 280 rear panel, reinstall the rear panel with the six screws previously removed. Reconnect the power cord and turn on the power.
10. Place solvent lines in the solvent reservoirs. Run the Benchmark Test diagnostic method (#30) (see Section 5.16).

5.2 Tightening the Nitrogen Manifold Fittings

If there is a leak from the nitrogen manifold, tighten the fittings.

Parts and Tools Required

The following parts and tools are required to complete this procedure:

- #2 Phillips screwdriver
- Soap solution
- Cotton-tipped swabs

Tighten the Fittings

1. Turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

2. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.
3. Tighten all of the nitrogen manifold fittings.
4. One at a time, swab the area around each fitting with a cotton-tipped swab dipped in soap solution. If no soap bubbles form, the fitting is not leaking.
5. Reinstall the Dionex AutoTrace 280 rear panel with the six screws previously removed.
6. Reconnect the power cord and turn on the power.
7. Run the Benchmark Test diagnostic method (#30) (see Section 5.16).

5.3 Replacing a Cartridge Holder O-Ring

Replace the O-ring in a cartridge holder if there is leakage around the O-ring while a method is running.

Parts

The following parts are required to complete this procedure:

- Lint-free laboratory tissue
- Cartridge holder O-ring (see Appendix C for part numbers)

Replace the O-Ring

1. Disengage the plunger of the leaking channel. Lift the plunger up and out of the cartridge to expose the plunger O-ring.
2. Remove the old O-ring by pressing on it firmly to roll it out of the groove in the plunger.
3. Use a lint-free laboratory tissue to clean the plunger and groove. Be sure to remove all particulates from the groove.
4. Install the new O-ring in the groove. Be careful not to tear the new O-ring; this will prevent a proper seal.
5. Reinsert the plunger into the cartridge and re-engage the plunger securely. Check that the LED for the channel is lighted.
6. Run the Benchmark Test diagnostic method (#30) (see Section 5.16). While the method is running, check for leaks or any problems.

5.4 Replacing a Disk Holder O-Ring

Replace a disk holder O-ring if a leak develops around the O-ring while a method is running.

Parts

The following parts are required to complete this procedure:

- Disk Holder O-Ring Kit (P/N 071059)

NOTE If one O-ring leaks, Thermo Fisher Scientific recommends replacing the O-ring on each channel. The kit contains six O-rings.

Remove the Defective O-Ring

1. Disengage the disk holder and unscrew the locking collar.
2. Slide the sleeving tubing up to reveal the inner tubing. Be careful not to crimp or kink any tubing.
3. Remove the tubing clamp and tubing from the top of the disk holder.
4. Unscrew the bolt that secures the disk holder top assembly to the clamp mechanism.
5. Locate the snap ring pliers provided in the Disk Holder O-Ring Kit. Set the pliers for use with an external snap ring (i.e., as you squeeze in on the handles, the tips of the pliers should move away from each other).
6. Remove the snap ring holding the locking collar and large washer to the top (white polymer) part of the disk holder (see Figure 5-1).

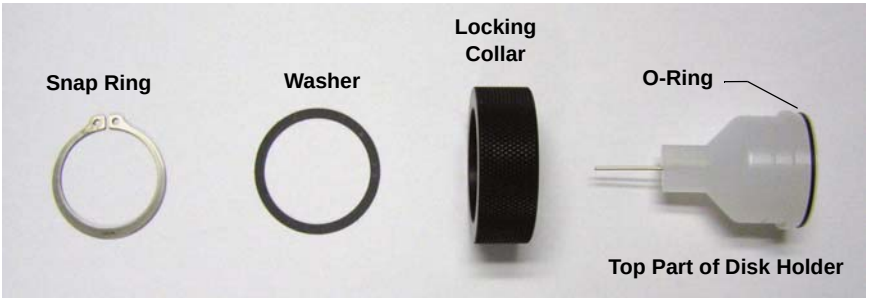

Figure 5-1. Top Part of Disk Holder, Unassembled

7. Remove the O-ring from the top part of the disk holder (see Figure 5-1):
   a. Turn the top part of the disk holder upside down.
   b. Rest one thumb and finger on the O-ring at opposite sides of the disk holder. Press firmly on the O-ring.
   c. While applying steady pressure to the O-ring, begin sliding your thumb and finger around the O-ring. The pressure will cause the O-ring to pop out of the groove slightly; when this happens, slide the tip of your index finger under the O-ring and remove it from the groove.

Install the New O-Ring

1. Rinse and clean the groove in the top of the disk holder. Be careful not to scratch the groove; scratches will prevent a proper seal.
2. Install the new O-ring. Be careful not to rip or tear the O-ring.
3. Reinstall the large washer and locking collar. Place the disk holder on a slightly elevated surface (for example, a bottle stopper or bottle cap) to keep the washer and collar in place, and then reinstall the snap ring.
4. Reattach the disk holder assembly to the clamp mechanism.
5. Reinstall the tubing and tubing clamp. Move the 3-mm (1/8-in) OD sleeving tubing down over any exposed tubing.
6. Repeat the steps above to replace the remaining disk holder O-rings.

Complete the Procedure

After replacing all of the disk holder O-rings, run the Benchmark Test diagnostic method (#30) (see Section 5.16). While the method is running, check for leaks or any problems.

5.5 Replacing the Liquid Handling Syringe

If the liquid handling syringe leaks, replace the syringe.

Parts

The following item is required to complete this procedure:

- Liquid handling syringe, 10 mL (P/N 070579)

Purge the Solvent Lines

Follow these steps to purge the liquid handling syringe and its tubing.

> **NOTE** **If the syringe is not operable, skip this section and go directly to "Remove the Defective Syringe" on page 86.**

1. Remove the solvent lines from their reservoirs.
2. Select the Prime Solvents diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 29.
   c. Press **CONT** once to select method 29.
3. Press **CONT** to run the method.

Center the Syringe

Follow these steps to center the syringe plunger and prepare the syringe for removal.

> **NOTE** **If the syringe is not operable, skip this section and go directly to "Remove the Defective Syringe" on page 86.**

1. Select the Adjust Liq Syringe diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 26.
   c. Press **CONT** once to select method 26.
2. Press **CONT** to run the method.

Remove the Defective Syringe

1. Remove the two screws from the mounting bracket that secure the syringe to the housing (see Figure 5-2).

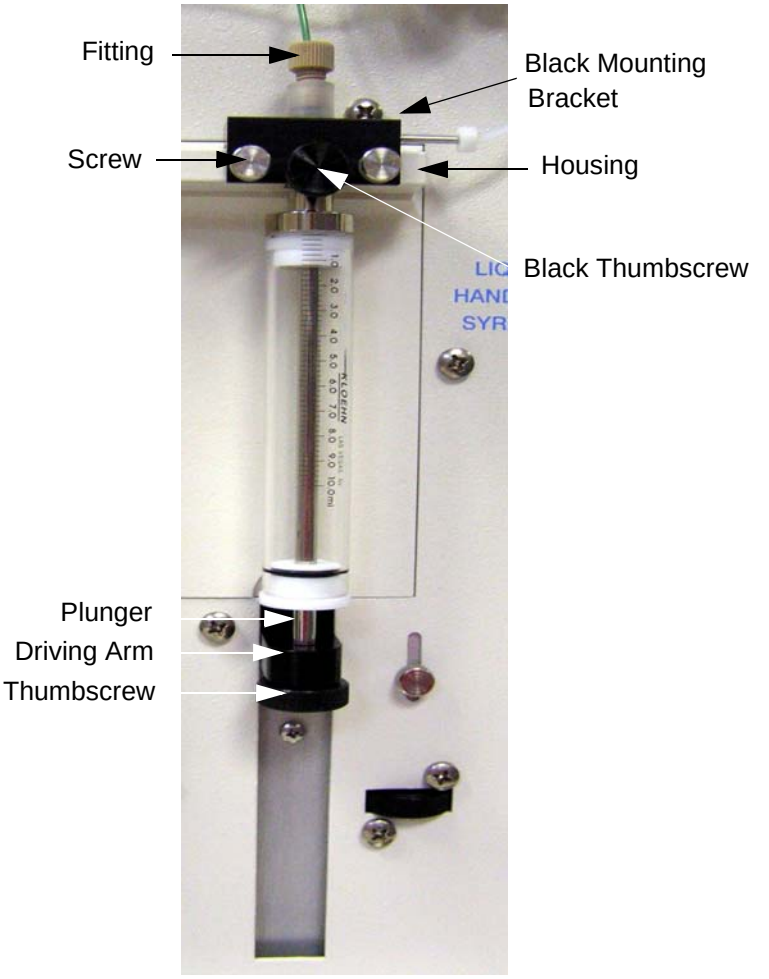

Figure 5-2. Syringe Screws and Mounting Bracket

2. Remove the black thumbscrew from the bottom of the syringe plunger.
3. Gently slide the syringe assembly out of the housing.
4. Loosen the small black thumbscrew on the mounting bracket.
5. Holding the black mounting bracket in your left hand and the syringe in your right hand, turn the syringe counterclockwise until it disengages from the fitting.
6. Separate the syringe from the fitting.

Mount the New Syringe

1. Slide the new syringe into the fitting. When aligned, turn the syringe clockwise to secure it in the fitting.
2. Tighten the small black thumbscrew on the mounting bracket.
3. Slide the syringe assembly into the housing and secure the mounting bracket, using the two screws previously removed.
4. Gently pull the syringe plunger down until it contacts the top of the driving arm.
5. Secure the plunger to the arm with the black thumbscrew previously removed.

