



thermoscientific

Vanquish

Split Samplers

VC-A12, VC-A13,
VF-A10, VF-A40,
VH-A10, VH-A40

Operating Manual

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SCIENTIFIC

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Original Operating Manual

The hardware descriptions in this manual revision refer to devices: VC-A12-A-02, VC-A13-A-02, VF-A10-A-02, VF-A40-A-02, VH-A10-A-02, VH-A40-A-02.

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Contents

1	Using this Manual	11
1.1	About this Manual	12
1.2	Conventions	13
1.2.1	Conventions for Safety Messages	13
1.2.2	Special Notices	13
1.2.3	Typographical Conventions	14
1.3	Reference Documentation	15
2	Safety	17
2.1	Safety Symbols and Signal Words	18
2.1.1	Safety Symbols and Signal Words in this Manual	18
2.1.2	Observing this Manual	18
2.1.3	Safety Symbols on the Device	19
2.1.4	Rating Plate	19
2.2	Intended Use	20
2.3	Safety Precautions	21
2.3.1	General Safety Information	21
2.3.2	Qualification of the Personnel	22
2.3.3	Personal Protective Equipment	23
2.3.4	Electrical Safety Precautions	23
2.3.5	General Residual Hazards	24
2.3.6	In Case of Emergency	26
2.4	Solvent and Additive Information	27
2.4.1	General Compatibility	27
2.4.2	Allowed pH Ranges	27
2.4.3	Allowed Concentrations	28
2.4.4	Further Information	28
2.5	Compliance Information	29
3	Device Overview	31
3.1	Autosampler Features	32
3.2	Operating Principle	34
3.3	Interior Components	37
3.3.1	Single Split Samplers (VC-A12 and VC-A13)	37
3.3.2	Single Split Samplers (VH-A10 and VF-A10)	40
3.3.3	Dual Split Samplers (VH-A40 and VF-A40)	42

3.4	Sample Compartment	44
3.4.1	Sample Compartment Thermostating (except VC-A13).....	44
3.4.2	Carousel.....	45
3.4.3	Rack Type Identification	46
3.4.4	Sample Capacity Extension with the Charger.....	46
3.5	Leak Detection	48
3.6	Operation.....	49
4	Unpacking	51
4.1	Unpacking	52
4.2	Scope of Delivery	55
5	Installation	57
5.1	Safety Guidelines for Installation	58
5.2	Installing the Device	59
5.3	Site Requirements.....	61
5.3.1	Power Considerations	61
5.3.2	Power Cord.....	61
5.3.3	Condensation	62
5.4	Accessing the Interior Components	63
5.5	Setting Up the Hardware	64
5.5.1	System Arrangement.....	64
5.5.2	Connecting the Device	65
5.5.3	Connecting the Power Cord	67
5.6	Setting Up the Flow Connections.....	68
5.6.1	General Information and Guidelines.....	68
5.6.2	Guiding Capillaries and Tubing Through the System.....	69
5.6.3	Connecting Fittings, Capillaries, and Tubing	71
5.6.4	Guiding Liquids to Waste	73
5.7	Seal Wash System	74
5.7.1	Choosing the Seal Wash Liquid	74
5.7.2	Setting Up the Seal Wash System	75
5.8	Needle Wash System	82
5.8.1	Choosing the Needle Wash Liquid.....	83
5.8.2	Connecting the Needle Wash Reservoir.....	83
5.9	Injection Valve	87
5.9.1	Port assignments of the injection valve	87

5.9.2	Connecting the Pump and Autosampler	89
5.9.3	Connecting the Column Compartment	91
5.10	Installing the Protective Cover (Optional for VH-A10 and VF-A10)	92
5.11	Insulation Loop Cover (VC-A12 and Dual Split Samplers only).....	94
5.11.1	Removing the Insulation Loop Cover	95
5.11.2	Installing the Insulation Loop Cover	95
5.12	Turning On the Device	97
5.13	Setting Up the Device in the Software	98
6	Operation.....	99
6.1	Introduction to this Chapter	100
6.2	Safety Guidelines for Operation.....	101
6.3	General Guidelines.....	103
6.4	Control Elements	104
6.4.1	Keypad.....	104
6.4.2	Status Indicators.....	107
6.5	Power On/Off Control	108
6.6	Preparing the Device for Operation	109
6.6.1	Thermostating the Sample Compartment	111
6.6.2	Loading the Carousel.....	112
6.6.3	Rack Type Settings.....	115
6.6.4	Synchronizing the Injection Time with the Pump Strokes.....	116
6.7	Important Operating Parameters	117
6.7.1	User-Defined Programs	121
6.8	Operation with the Vanquish Charger	122
6.8.1	Guidelines for Carousel and Charger.....	122
6.8.2	Guidelines for Operational Settings	123
6.8.3	Closing the Charger Extension Opening	123
6.9	Shutting Down the Device	125
6.9.1	Short-Term Shutdown (Interruption of Operation)	125
6.9.2	Long-Term Shutdown	126
6.9.3	Restart after Long-Term Shutdown.....	129
7	Maintenance and Service	131
7.1	Introduction to Maintenance and Service	132
7.2	Safety Guidelines for Maintenance and Service	133
7.3	General Rules for Maintenance and Service	135

7.4	Routine and Preventive Maintenance	136
7.4.1	Maintenance Plan	136
7.4.2	Cleaning or Decontaminating the Device.....	137
7.4.3	Predictive Performance.....	139
7.5	Before Maintenance	140
7.5.1	Preparing the Autosampler for Maintenance	140
7.5.2	Securing the Needle Unit	140
7.5.3	Removing the Sample Loop Carrier Plate (Dual Split Samplers only).....	142
7.6	Mounting Frame (Dual Split Samplers only)	143
7.6.1	Removing and Installing the Horizontal Frame Part.....	144
7.6.2	Removing and Installing the Vertical Frame Part.....	145
7.7	Needle Wash System	147
7.7.1	Needle Wash Liquid Guidelines.....	147
7.7.2	Washing the Needle	147
7.7.3	Replacing Needle Wash Lines.....	148
7.8	Seal Wash System	156
7.8.1	Replacing the Seal Wash Lines	156
7.9	Sample Loop.....	169
7.9.1	Components of the Sample Loop Unit	169
7.9.2	Replacing the Sample Loop in a Single Split Sampler	170
7.9.3	Replacing Sample Loops in a Dual Split Sampler	173
7.9.4	Completing the Sample Loop Replacement	179
7.10	Replacing Needle Unit and Needle Seat	181
7.11	Metering Device Head	187
7.11.1	Disconnecting and Connecting Metering Device Head Capillaries.....	188
7.11.2	Replacing the Metering Device Head	189
7.11.3	Piston Gets Stuck Upon Metering Device Head Removal	193
7.12	Injection Valve	194
7.12.1	Guidelines for Handling the Injection Valve	194
7.12.2	Inspecting the Injection Valve for Leakage	194
7.12.3	Replacing the Injection Valve	196
7.13	Drain Pump Tubing	202
7.13.1	Testing the Drain Pump Tubing for Blockage	203
7.13.2	Testing the Drain Pump Tubing for Leakage	203
7.14	Replacing the Drain Pump Tubing.....	205
7.15	After Maintenance	207
7.15.1	Restarting the Autosampler after Maintenance	207
7.15.2	Installing the Sample Loop Carrier Plate (Dual Split Samplers only)	208

7.15.3	Unlocking the Needle Unit	209
7.16	Replacing the Main Power Fuses	212
7.17	Updating the Device Firmware	214
7.18	Replacing the Doors	216
7.19	Transporting or Shipping the Device.....	218
7.19.1	Preparing the Device for Transport.....	218
7.19.2	Transporting the Device to a New Location	221
7.19.3	Shipping the Device.....	222
7.20	Replacing the Slide-In Module	223
7.20.1	Removing the Slide-In Module	223
7.20.2	Returning the Slide-In Module	225
7.20.3	Installing the Slide-In Module	226
7.20.4	Setting Up the Slide-In Module	228
8	Troubleshooting	229
8.1	General Information about Troubleshooting.....	230
8.2	Messages.....	232
8.3	Operating Issues.....	237
8.3.1	Resolving Liquid Leaks.....	237
8.3.2	Resolving Clogging in the Autosampler.....	238
8.3.3	Additional Operating Issues	242
9	Modifying the Autosampler for Specific Applications.....	243
9.1	Normal-Phase Compatible Solvents and Additives.....	244
10	Specifications	245
10.1	Performance Specifications	246
10.2	Physical Specifications	250
11	Accessories, Consumables and Replacement Parts	251
11.1	General Information	252
11.2	Ship Kit	253
11.2.1	Single Split Samplers (VC-A12 and VC-A13)	253
11.2.2	Single Split Samplers (VH-A10 and VF-A10)	254
11.2.3	Dual Split Samplers (VH-A40 and VF-A40).....	254
11.3	Optional Accessories.....	255
11.4	Consumables and Replacement Parts.....	256

- 12 Appendix..... 261**
 - 12.1 Compliance Information 262
 - 12.1.1 Declarations of Conformity 262
 - 12.1.2 WEEE Compliance 263
 - 12.1.3 FCC Compliance..... 263
 - 12.1.4 Manual Release History..... 264
 - 12.2 Digital I/O 265

- Index 269**

1 Using this Manual

This chapter provides information about this manual, the conventions used throughout the manual, and the reference documentation that is available in addition to this manual.

1.1 About this Manual

This manual describes the functional features and operating principle of your Vanquish™ device and provides instructions for installation, set up, start up, shut down, operation, maintenance and troubleshooting.

This manual also contains safety messages, precautionary statements, and special notices. Follow these properly to prevent personal injury, damage to the device, or loss of data.

Note the following:

- The device configuration may vary; therefore, not all descriptions necessarily apply to your particular device.
- If some detail applies to only one model or variant, the model or variant is identified by name.
- Illustrations in this manual are provided for basic understanding. They can vary from the actual model of the device or component. However, this does not influence the descriptions. No claims can be derived from the illustrations in this manual.

The descriptions in this manual assume that the device is installed in the Vanquish system stack. If this is not the case, additional hardware is required and must be ordered separately. The information in this manual applies correspondingly.

1.2 Conventions

This section describes the conventions that are used throughout this manual.

1.2.1 Conventions for Safety Messages

The safety messages and precautionary statements in this manual appear as follows:

- Safety messages or precautionary statements that apply to the entire manual and all procedures in this manual are grouped in the Safety chapter.
- Safety messages or precautionary statements that apply to an entire section or to multiple procedures in a section appear at the beginning of the section to which they apply.
- Safety messages that apply to only a particular section or procedure appear in the section or procedure to which they apply. They appear different from the main flow of text.

Safety messages are often preceded by an alert symbol and/or alert word. The alert word appears in uppercase letters and in bold type.

Make sure that you understand and follow all safety messages presented in this manual.

1.2.2 Special Notices

Special notices and informational notes in this manual appear different from the main flow of text. They appear in boxes and a note label identifies them. The label text appears in uppercase letters and in bold type.

NOTICE

Highlights information necessary to prevent damage to the device or invalid test results.

TIP Highlights information of general interest or helpful information that can make a task easier or optimize the performance of the device.

1.2.3 Typographical Conventions

These typographical conventions apply to the descriptions in this manual:

Data Input and Output

The following appears in **bold** type:

- Input that you enter by the keyboard or that you select with the mouse
- Buttons that you click on the screen
- Commands that you enter by the keyboard
- Names of, for example, dialog boxes, properties, and parameters

For brevity, long expressions and paths appear in the condensed form, for example: Click **File > Save as**.

References and Messages

- References to additional documentation appear *italicized*.
- Messages that appear on the screen are identified by quotation marks.

Viewpoint

If not otherwise stated, the expressions *left* and *right* in this manual always refer to the viewpoint of a person that is facing the device from the front.

Particularly Important Words

Particularly important words in the main flow of text appear *italicized*.

Electronic Manual Version (PDF)

The electronic version (PDF) of the manual contains numerous links that you can click to go to other locations within the manual. These include:

- Table of contents entries
- Index entries
- Cross-references (in blue text)

1.3 Reference Documentation

In addition to this operating manual, other documentation is available for reference.

Hardware Documentation

Additional hardware documentation includes the following:

- *Operating manuals* for the other modules of the Vanquish system
- *Vanquish System Operating Manual*
- *Instrument Installation Qualification Operating Instructions*

Thermo Fisher Scientific provides up-to-date operating manuals as PDF (Portable Document Format) files that you can access from our customer manuals web site. To open and read the PDF files, Adobe™ Reader™ or Adobe™ Acrobat™ is required.

Go to the following web site: www.thermofisher.com/HPLCmanuals

Software Documentation

Additional software documentation includes the following:

- *Chromeleon™ Help and documents*
The *Chromeleon Help* provides extensive information and comprehensive reference material for all aspects of the software.

In addition, the following documentation is available (availability depends on the software version):

- *Installation Guide*
For basic information about device installation and configuration, refer to the *Installation Guide*.
- *Instrument Configuration Manager Help*
For specific information about a certain device, refer to the *Instrument Configuration Manager Help*. In Chromeleon 7, devices are called modules.
- *Quick Start Guide*
For information about the main elements of the user interface and step-by-step guidance through the most important workflows, refer to the *Quick Start Guide*.
- *Reference Card*
For a concise overview of the most important workflows, refer to the *Reference Card*.

TIP The *Chromeleon Help* and documents are included in the software shipment.

Third-Party Documentation

Refer also to the user documentation provided by the manufacturers of third-party components and materials, for example, Safety Data Sheets (SDSs).

2 Safety

This chapter provides general and specific safety information and informs about the intended use of the device.

2.1 Safety Symbols and Signal Words

2.1.1 Safety Symbols and Signal Words in this Manual

This manual contains safety messages to prevent injury of the persons using the device.

The safety symbols and signal words in this manual include the following:



Always be aware of the safety information. Do not proceed until you have fully understood the information and consider the consequences of what you are doing.



CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.



WARNING

Indicates a hazardous situation that, if not avoided, could result in serious injury.

2.1.2 Observing this Manual

Observe the following:

- Before installing or operating the device, read this manual carefully to be familiar with the device and this manual. The manual contains important information with regard to user safety as well as use and care of the device.
- Always keep the manual near the device for quick reference.
- Save this manual and pass it on to any subsequent user.



Read, understand, and comply with all safety messages and precautionary statements presented in this manual.

2.1.3 Safety Symbols on the Device

The table lists the safety symbols that appear on the device or on labels affixed to the device. Follow the safety notices in this manual to prevent the risk of operator injury or damage to the device.

Symbol	Description
	Indicates a potential hazard. Refer to this manual to avoid the risk of personal injury and/or to prevent damage to the device.
— O	Power supply is on Power supply is off
	Indicates alternating current.
	Indicates a potential pinch point hazard. Keep your hands clear to avoid harming your hands.

2.1.4 Rating Plate

The rating plate is present on the device near the electrical connections. The rating plate indicates the serial number, part number, module name, revision number (if any), and the line and fuse rating.

TIP An additional type label on the leak tray of the device indicates the module name, serial number, part number, and revision number (if any). To facilitate device identification, have the information from this label available when communicating with Thermo Fisher Scientific.

2.2 Intended Use

The device is intended to be part of the Vanquish system.

The intended use of the Vanquish system is to analyze mixtures of compounds in sample solutions.

The device is for use by qualified personnel and in laboratory environment only.

The device and Vanquish system are intended to be used as General Laboratory Equipment (GLE).

They are not intended for use in diagnostic procedures.

Laboratory Practice

Thermo Fisher Scientific recommends that the laboratory in which the Vanquish system is used follow best practices for LC analyses. This includes among others:

- Using appropriate standards
- Regularly running calibration
- Establishing shelf life limits and following them for all consumables used with the system
- Running the system according to the laboratory's verified and validated 'lab developed test' protocol

2.3 Safety Precautions

2.3.1 General Safety Information

All users must observe the general safety information presented in this section and all specific safety messages and precautionary statements elsewhere in this manual during all phases of installation, operation, troubleshooting, maintenance, shutdown, and transport of the device.



If the device is used in a manner not specified by Thermo Fisher Scientific, the protection provided by the device could be impaired. Observe the following:

- Operate the device only within its technical specifications.
- Use only the replacement parts and additional components, options, and peripherals specifically authorized and qualified for the device by Thermo Fisher Scientific.
- Perform only the procedures that are described in this operating manual and in supporting documents for the device. Follow all instructions step by step and use the tools recommended for the procedure.
- Open the enclosure of the device and other components only if specifically instructed to do so in this manual.
- Thermo Fisher Scientific cannot be held liable for any damage, material or otherwise, resulting from inappropriate or improper use of the device. If there is any question regarding appropriate usage, contact Thermo Fisher Scientific before proceeding.

Safety Standard

This device is a Safety Class I instrument (provided with terminal for protective grounding). The device has been manufactured and tested according to international safety standards.

2.3.2 Qualification of the Personnel

Observe the information below on the proper qualification of the personnel installing and/or operating the device.



Installation

Only skilled personnel are permitted to install the device and to establish the electrical connections according to the appropriate regulations.

- Thermo Fisher Scientific recommends always having service personnel certified by Thermo Fisher Scientific perform the installation (for brevity, referred to as Thermo Fisher Scientific service engineer).
- If a person other than a Thermo Fisher Scientific service engineer installs and sets up the module, the installer is responsible for ensuring the safety of the module and system.



General Operation

The device is designed to be operated only by trained and qualified personnel in a laboratory environment.

All users must know the hazards presented by the device and the substances they are using. All users should observe the related Safety Data Sheets (SDSs).

2.3.3 Personal Protective Equipment

Wear personal protective equipment and follow good laboratory practice to protect you from hazardous substances. The appropriate equipment depends on the hazard. For advice on the hazards and the equipment required for the substances you are using, refer to the material handling and safety data sheet provided by the vendor.



An eyewash facility and a sink should be available nearby. If any substance contacts your skin or eyes, wash the affected area and seek medical attention.

Protective Clothing

To protect you from chemical splashes, harmful liquids, or other contamination, put on appropriate protective clothing, such as a lab coat.

Protective Eyewear

To prevent liquids from striking your eyes, put on appropriate protective eyewear, such as safety glasses with side shields. If there is a risk of splashing liquids, put on goggles.

Gloves

To protect you from harmful liquids and avoid personal injury during maintenance or service, put on appropriate protective gloves.

2.3.4 Electrical Safety Precautions



WARNING—Electric Shock or Damage to the Device

High voltages are present inside the device that could cause an electric shock or damage to the device.

- Do not make any changes to the electrical or grounding connections.
- If you suspect any kind of electrical damage, disconnect the power cord and contact Thermo Fisher Scientific Technical Support for assistance.
- Do not open the housing or remove protective panels unless specifically instructed to do so in this manual.
- Do not place liquid reservoirs directly upon the device. Liquid might leak into the device and get into contact with electronic components causing a short circuit. Instead, place liquid reservoirs in the solvent rack that is available for the Vanquish system.

2.3.5 General Residual Hazards

Pay attention to the following general residual hazards when working with the device:



WARNING—Hazardous Substances

Solvents, mobile phases, samples, and reagents might contain toxic, carcinogenic, mutagenic, infectious, or otherwise harmful substances. The handling of these substances can pose health and safety risks.

- Be sure that you know the properties of all substances that you are using. Avoid exposure to harmful substances. If you have any doubt about a substance, handle the substance as if it is potentially harmful.
- Wear personal protective equipment as required by the hazard and follow good laboratory practice.
- Reduce the volume of substances to the minimum volume required for sample analysis.
- Avoid handling of solvent reservoirs above head height.
- Do not operate the device in a potentially flammable environment.
- Avoid accumulation of harmful substances. Make sure that the installation site is well ventilated.
- Dispose of hazardous waste in an environmentally safe manner that is consistent with local regulations. Follow a regulated, approved waste disposal program.



WARNING—Biohazard

Biohazardous material, for example microorganisms, cell cultures, tissues, body fluids, and other biological agents can transmit infectious diseases. To avoid infections with these agents:

- Assume that all biological substances are at least potentially infectious.
- Wear personal protective equipment as required by the hazard and follow good laboratory practice.
- Dispose of biohazardous waste in an environmentally safe manner that is consistent with local regulations. Follow a regulated, approved waste disposal program.

**WARNING—Self-Ignition of Solvents**

Solvents with a self-ignition temperature below 150 °C might ignite when in contact with a hot surface (for example, due to leakage in the chromatography system).

Avoid the use of these solvents.

**WARNING—Hazardous Vapors**

Mobile phases and samples might contain volatile or flammable solvents. The handling of these substances can pose health and safety risks.

- Avoid accumulation of these substances. Make sure that the installation site is well ventilated.
- Avoid open flames and sparks.
- Do not operate the device in the presence of flammable gases or fumes.

**WARNING—Flammable and Hazardous Vapors**

Flammable or hazardous vapors can escape from improperly sealed sample containers with flammable or volatile samples, and can accumulate inside the autosampler. This can pose health and safety risks and lead to wrong results.

- Use only vials or well plates that are made gas-tight by means of caps, sealing mats, or sealing tapes. Refer to the latest list of closures approved by Thermo Fisher Scientific.
- Inspect vials for cracks or defects before use. Do not use cracked or damaged vials.

**CAUTION—Escape of Hazardous Substances from PEEK Capillaries**

Some capillaries in the system are made of PEEK. Swelling or attack by acids can cause PEEK capillaries to start leaking or to burst. Certain chemicals, for example, trichloromethane (CHCl₃), dimethyl sulfoxide (DMSO), or tetrahydrofuran (THF) can cause PEEK to swell. Concentrated acids, such as sulfuric acid and nitric acid, or a mixture of hexane, ethyl acetate, and methanol, can attack PEEK.

- Swelling or attack is not a problem with brief flushing procedures.
- For more information, refer to the technical literature on the chemical resistance of PEEK.

**CAUTION—Allergic Reaction**

Some capillaries in the system are made of MP35N™, a nickel/cobalt-based alloy. Individuals with sensitivity to nickel/cobalt may show an allergic reaction from skin contact.

**CAUTION—Sparking due to Electrostatic Discharge**

Liquid flowing through capillaries can generate static electricity. This effect is particularly present with insulating capillaries and non-conductive solvents (for example, pure acetonitrile). Discharge of electrostatic energy might lead to sparking, which could constitute a fire hazard.

Prevent the generation of static electricity near the chromatography system.

2.3.6 In Case of Emergency

**WARNING—Safety Hazard**

In case of emergency, disconnect the device from the power line.

2.4 Solvent and Additive Information

2.4.1 General Compatibility

To protect optimal functionality of the Vanquish system, observe these recommendations on the use of solvents and additives:

- The system must be used with reversed-phase (RP) compatible solvents and additives only.
- Use only solvents and additives that are compatible with all parts in the flow path.

TIP In a Vanquish Core system, normal-phase (NP) compatible solvents and additives may be used if the system modules have been modified for NP applications. Refer to the *Vanquish System Operating Manual*.

Piston Seal Compatibility

- In rare cases, a shortened lifetime of reversed-phase (UHMW-PE) piston seals has been observed with high pH, ammonium hydroxide containing mobile phases and prolonged exposure.

2.4.2 Allowed pH Ranges

Allowed pH ranges (standard system configuration):

System (Standard Configuration)	Allowed pH ranges	Remarks
Vanquish Core	1-13	<ul style="list-style-type: none"> • <i>pH value of 2 (Vanquish Horizon/Flex)</i>: Short-term use only. The application time should be as short as possible. Flush the system thoroughly after these applications. • <i>pH value of 1-2 (Vanquish Core)</i>: The application time should be as short as possible. Flush the system thoroughly after these applications. • <i>pH values higher than 9.5 with optical detectors</i>: Avoid using mobile phases with a pH value higher than 9.5 together with optical detectors. This can impair the functionality and optical performance of the detector flow cell.
Vanquish Horizon	2-12	
Vanquish Flex		

2.4.3 Allowed Concentrations

Allowed concentrations (standard system configuration):

System (Standard Configuration)	Chloride	Buffer	Remarks
Vanquish Core	0.1 mol/L or less	1 mol/L or less	<i>High chloride concentration:</i> The application time should be as short as possible. Flush the system thoroughly after these applications.
Vanquish Horizon Vanquish Flex	1 mol/L or less	-	

2.4.4 Further Information

- For details about the materials that are used in the analytical flow path of the device, see the *Specifications* chapter in this manual. For information about the materials that are used in the flow path of the other modules in the Vanquish system, refer to the *Specifications* chapter in the *Operating Manual* for the modules.
- Observe the general guidelines and recommendations on the use of solvents and additives in the chromatography system. Refer to *Use of Solvents and Additives* in the *Vanquish System Operating Manual*.
- Refer also to the *Operating Manuals* for all modules in the Vanquish system. They may provide additional guidelines and information.