Adjust the New Syringe

1. Loosen the knurled thumbscrew approximately two turns (see Figure 5-3).

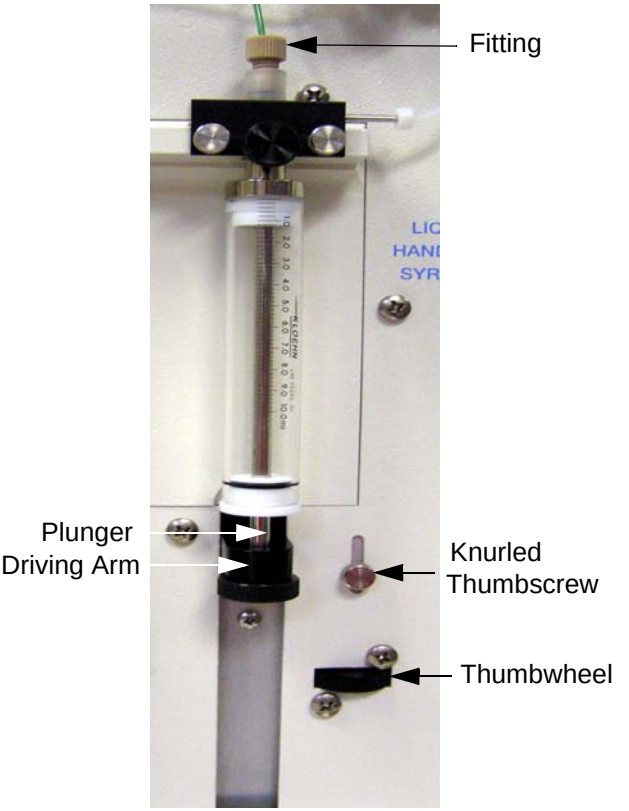

Figure 5-3. Syringe Knurled Thumbscrew

2. Turn the thumbwheel to the left two full turns.
3. Select the Adjust Liq Syringe diagnostic method (#26) again and press **CONT** to run the method. As the plunger moves up, you should hear a clicking sound.

4. Turn the thumbwheel to the right until the clicking just stops. Then turn it one more partial turn (see Figure 5-4).

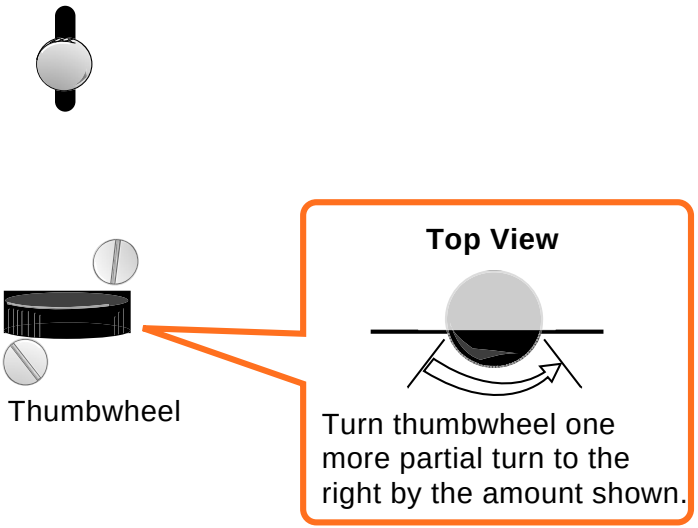

Figure 5-4. Thumbwheel Rotation

5. Tighten the knurled thumbscrew to secure the position.

Complete the Procedure

Run the Benchmark Test diagnostic method (#30) (see Section 5.16) to verify that the new syringe works properly.

5.6 Replacing the Air Push Syringe

Parts

The following item is required to complete this procedure:

- Air push syringe, 10 mL (P/N 070296)

Center the Syringe Plunger

Follow these steps to center the syringe plunger and prepare the syringe for removal.

1. Select the Adjust Air Syringe diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.

b. Press **LOAD** to increment the displayed method to 27.

c. Press **CONT** once to select method 27.

2. Press **CONT** to run the method.

Remove the Defective Syringe

1. Loosen the knurled knobs on both sides of the syringe clamp. Pivot the open end of the syringe clamp out of the way (see Figure 5-5).

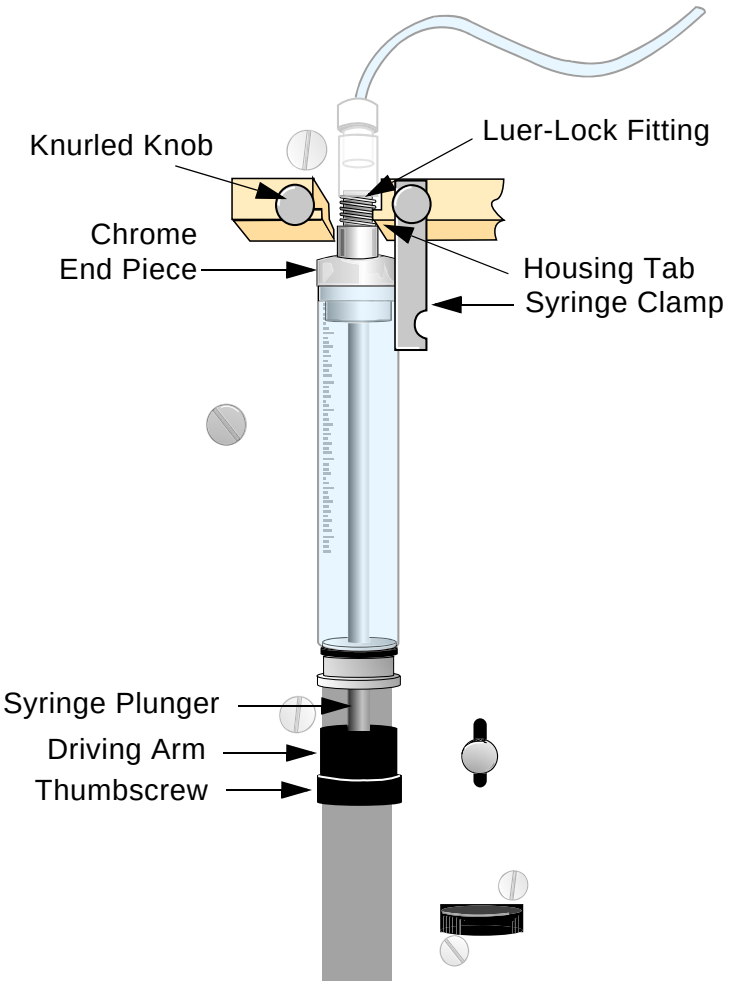

Figure 5-5. Syringe Clamp Knurled Knobs

2. Remove the black thumbscrew from the bottom of the syringe plunger.
3. Gently slide the syringe assembly out of the housing.
4. Holding the Luer-Lock fitting in your left hand and the syringe in your right hand, turn the syringe counterclockwise until it disengages from the fitting.

Mount the New Syringe

1. Insert the Luer-Lock fitting into the chrome end piece of the new syringe and turn the syringe clockwise until secure.
2. Align the grooves in the chrome end piece with the tabs in the housing.
3. Gently push the syringe into place.
4. Position the syringe clamp across the chrome end piece and secure it in place by tightening the knurled knob.
5. Gently pull the syringe plunger down until it contacts the top of the driving arm.
6. Secure the plunger to the arm with the black thumbscrew previously removed.

Adjust the New Syringe

1. Loosen the knurled thumbscrew approximately two turns, as shown in Figure 5-6.

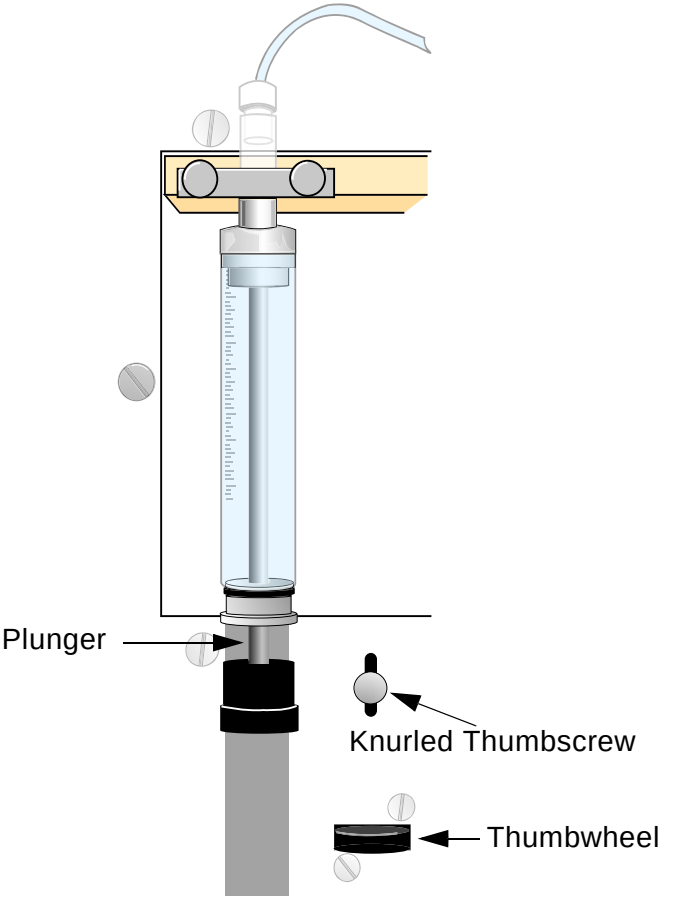

Figure 5-6. Syringe Knurled Thumbscrew

2. Turn the thumbwheel to the left two full turns.
3. Select the Adjust Air Syringe diagnostic method (#27) again and press **CONT** to run the method. As the plunger moves up, you should hear a clicking sound.

4. Turn the thumbwheel to the right just until the clicking sound stops. Then, turn it one more partial turn (see Figure 5-7).

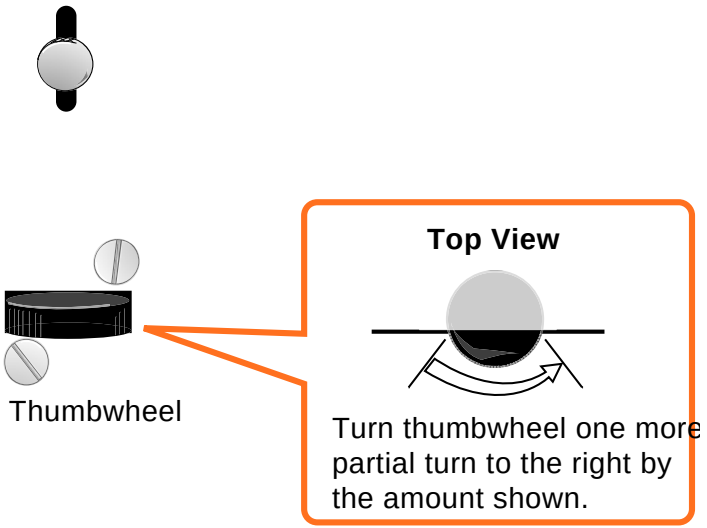

Figure 5-7. Thumbwheel Rotation

5. Tighten the knurled thumbscrew to secure the position.

Complete the Procedure

Run the Benchmark Test diagnostic method (#30) (see Section 5.16) to verify that the new syringe works properly.

5.7 Converting a Cartridge Holder

Follow the procedure below to convert the Dionex AutoTrace 280 cartridge holder to accommodate a cartridge of a different size.

Parts

To convert your cartridge holder, you must first obtain the appropriate plunger assembly for the new cartridge size. For descriptions and part numbers, see Appendix C.

Remove the Old Plunger Assembly

Follow these steps to remove the existing plunger assembly for each cartridge holder to be converted.

1. Grasp the 3-mm (1/8-in) OD outer sleeve and pull it up and out of the way to reveal 5 cm (2 in) of the PTFE tubing.
2. Slide the tubing clamp up so that it is no longer over the stainless steel tubing (see Figure 5-8).

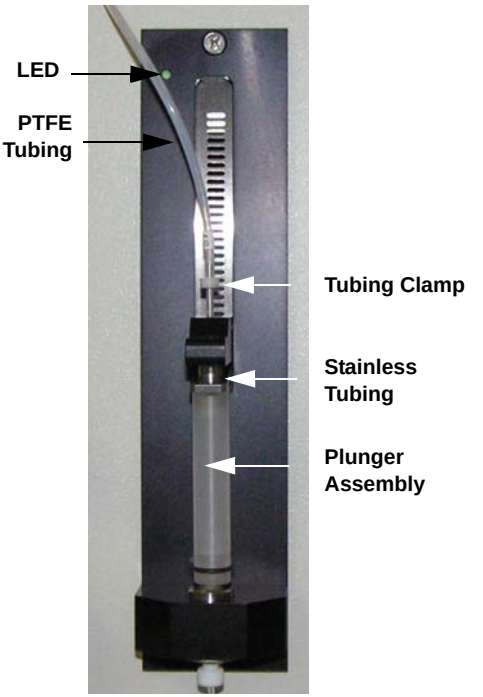

Figure 5-8. Tubing Clamp Movement

3. Grasp the bottom of the PTFE tubing and the tubing clamp and carefully pull upward until they slide off the top end of the stainless tubing.
4. Disengage the plunger clamp, and then move the plunger up and out of the cartridge.
5. Unscrew the plunger assembly (see Figure 5-8) and pull it down to remove it from the cartridge holder.
6. Set the plunger assembly aside.
7. Repeat Step 1 through Step 6 for each cartridge holder you need to convert.

Install the New Plunger Assembly

Follow these steps to install the new plunger assembly for each cartridge holder to be converted.

1. Screw the new plunger assembly into position on the cartridge holder.
2. Engage the plunger clamp.
3. Carefully, without developing kinks in the tubing, push the PTFE tubing end downward, over the top of the stainless tubing, as shown in Figure 5-9.

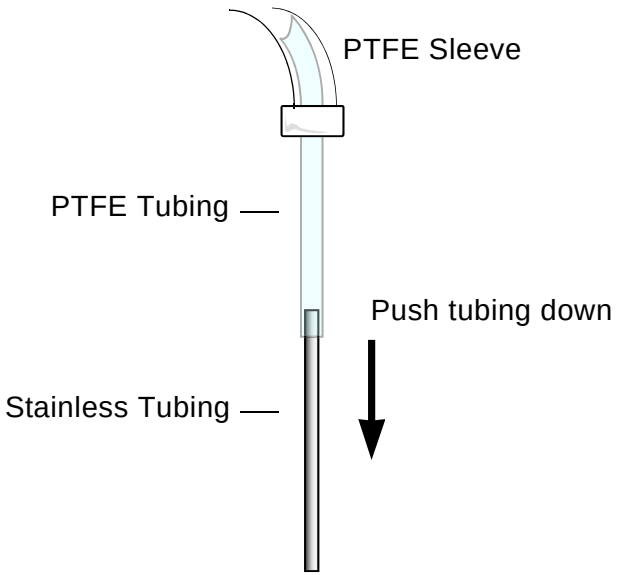

Figure 5-9. PTFE Tubing Installation

4. Now, push the tubing clamp down until it is positioned as shown in Figure 5-10.

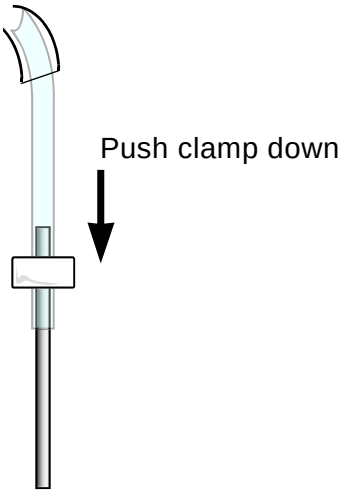

Figure 5-10. Tubing Clamp Positioning

5. Slide the sleeve down to meet the tubing clamp.
6. Disengage the plunger clamp. Do not leave the plunger clamped; this will deform the O-ring seal.

Complete the Procedure

Run the Benchmark Test diagnostic method (#30) (see Section 5.16) to verify that the cartridge holder works properly.

5.8 Cleaning a Sample Pump Cylinder and Piston

Clean the sample pump cylinder and piston if a pump leak is detected.

Parts and Tools

The following parts and tools are required to complete this procedure:

- #2 Phillips screwdriver
- Deionized water

Clean the Pump

1. Stop all sample pumps and any methods that are running.
2. Remove the compression fittings and the inlet and outlet tubing connected to the pump to be cleaned.
3. **For the Dionex AutoTrace 280 disk model:** Remove the pulse damper from the pump outlet.
4. Use the #2 Phillips screwdriver to remove the two Phillips screws on the front of the pump. Remove the black cover.
5. Remove the white plastic pump head by pulling it straight away from the pump.
6. Unscrew the metal retainer from the pump head. **Tip:** If necessary, use pliers to loosen the retainer.

   Note the order of the parts inside the retainer: The white washer is closest to the retainer; the two red seals are closest to the pump head.
7. Rinse the bore in the pump head, the washer, and both seals with deionized water. Be careful not to scratch the ID of the pump head bore; scratches will prevent a proper seal.
8. Remove the piston from the pump by angling the piston and pulling it out.
9. Rinse the piston with deionized water. Be careful not to scratch the piston; scratches will prevent a proper seal.
10. Place the metal retainer onto the piston, followed by the white washer and the two red seals. The red seals must be placed onto the piston carefully, so as not to deform them as they pass across the notched cutout of the piston. Install the seals in the retainer in the order in which they were removed.

11. Reinstall the piston/retainer/washer/seal assembly by inserting the dowel pin at the end of the piston into the hole in the bearing inside the pump drive bore.
12. Screw the pump head carefully onto the piston/retainer/washer/seal assembly. Tighten the retainer. Using pliers, turn the retainer 10 degrees past fingertight.
13. Replace the black cover and reinstall the two Phillips screws on the front of the pump.
14. Replace the compression fittings and the inlet and outlet tubing.
15. **For the Dionex AutoTrace 280 disk model:** Reinstall the pulse damper.
16. To verify that the pump is running correctly, run the Calibrate Pump diagnostic method (#31). While the method runs, check for leaks from the pump and pump volume accuracy.

5.9 Calibrating a Sample Pump

Calibrate a sample pump (by running the Calibrate Pump diagnostic method) **only** if the volume removed from the sample container does not match the sample volume requested in the **Load Sample** step of your method.

Parts and Tools

The following parts and tools are required to complete this procedure:

- Allen wrench, 3/32-in
- Sample container with approximately 120 mL of water/pump being calibrated
- Balance
- 1.6-mm (1/16-in) ID tubing (P/N 070358) provided in the Dionex AutoTrace 280 Ship Kit (P/N 071383)

Calibrate the Pump

Perform the following steps on each sample pump that requires calibration.

1. Run a single-step **Clean Sample Path** method (see Section 3.2.2), using deionized water.
2. Select the Calibrate Pump diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 31.

c. Press **CONT** once to select method 31.

3. Press **CONT** to load the method.
4. Follow the on-screen instructions as they appear.
5. As instructed, weigh the collection vessel before and after pumping. Determine the percentage difference between the **expected** volume of 100 mL and the **delivered** volume.

   Example:

   If the volume of water that the method pumps is 103 mL rather than the expected 100 mL, the volume is off by 3%.