NOTICE

If the system configuration includes a non-standard detector, for example, a charged aerosol detector or refractive index detector, refer to the *Operating Manual* for the detector for specific recommendations regarding solvents and additives.

2.5 Compliance Information

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the device is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in this manual.

Changes that you make to the device may void compliance with one or more of these EMC and safety standards. Changes to the device include replacing a part or adding components, options, or peripherals not specifically authorized and qualified for the product by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

The device has been shipped from the manufacturing site in a safe condition.

See also

 [Compliance Information \(► page 262\)](#)

3 Device Overview

This chapter introduces you to the device and the main components.

3.1 Autosampler Features

The autosampler comprises the following features:

Main Features

- Split-loop injection principle for zero sample loss, short injection times at high precision and accuracy, minimum carry-over and variable injection volumes
- Standard injection volume
 - ◆ for VH- and VF-autosamplers from 0.01 to 25 μL , extendable to 100 μL
 - ◆ for VC-Autosamplers from 0.01 to 100 μL , extendable to 1000 μL
- Support of sample racks and well plates with a footprint as specified by the Society for Biomolecular Screening (SBS footprint)
- Seal wash for the metering device head to maintain the lifetime of the seals, especially with eluents that contain salts
- Washing of the outer needle surface for minimum LC/MS carry-over
- VH- and VF-autosamplers only: Biocompatible components
- Operating pressure as specified:
 - ◆ VC-autosamplers are designed for an operating pressure of up to 70 MPa
 - ◆ VF-autosamplers are designed for an operating pressure of up to 103 MPa
 - ◆ VH-autosamplers are designed for an operating pressure of up to 151 MPa
- All autosamplers except VC-A13: Temperature control for thermostating the sample compartment. For details, see [Sample Compartment Thermostating \(except VC-A13\)](#) (▶ page 44).
- A barcode reader inside the autosampler identifies sample racks and well plates with barcodes for Vanquish rack type identification. For details, see [Rack Type Identification](#) (▶ page 46).
- Sample compartment is extendable using the Vanquish Charger. For information about the Charger, refer to the *Charger Operating Manual*. For details, see [Sample Capacity Extension with the Charger](#) (▶ page 46).

- VC-A12 / VC-A13 only:
 - ◆ Multidraw for high sample volumes up to 1000µL
 - ◆ Adjustable gradient delay volume (GDV)
 - ◆ As an optional feature for VC-autosamplers:
Normal-phase (NP) support. Modification of the system required. For details, refer to the *Vanquish System Operating Manual*.

Special Features of the Dual Split Sampler

The dual split sampler provides two independent injection units. Each injection unit includes its own injection valve, sample loop, metering device, needle unit, and needle seat as well as wash port. Only the sample compartment and its temperature control is shared. This allows connecting two pumps, two columns and individual solvents for multi-channel liquid chromatography.

3.2 Operating Principle

The operating principle of the autosampler is based on the split-loop injection principle. In this injection principle, the needle is part of the sample loop.

The needle moves from the needle seat to the pre-defined sample in the carousel. The needle descends into the sample container. The metering device draws the sample from the sample container through the needle into the sample loop. The needle withdraws from the sample container and moves back to the needle seat, which seals the needle tip against the system pressure. The injection valve switches to Inject position to establish the required flow path so that the eluent from the pump flows through metering device, sample loop and needle and flushes the sample through the injection valve onto the column. To remove residual sample from the needle between injections, the needle moves to the wash port and descends into it. The needle wash pump supplies needle wash liquid to the wash port to rinse the outer surface of the needle to the wash waste.

Dual Split Samplers (VH-A40 and VF-A40)

In the dual split sampler, each of the two independent injection units operate in the same way as the injection unit in the single split sampler.

The dual split sampler considers the shared carousel and schedules the two needle movements into the sample compartment accordingly.

The following picture illustrates how the VH- and VF-Autosamplers operates:

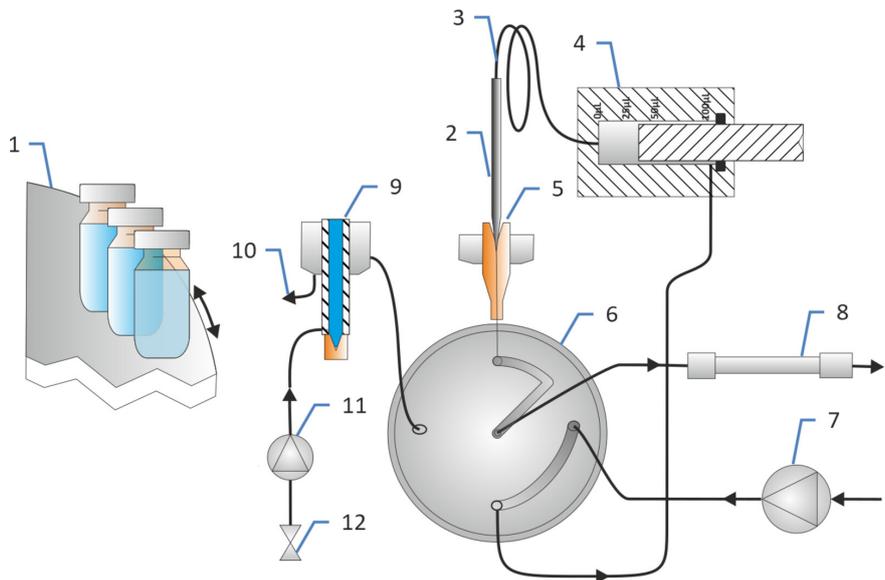


Figure 1: Operating principle VH- and VF-Autosampler

No.	Description
1	Carousel
2	Needle
3	Sample loop
4	Metering device
5	Needle seat
6	Injection valve
7	Pump
8	Column
9	Wash port
10	Wash waste
11	Needle wash pump
12	Needle wash liquid

For detailed information on the assignments of the ports see [Port assignments of the injection valve](#) (► page 87).

The following picture illustrates how the VC-Autosampler operates:

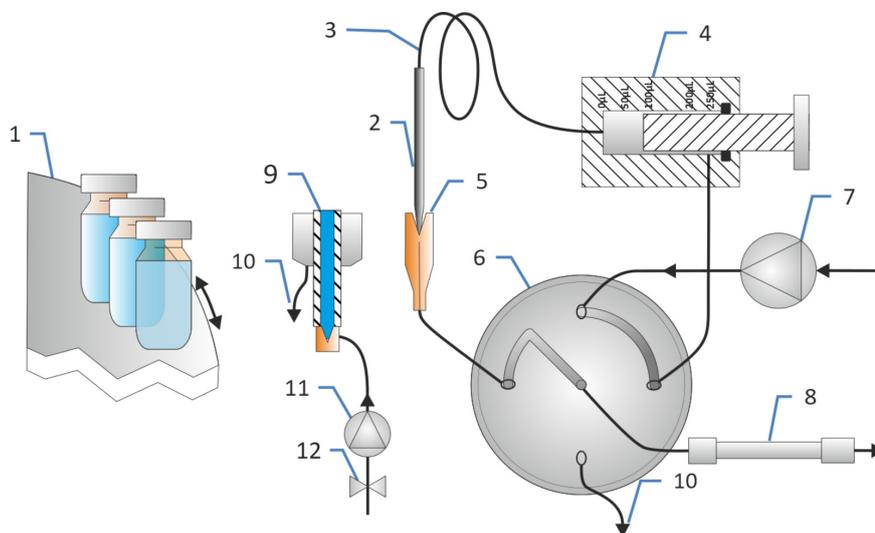


Figure 2: Operating principle VC-Autosampler

No.	Description
1	Carousel
2	Needle
3	Sample loop
4	Metering device
5	Needle seat
6	Injection valve
7	Pump
8	Column
9	Wash port
10	Wash waste
11	Needle wash pump
12	Needle wash liquid

For detailed information on the assignments of the ports see [Port assignments of the injection valve](#) (► page 87).

3.3 Interior Components

3.3.1 Single Split Samplers (VC-A12 and VC-A13)

The user-accessible components are located directly behind the front doors of the autosampler:

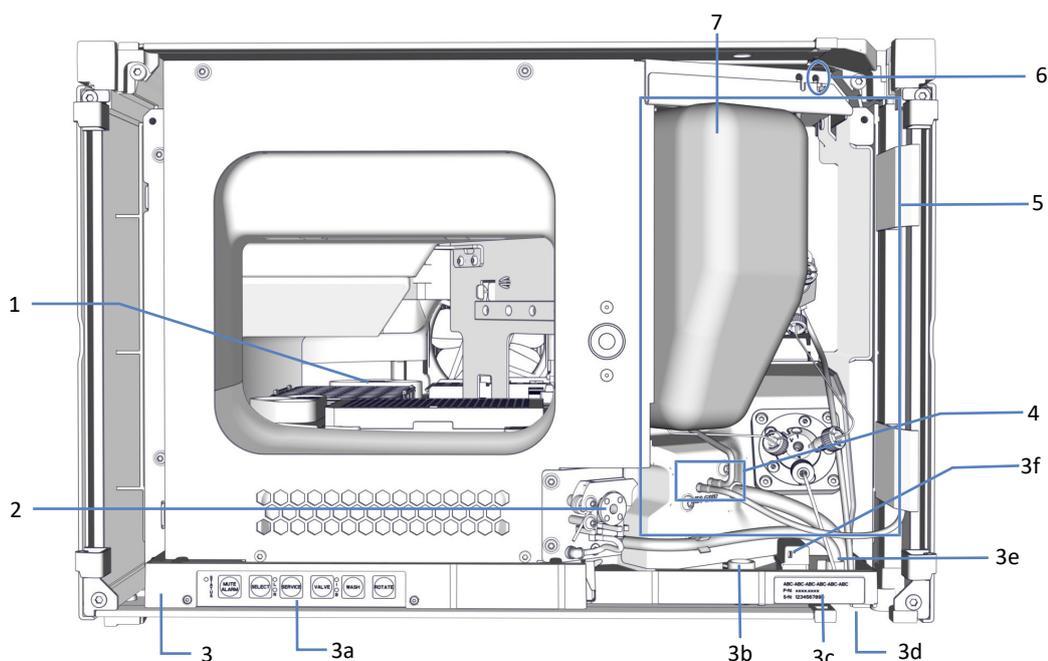


Figure 3: VC-A12 Single split sampler interior view

No.	Description
1	Sample compartment with carousel (see Sample Compartment (▶ page 44))
2	Drain pump
3	Leak tray, with:
3a	Keypad with status indicators
3b	Pump capillary guide hole in slide-in module and enclosure
3c	Type label (with module name, serial number, part number, revision number (if any))
3d	Drain funnel
3e	Drain ports
3f	Leak sensor
4	Needle wash pump inlet (left) and outlet (right)
5	Injection unit (refer to next page for detailed view)
6	Wash tubing connectors with seal wash inlet port (right tubing connector)
7	VC-A12 only: Insulation loop cover

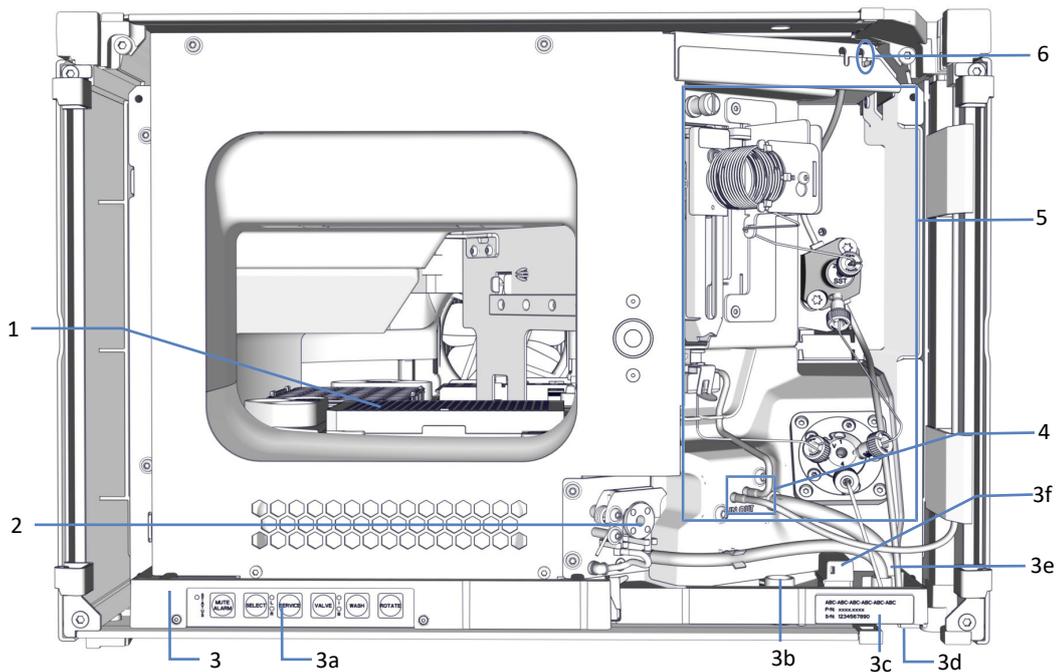


Figure 4: VC-A12 with removed loop cover / VC-A13 Single split sampler interior view

No.	Description
1	Sample compartment with carousel For details, see Sample Compartment (▶ page 44).
2	Drain pump
3	Leak tray, with:
3a	Keypad with status indicators
3b	Pump capillary guide hole in slide-in module and enclosure
3c	Type label, indicating the module name, serial number, part number, and revision number (if any)
3d	Drain funnel
3e	Drain ports
3f	Leak sensor
4	Needle wash pump inlet (left) and outlet (right)
5	Injection unit (refer to next page for detailed view)
6	Wash tubing connectors, with seal wash inlet port (right tubing connector)
7	VC-A12 only: Insulation loop cover

Injection Unit

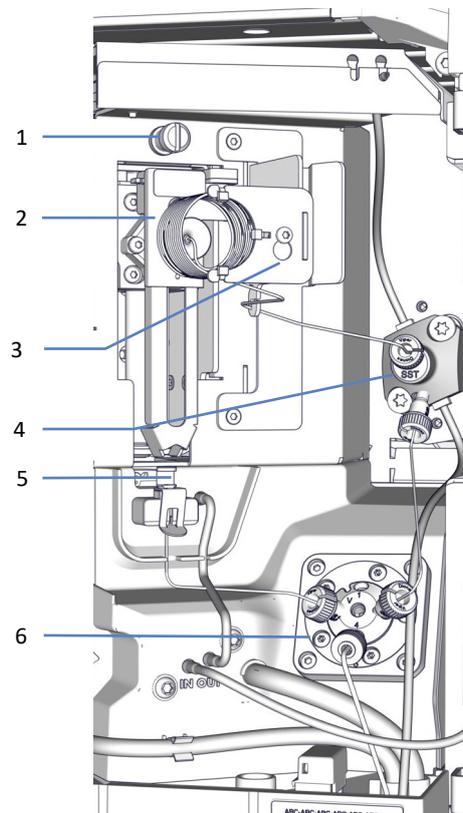


Figure 5: Injection unit in the VC-Single split sampler (without insulation loop cover)

No.	Description
1	Shipping lock screw for needle unit
2	Needle unit with vial pusher
3	Sample loop unit
4	Metering device head
5	Needle seat
6	Injection valve

3.3.2 Single Split Samplers (VH-A10 and VF-A10)

Overview

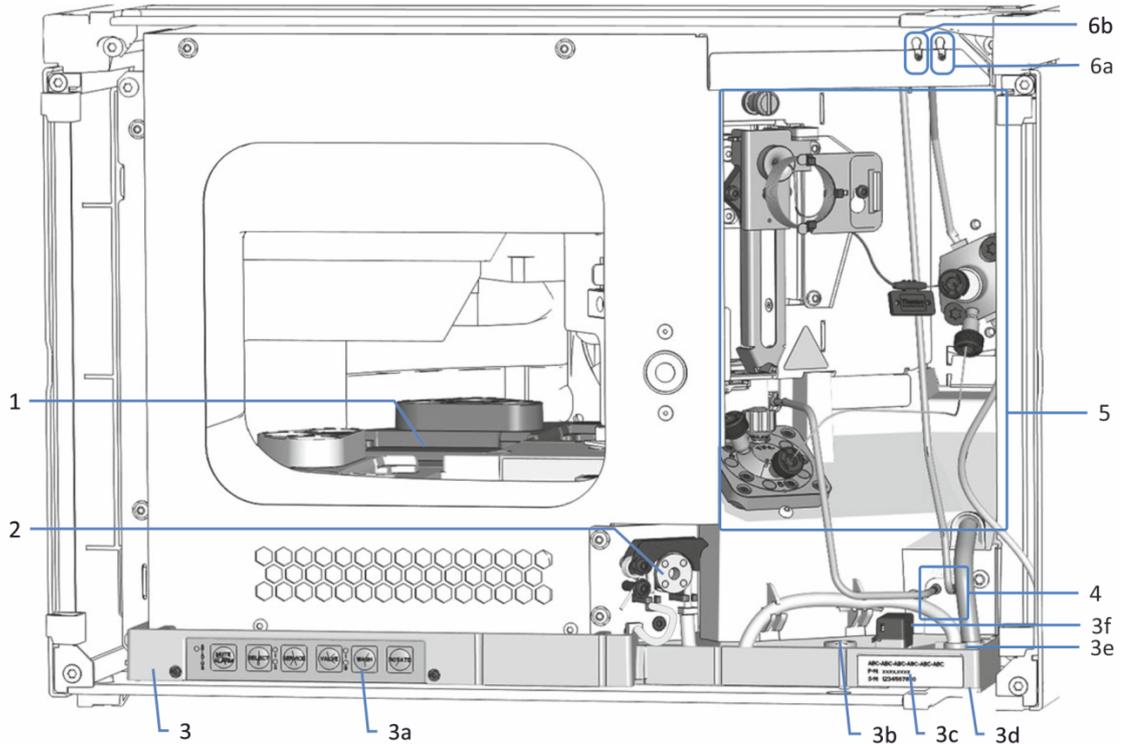


Figure 6: VH-A10 / VF-A10 Single split sampler interior view

No.	Description
1	Sample compartment with carousel (see Sample Compartment (▶ page 44))
2	Drain pump
3	Leak tray, with:
3a	Keypad with status indicators
3b	Pump capillary guide hole in slide-in module and enclosure
3c	Type label, indicating the module name, serial number, part number, and revision number (if any)
3d	Drain funnel
3e	Drain ports
3f	Leak sensor
4	Needle wash pump inlet and outlet
5	Injection unit (for details, see image below)
6	Wash tubing connectors, with:
6a	Seal wash inlet port (right tubing connector)
6b	Needle wash inlet port (left tubing connector)

Injection Unit

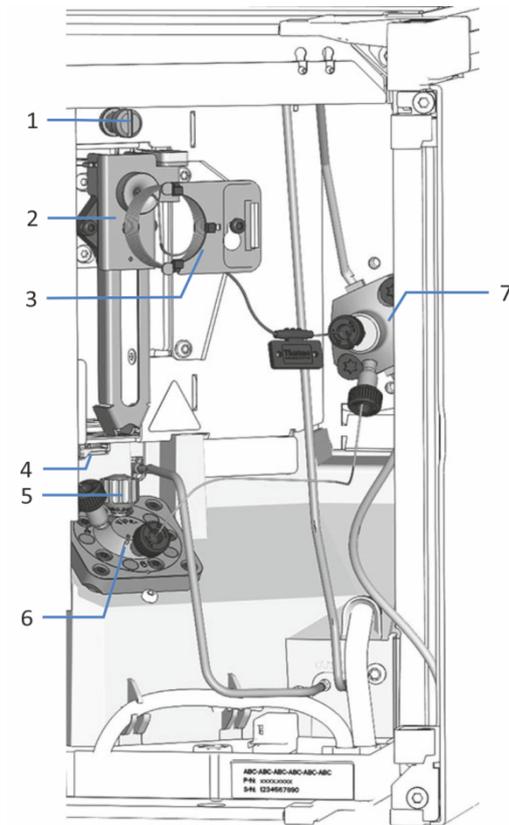


Figure 7: Injection unit in the single split sampler

No.	Description
1	Shipping lock screw for needle unit
2	Needle unit with vial pusher
3	Sample loop unit
4	Wash port
5	Needle seat
6	Injection valve
7	Metering device head

3.3.3 Dual Split Samplers (VH-A40 and VF-A40)

Overview

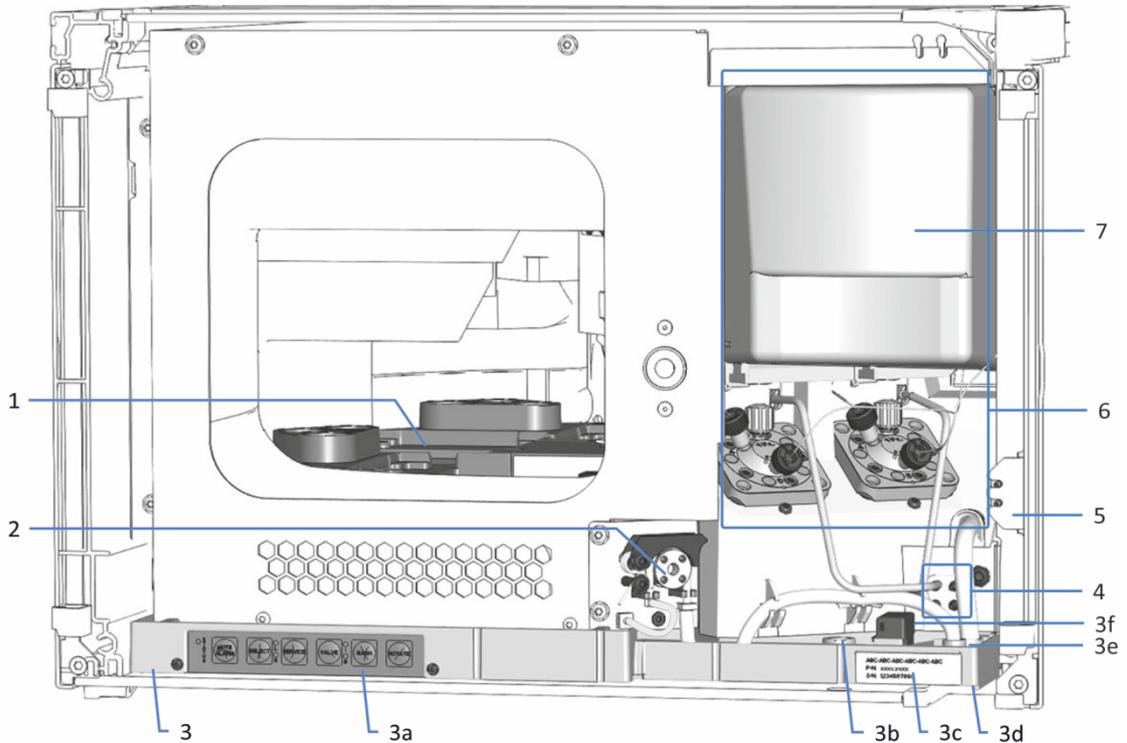


Figure 8: Dual split sampler interior view with insulation loop cover

No.	Description
1	Sample compartment with carousel (see Sample Compartment (▶ page 44))
2	Drain pump
3	Leak tray, with:
3a	Keypad with status indicators
3b	Pump capillary guide hole in slide-in module and enclosure
3c	Type label, indicating the module name, serial number, part number, and revision number (if any)
3d	Drain funnel
3e	Drain ports
3f	Leak sensor
4	Needle wash pump inlets and outlets for each injection unit
5	Seal wash ports (tubing connectors)
6	Injection units (partially covered by the insulation loop cover) For details, see image further down.
7	Insulation loop cover