6. Locate the pump's calibration screw in the hole on the right side of the pump (see Figure 5-11).

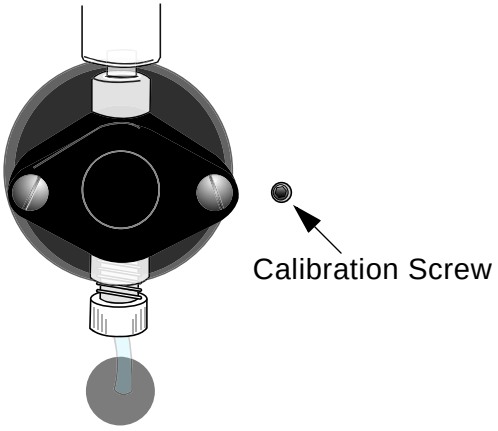

Figure 5-11. Pump Calibration Screw

7. Use a 3/32-in Allen wrench to adjust the screw as follows:

   a. Turn one-quarter turn clockwise to **decrease** the volume 2.5%.

   b. Turn one-quarter turn counterclockwise to **increase** the volume 2.5%.

   Example:

   For the example above, you would turn the adjustment screw clockwise approximately one-quarter of a turn.

8. If the pump needs additional adjustments, press **PAUSE** to repeat the calibration.
9. Repeat Step 2 through Step 8 for each sample pump that requires calibration.

5.10 Replacing a Sample Pump

If the sample pump motor or sensor fails, replace the pump.

Parts and Tools Required

- #2 Phillips screwdriver
- For cartridge model: Sample pump (P/N 071529)
- For disk model: Sample pump (P/N 070530)

Getting Started

Before removing the pump, follow the steps below to create and run a method that will dry the line that runs from the pump to the switching valve. This prevents leaking during the pump replacement.

1. In the AutoTrace software main window, click **Methods**. The Set Up Methods window opens.
2. On the Set Up Methods window toolbar, click **New**.
3. In the **Name** box, enter **Dry Lines** as the method name.
4. Click the **Edit** button.
5. Under **AutoTrace Method Step**, expand the **Solid Phase Extract** option to display the SPE commands.
6. Double-click the **Load Sample** command and set the volume to **10.0** mL.
7. Double-click the **Dry with Gas** command and set the time to **0.5** mins.
8. To save the method, click **Save** on the toolbar.
9. On the toolbar, click the down arrow next to **Command** and select **Download Method**.
10. If the Set Up Methods window is not currently open, the Find Method window opens. Double-click **Dry Lines,** the name of the method you want to download.

11. When asked to confirm that you want to download the method to the Dionex AutoTrace 280, click **Yes**.
12. Place the sample lines in an empty, clean container.
13. Run the Dry Lines method.
14. When the method has finished running, turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

Remove the Defective Pump

1. One piece at a time, unscrew the pump's compression fittings (see Figure 5-12) and secure the tubing to the front of the system with a piece of tape.

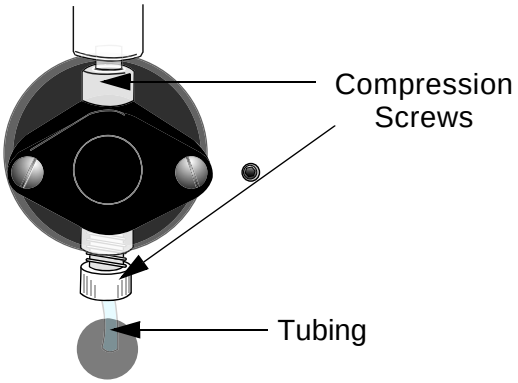

Figure 5-12. Pump, Front View

2. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.
3. Locate the back of the defective pump and follow the pump's wires to the CPU board. Disconnect the pump from the board.
4. Remove the two screws that secure the pump to the pump mounting bracket. Set the screws aside.
5. Carefully pull the pump away from the mounting bracket.

Install the New Pump

1. Carefully place the new pump onto the mounting bracket.
2. Attach the pump to the pump mounting bracket, using the two screws previously removed.
3. Plug the pump connector into the CPU board.
4. Reinstall the rear panel with the six screws previously removed.
5. Reconnect the pump's compression fittings and tubing.
6. Reconnect the power cord and turn on the Dionex AutoTrace 280 power.
7. Select the Calibrate Pump diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 31.
   c. Press **CONT** once to select method 31.
8. Press **CONT** to run the method. Follow the on-screen instructions as they appear.

5.11 Replacing the 12-Port Valve Rotor

Replace the rotor in the 12-port valve if fluid leaks from underneath the stator.

Parts and Tools

The following parts and tools are required to complete this procedure:

- 7/64-in hex wrench
- 12-port valve rotor (P/N 072592)

Remove the Defective Rotor

1. Use the 7/64-in hex wrench to remove the three hex screws on the front of the valve, and then remove the stator from the valve. (It is not necessary to remove all the fittings, only those required to gain access to the hex screws.)
2. Remove the spacer ring from the valve.
3. Grasp the edges of the rotor and pull it out of the metal cup on top of the drive shaft. If necessary, use the three tabs on the outside of the rotor for a better grip.
4. Inspect the stator sealing face to verify that it is smooth and free from scratches or other defects. Burrs on the stator may scratch the new rotor. If the stator is defective, it will have to be replaced after the rotor is replaced.

Install the New Rotor

1. Note the groove on one side of the new rotor. Hold the rotor with the groove facing you and with the groove oriented down. (This orientation ensures that the groove connects the center port of the stator with the waste port.) Align the three tabs on the rotor with the three cutouts in the metal cup, and press the rotor firmly into place.

   NOTE When correctly installed, the surface of the rotor is nearly flush with the edges of the metal cup.

2. Reinstall the spacer ring.
3. To reinstall the old stator or install a new stator (P/N 072593): Align the two small holes on the underside of the stator with the two alignment pins on either side of the metal cup, and then press the stator into place.

4. Replace the hex screws on the front of the valve and tighten the hex screws evenly. Tighten the rotor until it bottoms out on the spacer ring. The rotor is spring-loaded for tension.

Complete the Procedure

To verify that the valve works properly, run the12-Port Valve Test diagnostic method (#28), followed by the Benchmark Test diagnostic method (#30) (see Section 5.16).

NOTE Do not run the 12-Port Valve Test if the solvent lines have not been primed yet.

5.12 Replacing the 12-Port Valve Stator

Replace the stator in the 12-port valve if the valve continues to leak after the rotor is replaced or if the ports in the stator become blocked. If you suspect that the ports are blocked, use a syringe to attempt to force water through each port.

The replacement procedure for the stator is the same as for the rotor, except that all of the fittings are reinstalled onto the new stator. For details, see Section 5.11.

Parts and Tools

The following parts and tools are required to complete this procedure:

- 7/64-in hex wrench
- 12-port valve stator (P/N 072593)

5.13 Replacing the 12-Port Valve

Replace the 12-port valve if the valve continues to leak after both the rotor and stator have been replaced.

Parts and Tools

The following parts and tools are required to complete this procedure:

- 1/4-in wrench
- #2 Phillips screwdriver
- 12-port valve and motor (P/N 071329)

Remove the Defective Valve

1. Remove the solvent lines from the solvent reservoirs.
2. Select the Prime Solvents diagnostic method:
   a. Press **LOAD** to display the **LOADING METHOD** screen.
   b. Press **LOAD** to increment the displayed method to 29.
   c. Press **CONT** once to select method 29.
3. Press **CONT** to run the method.
4. Turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

5. Open the left-side door. Disconnect all of the fittings on the 12-port valve stator. If a fitting is too tight to be removed, loosen it with a 1/4-in wrench.

6. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.
7. Remove the electrical cable from the bottom of the 12-port valve.
8. Note the four Phillips screws next to the valve stator. (The screws are on the outside, near the face of the 12-port valve.) While holding the valve in place, remove the four screws.

NOTE If you do not support the valve, it will fall down inside the Dionex AutoTrace 280 when you are undoing the last screw.

Install the Bracket on the New Valve

1. Remove the bracket from the motor on the defective valve by unscrewing the 3-mm hex screws.
2. Install the bracket onto the new valve, using the 3-mm hex screws.

Install the New Valve

1. Install the new valve, using the four Phillips screws previously removed.

NOTE Be sure to align the valve correctly on the instrument panel. Port 1 should be toward the top, and aligned with the top P on the panel.

2. Reconnect the electrical connection.
3. Reinstall the Dionex AutoTrace 280 rear panel with the six screws previously removed.
4. Reattach the fittings to the valve stator as shown in Figure 5-13 and Table 5-3. These are polymeric fittings; do not overtighten.

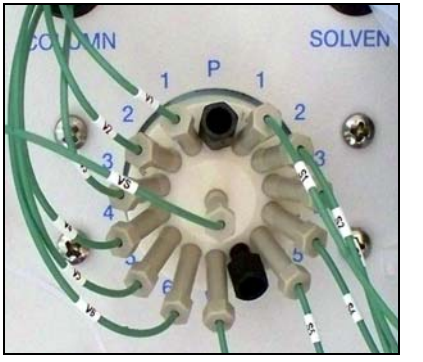

Figure 5-13. 12-Port Valve Fitting Connections

Tubing/Fitting Label	Instrument Panel Label	Valve Stator Label
V1	1 (left side)	2
V2	2 (left side)	3
V3	3 (left side)	4
V4	4 (left side)	5
V5	5 (left side)	6
V6	6 (left side)	7
W	W	8
S1	1 (right side)	14
S2	2 (right side)	13
S3	3 (right side)	12
S4	4 (right side)	11
S5	5 (right side)	10
VS	None	None (center hole)
Plug	P	1
Plug	P	9

Table 5-3. Tubing/Fitting Connections for the 12-Port Valve

5. Reconnect the power cord and turn on the power.
6. Place solvent lines in the solvent reservoirs. Run the Prime Solvents diagnostic method (#29).

Complete the Procedure

Run the Benchmark Test diagnostic method (#30) (see Section 5.16) to verify that the new valve works properly.

5.14 Replacing the Air Push Valve

If the air push valve leaks, replace the valve.