Injection Units

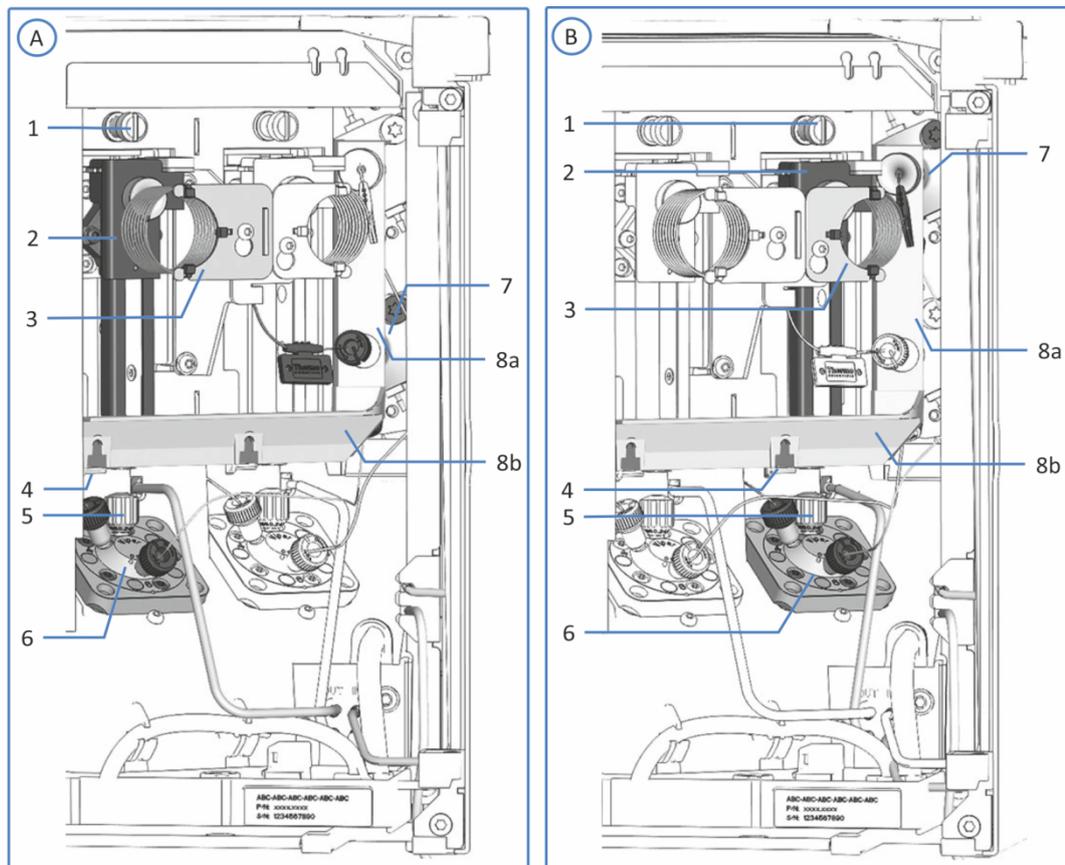


Figure 9: Injection units in the dual split sampler without insulation loop cover

No.	Description
A	Left injection unit
B	Right injection unit
1	Shipping lock screw for needle unit, left and right
2	Needle unit with vial pusher, left and right
3	Sample loop unit, left and right
4	Wash port, left and right (behind the horizontal frame part)
5	Needle seat, left and right
6	Injection valve, left and right
7	Metering device head, bottom (left) and top (right)
8	Mounting frame, consisting of:
8a	Vertical frame part
8b	Horizontal frame part

3.4 Sample Compartment

The sample compartment of the autosampler accommodates a carousel with four color-coded segments, each with an additional three-position vial holder for 10 mL vials.

The autosampler supports sample racks and well plates with a footprint as specified by the Society for Biomolecular Screening (SBS footprint).

The sample compartment provides the following features:

- Except VC-A13: Sample compartment thermostating, see [Sample Compartment Thermostating \(except VC-A13\)](#) (▶ page 44).
- Rack type identification and verification, empty segment detection, inventory management, see [Rack Type Identification](#) (▶ page 46).
- Extendable sample capacity (optional), see [Sample Capacity Extension with the Charger](#) (▶ page 46).

3.4.1 Sample Compartment Thermostating (except VC-A13)

Temperature control can be enabled for sample compartment thermostating. Circulating air is used to cool or heat the sample compartment to the selected temperature, thus allowing precise equalization of the sample temperature.

To achieve an optimum thermostating performance, keep the front doors of the autosampler closed during sample analysis. Open the front doors only if required, for example to load the autosampler with sample containers.

Sample compartment thermostating provides a temperature range of +4 °C to +40 °C. Sample cooling is possible to max. 23 K below ambient temperature.

Depending on the ambient humidity, condensation liquid may occur during sample cooling. A drain pump (peristaltic pump) in the autosampler actively removes any occurring condensation liquid from the sample compartment.

VC-A12 and Dual Split Samplers only

The VC-A12 single split sampler and the dual split samplers are equipped with an insulation loop cover covering the sample loops. This cover protects the interior components from high humidity and extensive condensation when thermostating the sample compartment. If the cover is not installed properly, thermostating cannot be enabled or will be turned off automatically.

3.4.2 Carousel

The carousel separates into four color-coded segments: red (**R**), green (**G**), blue (**B**) and yellow (**Y**).

Each segment separates into the following areas:

- Positioning area that accommodates space for one sample rack or well plate
- Support vial holder that comprises three vial positions for vials with a volume of up to 10 mL, such as reagent vials
The support vial holder is positioned left of the area for the sample rack or well plate in each segment.

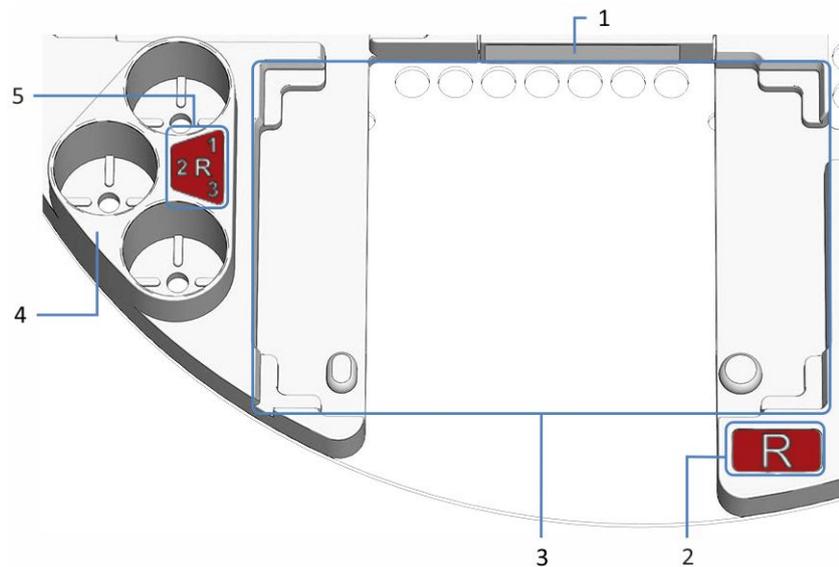


Figure 10: Detailed view on segment in the carousel

No.	Description
1	Barcode label 'empty' Label that identifies that the segment is empty for the barcode reader
2	Color code for the segment (<i>here: R</i> for the red segment)
3	Positioning area of the segment Space to position a sample rack or well plate With alignment angles and alignment points to align the sample rack or well plate
4	Support vial holder For three vials with a volume of up to 10 mL
5	Color code for the support vial holder (<i>here: R1</i> for example for the first vial holder in the red segment)

3.4.3 Rack Type Identification

A barcode reader inside the sample compartment allows automatic identification of the rack type for sample racks and well plates on which a Vanquish rack type 2D barcode is present.

During operation, the barcode reader performs an inventory scan and reads the Vanquish rack type barcode if present. The barcode reader automatically identifies the rack type and orientation. This information is sent to the chromatography data system.

To allow the identification of the sample rack or well plate type, use sample racks and well plates with such barcodes for rack type identification.

Each segment accommodates a barcode label that informs the barcode reader that the segment is empty if no sample rack or well plate is installed.

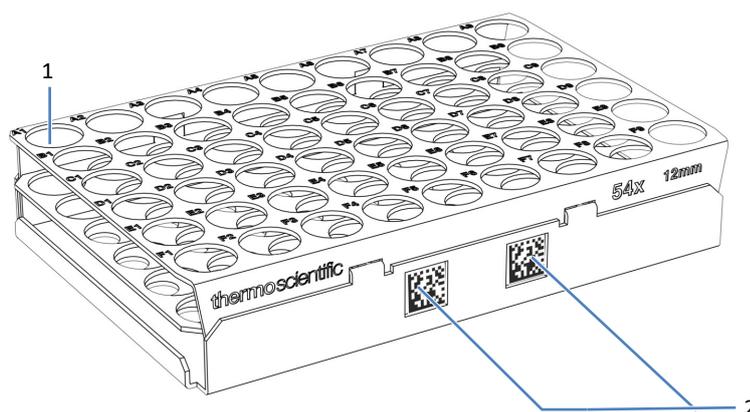


Figure 11: Sample rack with barcodes for rack type identification

No.	Description
1	Sample position A1
2	Vanquish rack type barcode

3.4.4 Sample Capacity Extension with the Charger

The sample capacity is optionally extendable using the Vanquish Charger. An extension opening on the left side of the autosampler enclosure allows attaching the Charger directly to the sample compartment of the autosampler.

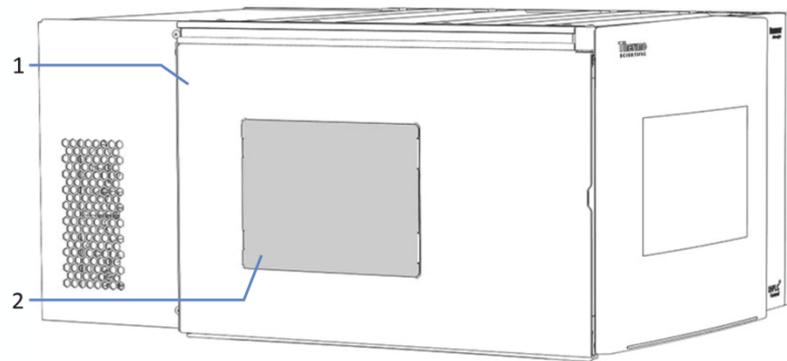


Figure 12: Charger extension opening on the left side of the autosampler

No.	Description
1	Left side of the autosampler enclosure (view from front)
2	Cover on the charger extension opening

For information about the Charger, refer to the *Vanquish Charger Operating Manual*.

3.5 Leak Detection

Leaks are a potential safety issue.

The leak sensor inside the device monitors the device for liquid leaks from the flow connections. The liquid is collected in the leak tray and guided to the drain port. From the drain port, the liquid is discharged to waste through the drain system of the Vanquish system.

When the leak sensor detects leakage, the status indicators change to red and beeping starts to alert you. Follow the instructions in this manual to find and eliminate the source for the leakage.

3.6 Operation

The device is designed to be operated from a computer configured with the Chromeleon Chromatography Data System (CDS). The Chromeleon software provides complete instrument control, data acquisition, and data management.

For a basic description of instrument control and automated sample analysis with the Chromeleon software, refer to the *Vanquish System Operating Manual*. Details on control and operation of the device are available in the *Chromeleon Help*.

TIP The device can be operated also with other data systems, such as Thermo Scientific™ Xcalibur™. In this case, installation of additional software is required in addition to the data system software. For details, contact the Thermo Fisher Scientific sales organization.

A keypad is available inside the device, allowing you to perform certain basic functions directly from the device.

4 Unpacking

This chapter provides information for unpacking the device and informs you about the scope of delivery.

4.1 Unpacking

Damaged Packaging, Defective on Arrival

Inspect the shipping container for signs of external damage and, after unpacking, inspect the device for any signs of mechanical damage that might have occurred during shipment.

If you suspect that the device may have been damaged during shipment, immediately notify the incoming carrier and Thermo Fisher Scientific about the damage. Shipping insurance will compensate for the damage only if reported immediately.

Unpacking the Device



CAUTION—Heavy Load, Bulky Device

The device is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the device, observe the following guidelines:

- Physical handling of the device, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the device into the system stack or when removing it.
- Use the carrying handles that were shipped with the device to move or transport the device. Never move or lift the device by the front doors. This will damage the doors or the device.

Tools required

Screwdriver, Torx™ T20

Follow these steps

1. Place the shipping container on the floor and open it.
2. Remove the ship kit from the shipping container.
3. Remove the device from the shipping container: Grasp the device by the carrying handles. Slowly and carefully, lift the device out of the shipping container.

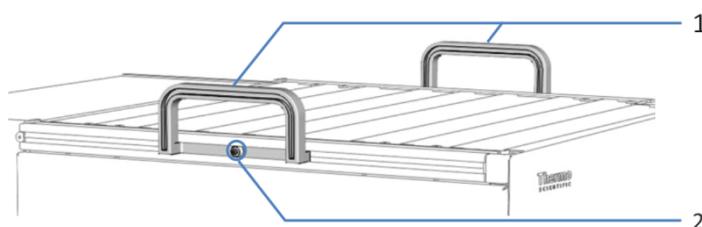


Figure 13: Carrying handles on the device

No.	Component
1	Carrying handles
2	Attachment screw (one on each carrying handle)

4. Place the device on a stable surface.
5. *If applicable:*
Remove any additional packing material. Leave any protective films attached to the surfaces of the device until it is properly positioned in the system stack.
6. Transport the device by the carrying handles to the installation site, if it is not already there, and place it in the system stack (see [System Arrangement](#) (► page 64)).
7. On each carrying handle, loosen the attachment screw until the carrying handle is moveable in the rail. Do not remove the screws from the carrying handles completely.
8. Slide off the carrying handles from the rails towards the rear of the device.

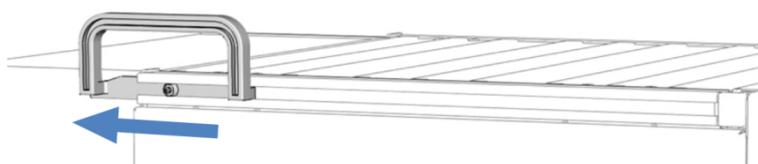


Figure 14: Sliding off the carrying handle from the left rail

TIP Keep the shipping container, the carrying handles with the attachment screws, and all packing material. These items will be needed if the device is transported to a new location or shipped.

9. Some surfaces including the doors of the device are covered by a protective film during shipment. Remove the protective film from all surfaces as applicable.

10. Remove any remaining shipping locks or protective covers from the autosampler as required. Shipping locks are marked for removal.
11. *VC-A12 and Dual split sampler only:* Remove the insulation loop cover. Keep the cover for operation. See [Removing the Insulation Loop Cover](#) (▶ page 95).

NOTICE

If the shipping lock screw is not properly loosened, the autosampler may be damaged. Ensure that the shipping lock screw is completely loosened before turning on the autosampler.

12. Loosen the shipping lock screw above the needle unit: Turn the captive screw counterclockwise with your fingers until it hangs loosely in its spring. The use of a slotted screwdriver may facilitate turning the screw.

Dual split sampler: If both shipping lock screws are tightened, loosen the shipping lock screws above both needle units.

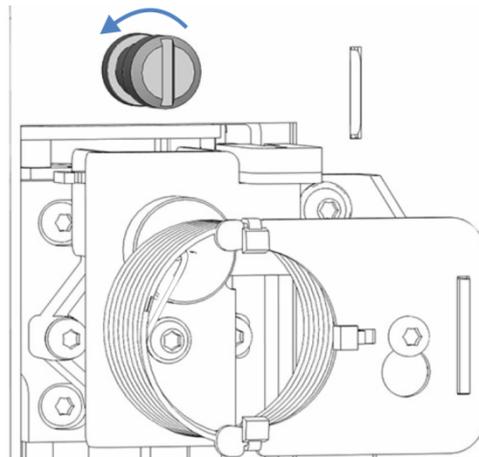


Figure 15: Loosening the shipping lock screw

4.2 Scope of Delivery

The following items are included in the delivery:

- Autosampler
- Ship Kit
For details about the kit content, see [Ship Kit](#) (► page 253).
- Sample container kit, including vials and well plates
- *Single split sampler*: 1 reservoir, 0.25 L, with reservoir cap
- *Dual split sampler*: 2 reservoirs, 0.25 L, with reservoir cap each
- Operating manual (downloadable from customer manual web site)
- Power cord

5 Installation

This chapter specifies the requirements for the installation site and describes how to set up, install, and configure the device in the Vanquish system and in the chromatography software.

5.1 Safety Guidelines for Installation

Pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (► page 21).



WARNING—Sharp Tip of Injection Needle

The injection needle has a very sharp tip that can cause injury to the skin.

To avoid personal injury, never touch the needle tip.



CAUTION—Heavy Load, Bulky Device

The device is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the device, observe the following guidelines:

- Physical handling of the device, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the device into the system stack or when removing it.
- Use the carrying handles that were shipped with the device to move or transport the device. Never move or lift the device by the front doors. This will damage the doors or the device.



CAUTION—Electric Shock or Damage to the Device

After the power to the device is turned off, the device is still energized as long as the power cord is connected. Repair work on the device while the device is connected to power could lead to personal injury.

- Always unplug the power cord before starting repair work inside the device.
- If you were instructed to remove any housing covers or panels, do not connect the power cord to the device while the cover or panels are removed.

5.2 Installing the Device

A Thermo Fisher Scientific service engineer installs and sets up the Vanquish system, including all modules and options or parts shipped with them. The service engineer checks that the installation is correct and that the Vanquish system and modules operate as specified. The engineer also demonstrates the basic operation and main features.

If personnel other than a Thermo Fisher Scientific service engineer installs the device, follow the steps below.

NOTICE

The device is part of the Vanquish system. Therefore, follow the order for installing the system modules as described in the *Vanquish System Operating Manual*.

1. Pay attention to the safety guidelines and observe all site requirements. See [Safety Guidelines for Installation](#) (▶ page 58) and [Site Requirements](#) (▶ page 61).
2. Set up the device hardware. See [Setting Up the Hardware](#) (▶ page 64).
3. Set up the flow connections. See [Setting Up the Flow Connections](#) (▶ page 68).
4. *VC-A12 and Dual split sampler only:* Install the insulation loop cover. See [Installing the Insulation Loop Cover](#) (▶ page 95).
5. Turn on the device. See [Turning On the Device](#) (▶ page 97).

TIP

Before turning on the power to a Vanquish system module for the first time, verify that the chromatography software is installed on the data system computer. When the power is turned on, the required USB drivers are automatically found and the Windows™ operating system can detect the device.

6. Set up the device in the software. See [Setting Up the Device in the Software](#) (▶ page 98).

7. *Recommended:*

Perform Instrument Installation Qualification.

In the Chromeleon software, a wizard is available to guide you through the qualification process. On the **Chromeleon 7 Console**: Click **Tools > Instrument Qualification > Installation Qualification**.

Follow the instructions in the *Instruments Installation Qualification Operating Instructions*. The manual provides information about the required materials and detailed instructions.

NOTICE

If the device is operated with another data system, refer to the documentation for the software that you are using and/or perform the qualification manually. The *Instruments Installation Qualification Operating Instructions* provide information about the parameters to be adapted and the required settings.

8. *Recommended:* Perform Operational Qualification.

The qualification kit includes all materials required for the qualification and detailed instructions.

Moving the Device after Installation

If you have to move the device after it has been set up and installed in the Vanquish system, prepare the device for transport and move it to the new location. Follow the instructions in [Transporting or Shipping the Device](#) (▶ page 218).

TIP When the power is turned off to the autosampler, the left front door of the autosampler is opened automatically for proper ventilation of the sample compartment and cannot be closed while the power is turned off.

5.3 Site Requirements

The operating environment is important to ensure optimal performance of the device.

This section provides important requirements for the installation site. Note the following:

- Operate the device only under appropriate laboratory conditions.
- The device is intended to be part of the Vanquish system. Observe the site requirements for the Vanquish system as stated in the *Vanquish System Operating Manual*.
- For specifications, see [Specifications](#) (▶ page 245) and the *Specifications* sections in the *Operating Manuals* for the other modules in the Vanquish system.
- For general residual hazards, see [General Residual Hazards](#) (▶ page 24).

5.3.1 Power Considerations

The power supply of the device has wide-ranging capability, accepting any line voltage in the range specified for the device.



CAUTION—Electric Shock or Damage to the Device

Connecting the device to a line voltage higher or lower than specified could result in personal injury or damage to the device.

Connect the device to the specified line voltage only.

5.3.2 Power Cord

The power cords are designed to match the wall socket requirements of the country in which they are used. The end of the power cords that plugs into the power socket on the device is identical for all power cords. The end of the power cords that plugs into the wall socket is different.

**WARNING—Electric Shock or Damage to the Device**

- Never use a power cord other than the power cords provided by Thermo Fisher Scientific for the device.
- Only use a power cord that is designed for the country in which you use the device.
- Do not use extension cords.
- Never plug the power cord to a power socket that is shared with other equipment (for example, multiple sockets).
- Operate the device only from a power outlet that has a protective ground connection.
- In case of emergency, it must be possible to reach the power cord easily at any time to disconnect the device from the power line.

**WARNING—Electric Shock or Damage to a Product**

Misuse of the power cords could cause personal injury or damage the instrument. Use the power cords provided by Thermo Fisher Scientific only for the purpose for which they are intended. Do not use them for any other purpose, for example, for connecting other instruments.

5.3.3 Condensation

NOTICE—Condensation in the device can damage the electronics.

- When using, shipping, or storing the device, avoid or minimize conditions that can lead to a build-up of condensation in the device. For example, avoid significant or fast changes in environmental conditions.
- If you suspect that condensation is present, allow the device to warm up to room temperature. This may take several hours. Wait until the condensation is gone completely before connecting the device to the power line.

5.4 Accessing the Interior Components

Opening the Front Doors

To access the interior components in the device, open the front doors. To allow easy access from the front, the user-accessible components and flow connections in the device are located directly behind the doors.

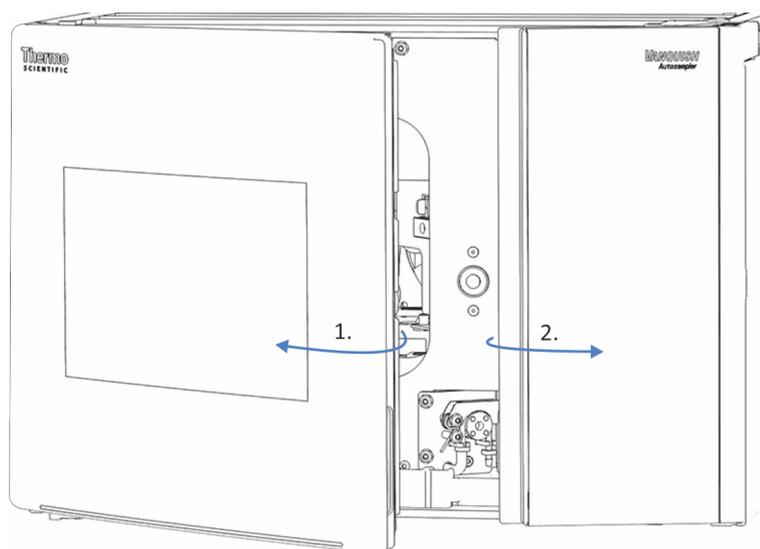


Figure 16: Opening the front doors

Front Door Opening Mechanism

The left front door of the autosampler is equipped with a mechanism that opens the door automatically for proper ventilation of the sample compartment when the autosampler is turned off.

When the autosampler is turned on, the left front door can be closed. If a power failure occurs or if the power cord is disconnected while the autosampler has been turned on, the mechanism opens the left front door automatically.