Parts and Tools Needed

- #2 Phillips screwdriver
- Air push valve (P/N 070325)

Remove the Defective Valve

1. Turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

DANGER

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

DANGER

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

ACHTUNG

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

2. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.
3. Remove the three white compression fittings on the air push valve (see Figure 5-14).

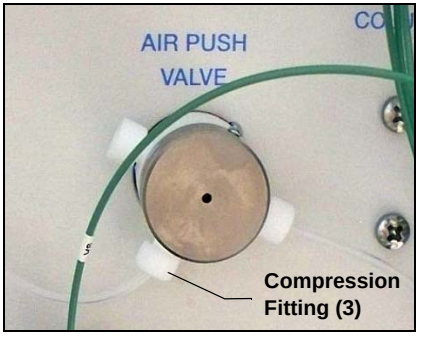

Figure 5-14. Compression Fittings

4. Locate and disconnect the valve wiring connector from the Valve Distribution board (see Figure 5-15).

Figure 5-15. Air Push Valve Wiring Connector

5. Loosen the screw on the clamp that holds the valve.
6. Remove the defective valve from the system.

Install the New Valve

1. Install the new air push valve, aligning the post with the notch on the panel (see Figure 5-16).

Figure 5-16. Air Push Valve Alignment Notch

2. Tighten the valve clamp screw.

3. Reconnect the wiring connector to the Valve Distribution board (see Figure 5-15).
4. Reattach the white compression fittings to the valve:
   a. Valve port NO connects to the air inlet (no tubing).
   b. Valve port COMM connects to the air push syringe tubing.
   c. Valve port NC connects to the liquid syringe tubing.
5. Reinstall the Dionex AutoTrace 280 rear panel with the six screws previously removed.
6. Reconnect the power cord and turn on the power.
7. Place solvent lines in the solvent reservoirs. Run the Prime Solvents diagnostic method (#29).

Complete the Procedure

Run the Benchmark Test diagnostic method (#30) (see Section 5.16) to verify that the new valve works properly.

5.15 Replacing the Switching Valve

If the switching valve leaks, it should be replaced.

Parts and Tools

You need the following parts and tools to complete this procedure:

- #2 Phillips screwdriver
- Switching valve (P/N 070273)

Remove the Defective Valve

1. Turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

DANGER

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

ACHTUNG

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

2. Disconnect or turn off the gas supply to the instrument.
3. Open the door on the left side of the Dionex AutoTrace 280 and locate the defective valve.
4. Unscrew all four compression fittings from the valve (see Figure 5-17).

Figure 5-17. Switching Valve Compression Fittings

5. Using the #2 Phillips screwdriver, remove the six Phillips screws securing the rear panel to the system. Set the panel and screws aside.

6. Locate the connector for the defective valve on the Valve Distribution PC board (see Figure 5-18). Unplug the connector.

Figure 5-18. Switching Valve Connectors on Valve Distribution PCB

7. Follow the group of green wires and carefully undo the wires from the wire fasteners.
8. From the left side of the Dionex AutoTrace 280, locate the mounting bracket that holds the defective valve to the side panel.
9. Remove the two screws that hold the mounting bracket to the side panel. Set the screws aside.
10. Route the defective valve wires from the inside of the system through the hole.
11. Remove the valve from the Dionex AutoTrace 280.
12. Remove the two screws in the valve to separate the valve from its bracket.

Install the New Valve

1. Secure the new valve to the mounting bracket with the two screws previously removed. Make sure you do not pinch the wires between the valve and the bracket.
2. Feed the new valve's wires and connector through the hole in the side of the Dionex AutoTrace 280.

3. Position the valve/mounting bracket assembly on the side panel, making sure the assembly does not pinch any of the wires.
4. Secure the assembly to the system, using the two screws previously removed.
5. Attach the compression fittings and tubing to their appropriate positions on the valve. Make sure all compression fittings are securely fingertight.
6. Route the wires from the back of the new valve to the appropriate receptacle on the Valve Distribution board by following along the main group of valve wires.
7. Plug the connector into the receptacle.
8. Using the wire fasteners, neatly secure the new valve's wires to the main wire group.
9. Close the door on the left side of the Dionex AutoTrace 280.
10. Reinstall the Dionex AutoTrace 280 rear panel with the six screws previously removed.
11. Reconnect the power cord and turn on the power.
12. Reconnect the gas supply to the instrument.
13. Place solvent lines in the solvent reservoirs. Run the Prime Solvents diagnostic method (#29).

Complete the Procedure

To ensure proper function of the new switching valve, run the Benchmark Test diagnostic method (#30) (see Section 5.16).

5.16 Running the Benchmark Test Diagnostic Method

Run the Benchmark Test diagnostic method if:

- You replace any of these system components: tubing, syringe, valve, or cartridge holder. (The Thermo Fisher Scientific Service Representative will run the Benchmark Test after replacing either the keypad or a PC board.)
- There is any indication of trouble with the Dionex AutoTrace 280.

Parts

The following parts are required to complete this procedure:

- Six 16 x 100 mm test tubes and elution rack (for optional wet test)
- Sample container with at least 100 mL of water (for optional wet test)
- Solvent containers filled with colored water (for optional wet test)

Run the Benchmark Test

1. Select the Benchmark Test diagnostic method:
    a. Press **LOAD** to display the **LOADING METHOD** screen.
    b. Press **LOAD** to increment the displayed method to 30.
    c. Press **CONT** once to select method 30.
2. Press **CONT** to run the method.
3. As the method runs, follow the on-screen instructions to verify that the:
    - Front panel **RUN** LED turns on.
    - Front panel **ERROR** LED turns on.
    - Elution shuttle moves to its three different positions.
    - Exhaust fan turns on.
    - Cartridge holder's LEDs are lighted.
4. Perform the following wet test whenever tubing, valves, or syringes have been replaced. Follow the on-screen instructions and do the following:
    a. Place six empty test tubes in the 16 x 100 mm elution rack.
    b. Place the system's five solvent lines in containers holding water solutions of different colors.

c. Observe that the tubes are filled with water as follows:

Tube #1 fills with 10 mL from **solvent container #1**.

Tube #2 fills with 10 mL from **solvent container #2**.

Tube #3 fills with 10 mL from **solvent container #3**.

Tube #4 fills with 10 mL from **solvent container #4**.

Tube #5 fills with 10 mL from **solvent container #5**.

Tube #6 fills with 10 mL from **solvent container #1**.

d. With the gas turned on, verify gas valve operation by placing a finger under the elution manifold's nozzles and sensing the gas flow.

e. Place all sample lines in a container holding at least 100 mL of water.

f. Verify that all pumps direct sample to aqueous waste.

5. If you need to repeat this test, select the Benchmark Test (#30) again and press **CONT** to run the method.

5.17 Replacing the Main Power Fuses

Parts and Tools

The following parts and tools are required to complete this procedure:

- Small screwdriver
- 3.15 amp IEC127 fast-blow fuses (P/N 954745), 2

Replace the Fuses

1. Turn off the Dionex AutoTrace 280 power switch and disconnect the power cord from both its source and from the Dionex AutoTrace 280 right-side panel.

HIGH VOLTAGE—Disconnect the main power cord from its source, as well as from the right-side panel of the Dionex AutoTrace 280.

HAUTE TENSION—Débranchez le cordon d'alimentation principal de sa source et du panneau de droit-côté du Dionex AutoTrace 280.

ACHTUNG

HOCHSPANNUNG—Ziehen Sie das Netzkabel aus der Steckdose und der Netzbuchse auf dem rechten Seitenteil des Dionex AutoTrace 280.

2. The fuse drawer is located above the main power switch (see Figure 5-19). A small tab locks the fuse drawer in place. Using a small screwdriver, press the tab *in* and *then up* to release the fuse drawer.
3. Pull the fuse drawer out of the right-side panel and remove the old fuses. Thermo Fisher Scientific recommends always replacing *both* fuses.

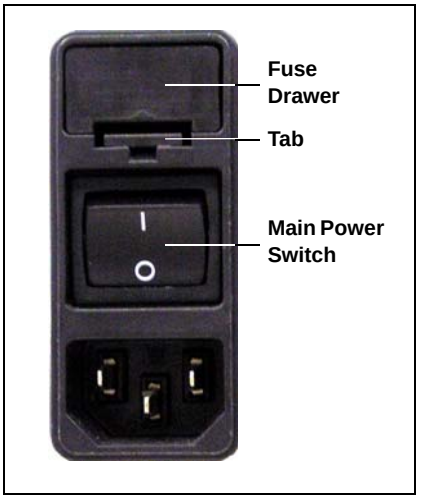

Figure 5-19. Fuse Drawer

4. Insert two new 3.15 amp IEC127 fast-blow fuses into the springs in the fuse drawer. Press gently to fully insert the fuses into the drawer.
5. Insert the fuse drawer into the right-side panel and press until the drawer snaps into place.
6. Reconnect the power cord and turn on the power switch.
7. Verify that the **READY** light comes on and the system operates normally.

A • Specifications

A.1 Electrical

Power Recommendations	100 to 240 Vac (±10%), 47 to 63 Hz. The Dionex AutoTrace 280 main power supply is auto-sensing and requires no voltage or frequency adjustment.
Typical Input Power	100 W
Maximum Line Draw	1.2 A
Fuse Requirements	Two fast-blow IEC 127 fuses (P/N 954745) rated 3.15 A

A.2 Environmental

Operating Temperature	10 to 40 °C (50 to 104 °F) **Note:** The Dionex AutoTrace 280 is intended for operation indoors only.
Operating Humidity	20% to 80% relative humidity (noncondensing)
Operating Altitude	-61 to 2000 meters (-200 to 6562 ft)

A.3 Physical

Dimensions (H x W x D)	69 x 57 x 63.5 cm (27 x 23 x 25 in) Sample rack: 42.16 x 33.02 cm (16.6 x 13.0 in)
Weight	43.09 kg (95 lb)

A.4 Gas Regulator and Gas Gauge Range

Output	0 to 0.14 MPa (0 to 20 psi)
Input	0.69 MPa (100 psi)

A.5 Front Panel Display and Keypad

Display	Liquid crystal with adjustable contrast
Keypad	3 status LEDs; 3 buttons for entering commands and selecting methods

A.6 Liquid Management

Air Push Syringe	10 mL
Liquid Handling Syringe	10 mL
12-Port Valve	Rotary
Air Push Valve	3-way, PTFE
Switching Valves	3 input ports to 1 output port; pump input port normally open
Nozzles	Stainless steel
Tubing	TFE, PEEK; *most lengths critical*
Solvent Waste Reservoir	1 liter (one supplied)
Waste Reservoir	10 liters (two supplied)

A.7 Solid Phase Extraction Configurations

SPE Cartridges	Syringe-compatible polymer cartridges: 1 mL, 3 mL, and 6 mL Syringe-compatible glass cartridges: 6 mL
Cartridge Plunger	Adapters available for 4 cartridge types
Extraction Disks	47 mm

A.8 Collection Container Racks

Tube Racks	16 x 100 mm stainless steel
Vial Racks	11 mm GC, 17 x 60 mm, 4 mL screw cap
Conical Racks	15 mL

A.9 Sample Pumps

Displacement	Positive
Accuracy	±2.5%
Tube Fitting	Kynar™
Piston and Liner	Ceramic

IMPORTANT

Acetone is harmful to the sample pumps and should never be used to clean the sample path or rinse the sample container.

Do not run the sample pumps dry. Always leave deionized water in the sample lines when the system is not in use.

B.1 Facility Requirements

- Check that the installation site meets the power and environmental specifications listed in Appendix A.
- Provide a level, stable, and flat surface with enough room to accommodate the Dionex AutoTrace 280's 57 cm (23 in) width, 69 cm (27 in) height, and 63.5 cm (25 in) depth.
- Make sure there is an additional 1 sq. meter (2 to 3 sq. ft.) of space on the left side of the Dionex AutoTrace 280 for the solvent reservoirs.
- If the 6-position sample rack (P/N 071333) will be installed, make sure there is enough room for the 42.16 x 33.02 cm (16.6 x 13.0 in) sample rack on the right side of the Dionex AutoTrace 280.

B.2 Unpacking the Dionex AutoTrace 280

Lift the Dionex AutoTrace 280 only from the bottom and/or sides of the instrument. Use caution when lifting the Dionex AutoTrace 280: it weighs 43.09 kg (95 lb).

Ne soulevez le Dionex AutoTrace 280 que par le fond ou les côtés. Soyez prudent lorsque vous soulevez le Dionex AutoTrace 280: il pèse 43.09 kg.

Wenn Sie den Dionex AutoTrace 280 anheben oder bewegen möchten, greifen Sie bitte unter den Boden oder heben Sie das Gerät an den Seiten an. Seien Sie vorsichtig, wenn Sie den Dionex AutoTrace 280 anheben. Das Gerät wiegt 43.09 kg.

1. Open the Dionex AutoTrace 280 shipping container. Remove the Dionex AutoTrace 280 and place it on the workbench.
2. Unpack the Dionex AutoTrace 280 Ship Kit (P/N 071383) and all other items included in the shipping container. Place the items in a convenient location

and check them against the packing list. Report any discrepancies to Thermo Fisher Scientific immediately.

B.3 Installation Instructions

Installing the Dionex AutoTrace 280 involves the following steps:

- Make solvent connections.
- Install the waste drain and tubing.
- Connect the exhaust hose and gas supply.
- Check compression fittings for tightness.
- Turn on the power.
- Provide access to a computer.
- Install the AutoTrace software.

NOTE For installation instructions for the sample reservoirs, see page 53.

B.3.1 Connecting the Solvent Reservoirs

To connect the solvent reservoirs to the solvent tubing lines on the left side of the Dionex AutoTrace 280:

1. Position the reservoirs to the left of the Dionex AutoTrace 280, keeping the following in mind:
   - The reservoirs must be within reach of the tubing that extends from the left side of the system.
   - The most precise liquid transfer occurs with the solvent reservoirs positioned slightly higher than the system's 12-port valve. Thermo Fisher Scientific recommends that you do not place the solvent reservoirs on the top of the system.

IMPORTANT **You must provide up to five suitable containers for your solvents. Thermo Fisher Scientific offers 1-liter glass bottles (P/N 045900) for this purpose. The plastic bottle supplied with the Dionex AutoTrace 280 should only be used for water. Do not use the bottle for solvents; if you do, components of the plastic in the bottle may appear in your chromatogram.**

2. Uncap the solvent reservoirs and fill them with the required solvents.
3. Locate the Tubing Weight Kit (P/N 072580) provided in the Dionex AutoTrace 280 Ship Kit (P/N 071383).

   Remove the tubing weights (P/N 071360) and barbed fittings (P/N 070357) from the Tubing Weight Kit.
4. Insert the end of the tubing from solvent port #1 through the hole in one of the reservoir caps. Cut the tubing length, if necessary, to avoid slack or kinks in the solvent lines.
5. Push the tubing end through the small hole in the top of one of the tubing weights until the tubing extends through the opposite end (see Figure B-1).

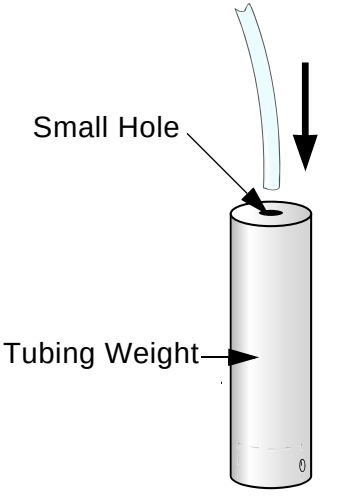

Figure B-1. Tubing in Tubing Weight

6. Push a barbed fitting into the end of the tubing (see Figure B-2).

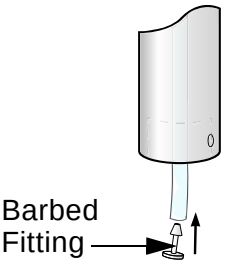

Figure B-2. Barbed Fitting

IMPORTANT **To hold the tubing in your fingers while installing the barbed fitting, grasp the tubing using a flat rubber band or piece of emery cloth.**

7. Gently pull the tubing upward until the barbed fitting seats itself within the recess of the tubing weight (see Figure B-3).

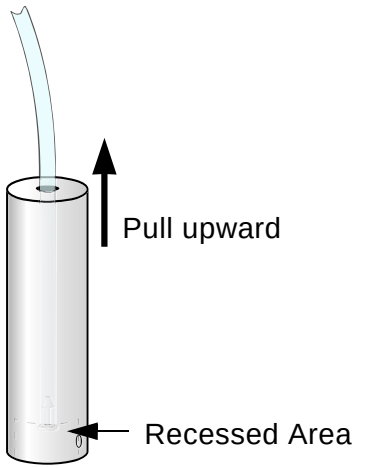

Figure B-3. Pulling Tubing Upward

8. Cap the bottle and adjust the length of tubing until the weight touches the bottom surface of the reservoir (see Figure B-4).

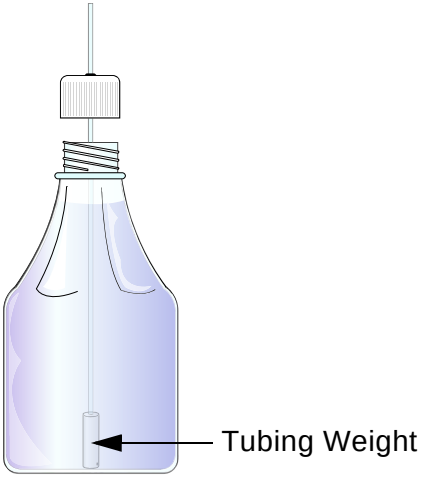

Figure B-4. Tubing Weight in Reservoir

9. Repeat Step 4 through Step 8 for each reservoir to be used.

B.3.2 Installing the Waste Drain and Tubing

To install and orient the waste drain, and connect the solvent and waste tubing:

1. Locate and remove the waste drain (P/N 071362) from its shipping box in the Dionex AutoTrace 280 Ship Kit (P/N 071383) (see Figure B-5).

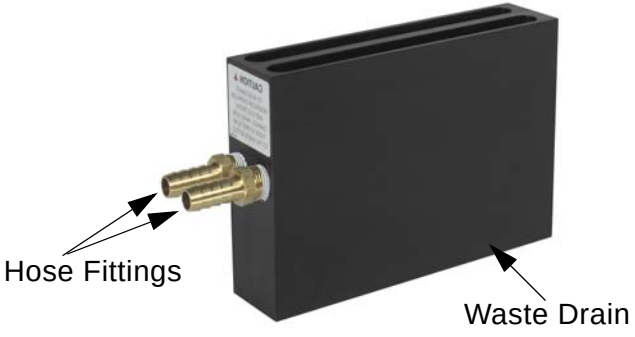

Figure B-5. Waste Drain

2. Decide whether you want the waste tubing to extend from the left or right side of the Dionex AutoTrace 280, and then orient the waste drain's hose fittings to the appropriate side.
3. Install the waste drain onto the elution station's two ball studs, making sure the waste drain snaps into place and sits flush on the base plate (see Figure B-6).