5.5 Setting Up the Hardware

This section describes how to set up the hardware and provides information about the device connectors and cables.

5.5.1 System Arrangement

The device is part of the Vanquish system. The system modules are typically arranged in a system stack, with the arrangement depending on the system configuration.

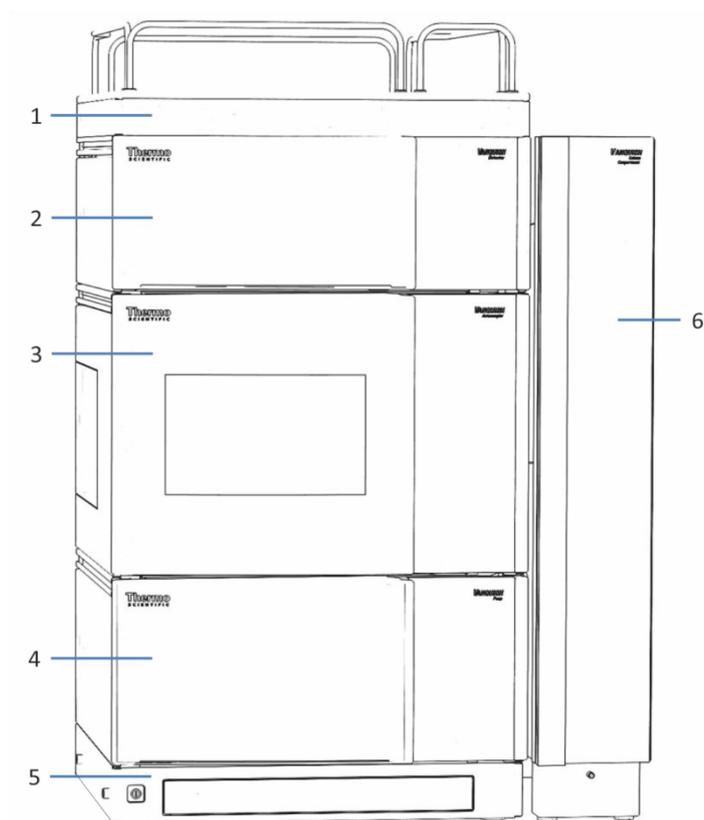


Figure 17: Vanquish system, standard configuration (example)

No.	Description
1	Solvent Rack
2	Detector
3	Autosampler
4	Pump
5	System Base
6	Column Compartment

For instructions on how to set up the system stack, refer to the *Vanquish System Operating Manual*.

5.5.2 Connecting the Device

Device Connectors

The following connectors are provided on the device:

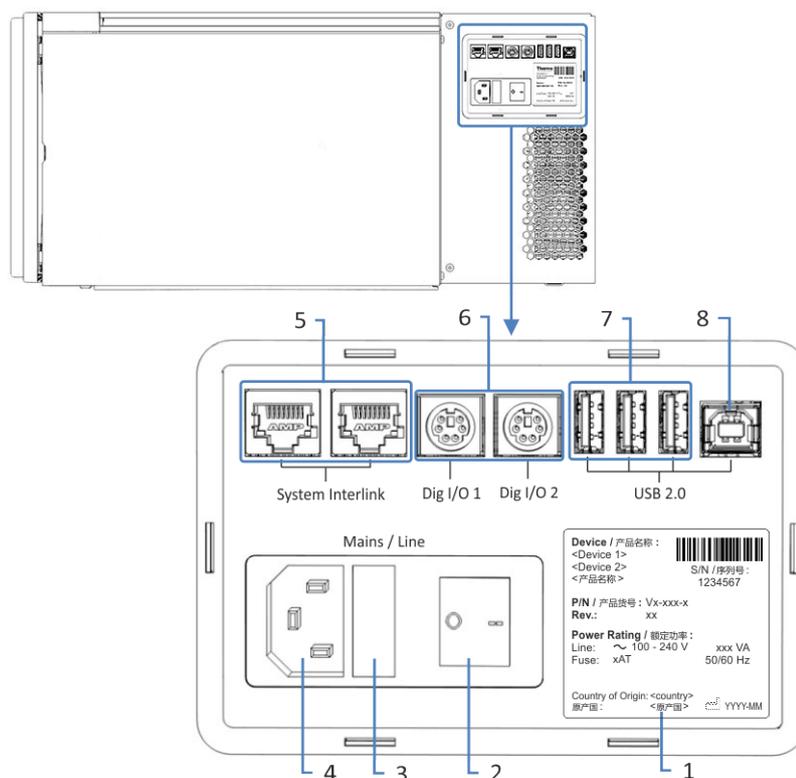


Figure 18: Electrical connectors on the right side of the autosampler

No.	Description
1	Rating plate, indicating the serial number, part number, module name, revision number (if any), line and fuse rating
2	Main power switch (on/off control)
3	Fuse holder
4	Power-inlet connector
5	System Interlink port Allows power on/off control for the device from the Vanquish system base and device communication For example, the interconnection between autosampler and detector automatically enables direct synchronization of sample inject and data acquisition start in the detector. As a result, the synchronization improves the retention time reproducibility.
6	Digital I/O ports (Dig I/O) Allow exchange of digital signals with external instruments Each digital I/O port provides one input and one relay output. For connection and pin assignment information, see Digital I/O (page 265).

No.	Description
7	USB hub ("A" type connector) Allows connection to other modules in the Vanquish system
8	USB (Universal Serial Bus) port ("B" type connector) Allows connection to other modules in the Vanquish system or the computer on which the data management system is installed, such as the Chromeleon software

TIP Thermo Fisher Scientific recommends using the USB ports only as described above. If the USB ports are used for any other purpose, Thermo Fisher Scientific cannot ensure proper functionality.

Follow these steps

NOTICE

- Never use defective communication cables. If you suspect that a cable is defective, replace the cable.
- To ensure trouble-free operation, use only the cables provided by Thermo Fisher Scientific for connecting the device.

1. Place the device in the system as required by the system configuration. For details, refer to the *Vanquish System Operating Manual*.
2. Connect the required interface cables to the device. For information about how to connect the device to other modules in the Vanquish system or to the chromatography data system computer, refer to the *Vanquish System Operating Manual*.
3. Connect the power cord (see [Connecting the Power Cord](#) (▶ page 67)).

5.5.3 Connecting the Power Cord

NOTICE

Condensation in a device can damage the electronics.

- Before connecting the devices to the power line, be sure that no condensation is present in the devices.
- If you suspect that condensation is present, allow the device to warm up to room temperature slowly. Wait until the condensation is completely gone before proceeding.

1. Verify that the power switch on the device is set to OFF.
2. Connect the power cord to the power inlet connector on the device.
3. Connect the free end of the power cord to an appropriate power source.

5.6 Setting Up the Flow Connections

This section describes how to set up the flow connections to and from the device and additional flow connections, if required.

5.6.1 General Information and Guidelines

Certain flow connections between components on the autosampler are already installed when the autosampler is shipped.

When setting up flow connections, follow these rules and recommendations:



Flow connections can be filled with hazardous substances. Observe the warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 21).

- Dirty components can contaminate the chromatography system. Contamination leads to poor performance of the modules and entire system or can even cause damage to the modules and system. Therefore:
 - ◆ Always wear appropriate gloves.
 - ◆ Place the components only on a clean, lint-free surface.
 - ◆ Keep your tools clean.
 - ◆ Use only lint-free cloth for cleaning.
- For installation instructions and guidelines and for handling recommendations, see [Connecting Fittings, Capillaries, and Tubing](#) (▶ page 71).

NOTICE

When you install devices or components to the system, always flush them to waste before connecting them in the system flow path. To flush the Vanquish modules, follow the instructions in the *Vanquish System Operating Manual*.

TIP Components or connections in the flow path to other system modules may be closed with plugs to protect the component or connection during transport.

When you remove the plugs to connect the device in the system, keep the plugs. You may need them to close the connections again, for example, for future transport.

Follow these steps

To set up the additional flow connections and complete the installation, follow these steps:

1. Connect the autosampler to the drain system (see [Guiding Liquids to Waste](#) (▶ page 73)).
2. Set up the seal wash system (see [Seal Wash System](#) (▶ page 74)).
3. Connect the needle wash reservoir (see [Needle Wash System](#) (▶ page 82)).
4. Set up the injection valve connections (see [Injection Valve](#) (▶ page 87)).
5. *VC-A12 and Dual split samplers only:* Install the insulation loop cover (see [Installing the Insulation Loop Cover](#) (▶ page 95)).

5.6.2 Guiding Capillaries and Tubing Through the System

Flow connections between the modules of the Vanquish system are guided through either the tubing chase in the devices or the guide holes or capillary clips of the devices.

Tubing Chase with Tubing Guides

To guide certain tubes and lines from the top module to the bottom module in the Vanquish system stack, the stackable modules have a tubing chase on the inside right. The tubing chase provides four tubing guides.

Each guide can hold up to three tubes or lines. In each module, push the tube (or line) into the appropriate guide.

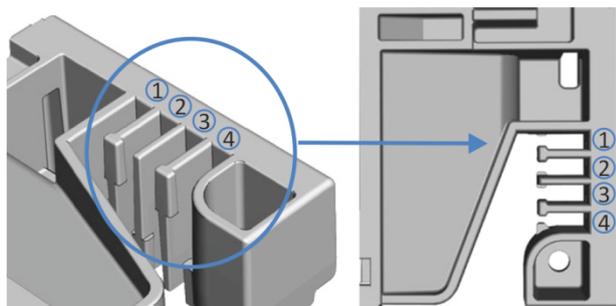


Figure 19: Tubing chase with tubing guides (left: view from inside, right: view from top)

No.	Use for
1	Solvent tubing (up to three solvent lines)
2	Solvent tubing (up to three solvent lines)
3	Wash liquid tubing (seal wash, autosampler needle wash)
4	Detector waste line

Tubing Brackets

Tubing brackets are available for holding the tubing in place. Slip the bracket side onto the drain pipe.

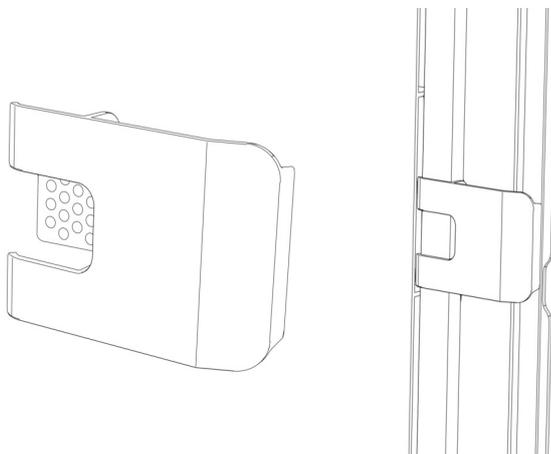


Figure 20: Tubing bracket (left), tubing bracket installed (right)

Dual System Arrangements

The number of tubes may exceed the capacity that the tubing guides can hold. In this case, it is recommended to place the solvent lines in the tubing guides and route any additional tubes freely in the tubing chase.

Guide Holes and Capillary Clips

Guide holes and capillary clips are provided at specific positions on the system modules. Route flow connections from one module to the next module in the Vanquish system through the appropriate guide hole or capillary clip when instructed to do so in the manual.

5.6.3 Connecting Fittings, Capillaries, and Tubing

This section provides information about how to connect and handle capillaries, fittings, and tubing.

5.6.3.1 General Guidelines

When connecting capillaries and tubing, follow these general recommendations:

- Use only the capillaries and tubing (for example, solvent lines or waste tubing) that are shipped with the product or additional or spare capillaries and tubing as recommended by Thermo Fisher Scientific.
- The connectors must be free from contaminants. Even minute particles may cause damage to the system or lead to invalid test results.
- Do not install capillaries or tubes that are stressed, nicked, kinked, or otherwise damaged.
- Install capillaries and fittings only at the positions for which they are intended.

5.6.3.2 Connecting Viper Capillaries

This section describes how to connect Viper™ capillaries. All Viper flow connections in the Vanquish system are designed to be finger-tight.

To connect Viper capillaries with knurls, follow these steps:

NOTICE

- Tighten or loosen Viper capillaries *only* with your fingers. Do not use tools other than the knurl that comes with the capillary.
- To avoid damage to the capillary or connection, tighten and loosen the Viper capillaries *only* when the system pressure is down to zero.

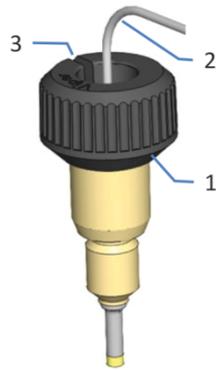


Figure 21: Viper fitting with knurl

No.	Description
1	Knurl
2	Capillary
3	Slot

1. Insert the Viper capillary into the connection port.
2. Tighten the connection by the knurl.

TIP Note the slot in the knurl. You can easily remove the knurl from the capillaries through this slot if space is limited.

3. Check whether the connection leaks. If leakage exists, follow the steps further down.

Resolving Leakage of Viper Fittings with Knurls

1. Tighten the connection a little more.
2. If leakage continues, remove the capillary.
3. Clean the capillary ends carefully by using a lint-free tissue wetted with isopropanol.
4. Reinstall the capillary.
5. If the connection continues to leak, install a new Viper capillary.

5.6.4 Guiding Liquids to Waste

Waste liquids from the needle wash system and the drain pump in the autosampler are routed through separate drain ports directly into the drain system.

Leaking liquids of the autosampler collect in the leak tray and flow off through the funnel at the bottom right of the leak tray into the drain system.

For information about how the liquid is discharged to waste through the Vanquish drain system, refer to the *Vanquish System Operating Manual*.

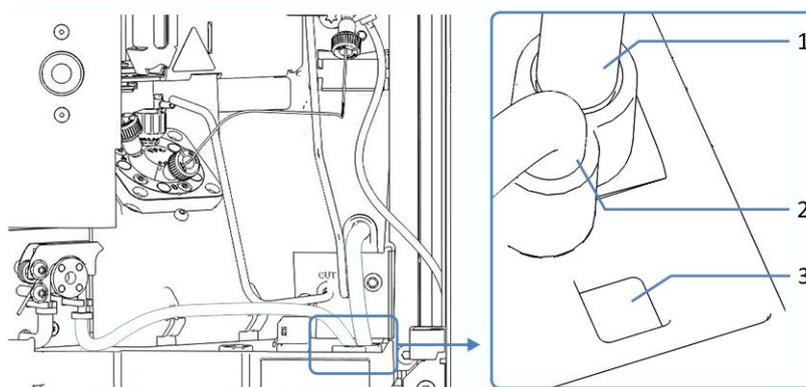


Figure 22: Drain ports in the leak tray of a VH/VF single split sampler

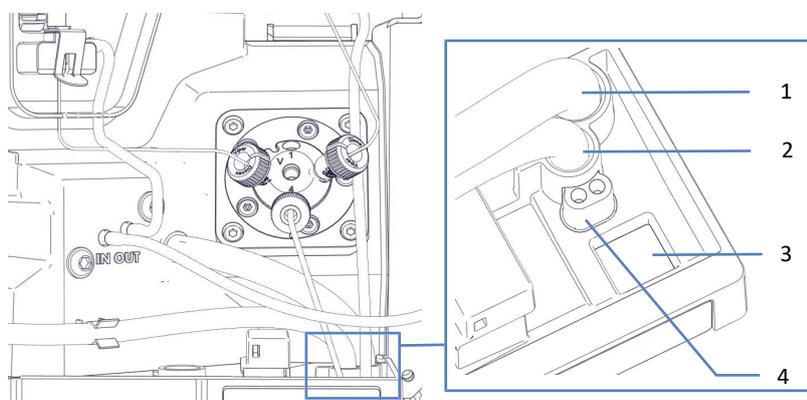


Figure 23: Drain ports in the leak tray of the VC single split sampler

No.	Description
1	Drain port for needle wash system
2	Drain port for drain pump
3	Funnel to drain system
4	VC-Autosampler only: Drain port for injection valve waste tubing

5.7 Seal Wash System

The flow path of the seal wash system passes through the metering device head in the autosampler and the pump heads in the pump. The seal wash system comprises the following parts:

- In the pump: Seal wash pump (peristaltic pump), seal wash lines, and seal wash detector (drop detector)
- In the autosampler: Seal wash lines
- Reservoir for the seal wash liquid

Both, the autosampler and pump are shipped with the seal wash components installed and the lines connected within each of the two modules.

To complete the setup, interconnect the seal wash paths of the modules, connect and fill the seal wash reservoir, and flush the seal wash system (see [Setting Up the Seal Wash System](#) (► page 75)).

In the dual split sampler, the flow path of the seal wash system passes through both metering device heads.

5.7.1 Choosing the Seal Wash Liquid

Depending on the Vanquish system, observe the following for the seal wash liquid:

VH-autosamplers and pumps

Use 75% isopropanol in water and 0.1% formic acid (HPLC-grade; preparation by volume, for example, 75 mL isopropanol + 25 mL water + 0.1 mL formic acid).

VC- and VF-autosamplers and pumps

Use seal wash liquid that fulfills the following requirements:

- The seal wash liquid is miscible with the solvent that is used in the pump.
- The seal wash liquid is compatible with the seal wash tubing.
- The seal wash liquid provides certain conductivity for reliable performance of the seal wash detector.
 - ◆ HPLC-grade water with 10% methanol is an appropriate choice.
 - ◆ With a Vanquish Core system that has been modified for NP applications, the appropriate liquid depends on the application:
NP application:
Use ammonium formate in isopropanol (2 mmol/L).
RP application:
Use HPLC-grade water with 10% methanol.

5.7.2 Setting Up the Seal Wash System

Parts and tools required

- Seal wash reservoir assembly, including reservoir, reservoir cap, cap plugs, and retaining guide for the seal wash line
- Seal wash line (silicone tubing) for connection to the seal wash pump; the line is pre-installed to the seal wash outlet of the metering device head
- Seal wash line (silicone tubing) for connection to the seal wash reservoir

TIP To avoid the formation of air bubbles in liquid lines, always place reservoirs in the solvent rack on top of the system stack.

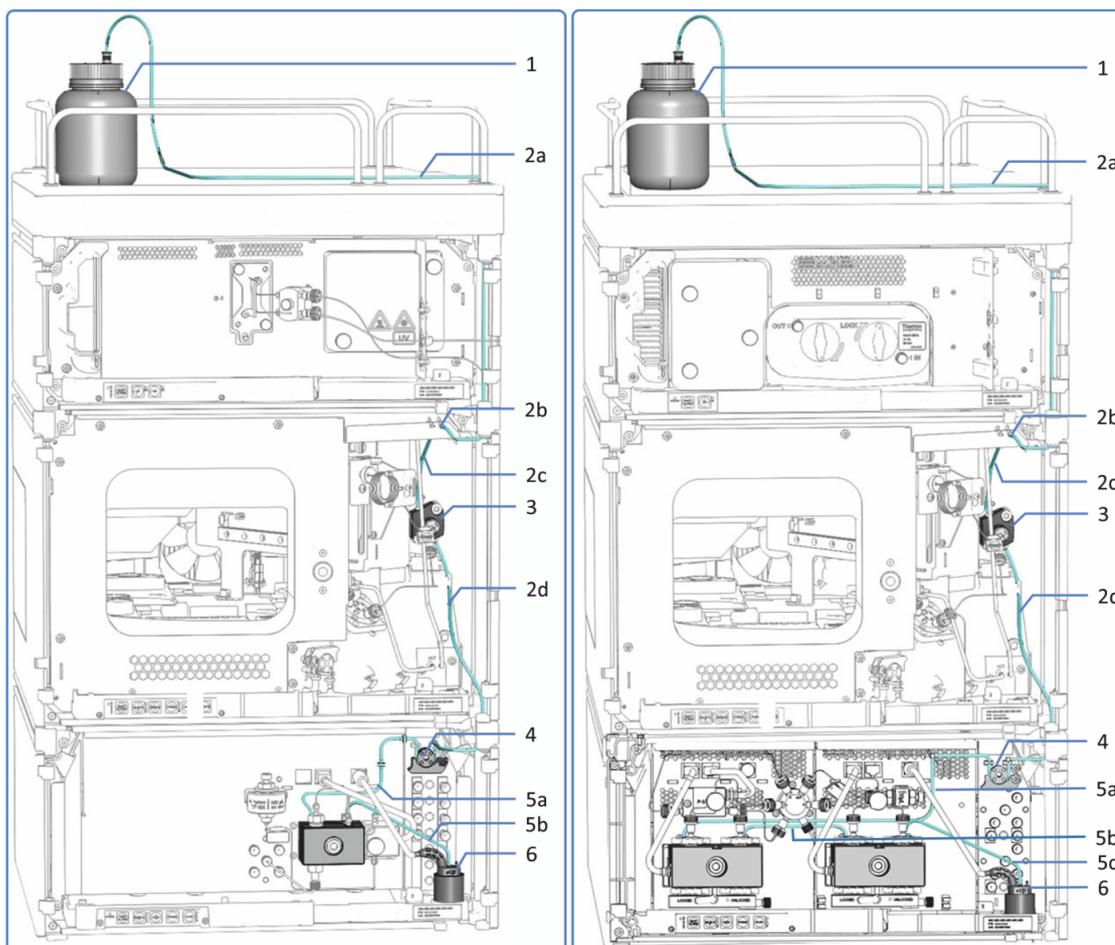


Figure 24: Seal wash system in the Vanquish system (examples with a VF/VH single split sampler, left: with quaternary pump, right: with binary pump)

No.	Description
1	Seal wash reservoir
2	Seal wash lines in the autosampler (thick tubing), with
2a	Wash line from reservoir to inlet port
2b	Seal wash inlet port (right tubing connector)
2c	Wash line from inlet port to metering device head
2d	Wash line to seal wash pump
3	Metering device head
4	Seal wash pump (peristaltic pump)
5	Seal wash lines in the pump (thin tubing), with
5a	Wash lines from seal wash pump to pump head (<i>binary pump, dual pump</i> : to left pump head)

No.	Description
5b	<i>Isocratic pump, quaternary pump:</i> Wash line from pump head to seal wash detector <i>Binary pump, dual pump:</i> Wash line from left pump head to right pump head
5c	<i>Binary pump, dual pump:</i> Wash line from right pump head to seal wash detector
6	Seal wash detector (drop detector)

Preparations

Rinse the seal wash reservoir thoroughly. Use a high-purity solvent for rinsing.

Follow these steps

Setting up the seal wash system comprises the following steps:

1. Engaging the peristaltic tubing
2. Connecting the seal wash line between autosampler and pump
3. Routing the seal wash line to the solvent rack
4. Connecting the seal wash line to the seal wash reservoir
5. Flushing the seal wash system

Follow the steps in the respective sections.

Engaging the Peristaltic Tubing

In the pump, engage the peristaltic tubing (PharMed™ tubing) in the seal wash pump:

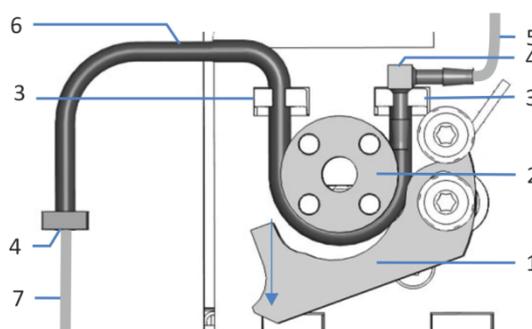


Figure 25: Seal wash pump

No.	Description
1	Pump lever
2	Pump rotor

No.	Description
3	Tubing holder (peristaltic tubing)
4	Tubing connector
5	Seal wash line from autosampler (silicone tubing)
6	Peristaltic tubing
7	Seal wash tubing to pump head (silicone tubing)

1. Press down the lever on the seal wash pump and hold it in that position with one hand.
2. With your other hand, insert the tubing between the lever and the rotor and wind it around the rotor.
3. Release the lever.
4. Check that the peristaltic tubing is inserted properly in the tubing holders. If it is not, push the tubing into the holders. Make sure that the tubing is not pinched or squeezed in the holders.
5. Check that the right tubing connector rests on the tubing holder. If it does not, push the tubing connector onto the holder.