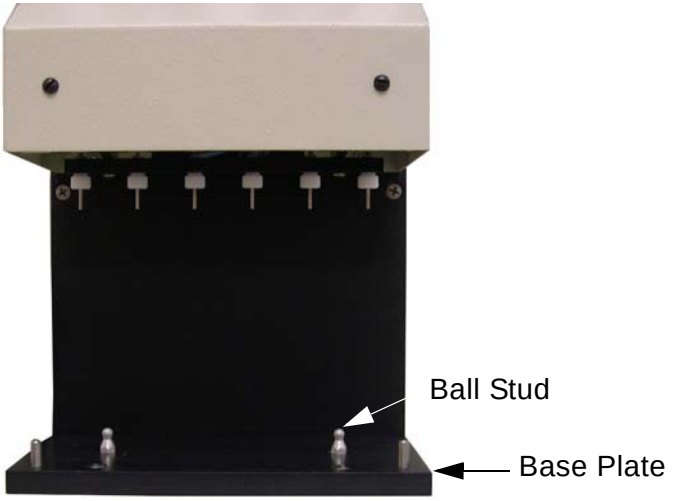

Figure B-6. Ball Stud and Base Plate

4. Push the waste drain toward the back of the system; it moves only about 3 mm (1/8 in). This correctly positions the drain under the manifold.

5. Note the 2.44-m (8-ft) length of tubing (P/N 071147) connected to the caps of the two 12-liter waste containers (P/N 071159). One piece of tubing is for aqueous waste; the other is for solvent waste. Screw the caps onto the waste containers.
6. With one hand supporting the waste drain, press the free ends of the waste tubing onto the drain's hose fittings (see Figure B-7).

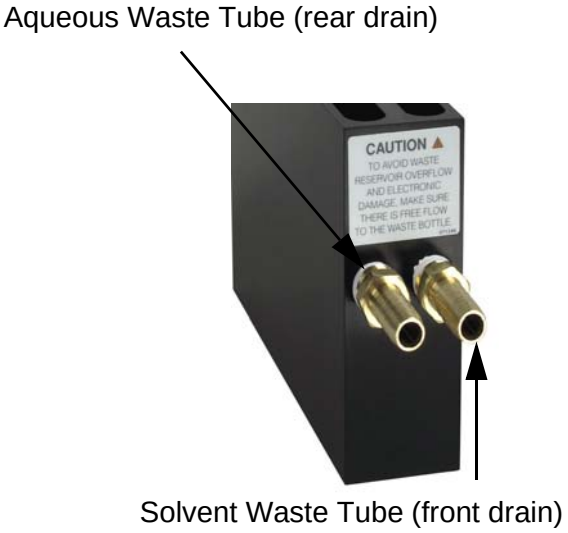

Figure B-7. Waste Tubing Connections

7. Route the two waste lines as follows:
   a. Connect the cap of the solvent waste tubing (the tubing connected to the front drain trough) to one of the waste containers, making sure the waste container tubing never drops below the level of the waste container cap.
   b. Connect the cap of the aqueous waste tubing (the tubing connected to the rear drain trough) to the remaining waste container, making sure the waste tubing never drops below the level of the waste container cap. If you route the aqueous waste tubing to a drain, make sure you follow the same tubing guidelines.
   c. If necessary, cut the tubing to the desired length with wire cutters or scissors.

8. Locate the tubing port labelled **WASTE** directly below the five solvent tubing lines on the left side of the system (see Figure B-8).

Figure B-8. Waste Tubing Port

9. Insert the waste tubing from this port into one of the bottles supplied with the system, keeping the following in mind:
   - Make sure the end of the tubing extends just below the top of the container.
   - Avoid sharp turns and uphill pieces of tubing from the system to the container.

B.3.3 Connecting the Exhaust Hose

If the eluted solvents need to be vented, use the system's internal fan to safely vent solvent vapors. To connect the system's exhaust hose:

1. Connect the exhaust hose (P/N 071090) to the system's exhaust port by sliding and rotating the hose onto the port (see Figure B-9).

Figure B-9. Exhaust Port

2. Route the hose to a suitable vent location. If necessary, use wire cutters or scissors to cut any excess hose as required.

B.3.4 Connecting the Gas Supply

To connect the gas supply to the system's gas inlet:

1. Locate the 3-m (10-ft) length of 1/8-in ID x 3/16-in OD tubing (P/N 070379) and the 1/8-in Quick-disconnect fitting in the Dionex AutoTrace 280 Ship Kit (P/N 071383). Push the barbed end of the fitting into one end of the tubing (see Figure B-10).

Figure B-10. Barbed Fitting on Tubing

2. Connect the open end of the Quick-disconnect fitting (see Figure B-11) to the gas inlet on the lower-left side of the system (see Figure B-12).

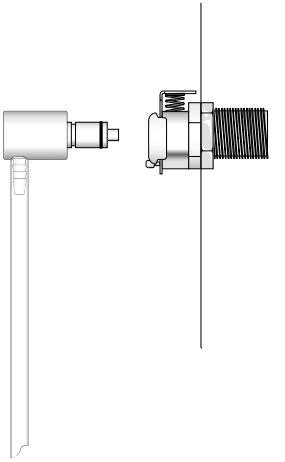

Figure B-11. Quick-Disconnect Fitting

Figure B-12. Gas Inlet

3. Using the supplied 1/4-in NPT x 1/8-in barb fitting (P/N 071151), connect the other end of the tubing to the gas supply. (If necessary, substitute the supplied 1/8-in NPT x 1/8-in barb fitting (P/N 071152) for the connection.)
4. Turn on the gas supply. The gas supply must be clean and filtered with an incoming pressure of no more than 0.69 MPa (100 psi).
5. Before operating the Dionex AutoTrace 280, you must set the system pressure to 0.07 MPa (10 psi). Refer to Section 3.5 for instructions.

B.3.5 Checking the Compression Fittings

IMPORTANT **All compression fittings must be tightened securely for leak-free operation.**

To check the tightness of the system's compression fittings:

1. Open the left-side door and locate the compression fittings on the switching valves, air push valve, and syringes (see Figure B-13).

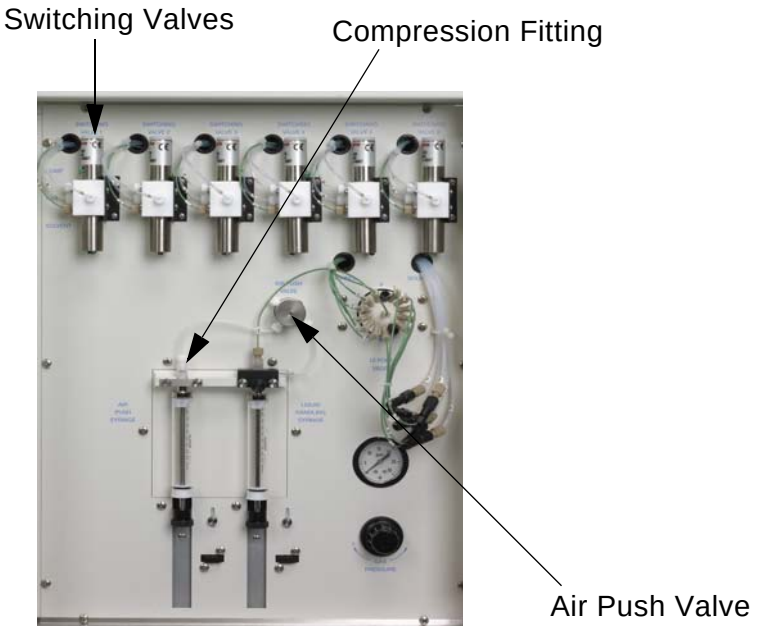

Figure B-13. Dionex AutoTrace 280 Left-Side View

2. Make sure each compression fitting is fingertight. **Tip:** If necessary, you can remove any switching valve from the left-side panel to improve access to the valve fittings.
3. Perform the same check for the compression fittings on the pumps and cartridge or disk holders on the front of the system.

B.3.6 Installing the AutoTrace Software

Always install the AutoTrace software *before* connecting the USB cable or turning on the power to the Dionex AutoTrace 280 and the PC. This ensures that the USB driver for the Dionex AutoTrace 280 is automatically loaded and the Microsoft Windows operating system can detect the system when the power is turned on.

1. For a local PC: Log onto Windows 7, Windows Vista, or Windows XP as an administrator.

   For a network PC: Log on as a user with local PC administrator privileges.
2. Insert the AutoTrace software CD (P/N 072581) into the CD drive.
3. Select the appropriate option:
   - **Windows XP** (Select this option if Windows Vista is installed.)
   - **Windows 7, 32-bit**
   - **Windows 7, 64-bit**

   NOTE If you are not sure which Windows 7 version is installed, contact your local PC administrator for assistance.
4. Follow the instructions in the AutoTrace SPE Instrument Setup Wizard to begin installing the software. By default, the software is installed in the following directories:
   - On a PC running Windows 7 (32-bit version): C:\Program Files (x86\Thermo Fisher Scientific\AutoTrace SPE Instrument
   - On a PC running Windows 7 (64-bit version): C:\Program Files (x64\Thermo Fisher Scientific\AutoTrace SPE Instrument

- On a PC running Windows Vista or Windows XP: C:\Program Files\AT

5. While the AutoTrace software is being installed, Windows will launch the Device Driver Installation Wizard. Follow the instructions on the wizard pages. When the wizard is done, click **Finish** to return to the AutoTrace software wizard.
6. The AutoTrace software wizard checks the version of the Help file on your PC and updates it, if necessary. If the newest Help version is already installed, a message reports that no update is required. Click **OK** to close the message box.
7. When the AutoTrace software wizard is done, click **Finish**. Remove the AutoTrace software CD from the drive. Store the CD in a safe place, away from heat and moisture.
8. Connect the USB cable from the Dionex AutoTrace 280 to a USB 2.0 port on the PC.

   NOTE If you connect the USB cable to a USB 3.0 port, the system will not operate correctly.

9. Turn on the power to the Dionex AutoTrace 280 and the PC.

B.3.7 Selecting the Method Type

Before creating any methods, you must select the method type that corresponds to the type of Dionex AutoTrace 280 (cartridge or disk model) on which the method will run. Typically, you select the method type that matches the model type set at the factory. However, it is possible to create a method for either type of model.