Connecting the Seal Wash Line between Autosampler and Pump

1. In the autosampler, locate the seal wash line (clear silicone tubing) to the pump:
 - ◆ *Single split sampler:* The seal wash inlet port is located on the top enclosure frame (right tubing connector). The seal wash line to the pump is interconnected to the seal wash inlet port.
 - ◆ *Dual split sampler:* The seal wash inlet port is located on the right enclosure frame (top tubing connector). The seal wash line to the pump interconnects seal wash inlet and outlet port.
2. Disconnect the seal wash line from the seal wash inlet port.
3. Route the seal wash line from the seal wash outlet in the autosampler through the tubing guides to the peristaltic tubing in the pump.
 - ◆ *Single split sampler:* The seal wash outlet is located on the bottom end of the metering device.
 - ◆ *Dual split sampler:* The seal wash outlet is located on the right enclosure frame (bottom tubing connector).

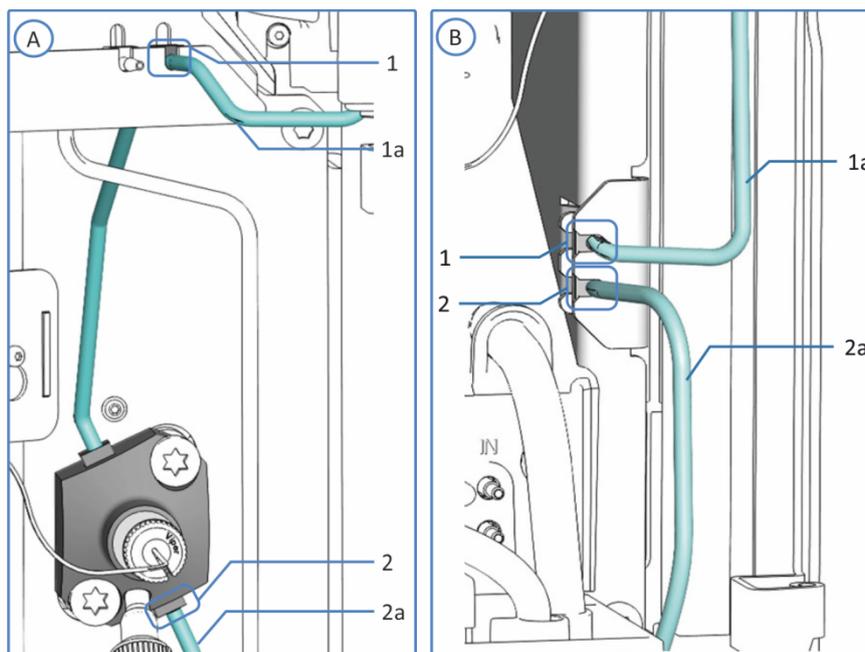


Figure 26: Seal wash connections

No.	Description
A	<i>Single split sampler:</i> Seal wash connections on the top enclosure frame
B	<i>Dual split sampler:</i> Seal wash connections on the right enclosure frame
1	Seal wash inlet port
1a	Seal wash line to reservoir
2	Seal wash outlet
2a	Seal wash line to pump

- In the pump, connect the seal wash line to the tubing connector on the free end of the peristaltic tubing.

Routing the Seal Wash Line to the Solvent Rack

- Locate the seal wash line for connection from the autosampler to the seal wash reservoir.
- Connect the seal wash line on the autosampler:
 - ◆ *Single split sampler:* Connect the line to the seal wash inlet port on the top enclosure frame (right tubing connector).
 - ◆ *Dual split sampler:* Connect the line to the seal wash inlet port on the right enclosure frame (top tubing connector).
- Route the seal wash line from the autosampler to the solvent rack through the tubing guides in the autosampler and all modules above the autosampler in the system stack.

4. Route the seal wash line through the guide hole in the solvent rack and fix it in the appropriate tubing guide.

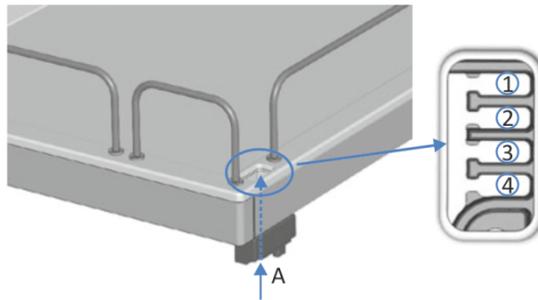


Figure 27: Guide hole and tubing guides in the solvent rack

No.	Description
A	Guide hole (solvent rack)
1+2	Not to be used for seal wash line; reserved for other tubing
3	Tubing guide for seal wash line
4	Not to be used for seal wash line; reserved for other tubing

Connecting the Seal Wash Line to the Seal Wash Reservoir

Mind the requirements outlined in [Choosing the Seal Wash Liquid](#) (► page 74).

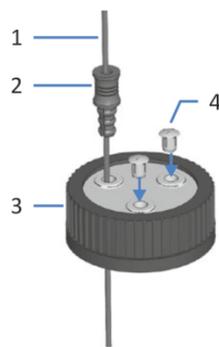


Figure 28: Wash line and reservoir cap

No.	Description
1	Wash line
2	Retaining guide
3	Reservoir cap
4	Cap plugs

1. Feed the wash line through the retaining guide.
2. Feed the wash line through an open hole in the cap of the wash reservoir. The retaining guide keeps the tubing in place in the reservoir.
3. Close any open holes in the reservoir cap with cap plugs.
4. Fill the wash reservoir with wash liquid.
5. Tighten the reservoir cap hand-tight. Press the retaining guide into the hole in the reservoir cap so that the tubing is kept in place in the cap.
6. Place the wash reservoir in the solvent rack.
7. Position the wash lines straight in the tubing guides.
8. Check the wash lines over the entire flow path:
 - a) Make sure that no bending (kink), pinching or squeezing of the wash lines is present at any point in the flow path.
 - b) If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.

Flushing the Seal Wash System

For instructions, refer to the *Vanquish Pump Operating Manual*.

TIP The Vanquish pump starts and controls the seal wash system. Whenever you turn on power to the pump, the pump starts operation with a seal wash cycle. Before turning on the pump, check the liquid level in the seal wash reservoir.

5.8 Needle Wash System

The needle wash system of the autosampler consists of needle wash pump, needle wash reservoir, needle wash lines and waste line. In dual split samplers, the two injection units accommodate a separate needle wash system each. The needle wash components are pre-installed within the autosampler upon shipment.

To complete the setup of the needle wash system, connect the needle wash reservoir.

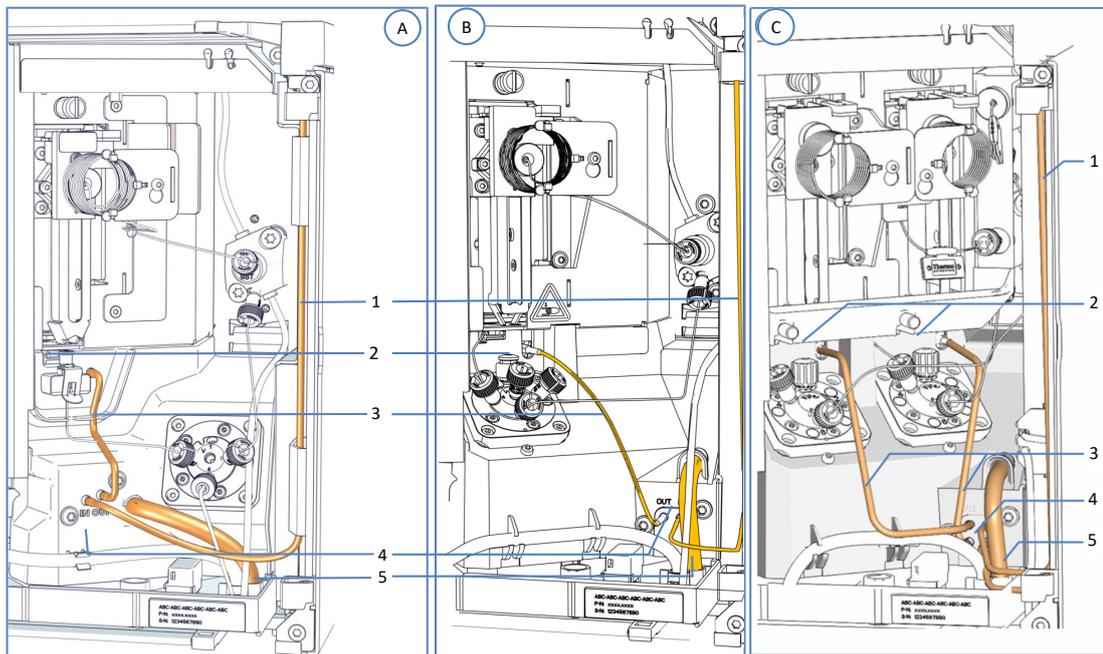


Figure 29: Needle wash components

No.	Description
A	VC-Single split sampler: Needle wash system
B	VF/VH-Single split sampler: Needle wash system
C	Dual split sampler: Needle wash system per injection unit
1	Needle wash line to needle wash reservoir (may be routed differently in some VF/VH-Single split samplers)
2	Wash port
3	Needle wash line from needle wash pump outlet to wash port
4	Needle wash pump
5	Needle wash waste line

5.8.1 Choosing the Needle Wash Liquid

Use needle wash liquid that fulfills the following requirements:

- Before filling the needle wash reservoir, rinse the reservoir thoroughly. Make sure that no particles, dust or algae are present.
- *Recommended when using 100% water as needle wash liquid:* Replace the needle wash liquid daily.
- Use a needle wash liquid that is suitable for your application and that removes residual sample from the needle sufficiently.
- *Dual split sampler only:* Each of the two needle wash systems can use a separate needle wash liquid.

After shipment of the autosampler

Check if the needle wash waste line is properly connected to the drain port and has not moved during shipment of the autosampler.

5.8.2 Connecting the Needle Wash Reservoir

Parts and tools required

- *Single split sampler*
 - ◆ Needle wash line for connection to the needle wash reservoir
 - ◆ Needle wash reservoir
- *Dual split sampler*
 - ◆ Two needle wash lines for connection of both needle wash pump inlets to the needle wash reservoir
 - ◆ Depending on whether the same needle wash liquid is used for each needle wash system or different needle wash liquids are used: One or two needle wash reservoirs
- Tubing cutter (optional)

Preparations

Prepare the needle wash liquid and needle wash reservoir. Observe the needle wash liquid guidelines in [Choosing the Needle Wash Liquid](#) (▶ page 83).

Rinse the needle wash reservoir thoroughly. Use a high purity solvent for rinsing.

Follow these steps

Setting up the needle wash system comprises the following steps:

1. Setting up the needle wash line in the autosampler
2. Connecting the needle wash line to the needle wash reservoir
3. Purging the needle wash system

Follow the steps in the respective sections further down.

Setting up the Needle Wash Line in the Autosampler

1. Connect the needle wash line on the autosampler:
 - ◆ *VF-A10/VH-A10*: Connect the needle wash line to the needle wash inlet port (left tubing connector) on the top enclosure frame of the autosampler.
 - ◆ *VC-A12/VC-A13*: Connect the needle wash line to the needle wash inlet on the needle wash pump.
 - ◆ *Dual split sampler*: Connect the two needle wash lines to the two needle wash inlets on the needle wash pump.

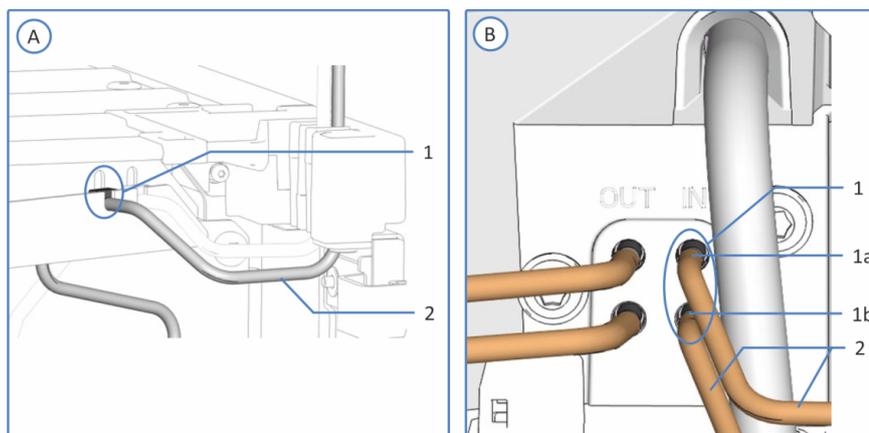


Figure 30: Needle wash inlet connections (shown here: VF- and VH-autosampler)

No.	Description
A	Single split sampler: Needle wash inlet port on the top enclosure frame
B	Dual split sampler: Needle wash inlets on the needle wash pump
1	Needle wash inlet port
1a	<i>Dual split sampler only</i> : Top needle wash inlet for left injection unit
1b	<i>Dual split sampler only</i> : Bottom needle wash inlet for right injection unit
2	Needle wash line to reservoir

2. Route the needle wash line from the autosampler to the solvent rack, through the tubing guides in the autosampler and all modules above the autosampler in the system stack.
3. Route the needle wash line through the guide hole in the solvent rack and fix it in the appropriate tubing guide.

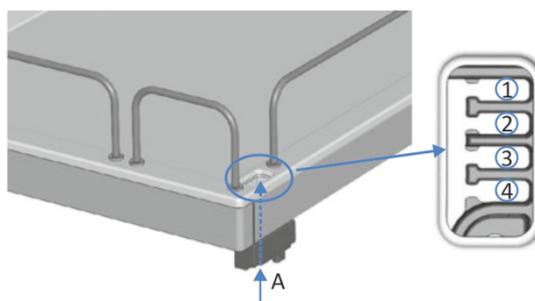


Figure 31: Guide hole and tubing guides in the solvent rack

No.	Description
A	Guide hole (solvent rack)
1+2	Not to be used for needle wash line; reserved for other tubing
3	Tubing guide for needle wash line
4	Not to be used for needle wash line; reserved for other tubing

Connecting the Needle Wash Line to the Needle Wash Reservoir

Dual split sampler only: If two needle wash reservoirs are to be used, perform the steps for each needle wash reservoir.

1. Connect the needle wash reservoir to the line:
 - a) Rinse the needle wash reservoir thoroughly with a high-purity solvent.
 - b) Fill the needle wash reservoir with fresh needle wash liquid.
 - c) Feed the needle wash line through the retaining guide and through an open hole in the cap of the needle wash reservoir. The retaining guide keeps the tubing in place in the reservoir. Close any open holes in the reservoir cap with cap plugs.

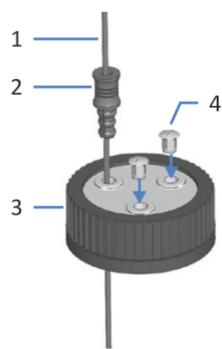


Figure 32: Wash line and reservoir cap

No.	Description
1	Wash line
2	Retaining guide
3	Reservoir cap
4	Cap plugs

2. Tighten the reservoir cap hand-tight. Press the retaining guide into the hole in the reservoir cap so that the tubing is kept in place in the cap.
3. Place the needle wash reservoir in the solvent rack.
4. Check the wash lines over the entire flow path:
 - a) Make sure that no bending (kink), pinching or squeezing of the wash lines is present at any point in the flow path.
 - b) If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.

Purging the Needle Wash System

After the autosampler has been turned on, purge the needle wash system using the chromatography data system to fill the wash port with the fresh needle wash liquid. During purging, the wash port is flushed continuously until the fresh needle wash liquid is present. See [Washing the Needle](#) (▶ page 147).

Dual split sampler only: Purge both needle wash systems.

5.9 Injection Valve

When the autosampler is shipped, the flow connections from the injection valve to internal autosampler components are installed.

In dual split samplers, each of the two injection units accommodates a separate injection valve.

5.9.1 Port assignments of the injection valve

The injection valve ports for VF- and VH-autosamplers are assigned as follows:

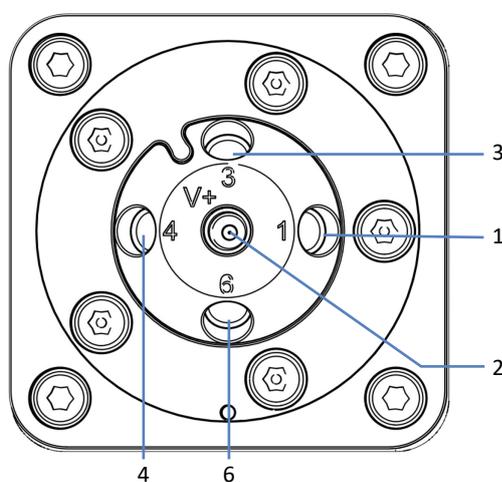


Figure 33: Injection valve of the VH- and VF-autosamplers

Port	Connected Component
1	Inlet capillary from the pump
2	Outlet capillary to the column
3	Needle seat (pre-installed)
4	Wash port waste (pre-installed)
6	Metering device (pre-installed)

NOTICE

- Tighten or loosen Viper capillaries *only* with your fingers. Do not use tools other than the knurl that comes with the capillary.
- To avoid damage to the capillary or connection, tighten and loosen the Viper capillaries *only* when the system pressure is down to zero.

The injection valve ports for VC-autosamplers are assigned as follows:

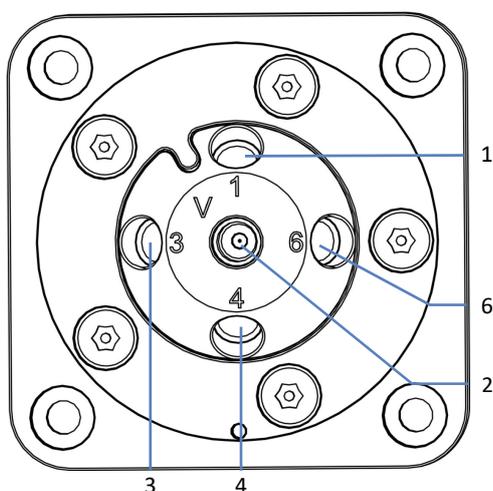


Figure 34: Injection Valve of the VC-autosampler

Port	Connected Component
1	Inlet capillary from the pump
2	Outlet capillary to the column
3	Needle seat (pre-installed)
4	Wash port waste (pre-installed)
6	Metering device (pre-installed)

Preparations – Dual Split Samplers only

For easier access to the injection valve ports, remove the horizontal mounting frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).

Follow these steps

1. Connect the pump. See [Connecting the Pump and Autosampler](#) (▶ page 89).
2. Connect the column compartment. See [Connecting the Column Compartment](#) (▶ page 91).
3. *Dual split sampler only:* If the horizontal mounting frame part was removed, reinstall the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).

5.9.2 Connecting the Pump and Autosampler

With dual split samplers, perform the steps in this section for both injection valves to connect them to the respective pump outlet according to the system arrangement.

TIP Dual split sampler only: If the system arrangement includes two pump modules, capillary guiding may differ.

Parts required

Capillary to connect the pump to the autosampler, as required for the flow path

Follow these steps

1. On the connecting capillary, remove the knurls.
2. Guide the connecting capillary through the guide holes in the housings of both, the pump and autosampler.

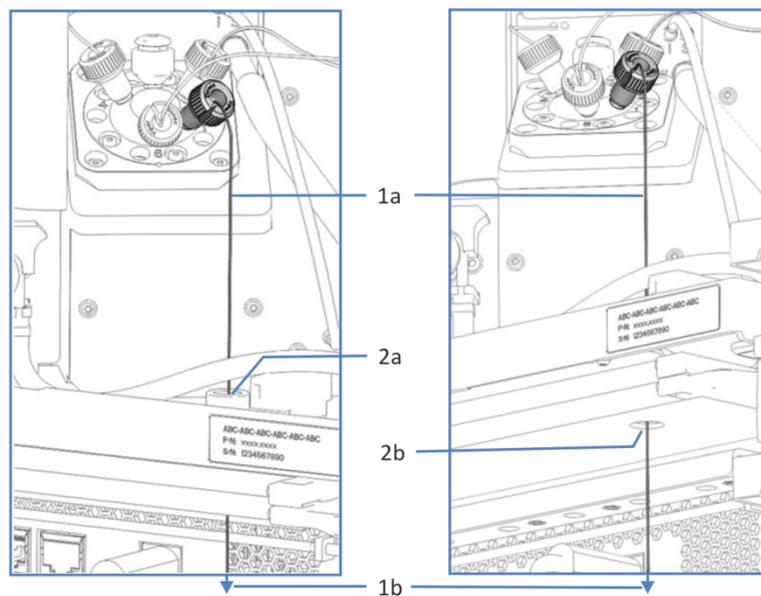


Figure 35: Guide holes in the autosampler and pump (left: view from VF-/VH-autosampler (example); right: view from pump)

No.	Description
1	Capillary connecting the pump and autosampler:
1a	Capillary end connected to the autosampler injection valve
1b	Capillary end to be connected to pump outlet
2	Guide holes in autosampler housing and pump housing:

No.	Description
2a	Guide hole in autosampler housing (view from above)
2b	Guide hole in pump housing (view from below)

3. Reattach the knurls to the connection capillary.
4. In the pump, connect the capillary to the pump outlet.
5. In the autosampler, connect the capillary to the injection valve.

See also

 [Port assignments of the injection valve \(► page 87\)](#)

5.9.3 Connecting the Column Compartment

With dual split samplers, perform the steps in this section for both injection valves.

Parts required

Capillary for connection between autosampler and column compartment

Follow these steps

1. Connect the outlet capillary to port 2 of the injection valve.
2. Route the capillary through the guide hole in the autosampler enclosure towards the column compartment.
3. Connect the capillary in the column compartment (refer to the *Vanquish Column Compartment Operating Manual*).

5.10 Installing the Protective Cover (Optional for VH-A10 and VF-A10)

A protective cover can be installed optionally on single split samplers to protect the interior components behind the right front door of the autosampler from high humidity and condensation.

Parts required

Protective cover

Preparations

Install all flow connections. See [Setting Up the Flow Connections](#) (▶ page 68).

Follow these steps

1. Open the autosampler doors.
2. Insert the top portion of the protective cover under the top enclosure frame on the right interior side.

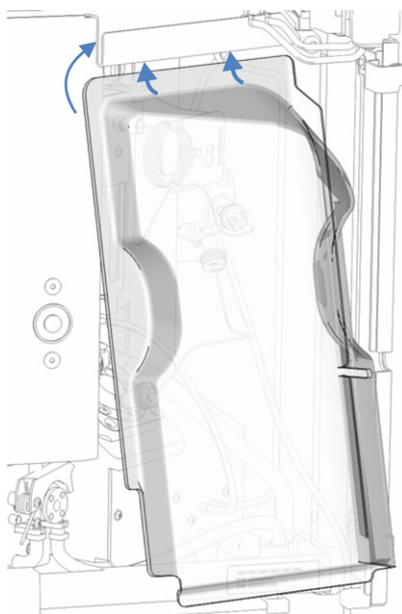


Figure 36: Sliding the protective cover under the top enclosure frame

3. Sort the tubes and capillaries behind the protective cover. Make sure that no tubing or capillary is nicked or kinked.
4. Insert the bottom portion of the protective cover behind the leak tray.