1. If Windows 7 is installed: Click **Start** (on the Windows taskbar), and point to **All Programs > AutoTrace SPE**. Click **Launch AT.EXE** to launch the AutoTrace software.

   If Windows Vista or Windows XP is installed: Click **Start** (on the Windows taskbar), and point to **All Programs > Dionex Corporation > Dionex AutoTrace 280**. Click **Launch AT.EXE** to launch the AutoTrace software.
2. Click **Login** on the toolbar.

3. Enter **ADMIN** in the **User ID** and **Password** fields.
4. On the AutoTrace software menu, click **Data** and select **Set Up Method Type**. A dialog box opens.

   –or–

   On the toolbar, click the down arrow next to **Data** and select **Set Up Method Type**.
5. Select **Cartridge Version** or **Disk Version** and click **OK**.

B.3.8 Connecting to the PC

While a computer is not required for Dionex AutoTrace 280 control, you must have access to a computer to write and download Dionex AutoTrace 280 methods. The computer must have the following specifications:

- Compatible with Microsoft Windows 7, Windows Vista, or Windows XP operating system, including the latest released service pack.
- Follow Microsoft's recommendation for the computer specification; these are the minimum hardware specifications:

Operating System	CPU	RAM
Windows 7 (32-bit)	1 GHz or faster	1 GB
Windows 7 (64-bit)	1 GHz or faster	2 GB
Windows Vista	400 MHz	128 MB
Windows XP	650 MHz	192 MB

To connect the USB cable:

1. Locate the USB cable (P/N 960777) in the Dionex AutoTrace 280 Ship Kit (P/N 071383).
2. Plug the cable's "A" connector into a USB 2.0 port on the AutoTrace software PC. Plug the cable's "B" connector into the USB receptacle on the right side of the Dionex AutoTrace 280 (see Figure 2-5).

NOTE If you connect the USB cable to a USB 3.0 port, the system will not operate correctly.

B.3.9 Connecting the Power Cord

Connect a modular power cord (IEC 320 C13) from the main power receptacle on the Dionex AutoTrace 280 right-side panel to a grounded, single-phase power source of 100 to 240 Vac, 47/63 Hz.

SHOCK HAZARD—To avoid electrical shock, a grounded receptacle must be used. Do not operate the Dionex AutoTrace 280 or connect it to AC power mains without an earthed ground connection.

The power supply cord is used as the main disconnect device. Make sure the socket-outlet is located near the Dionex AutoTrace 280 and is easily accessible.

Operation at AC input levels outside of the specified operating voltage range may damage the Dionex AutoTrace 280.

DANGER D'ÉLECTROCUTION—Pour éviter toute électrocution, il faut utiliser une prise de courant avec prise de terre. Ne l'utilisez pas et ne le branchez pas au secteur C.A. sans utiliser de branchement mis à la terre.

Le cordon d'alimentation principal est utilisé comme dispositif principal de débranchement. Veillez à ce que la prise de base soit située/installée près du module et facilement accessible.

STROMSCHLAGGEFAHR—Zur Vermeidung von elektrischen Schlägen ist eine geerdete Steckdose zu verwenden. Das Gerät darf nicht ohne Erdung betrieben bzw. an Wechselstrom angeschlossen werden.

Das Netzkabel ist das wichtigste Mittel zur Stromunterbrechung. Stellen Sie sicher, daß sich die Steckdose nahe am Gerät befindet und leicht zugänglich ist.

B.3.10 Installing the USB Driver

Follow the instructions below if Microsoft Windows Vista or Windows XP is installed on your PC. If Windows 7 is installed, skip this procedure; the USB driver is installed automatically when the AutoTrace software is installed.

NOTE Do not install the USB driver until after installation of the AutoTrace software (see Section B.3.6).

1. If you have not already done so, turn on the PC power.
2. For a local PC: Log onto Windows Vista or Windows XP as an administrator.

   For a network PC: Log on as a user with local PC administrator privileges.
3. Turn on the Dionex AutoTrace 280 power switch.
4. Windows Vista or Windows XP launches the Found New Hardware Wizard.
5. Complete the wizard by selecting the following options:
   a. If asked whether Windows can connect to Windows Update to search for software, select **No, not this time**.
   b. Select the **Install from a list or specific location (Advanced)** option and click **Next >**.
   c. On the next page of the wizard, verify that **Search for the best driver in these locations** is selected.
   d. Select the **Include this location in the search** check box. In the field below this, enter the letter of the CD drive. Browse to the location where the installation CD is located and select the USB_Driver folder. Click **Next >** to begin the driver installation.
   e. After the driver is installed, click **Finish** to exit the wizard.

C • Reordering Information

Part Number	Item	Quantity
	Cartridges	
074623	SolEx C18 1 mL cartridge with 0.1 g of packing	Pkg. of 100
074412	SolEx C18 3 mL cartridge with 0.5 g of packing	Pkg. of 50
074410	SolEx C18 6 mL cartridge with 1.0 g of packing	Pkg. of 30
074417	SolEx C18 6 mL cartridge with 0.5 g of packing	Pkg. of 50
074416	SolEx C18 (unendcapped material) 6 mL cartridge with 1.0 g of packing	Pkg. of 30
074415	SolEx C8 1 mL cartridge with 0.1 g of packing	Pkg. of 100
074413	SolEx C8 3 mL cartridge with 0.5 g of packing	Pkg. of 50
074411	SolEx C8 6 mL cartridge with 1.0 g of packing	Pkg. of 30
074589	SolEx Silica (unbonded) 6 mL cartridge with 0.5 g of packing	Pkg. of 50
070500	O-Ring for 1 mL cartridges	1
071057	O-Ring Kit for 3 mL cartridges	Pkg. of 6
071060	O-Ring Kit for 6 mL cartridges	Pkg. of 6
071074	O-Ring Kit for 6 mL glass cartridges	Pkg. of 6
071078	Plunger assembly for 1 mL cartridge	1
071079	Plunger assembly for 3 mL cartridge	1
071080	Plunger assembly for 6 mL cartridge	1
071081	Plunger assembly for 6 mL glass cartridge	1
071063	Cartridge Holder Replacement Kit	1
	Disks	
071059	Disk Holder O-Ring Kit	Pkg. of 6
072610	Dispersing Disk Kit	Pkg. of 25
071065	Disk Holder Replacement Kit	1
	Elution Manifold and Containers	
071068	Elution rack for 11 mm GC vials	1
071069	Elution rack for 15 mL conical tubes	1

Part Number	Item	Quantity
071070	Elution rack for 16 x 100 mm test tubes	1
071071	Elution rack for 17 x 60 mm vials	1
071072	Elution rack for 4 mL screw cap vials	1
071333	Sample rack, 6-position (holds 60 mL, 250 mL, and 1 L sample containers)	1
071056	Conical tubes, 15 mL	Case of 12
	Syringes	
070579	Liquid handling syringe, 10 mL	1
070296	Air push syringe, 10 mL	1
	Sample and Solvent Reservoirs	
048784	Sample vials, glass, 60 mL (includes lids)	Pkg. of 72
056284	Sample reservoirs, glass, 250 mL (includes lids)	Pkg. of 12
045900	Solvent or sample reservoir, glass, 1 liter	1
	Tubing Connections	
072599	Solvent Tubing Kit	1
070268	Sample Tubing Kit	1
071088	PTFE Tubing Kit	1
072600	PEEK Tubing Kit	1
071089	Waste Tubing Kit	1
072608	Tubing Fittings Kit (includes 10 fittings for 1.40-mm (0.055-in) ID PTFE tubing other than sample and waste lines)	1
	Sample Pumps	
071529	Sample pump for Dionex AutoTrace 280 cartridge model	1
070530	Sample pump for Dionex AutoTrace 280 disk model	1
	Valves	
071329	12-port valve and motor	1
072592	12-port valve rotor	1
072593	12-port valve stator	1

Part Number	Item	Quantity
072589	12-Port Valve Fittings Kit (includes 14 nuts and ferrules)	1
070325	Air push valve	1
070273	Switching valve	1
	Miscellaneous	
072598	Dionex AutoTrace 280 Preventive Maintenance Kit	1
954745	Fuse, 3.15 amp IEC127 fast-blow	1
960777	USB cable, 6 ft.	1
960779	USB cable, 16 ft.	1

D • Glossary

Air Factor

The adjustable factor that determines the distance liquid is pushed beyond the 12-port valve and the switching valves. The air push factor is used in **Solvent Conditioning** and **Elute to Soak** steps and pushes the liquid partially through the cartridge (or disk) path so that the cartridge (or disk) bed is not dried out.

The number (from 0.3 to 5) increases or decreases the standard 1.2 mL of air that follows the liquid being sent through the cartridge by a factor of 0.3 to 5 times.

If volumes greater than 5 mL are required, the **Dry with Gas** step in "Creating a Method to Clean the Sample Lines" on page 45 is recommended.

Air Push

A flow of air generated by the air push syringe that clears liquid from the liquid handling syringe and tubing lines after conditioning, rinsing, eluting, and syringe washing steps.

AutoTrace Software

Software used to set up, write, and review a Dionex AutoTrace 280 method and then run the method to control operation of the Dionex AutoTrace 280.

Flow Rate

The speed (in mL/min) at which to run the Dionex AutoTrace 280 syringes. Flow rates for solid phase conditioning, loading, rinsing, and eluting operations are designated in the Set Up Parameters window in the AutoTrace software.

Maximum Elution Volume

The maximum volume that can be eluted into the collection container, based on the container size.

Method

The list of steps that defines the operating conditions for a run. The method is created in the AutoTrace software and is then used by the software to run the samples.

Push Delay

The time (in seconds) to pause after liquid has been sent through the cartridge (or disk); this delay allows the pressure to equilibrate.

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