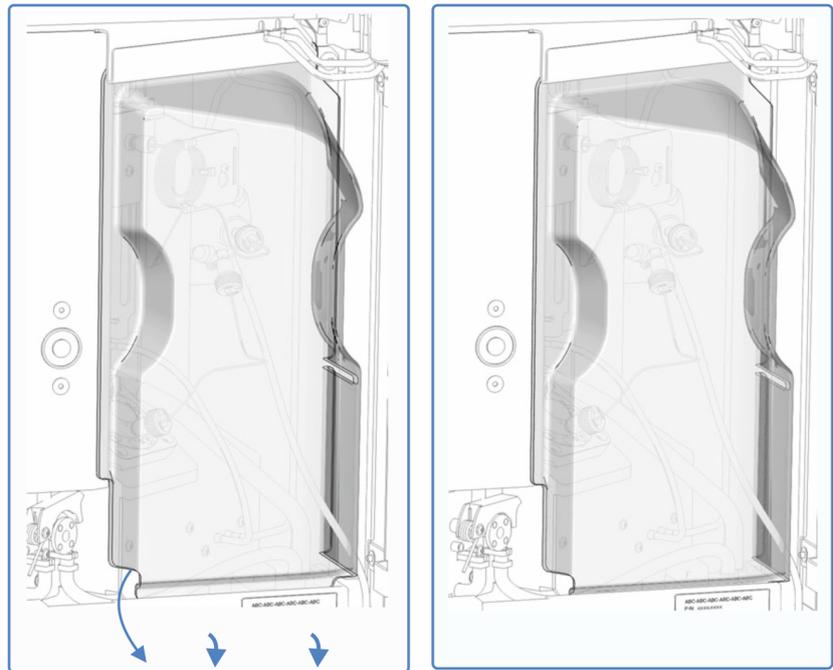


Figure 37: Left: Installing the protective cover behind the leak tray Right: Protective cover installed

5. When the protective cover sits behind the enclosure frame and the leak tray, push it downward until the cover sits firmly in the leak tray.
6. Close the right autosampler door.

5.11 Insulation Loop Cover (VC-A12 and Dual Split Samplers only)

The VC-A12 and the dual split samplers are shipped with a pre-installed insulation loop cover to protect the interior components from high humidity and extensive condensation when thermostating the sample compartment.

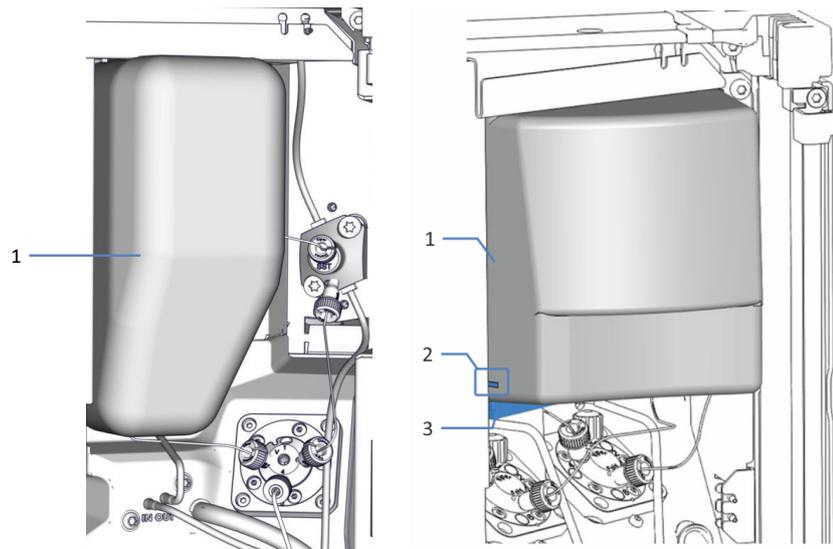


Figure 38: Insulation loop cover overview, left: VC-A12, right: Dual split sampler

No.	Description
1	Insulation loop cover
2	Groove for holding the insulation loop cover on the horizontal frame part
3	Horizontal frame part of the mounting frame

5.11.1 Removing the Insulation Loop Cover

NOTICE

This chapter describes the dual split sampler. Handling for removing the VC-A12 insulation loop cover is similar.

Follow these steps

1. Open the autosampler doors.
2. Take the cover by the bottom end and slightly pull the cover down to release the groove in the cover from the horizontal frame part.
3. Carefully pull the cover down to release it from the top enclosure frame.
4. Pull the cover away from the horizontal frame part of the mounting frame.
5. Keep the cover to reinstall it when using sample compartment thermostating.

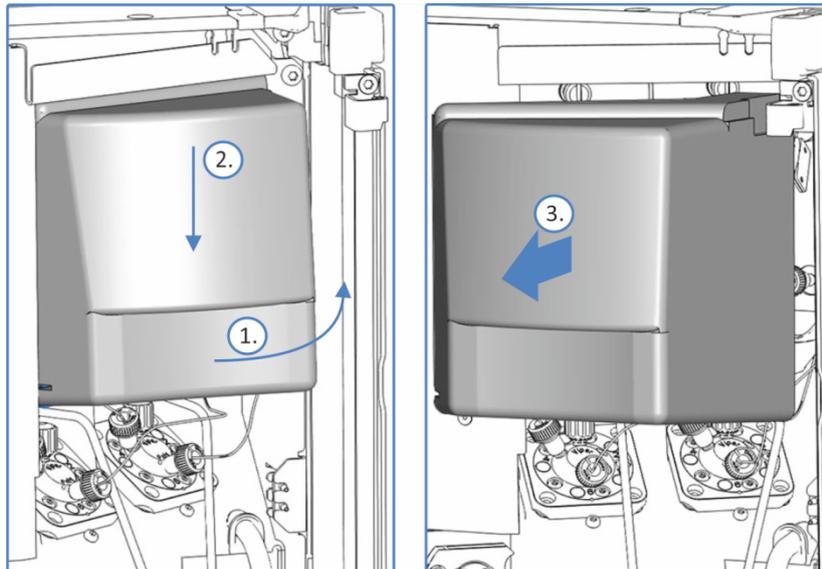


Figure 39: Insulation loop cover removal at dual split sampler

5.11.2 Installing the Insulation Loop Cover

Preparations

For dual split sampler only: If the horizontal mounting frame part was removed upon setting up flow connections for easier access to the components, check that it is properly mounted before installing the insulation loop cover.

Follow these steps

1. Align the cover with the needle units, sample loops and metering device heads on the interior front panel.
2. Position the grooves of the cover on the horizontal frame part and screws. Be careful not to clamp the seal wash lines with the cover.
3. Push the cover slightly upward to insert the top end of the cover behind the top enclosure frame.

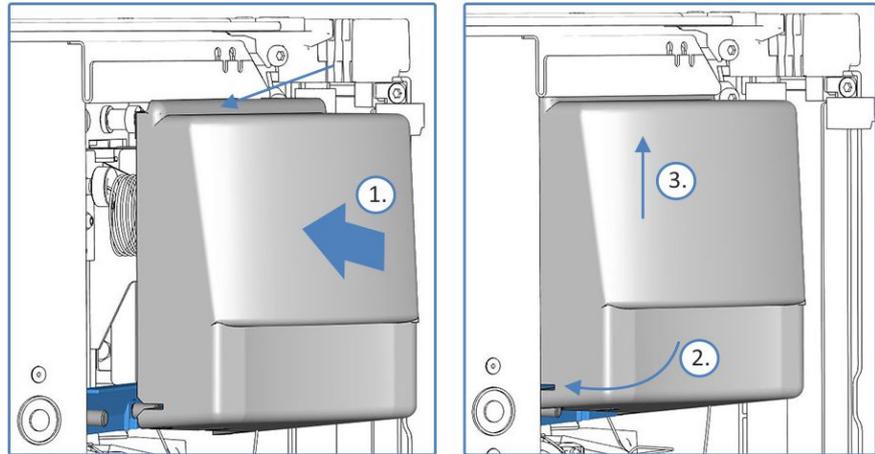


Figure 40: Insulation loop cover installation at the dual split sampler

NOTICE

For VC-A12 only: Guide the capillary from the needle seat and the tubing from the wash pump through the notches on the lower side of the insulation loop cover. Make sure that the tubing is not pinched or squeezed in the holders.

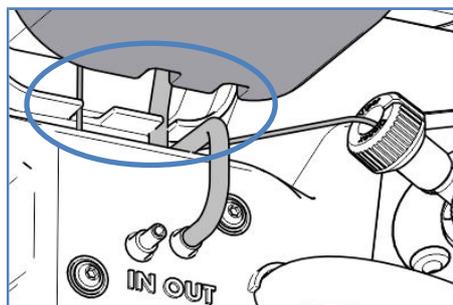


Figure 41: Loop cover notches

5.12 Turning On the Device

NOTICE

A tightened shipping lock screw can cause damage to the autosampler when you turn on the autosampler. Properly loosen the shipping lock screw of the needle unit. With dual split samplers, loosen the shipping lock screws of both needle units.

TIP

Before turning on the power to a Vanquish system module for the first time, verify that the chromatography software is installed on the data system computer. When the power is turned on, the required USB drivers are automatically found and the Windows™ operating system can detect the device.

To turn on the power to the device, follow these steps:

1. Check that the power button on the front left of the Vanquish system base (system power button) is pressed in. If the power button stands out, press the power button to turn on the power on the system base.
2. Turn on the device with its main power switch.

Turn off the device with the main power switch, when instructed to do so, for example, during maintenance. Pressing the system power button will not be sufficient to turn off the power to the device completely.

See also

 [Power On/Off Control \(▶ page 108\)](#)

5.13 Setting Up the Device in the Software

This manual assumes that the chromatography software is already installed on the data system computer and a valid license is available.

For more information about setting up the Vanquish system in the software, refer to the *Vanquish System Operating Manual*.

The Help for the software that you are using provides detailed information about the settings on each property page.

6 Operation

This chapter describes the elements for device control, provides information for routine operation and for shutdown.

6.1 Introduction to this Chapter

The information in this chapter assumes that the initial setup of the device has already been completed. If this is not the case, see the instructions in [Installation](#) (▶ page 57).

For a basic description of instrument control and automated sample analysis with the Chromeleon software, refer to the *Vanquish System Operating Manual*. Details on control and operation of the device are available in the *Chromeleon Help*.

Software descriptions in this manual refer to Chromeleon 7. Terminology may be different to that of other software versions.

6.2 Safety Guidelines for Operation

When operating the device, pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 21).



WARNING—Moving Parts

Parts inside the autosampler are moving when the autosampler prepares and performs the analyses of the sample. These moving parts can pose a pinch point hazard that may cause personal injury.

- Keep the autosampler front doors closed when the autosampler prepares and performs the analyses of the sample.
- During these phases, the LED bar on the autosampler is illuminated blue.



WARNING—Flammable and Hazardous Vapors from Spills

Flammable or hazardous vapors from sample spills can accumulate inside the autosampler. This can pose health and safety risks.

- Ensure that the sample racks and well plates are properly positioned in the segments.
- When you use sample racks, fill the sample rack with the vials before placing the sample rack in the carousel.
- If a spill occurs inside the autosampler, turn the autosampler power off. Clean up the spill and leave the autosampler door open. Allow sufficient time for the spill to dry and any vapors to disperse before putting the autosampler back into use.



CAUTION—High Luminosity of LED

The high luminosity produced by the LED illuminating the inside of the device can be harmful to the eyes.

- Do not look directly into the light produced by the LED.
- Do not use light-focusing instruments for viewing the light beam.

NOTICE

Pay attention also to the following guidelines:

- To prevent damage resulting from leakage or from running the pump dry, always set the lower pressure limit for the pump.
- If there is evidence of leakage in the device, turn off the pump flow and remedy the situation immediately.
- If the pump flow is interrupted, act appropriately to protect the components in the detector. For details, refer to the *Operating Manual* for the detector.
- Always verify that the autosampler is turned on before the pump flow is on and pressure builds up. If the autosampler is turned off, for example, after a power failure, stop the pump flow and wait until the pressure is down to zero before turning on the autosampler or other modules again.

6.3 General Guidelines

To optimize the performance of the device, consider the following general guidelines:

- Monitor the usage of specific device components that are subject to wear and stress and schedule appropriate maintenance intervals (see [Predictive Performance](#) (▶ page 139)).
- Observe the general guidelines and recommendations on the use of solvents and additives in the chromatography system. Refer to *Use of Solvents and Additives* in the *Vanquish System Operating Manual*.
- Perform a needle wash for lowest possible carry over. The needle wash ensures that the needle is properly cleaned from the remaining sample. For information on needle wash parameters, see [Important Operating Parameters](#) (▶ page 117).
- Before you switch the injection valve, make sure that pump flow is turned on. Avoid switching the injection valve without flow, i.e. switching the injection valve dryly.
- Reduce the time between the injections by enabling the sample preparation in Chromeleon. Sample preparation includes preparing needle wash steps or moving the carousel to the required segment.

TIP—Keep the Autosampler Doors Closed During Sample Processing

- If the doors are opened during needle and carousel movement, the autosampler stops the current movement of the needle arm. The needle does not puncture the sample container and does not draw sample. An acoustic signal alerts you that the doors are open.
- Every time the doors are closed, the autosampler performs an inventory scan of the sample racks and sample containers in the sample compartment.

6.4 Control Elements

The device is designed to be operated mainly from a computer running with the chromatography software.

In addition, the following elements are available on the device:

- **Keypad**
The keypad buttons allow you to perform certain functions directly from the device.
- **Status indicators**
The LEDs (Light Emitting Diodes) on the status indicator LED bar on the front side of the device and the **STATUS** LED on the keypad provide a quick visual check of the operational status of the device.

6.4.1 Keypad

The keypad inside the device allows you to perform certain functions directly from the device. When you press a button, a short beep confirms that the function is performed.

When the device is connected in the Chromeleon software, some functions may not be available from the keypad (see further down in this section).

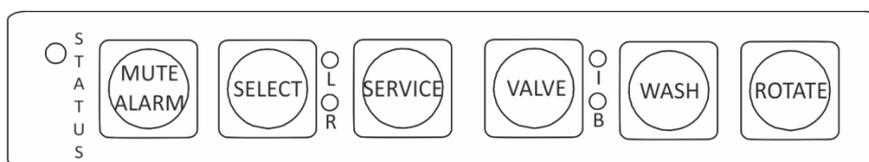


Figure 42: Keypad

STATUS

The **STATUS** LED provides a quick visual check of the operational status of the device.

When the doors are closed, the LED bar on the front side indicates the operational status.

For status details, see [Status Indicators](#) (► page 107).

MUTE ALARM

Beeping alerts you when the device detects a problem, for example, leakage. To turn off the beep for the current alarm, press this button. Eliminate the source for the alarm within 10 minutes. Otherwise, beeping starts again. If the device detects a different problem, beeping alerts you again immediately.

SELECT

Only enabled with dual split samplers (VH-A40 and VF-A40)

Pressing the **SELECT** button selects an injection unit to make further settings. If an injection unit is selected, the corresponding LED is illuminated green and the **SERVICE**, **VALVE** and **WASH** buttons are enabled for this injection unit.

Illuminated LED	Description
LED L	Left injection unit is selected
LED R	Right injection unit is selected

SERVICE

The **SERVICE** button has several functions:

- Pressing the **SERVICE** button one time moves the needle up from the needle seat and sets the injection valve to **Bypass** position. This is necessary, for example, when securing the needle unit by tightening the shipping lock screw.
- Pressing the **SERVICE** button a second time initializes the needle and the needle moves over the wash port.
- Pressing the **SERVICE** button a third time descends the needle back into the needle seat. Also the needle initializes and the injection valve is set to **Inject** position.

Note: The shipping lock screw should be loosened.

With dual split samplers, select the injection unit first using the **SELECT** button before you perform any actions on the injection unit.

VALVE

The **VALVE** button allows switching the injection valve between **Bypass** and **Inject** position. The LEDs next to the **VALVE** button indicate the position of the injection valve when they are illuminated green.

Illuminated LED	Position
LED I	The injection valve is in Inject position.
LED B	The injection valve is in Bypass position.

Illuminated LED	Position
Both LEDs I and B	The injection valve draws sample from the sample container.

With dual split samplers, select the injection unit first using the **SELECT** button before you perform any actions on the injection unit.

WASH

Pressing the **WASH** button initiates a manual needle wash cycle, in which the outer needle surface is washed in the wash port. The wash cycle is performed with the wash settings as defined in Chromeleon. After the needle wash cycle, the needle moves back to the needle seat.

With dual split samplers, select the injection unit first using the **SELECT** button before you perform any actions on the injection unit.

ROTATE

The **ROTATE** button allows rotating the carousel counterclockwise to the next loading position.

When the Device is Connected in the Chromeleon Software

The button functionality is as follows when the device is connected in the Chromeleon software:

- No injection or sequence is running:
All functions are available from the keypad.
- An injection or sequence is running:
The **MUTE ALARM** function remains available from the keypad, allowing you to turn off the beep for the current alarm.

In addition, the **ROTATE** button remains available from the keypad allowing you to rotate the carousel.

6.4.2 Status Indicators

The status LED bar on the front side of the device and the **STATUS** LED on the inside keypad provide information about the device status.

LED Bar

The LED bar colors provide the following information:

LED Bar	Description
Off (dark)	The power to the device is turned off.
Dimmed	The doors of the device are open.
Yellow, flashing slowly	The power to the device is turned on, but the device is not connected in the chromatography data system.
Yellow	The device is connected in the chromatography data system, but the device is not equilibrated.
Green, flashing	The device is equilibrating. If you use sample compartment thermostating, the thermostating temperature is not yet achieved.
Green	The device is equilibrated, but no data acquisition is running. If you use sample compartment thermostating, the thermostating temperature is achieved.
Blue, running	The autosampler performs preparations for injection. Parts of the autosampler are moving.
Blue	An injection or sequence is running, including data acquisition.
Red	A problem or error has occurred. For the related message, check the Instrument Audit Trail. For remedial action, see Troubleshooting (▶ page 229).

STATUS LED

The **STATUS** LED on the keypad inside the device provides the following information:

STATUS LED	Description
Off (dark)	The power to the device is turned off.
Green	The device is functioning properly.
Red	A problem or error has occurred. For the related message, check the Instrument Audit Trail. For remedial action, see Troubleshooting (▶ page 229).

For information about the LEDs that are present next to a button on the keypad, see [Keypad](#) (▶ page 104).

6.5 Power On/Off Control

The power switch on the device is the main switch for power on/off control. The main power switch is turned on during initial installation of the device.

For easier handling, you can use the power button on the front left of the Vanquish system base (system power button) for power on/off.

Observe the following:

- All modules in the Vanquish system that are connected to the system base via system interlink cables are turned on or off simultaneously when the system power button is pressed.
- When the power is on, the system power button is pressed in. When the power is off, the system power button stands out.
- If the main power switch on a device is off, you cannot turn on the device with the system power button.
- To turn off a device completely, you *have to* turn it off with the main power switch on the device. Pressing the system power button will not be sufficient to turn off the power to the device completely.

Upon power up, the device performs a self-test. If the self-test is not successful, the status indicators are red and the device is not ready for analysis. Check the Instrument Audit Trail for the related message and take appropriate remedial action.

At the end of the power up, the device sets the injection valve to Inject position.

6.6 Preparing the Device for Operation

This section gives information on any additional steps that are required to prepare the device for operation and sample analysis.

Before Operating the Device for the First Time

Prepare the device for the first-time operation, observing the following:

NOTICE

Flush the system flow path thoroughly before operating the device for the first time:

- When you install devices or components to the system, always flush them to waste before connecting them in the system flow path. To flush the Vanquish modules, follow the instructions in the *Vanquish System Operating Manual*.
 - Some components of the device are filled with isopropanol when the device is shipped from the manufacturing site. When operating the device for the first time, use solvents that are miscible with isopropanol. If they are not, use an appropriate intermediate solvent.
-
- To remove the isopropanol from the device components:
 - ◆ Verify that the flow cell and the column are not connected in the flow path.
 - ◆ Purge the pump and then have the pump deliver flow for a short time.
 - Verify that any air bubbles are completely flushed out of the system flow path.
 - *Only Vanquish systems with quaternary pump or dual pumps:* Synchronize the injection time of the Vanquish autosampler with the strokes of the pump. See [Synchronizing the Injection Time with the Pump Strokes](#) (▶ page 116).

Before Starting Sample Analysis

Before starting an analysis:

- Check the liquid level in the solvent reservoirs. Verify that the amount of solvent is sufficient for the analysis.
- Load the carousel with sample racks, sample containers and vials as required. See [Loading the Carousel](#) (▶ page 112).
- Set rack types, if applicable. See [Rack Type Settings](#) (▶ page 115).

TIP Before starting a sample or sequence, verify that the rack types set in Chromeleon match the rack types in the sample compartment.

- *VC-A12 and Dual split sampler only:* Install the insulation loop cover. See [Installing the Insulation Loop Cover](#) (▶ page 95).
- *Single split sampler only (optionally):* Install the protective cover behind the right front door of the autosampler, if applicable. See [Installing the Protective Cover \(Optional for VH-A10 and VF-A10\)](#) (▶ page 92).
- Close the doors of all modules in the Vanquish system, if not already done.
- Check the needle wash system:
 - ◆ Check the liquid level in the needle wash reservoir. Make sure that the amount of wash liquid is sufficient for the analysis.
 - ◆ In the chromatography data system, purge the needle wash system to fill the wash port with the fresh needle wash liquid. During purging, the wash port is flushed continuously until the fresh needle wash liquid is present. See [Washing the Needle](#) (▶ page 147).
- Make sure that the chromatography system is properly equilibrated (see further down).

System Equilibration

System equilibration should include the following operations:

- Purging the pump (*all* channels, including those not used for the application)
- Flushing the entire chromatography system with the starting solvent to rinse out any solvent from a previous analysis run
- Warming up (or cooling down) all temperature-controlled devices in the system to the starting temperature. Temperature-controlled devices can be, for example
 - ◆ Column compartment and post-column cooler
 - ◆ Sample compartment thermostating in the autosampler
 - ◆ Flow cell in a fluorescence detector
 - ◆ Evaporation tube in a charged aerosol detector
- Turning on the lamp (or lamps) in the UV/VIS detector

- Monitoring the pump pressure and pressure ripple and checking that the pressure is stable and the ripple within reasonable limits for the application
- Monitoring the detector signal and checking whether the detector signal is stable so that the drift and signal noise are within reasonable limits for the application
- Performing an autozero of the detector baseline

TIP The Chromeleon software supports procedures for automatically starting a chromatography system in the software (**Smart Startup**). The startup procedure includes the operations for system equilibration. For details, refer to the *Chromeleon Help*.

6.6.1 Thermostating the Sample Compartment

This section applies to all autosampler types except VC-A13.

NOTICE

for VC-A12 and Dual split samplers only: The insulation loop cover must be installed to use sample thermostating with VC-A12 and dual split sampler. If the cover is not installed properly, thermostating cannot be enabled or will be turned off automatically to protect the interior components from high humidity and extensive condensation when thermostating the sample compartment. In Chromeleon, the **Loop Cover Status** indicates if the cover is installed correctly.

To use thermostating of the sample compartment, define the following parameters:

- Temperature control
To thermostat the sample compartment, enable temperature control (**Temperature Control = On**).
- Target temperature

Define the temperature setpoint to which the sample compartment is to be cooled or heated (**Temperature Nominal**). Observe the following:

- ◆ Ensure that the thermostating temperature is suitable for your samples and within the specified temperature range of the autosampler.
- ◆ When you enter a temperature while temperature control is disabled, temperature control will be enabled.
- ◆ If the autosampler is turned off and on again, the temperature remains at the value set before power off. Check the temperature upon power up and adapt it if required.

TIP If the autosampler is operated with the Charger, the temperature control and the set target temperature also apply for the thermostating of the Charger compartment.

6.6.2 Loading the Carousel

For further information on the sample compartment in general, the carousel as well as the rack type identification, see [Sample Compartment](#) (► page 44).

Parts required

- *As required*
Vials (O.D. 22.5 mm) for the support vial holders (for example, 10 mL vials)
- Sample racks and/or well plates
Observe the following notes for selecting sample racks and/or well plates:
 - ◆ The autosampler supports sample racks and well plates with a footprint as specified by the **Society for Biomolecular Screening (SBS footprint)**.
 - ◆ Rack type identification
To allow the identification of the sample rack or well plate type with the barcode reader in the autosampler, use sample racks and well plates with such barcodes for rack type identification.

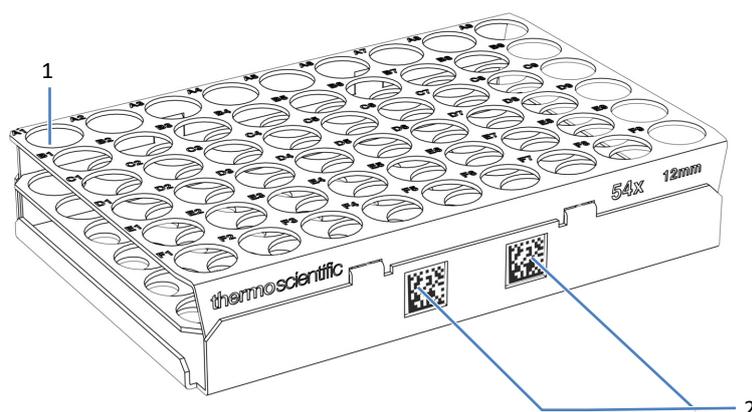


Figure 43: Sample rack with barcodes for rack type identification

No.	Description
1	Sample position A1
2	Vanquish rack type barcode

TIP For ordering information for sample racks and well plates for the autosampler, refer to the re-ordering information that is included in the sample container kit shipped with the autosampler.

Preparations

- *If autosampler is running and you want to unload and load the carousel:*
Before opening the autosampler front doors, check the LED bar of the autosampler. Do not open the front doors when the LED bar is running blue. Parts of the autosampler are moving.
- All autosamplers except VC-A13: Check the set temperature for sample compartment thermostating and set the temperature as required. See [Thermostating the Sample Compartment](#) (▶ page 111).
- If you operate the autosampler with the Charger, observe the guidelines for operation of the autosampler with the Charger. See [Operation with the Vanquish Charger](#) (▶ page 122).
- For use of sample racks, position the vials with your samples in the sample rack.

TIP If you install sample racks or well plates without Vanquish rack type barcodes to the carousel, the rack type and rack orientation will not be identified automatically. It may be helpful to write down the rack types that are installed in the carousel to enter them manually later in Chromeleon.

Follow these steps

1. Rotate the desired segment of the carousel to the front. You can rotate the carousel in the following ways:
 - ◆ Select the **ROTATE** button on the keypad. Pressing the button rotates the carousel counterclockwise to the next loading position.
 - ◆ Rotate the carousel manually to the desired direction.
 - ◆ Use Chromeleon to move the required segment to the front.
2. Position the sample rack or well plate in the selected segment. The sample rack or well plate must sit in the alignment frame and rest on the alignment points of the segment.

NOTICE—Correct Orientation of Sample Racks

Positioning sample racks or well plates in the wrong orientation may damage the autosampler or lead to wrong results.

Position sample racks and well plates always in the correct orientation in the carousel, with position A1 on the top left position.

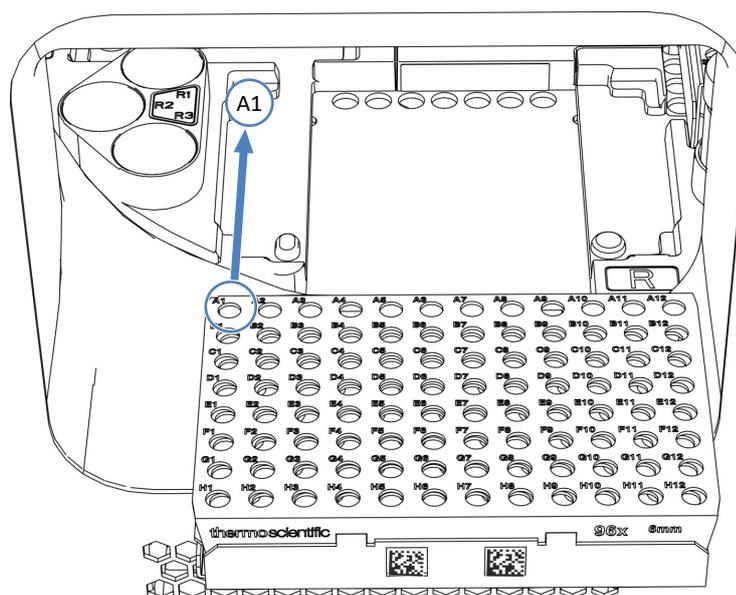


Figure 44: Correct orientation in carousel (here with a sample rack)

3. Load the support vial holders, if required.
4. Rotate to the next loading position and load it as required. Continue until you have loaded all segments as required.
5. Close the front doors of the autosampler.
The autosampler starts an inventory scan of the sample racks and sample containers in the sample compartment.
6. Continue as required by the sample racks or well plates that are installed in the carousel. See [Rack Type Settings](#) (▶ page 115).

6.6.3 Rack Type Settings

Depending on the sample racks or well plates installed in the carousel, proceed as required:

- *Sample racks or well plates with Vanquish rack type barcodes are used*
During the inventory scan, the autosampler rotates the carousel and detects the container type for sample racks and well plates with a Vanquish rack type barcode. Wait until the rack identification is completed.

The rack types are entered automatically for the **RackType** parameter of each segment in Chromeleon. Note the following:

- ◆ If a Charger is used with the autosampler, the yellow segment is reserved for the sample racks or well plates that are delivered from the Charger. The **RackType** is displayed as **Charger**.
- ◆ If no sample rack or well plate is installed in a segment of the carousel, the rack type for this segment is displayed as empty (**Empty**).
- *Sample racks or well plates without Vanquish rack type barcodes are used*
No rack type identification or rack orientation is available. Make sure that the sample rack or well plate is installed in correct orientation. Manually select the rack types for each segment in Chromeleon.

To change a sample rack or well plate, use the **ChangeRack** command for the respective segment in Chromeleon.

For details on the rack type settings, refer to the *Chromeleon Help*.

6.6.4 Synchronizing the Injection Time with the Pump Strokes

This section applies only to Vanquish systems with quaternary pumps, dual pumps and binary VH-pumps.

To enhance the retention time precision with gradient applications, you can synchronize the injection time of the Vanquish autosampler with the strokes of the Vanquish pump. The synchronization ensures that all injections are performed at the same phase of the pump cycle.

Synchronization is possible only when configured in the Chromeleon software (refer to the *Chromeleon Help*).

Then, the following properties are available in the Chromeleon software:

- **SyncWithPump**
To enable synchronization, set the property to **On**. To disable synchronization, for example, for a specific application, set **SyncWithPump** to **Off**.
- **Pump**
Shows the name of the pump to which the autosampler is linked.

6.7 Important Operating Parameters

The parameters described in this section should be considered for routine operation of the device. You can usually access these parameters from the Chromeleon user interface.

If a parameter listed below is not available in the Chromeleon software, consider updating the firmware and Chromeleon version.

For more information, refer to *Chromeleon Help and documents*.

TIP *Dual split sampler only:* In Chromeleon, the injection and needle wash parameters are available for the left and right injection unit, respectively.

Sample Compartment and Rack Parameters

Parameters	Description
Change rack	Rotate the required segment of the carousel to the front to install or remove a sample rack or well plate.
Needle height	<p>The needle height specifies the distance between the bottom of the sample container, as measured from the interior, and the tip of the needle.</p> <p>The needle height is pre-defined as Safe, which corresponds to a needle height of 2.0 mm. This value ensures that the needle does not touch the bottom of most common sample containers, such as conical vials provided by Thermo Scientific in a sample rack for 54 x 12 mm O.D. vials.</p>
Puncture offset	<p>The puncture offset defines how much the needle opens the septum. The carousel moves by the specified value while the needle is in the septum, thus enlarging the hole in the septum for equalizing the pressure.</p> <p>The puncture offset is pre-defined. This is the preferred setting.</p> <p>NOTE: Check and adapt the puncture offset especially when sample containers are filled to the maximum, or when using poorly degassed samples.</p>
Rack type (blue, green, red, yellow)	<p>The rack type specifies the type of sample rack or well plate that is installed in the respective segment (RackType_Blue, _Green, _Red or _Yellow).</p> <p>For details on the rack type settings, see Rack Type Settings (▶ page 115).</p>
Sample compartment light	<p>Turn the sample compartment light off or on.</p> <p>As a standard, the sample compartment light is turned on (Light = On).</p> <p>NOTE: The light is always turned on when the autosampler doors are opened, even if the sample compartment light has been turned off.</p>

Parameters	Description
Sample position	<p>The sample position identifies the position from which the needle draws the sample.</p> <p>The Sample Position consists of the color code for the segment and the position on the sample rack, well plate, or support vial holder, which are separated by a colon (for example, B:E8 for segment B, sample position E8).</p> <p>TIP: For vials in the support vial holders, the color codes are preceded by an 'S' (for example, SY:1 for the support vial holder (S) in segment Y, sample position 1).</p>

Injection and Sample Loop Parameters

Parameters	Description
Injection volume	Set the injection volume for the sample (in μL) that is to be injected.
Nominal loop volume	The nominal loop volume defines the maximum allowed injection volume (in μL) of the sample loop installed in the autosampler.
Total loop volume	The total loop volume is the actual volume of the sample loop. It is specified on the label of the sample loop in brackets, for example (V=50 μL) if a sample loop with a nominal loop volume of 25 μL is installed.
Preparation of sample injection	<p>The sample preparation defines if an advanced sampling is to be started during the equilibration period of the analysis. The autosampler carries out preparing steps for the sample. This can reduce the time between the injections.</p> <ul style="list-style-type: none"> • To use the sample preparation for this injection, select Prepare This Injection. • To use the sample preparation for the next sample, select Prepare Next Injection.
Pump	<p>Select the pump flow unit that delivers the flow through the autosampler during injection.</p> <p>As a standard, the name Pump is defined. To change the name, enter a different name in the name field.</p>
Synchronization of the injection time with the pump strokes	<p><i>Relevant for quaternary pump, dual pump, and binary VH-pump only</i></p> <p>Synchronizing the injection time with the pump strokes enhances the retention time precision. For details, see Synchronizing the Injection Time with the Pump Strokes (► page 116).</p>

Metering Device Parameters

Parameters	Description
Idle volume	The idle volume defines the idle position of the metering device during a sample run.
Metering head dock	Dock the metering device head after performing replacement. The autosampler prepares the metering device head for operation. TIP The ePanel Set for the autosampler in Chromeleon may provide a dialog with corresponding buttons.
Metering head undock	Undock the metering device head before starting replacement. The autosampler prepares the metering device head for replacement. TIP The ePanel Set for the autosampler in Chromeleon may provide a dialog with corresponding buttons.

Temperature Control Parameters

Parameters	Description
Drain pump	Indicates the status of the drain pump whether it is in operation. Can be used to manually switch the drain pump on or off. The parameter is controlled by the drain pump interval to remove the expected condensation from the sample compartment periodically. Most of the time the drain pump is disabled (Drain Pump = Off).
Drain pump interval	As a standard, the drain pump interval is set to 0 (Drain Pump Interval = 0 min, automatic mode). This is the preferred setting. The value drain pump interval can be controlled by manually setting a value larger than 0. If the value is set to 0 the firmware controls the drain pump interval automatically. In the automatic modus the drain pump is switched in periods depending on the environmental temperature and the sample compartment temperature to safely remove condensation. TIP If the automatic mode is not sufficient for extraordinary high humidity conditions, it is recommended to set a fixed period that fits to your environmental conditions. For example, start with 10 minutes and observe if air or air bubbles are pumped at the end of a typical interval. This means you can assume that all the liquid is removed from the condensation drain area. Decrease the interval to remove more liquid or increase the interval if less condensation liquid appears.

Parameters	Description
Loop cover status	<p><i>VC-A12 single split sampler and dual split sampler only</i></p> <p>The parameter indicates whether the insulation loop cover is properly installed. If the cover is not installed properly, temperature control cannot be enabled or will be turned off automatically.</p>
Temperature control	<p>Enable or disable the temperature control for the sample compartment and corresponding Charger, if available and connected. As a standard, the temperature control is enabled.</p> <p>This parameter is not available for VC-A13.</p> <p><i>VC-A12 and Dual split sampler only:</i> Temperature control can only be enabled if the insulation loop cover is installed properly.</p>
Temperature nominal	<p>The temperature setting defines the setpoint to which the sample compartment and corresponding Charger, if available and connected, is to be cooled or heated.</p> <p>As a standard, the default temperature is set to 20 °C (Temperature Nominal = 20). For details, see Thermostating the Sample Compartment (▶ page 111).</p> <p>This parameter is not available for VC-A13.</p>

Needle Wash Parameters

Parameters	Description
Wash	<p>Perform a manual needle washing procedure with the wash time and wash speed that is currently defined.</p> <p>Select Wash to perform a manual needle wash cycle.</p> <p>For details on washing the needle with fresh needle wash liquid, see Washing the Needle (▶ page 147).</p>
Inject wash mode	<p>The wash mode defines if and when an automatic needle wash is to take place during the sampling sequence. Needle wash helps to reduce carry-over.</p> <p>The following wash modes are available:</p> <ul style="list-style-type: none"> • No Wash: The needle wash in the wash port is not part of the sampling sequence. • Before Draw: The needle is washed before it draws new sample. • After Draw: The needle is washed after it has drawn sample. • Both: The needle is washed before it draws new sample and after it has drawn sample. <p>A needle wash is performed with the defined wash time and wash speed.</p> <p>As a standard, the wash mode is set to No Wash in Chromeleon.</p>

Parameters	Description
Wash pump	<p>Turn the needle wash pump on (Wash Pump = On) to flush the needle wash system with needle wash liquid.</p> <p>As a standard, the needle wash pump is turned off (Wash Pump = Off).</p> <p><i>Purging the needle wash system</i></p> <p>To purge the needle wash system with fresh needle wash liquid, for example after replacing the needle wash liquid, select the Purge needle wash button on the ePanel for the autosampler.</p> <p>Chromeleon turns on the needle wash pump and performs a needle wash cycle with dedicated wash settings for purging the needle wash system.</p> <p>After purging, the needle wash pump is turned off again and the previous wash settings are restored.</p>

Other Parameters

Parameters	Description
Digital I/O	For pin assignment, connection information and inject response signal synchronization, see Digital I/O (▶ page 265).
Leak detection	Leak detection is enabled as a standard when the device is shipped (Leak Sensor Mode = Enabled). This is the preferred setting.

6.7.1 User-Defined Programs

The Vanquish Autosamplers VC-A12, VC-A13, VF-A10 and VH-A10 support user-defined programs to setup individual injection routines, for instance to combine an automated sample preparation workflow with an injection.

These user-defined programs must be defined and configured in the Chromeleon Software. For more information, refer to *Chromeleon Help and documents*.

6.8 Operation with the Vanquish Charger

In addition to the guidelines and instructions in this section, observe the instructions, safety precautions and notes in the *Charger Operating Manual*.

6.8.1 Guidelines for Carousel and Charger

NOTICE

Always keep the front doors of the autosampler and the Charger closed while the mover is moving and the **Mover Status** LED is blinking green to ensure proper operation and interaction between the two devices.

- In the single split autosampler leave segment **Y** (yellow) of the carousel empty. By default the Charger delivers sample racks and well plates only to segment **Y**. It is possible to setup up to four positions in the configuration.
- In the dual split autosampler leave segment **Y** (yellow) and **B** (blue) of the carousel empty. By default the Charger delivers sample racks and well plates only to segment **Y** and **B**. It is possible to setup up to four positions in the configuration.
- If the Charger has delivered a sample rack or well plate to segment **Y** before you load the carousel, leave the sample rack or well plate in the segment. Do not manually remove the sample rack or well plate from segment **Y** during normal operation.
- *If a sample rack or well plate had to be removed manually from segment Y or if another control error occurred:*
In Chromeleon, perform the **Reset** command to reset the internal control information for the Charger and the autosampler.
- To allow identification of the sample rack or well plate type using the barcode readers in the Charger and in the autosampler, use sample racks and well plates with Vanquish rack type barcodes.

- Before opening the front door of the Charger to load or unload the Charger during analysis, observe the following:
 - ◆ Before you open the door, check the **Mover Status** LED on the front panel of the Charger. Avoid opening the doors of the Charger and the autosampler when the **Mover Status** LED is blinking green. This indicates that the mover is currently executing an operation.
 - ◆ When you open the door while the mover is executing an operation, the mover will finish the current movement and will then stop.
 - ◆ It is not possible to issue any commands from Chromeleon while the door is open. In addition, an open door may delay the processing of a queue.

6.8.2 Guidelines for Operational Settings

- Enable operation with the Charger in the configuration of the autosampler in Chromeleon.
- To connect the autosampler and the Charger in Chromeleon, verify that both, the autosampler and the Charger are turned on.
- To operate the autosampler without the Charger, disable the Charger in the configuration of the autosampler in Chromeleon.
- The temperature settings of the autosampler also apply for the Charger. If the temperature control is disabled for the autosampler, the Charger temperature control and settings are disabled as well.
- Adapt other operational settings for the Charger in Chromeleon as required.
For an overview of the operational settings for the Charger, refer to the *Charger Operating Manual*.

6.8.3 Closing the Charger Extension Opening

When the Charger has been removed, close the Charger opening to continue autosampler operation without the Charger:

1. Have the Charger dismantled by a Thermo Fisher Scientific service engineer.

2. To close the Charger opening of the autosampler:
 - a) Push the foam part from inside the sample compartment into the opening. Step not required for VC-A13 autosampler (no foam part used there).
 - b) Reinstall the metal cover plate. If the metal cover plate is attached with screws, tighten the screws.
3. In the Instrument Configuration Manager, open the autosampler configuration and disable the **Charger** check box.

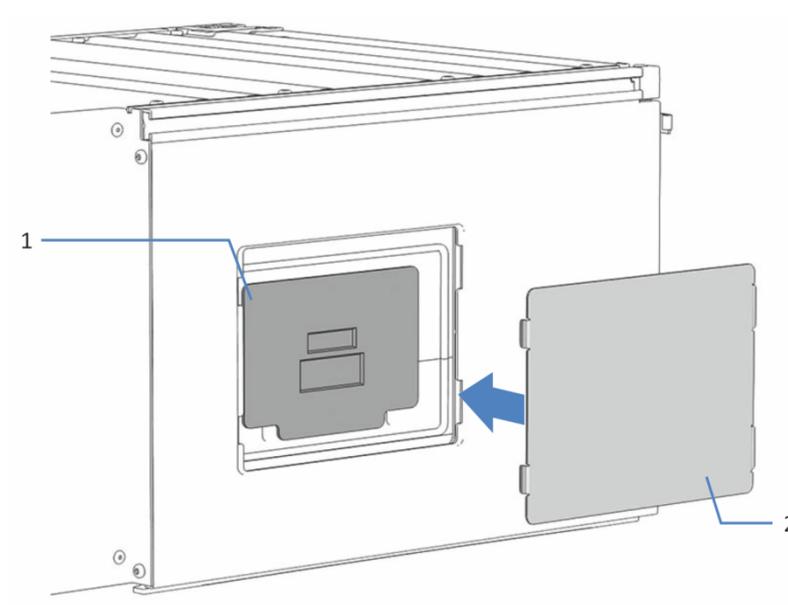


Figure 45: Closing the Charger opening (here with metal cover plate clamped in the opening)

No.	Description
1	Foam part to insulate the sample compartment (not available in VC-A13)
2	Metal plate cover to cover the charger extension opening in the enclosure

6.9 Shutting Down the Device

If the device will not be operated for some time, follow the instructions in this section to shut down the device.

TIP The Chromeleon software provides procedures for automatically preparing the chromatography system for shutdown. The procedures include, for example, operations for reducing the flow rate, reducing the temperature in temperature-controlled devices, and turning off the detector lamps. For information about **Smart Shutdown** and **Smart Standby**, refer to the *Chromeleon Help*.

6.9.1 Short-Term Shutdown (Interruption of Operation)

To interrupt operation of the device for a short period (short-term shutdown), for example, overnight, observe these guidelines for the Vanquish system modules, as required by your system arrangement:

TIP Flush the needle wash system with an organic needle wash liquid, such as isopropanol, before you interrupt operation to avoid organic growth in the needle wash system. Keep in mind that organic content in the needle wash liquid can vaporize during interruption, thus decreasing the wash liquid.

- For your Vanquish detector, note the following:

Detector Type	Description
Charged aerosol detector	Check that sufficient gas is available to continue gas flowing through the detector. This is to prevent any build-up of residue from solvents or analytes. Gas must be flowing when pump flow is delivered to the detector.
UV/VIS detectors	The lamp(s) in the detector can remain turned on. <i>Variable wavelength detector and VH-D10 diode array detector only:</i> The shutter can be moved to a closed position for protection of the flow cell.
Fluorescence detector	Turn off temperature control for the flow cell.

- Apply a flow of 0.05 mL/min and have the pump deliver an appropriate solvent.
Check the lower pressure limit for the pump and adapt the value if necessary. If the pressure falls below the lower limit, the pump stops the flow.
- Set the injection valve in the autosampler to the Inject position.

- Make sure that the temperature of the column does not exceed 40 °C.
- When resuming operation, let the flow equilibrate and verify that the operating parameters for the other system modules are set as required before proceeding.

6.9.2 Long-Term Shutdown

To interrupt operation for a longer period, follow the instructions below.

- If a Charger is connected to the autosampler and the autosampler is shut down, shut down the Charger, too.
- To shut down a dual split sampler, perform the instructions below for both injection units.

TIP Shutting down the device affects the operation of the system. When shutting down the device, also observe the shutting down instructions for the other Vanquish system modules and take appropriate action (refer to the *Operating Manuals* for the modules).

1. Set the injection valve to **Inject** position if the valve is not yet in this position.
2. Remove the column.
3. Flush the system with an appropriate solvent (minimum HPLC-grade). Observe the following:

TIP With a Vanquish Core system that has been modified for using normal-phase compatible solvents and additives, refer to the information about the flushing liquid in the *Considerations with Normal-Phase Compatible Solvents and Additives* section in the *Vanquish System Operating Manual*.

Situation after Shutdown	If no additive is used	If an additive is used
Device remains in the laboratory after shutdown	Flush the system, for example with methanol. 100% acetonitrile should not be used.	Flush the system with several volumes of methanol and water (50:50) (for example, 1.0 mL/min for 10 minutes with the standard system) to prevent salt buildup in the fluidics. If the solvents in the device are not miscible with water, use an appropriate intermediate solvent.
Device shall be transported or shipped after shutdown	Flush the system with isopropanol.	Flush the system first with several volumes of methanol and water (50:50) (for example, 1.0 mL/min for 10 minutes with the standard system) to prevent salt buildup in the fluidics. If the solvents in the device are not miscible with water, use an appropriate intermediate solvent. Afterward, flush the system with isopropanol.

4. Set the injection valve to **Bypass** position.
5. Turn off the pump flow. Wait until the system pressure is down to zero before you continue the shutdown of the device.
6. *If the autosampler shall be transported or shipped after shutdown:* Flush the needle wash system with an organic needle wash liquid, such as isopropanol, before you interrupt operation to avoid organic growth in the needle wash system.
7. To empty the drain pump, leave the drain pump turned on until no condensing water is present in the waste tubing of the drain pump. Then turn off the drain pump.

8. Remove the sample racks and sample containers from the sample compartment.
If condensation or spilled samples are present in the sample compartment, clean and decontaminate the sample compartment before you proceed. Verify that the autosampler has been cleaned and/or decontaminated as appropriate.
9. *If the autosampler shall be transported or shipped after shutdown:* Secure the needle unit (see [Securing the Needle Unit](#) (▶ page 140)).
10. *Dual split sampler only:* Before closing the autosampler doors, install the insulation loop cover (see [Installing the Insulation Loop Cover](#) (▶ page 95)).
11. The step depends as follows:

Situation	Steps
Device and all other system modules remain in the system stack and are to be turned off	Turn off the system with the system power button on the system base.
Device shall be transported or shipped after shutdown	If one of the modules shall be removed from the system stack, turn off <i>all</i> system modules with their main power switch. Pressing the system power button will not be sufficient to turn off the power to the devices completely. Follow the instructions in Transporting or Shipping the Device (▶ page 218).

TIP When the power is turned off to the autosampler, the left front door of the autosampler is opened automatically for proper ventilation of the sample compartment and cannot be closed while the power is turned off.

6.9.3 Restart after Long-Term Shutdown

To restart the device after a long-term shutdown, follow these steps:

1. *Dual split sampler only*: Remove the insulation loop cover (see [Removing the Insulation Loop Cover](#) (► page 95)).
2. Unlock the needle unit (see [Unlocking the Needle Unit](#) (► page 209)).
3. Turn on the device. Observe the following:

Situation	Action
If the device remained in the system stack and all system modules were turned off.	Turn on the system with the system power button on the system base.
If the device is restarted after transport.	Turn on the device with the main power switch.

4. Prepare and restart the other modules in the Vanquish system, following the instructions in the *Operating Manuals* for the modules. Pay special attention to the *Preparing the Module for Operation* section.
5. Turn on the pump flow and flush the flow path of the autosampler.
6. Before starting an analysis, let the device equilibrate and be sure that it is ready for operation. See *Preparing the Device for Operation*.

7 Maintenance and Service

This chapter describes the routine maintenance and the service procedures that the user may perform.

7.1 Introduction to Maintenance and Service

This chapter describes the routine maintenance and service and repair procedures that the user may perform.



Additional maintenance or service procedures must be performed only by service personnel certified by Thermo Fisher Scientific (for brevity, referred to as Thermo Fisher Scientific service personnel).

The device is designed for easy maintenance and service. The user-serviceable parts of the device can be accessed from the front. If not stated otherwise, the maintenance procedures do not require that you remove the device from the system.

The maintenance procedures do not require that you remove the doors. However, it is possible to remove a door if this should ever be required for a specific reason or procedure. If you need to remove a door, follow the related steps in [Replacing the Doors](#) (▶ page 216).

7.2 Safety Guidelines for Maintenance and Service

When performing maintenance or service procedures, pay attention to the following safety guidelines:



Observe all warning messages and precautionary statements presented in [Safety Precautions](#) (▶ page 21).



WARNING—High Voltage

High voltages are present inside the device that could cause an electric shock.

Do not open the housing or remove protective panels unless specifically instructed to do so in this manual.



WARNING—Sharp Tip of Injection Needle

The injection needle has a very sharp tip that can cause injury to the skin.

To avoid personal injury, never touch the needle tip.



WARNING—Escape of Hazardous Substances from Flow Connections

Flow and capillary connections can be filled with substances that can pose health risks. Solvent can spray when capillaries burst, slip out of their fittings, or are not properly tightened or when capillary connections are otherwise open.

- Wear appropriate protective equipment and follow good laboratory practice.
- Before starting maintenance or repair procedures, flush out harmful substances with an appropriate solvent.



WARNING—Tilting Liquid Reservoirs

Liquids in the reservoirs on the solvent rack might contain harmful substances. Spilling of these substances can pose health and safety risks.

To prevent the reservoirs from tilting, be careful not to pull on the liquid lines when performing maintenance.

**CAUTION—Spraying Solvent**

Solvents can spray when under high pressure.

- Stop the pump flow prior to opening the flow path.
- Wait until the system pressure is down to zero.
- When opening the flow path, wear appropriate protective equipment.

**CAUTION—Hydrostatic Pressure**

Solvent may spill when you open the flow path. This is due to hydrostatic pressure in the system when the solvent reservoirs are located above the pump outlet. Before you loosen a connection in the flow path:

- Turn off the pump flow and wait until the system pressure is down to zero.
- Unscrew the caps of the solvent reservoirs and remove the solvent lines together with the caps from the reservoirs.
- Empty the solvent lines. Refer to the *Operating Manual* for the pump.
- Retighten the reservoir caps.

**CAUTION—Electric Shock or Damage to the Device**

After the power to the device is turned off, the device is still energized as long as the power cord is connected. Repair work on the device while the device is connected to power could lead to personal injury.

- Always unplug the power cord before starting repair work inside the device.
- If you were instructed to remove any housing covers or panels, do not connect the power cord to the device while the cover or panels are removed.

TIP When the power is turned off to the autosampler, the left front door of the autosampler is opened automatically for proper ventilation of the sample compartment and cannot be closed while the power is turned off.

7.3 General Rules for Maintenance and Service

For successful maintenance and service procedures, follow the rules and recommendations below.

General Rules

- Before starting maintenance or service procedures, shut down the device when instructed to do so.
- Use only the replacement parts specifically authorized and qualified for the device by Thermo Fisher Scientific.
- Follow all instructions step by step and use the tools recommended for the procedure.
- *Dual split sampler only:* For easier access to the components of the right injection unit during maintenance or repair, unhinge the right door. Follow the door removal steps in [Replacing the Doors](#) (▶ [page 216](#)).

Opening Flow Path Connections

- Before opening the flow path to replace capillaries in the system, turn off the pump flow and wait until the system pressure is down to zero.
- Dirty components can contaminate the chromatography system. Contamination leads to poor performance of the modules and entire system or can even cause damage to the modules and system. Therefore:
 - ◆ Always wear appropriate gloves.
 - ◆ Place the components only on a clean, lint-free surface.
 - ◆ Keep your tools clean.
 - ◆ Use only lint-free cloth for cleaning.

NOTICE

Flow connections and capillary connectors are highly sensitive to contamination. Dust and debris can contaminate these connections.

Always install caps onto capillaries and plugs to open flow connections to protect them from contamination.

Depot Repair

- If you need to return the device for depot repair, follow the instructions in [Transporting or Shipping the Device](#) (▶ [page 218](#)).

7.4 Routine and Preventive Maintenance

Optimum device performance, maximum uptime of the device, and accurate results can be obtained only if the device is in good condition and properly maintained.

7.4.1 Maintenance Plan

Perform the maintenance procedures in the table on a regular basis. The frequency given in the table is a suggestion. The optimum frequency for maintenance depends on several factors, such as the types and amounts of samples and solvents used with the device.

Frequency	What you should do...
Daily	<ul style="list-style-type: none"> • Inspect the flow connections for signs of leakage or blockage. • When you use buffers or salt solutions, flush the device thoroughly after use with an appropriate solvent that does not contain buffers or salts. • Check the liquid level of the needle wash reservoir. Fill the needle wash reservoir with fresh needle wash liquid if required. • Initiate the purge of the needle wash system in the chromatography data system to fill the wash port with the fresh needle wash liquid. During purging, the wash port is flushed continuously until the fresh needle wash liquid is present (see Washing the Needle (▶ page 147)). • Check if particles, dust or algae are present in the needle wash liquid. • Inspect vials and well plates that are stored inside the autosampler for cracks or defects. Clean up spills if necessary.
Regularly	<ul style="list-style-type: none"> • Inspect the flow connections for damage, such as cracks, nicks, cuts, or blockage. • Replace the needle wash liquid in the needle wash reservoir regularly, approximately every 1 or 2 weeks (see Needle Wash Liquid Guidelines (▶ page 147)). • Use fresh seal wash liquid at regular intervals. Rinse the reservoir thoroughly before refilling it. Use a high-purity solvent for rinsing. • Replace the drain pump tubing every six months (see Replacing the Drain Pump Tubing (▶ page 205)). • Check that all warning labels are still present on the device and clearly legible. If they are not, contact Thermo Fisher Scientific for replacement.
Annually	<p>Have Thermo Fisher Scientific service personnel perform preventive maintenance once a year.</p>

TIP The Chromeleon software supports functions for estimating the lifetime of consumables (see [Predictive Performance](#) (▶ page 139)).

7.4.2 Cleaning or Decontaminating the Device

Cleaning and decontamination must be performed by qualified personnel wearing suitable personal protective equipment. Always observe national and local regulations.

NOTICE

Wipe up all liquids spilled onto the system immediately. If surfaces are exposed for longer periods, these liquids can cause damage.

Decontamination

Decontamination is required, for example, when leakage or spillage has occurred, or before service or transport of the device. Use a suitable cleaning detergent or disinfectant to ensure that the treatment renders the device safe to handle.

Parts required

- Suitable cleaning detergent (or disinfectant)
- Purified water
- Lint-free cloths or wipes



CAUTION—Explosive Gas Mixtures from Alcoholic Cleaning Detergents

Alcohol-containing cleaning detergents may form flammable and explosive gas mixtures when exposed to air.

- Use such cleaning detergents only when required and only in adequately ventilated rooms.
- Avoid open flames or exposure to excessive heat during the cleaning process.
- Wipe the cleaned components thoroughly dry after cleaning. Do not operate the device before it is completely dry.

NOTICE

Observe the following:

- Only use cleaning detergents that will not damage the surfaces of the system.
- Never use sharp tools or brushes for cleaning any surfaces.
- Do not use sprays for cleaning.
- Prevent cleaning detergent from entering the flow path.
- Do not use excessively wetted cloth or wipes for cleaning. Prevent any liquids from entering the functional components of the device. Liquids can cause a short circuit when getting in contact with the electronic components.

Preparations

1. Move the needle unit into the service position and secure the needle unit (see [Securing the Needle Unit](#) (► page 140)).
2. Turn off the power to the device and disconnect the power cord from the power source.
3. Remove all sample containers and sample racks from the sample compartment.

Follow these steps

1. Wipe the surfaces clean with a clean, dry, soft, lint-free cloth or wipe. If necessary, slightly dampen the cloth or wipe with a solution of lukewarm water and a suitable cleaning detergent.
2. Allow the cleaning detergent to react as recommended by the manufacturer.
3. Wipe the cleaned surfaces with purified water to ensure that all cleaning detergent residues have been removed.
4. Wipe the surfaces dry using a soft, lint-free cloth or wipe.

7.4.3 Predictive Performance

General Overview

The Chromeleon software supports functions for estimating the lifetime of consumables and for monitoring and recording service and qualification information about the device. These functions are called Predictive Performance. They allow you to schedule maintenance procedures based on the actual operating and usage conditions of the device.

On special wellness, service, and qualification panels, you can define intervals for replacing components that are subject to wear or stress and for service procedures or qualification procedures. In addition, you can set limits to alert you before and when the replacement, service, or qualification is due.

Color-coded bars on special panels provide visual feedback, allowing you to easily check and monitor the status. If a warning limit was set, a message in the Chromeleon Audit Trail alerts you when the action is due.

Some counters can be reset to zero after the required action was performed. To keep the Predictive Performance information up-to-date, consider resetting the counter when a maintenance, service, or qualification procedure has been performed.

For more information, refer to the *Chromeleon Help*.

Available Parameters for the Autosampler

The list shows the most important Predictive Performance counters for the Autosampler in Chromeleon. Consider resetting these parameters after performing the related maintenance procedure:

Predictive Performance Command	To perform...
MeteringHeadChanged	After replacement of the metering device head
NeedleChanged	After replacement of the needle unit
NeedleSeatChanged	After replacement of the needle seat
DrainPumpTubeChanged	After replacement of the drain pump tubing
QualificationDone	After qualification procedures, for example, Instrument Qualification or Performance Qualification.
ServiceDone	After annual maintenance by service personnel.

7.5 Before Maintenance

This section describes how to prepare the autosampler before starting maintenance on the flow components in the autosampler.

7.5.1 Preparing the Autosampler for Maintenance

When

See the *Preparations* in the respective maintenance section to obtain if shutting down and preparing the autosampler for maintenance is required for the procedure.

Follow these steps

1. Set the injection valve to **Inject** position if the valve is not yet in this position.
2. Flush the autosampler with an appropriate, pure solvent. If a buffer solution is part of the mobile phase, flush the autosampler with several volumes of methanol/water (50:50) before shutting down the autosampler.
3. Turn off the pump flow. Wait until the system pressure is down to zero before you continue the shutdown of the device.
4. To empty the drain pump, leave the drain pump turned on until no condensing water is present in the waste tubing of the drain pump. Then turn off the drain pump.
5. Move the needle unit into service position and secure the needle unit. See [Securing the Needle Unit](#) (► page 140).

7.5.2 Securing the Needle Unit

When

Before maintenance procedures or for transport

NOTICE

If the needle unit is not secured during maintenance or transport, it can damage the autosampler. Secure the needle unit when instructed to do so to avoid damage to the autosampler.

Tools required

Slotted screwdriver (optional)

Preparations – VC-A12 and Dual Split Samplers only

Remove the insulation loop cover. See [Removing the Insulation Loop Cover](#) (▶ page 95).

Driving the Needle Unit into Service Position

As required by the autosampler type:

Autosampler Type	Actions
Single split sampler	Press the SERVICE button on the keypad to move the needle unit upward from the needle seat into service position.
Dual split sampler	Select the respective needle unit with the SELECT button on the keypad of the autosampler. Press the SERVICE button on the keypad to move the needle unit upward from the needle seat into service position. If both needle units are to be secured, repeat the two steps also for the other needle unit.

Tightening the Shipping Lock Screw

Above the needle unit, tighten the shipping lock screw with your fingers until you cannot turn it further. The use of a slotted screwdriver may facilitate turning the screw.

Dual split sampler: If the shipping lock screws of both needle units are to be tightened, repeat this step also for the other needle unit.

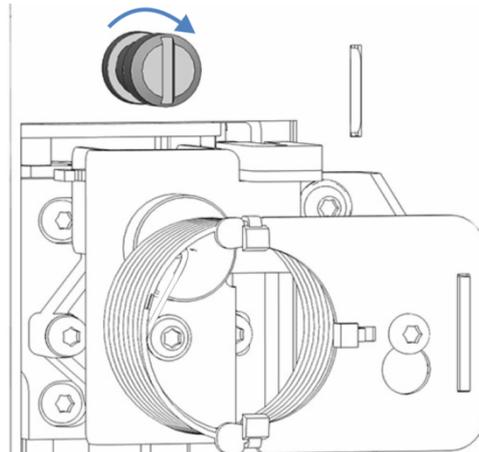


Figure 46: Tightening the shipping lock screw

7.5.3 Removing the Sample Loop Carrier Plate (Dual Split Samplers only)

When

If a needle unit is to be replaced

Tools required

Screwdriver, Torx T10

Preparations

1. Move the needle unit into service position and secure the needle unit. See [Securing the Needle Unit](#) (▶ page 140).

Follow these steps

1. Disconnect the sample loop fittings from both needle units and both metering device heads.
2. With the screwdriver, loosen the 2 screws that attach the carrier plate to the interior panel of the autosampler. The sample loops can remain fixed to the carrier plate.
3. Remove the carrier plate with the attached sample loops.

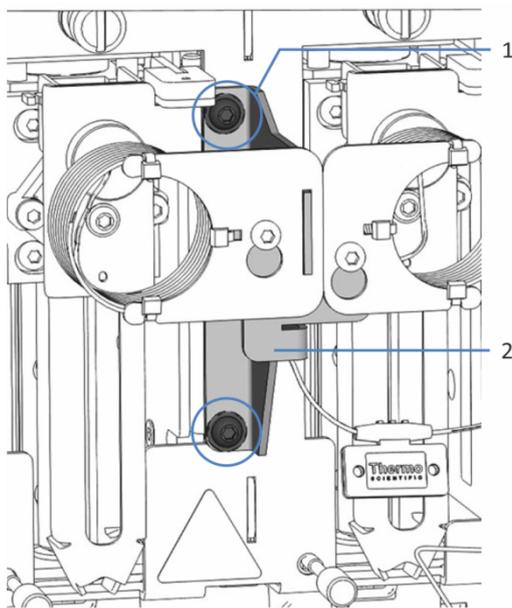


Figure 47: Carrier plate for the sample loops in the dual split sampler

No.	Description
1	Attachment screws
2	Carrier plate

7.6 Mounting Frame (Dual Split Samplers only)

The mounting frame in dual split samplers consists of two parts: horizontal frame part and vertical frame part. Both parts must be installed to hold the insulation loop cover.

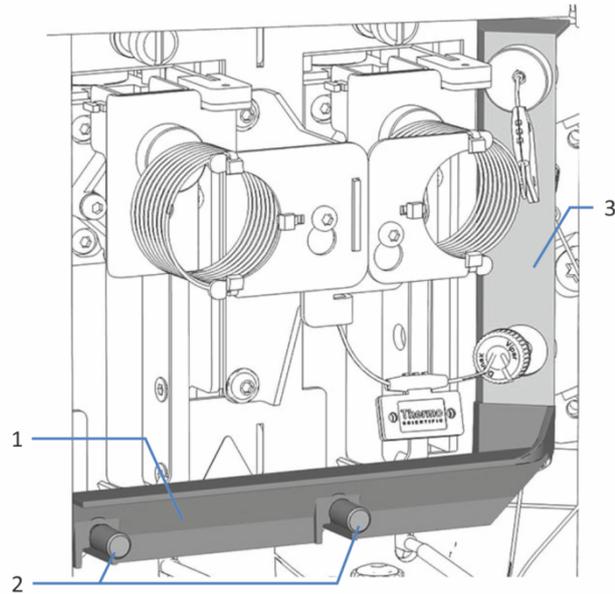


Figure 48: Mounting frame components

No.	Description
1	Horizontal frame part
2	Attachment screws for horizontal frame part
3	Vertical frame part

7.6.1 Removing and Installing the Horizontal Frame Part

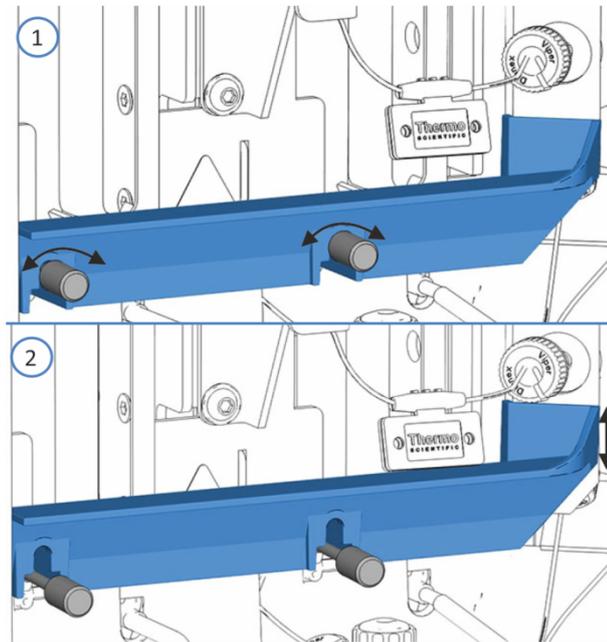


Figure 49: Horizontal frame part

No.	Description
1	Loosening or tightening the attachment screws
2	Moving the horizontal frame part

Removing the Horizontal Frame Part

1. Prepare the autosampler for maintenance, move the needle units into service position and secure the needle units. See [Before Maintenance](#) (▶ page 140).
2. Remove the insulation loop cover if it is not yet removed. See [Removing the Insulation Loop Cover](#) (▶ page 95).
3. On the mounting frame of the dual split sampler, loosen the 2 screws of the horizontal frame part by hand, and remove the screws.
4. Remove the horizontal frame part.

Installing the Horizontal Frame Part

1. Check that the vertical frame part is installed.
2. Align the horizontal frame part of the dual split sampler with the 2 screws on the interior panel and push it downward to lock it in the screws.

3. Tighten the 2 screws of the horizontal frame part by hand.
4. *If the vertical frame part has also been removed and reinstalled*
Turn on the autosampler with its main power switch. The autosampler performs a self-test. The needle initializes and adjusts its position.
5. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207).

7.6.2 Removing and Installing the Vertical Frame Part

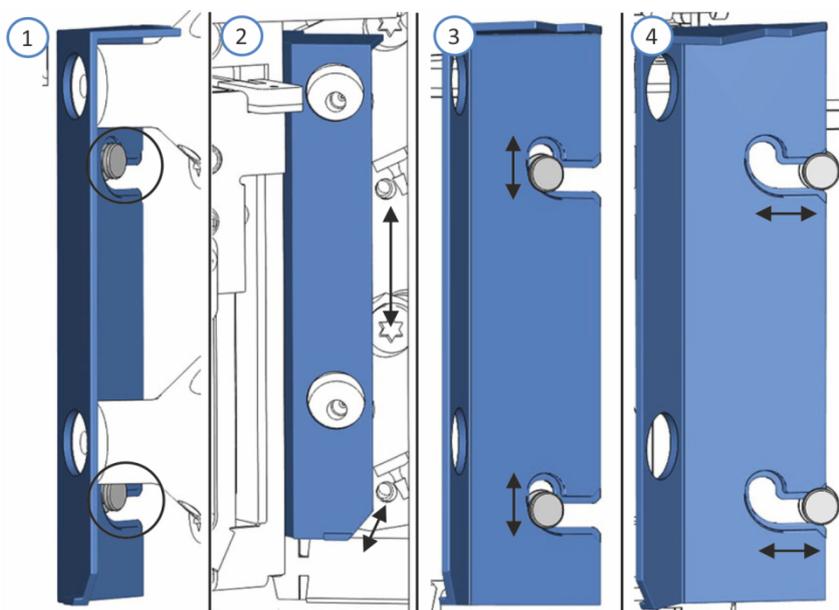


Figure 50: Vertical frame part

No.	Description
1	Retaining pins (view from right for orientation purposes, view covered by side panel)
2	Moving the vertical frame part (view from front)
3	Unlocking from the retaining pins
4	Removing from or aligning with the retaining pins

Removing the Vertical Frame Part

1. Remove the insulation loop cover if it is not yet removed. See [Removing the Insulation Loop Cover](#) (▶ page 95).
2. Remove the horizontal frame part if it is not yet removed (see [Removing and Installing the Horizontal Frame Part](#) (▶ page 144)).
3. Remove the right sample loop. Follow the removal steps in [Sample Loop](#) (▶ page 169).

4. Turn off the autosampler with its main power switch.
5. To enable better access to the vertical frame part:
 - a) Loosen the shipping lock screw above the right needle unit. See [Unlocking the Needle Unit](#) (▶ page 209).
 - b) Slightly push the right needle unit toward the sample compartment just so far that the needle unit is above the wash port.
6. Disconnect the left sample loop from the bottom metering device head.
7. Push the vertical frame part slightly upward to unlock it from the retaining pins on the panel and remove it.

Installing the Vertical Frame Part

1. Check that the capillaries from the injection valves and the seal wash lines are connected on the metering device heads. The capillaries from the sample loops must still be removed.
2. Align the vertical frame part with the retaining pins on the interior panel.
3. Hook the vertical frame part in the retaining pins to lock it.
4. Reset the right needle unit:
 - a) Pull the right needle unit to the front so that it is above the needle seat. Using the offset screwdriver may facilitate taking hold of the needle unit.
 - b) Tighten the shipping lock screw above the right needle unit again. See [Securing the Needle Unit](#) (▶ page 140).
5. Reconnect the sample loop fittings to the metering device heads.
6. Reinstall the right sample loop. Follow the installation steps in [Sample Loop](#) (▶ page 169).

To complete the mounting frame, reinstall the horizontal frame part.

7.7 Needle Wash System

Follow the instructions for the maintenance procedure that you want to perform:

- When you replace the needle wash liquid, observe the guidelines in [Needle Wash Liquid Guidelines](#) (▶ page 147).
- When you perform a needle wash cycle, purge or flush the needle wash system, see [Washing the Needle](#) (▶ page 147).
- To replace needle wash lines, see [Replacing Needle Wash Lines](#) (▶ page 148).

7.7.1 Needle Wash Liquid Guidelines

When replacing the needle wash liquid, with the same liquid or when changing the needle wash liquid, observe the following:

- Before filling the needle wash reservoir, rinse the reservoir thoroughly. Make sure that no particles, dust or algae are present.
- *Recommended when using 100% water as needle wash liquid:*
Replace the needle wash liquid daily.
- Use a needle wash liquid that is suitable for your application and that removes residual sample from the needle sufficiently.
- Check the liquid level of the needle wash reservoir. Fill the needle wash reservoir with fresh needle wash liquid if required.
- *If you want to use a completely different needle wash liquid:*
Ensure that it is compatible with the wash liquid used or change to the new wash liquid stepwise.
- *After replacing the needle wash liquid*
Initiate the purge of the needle wash system in the chromatography data system to fill the wash port with the fresh needle wash liquid. During purging, the wash port is flushed continuously until the fresh needle wash liquid is present. See [Washing the Needle](#) (▶ page 147).

7.7.2 Washing the Needle

The needle wash cycle can be part of the sampling sequence or can be performed manually. This section describes how to perform a manual needle wash cycle.

For information on automatic needle wash cycles using the wash modes in the chromatography data system, see [Important Operating Parameters](#) (▶ page 117).

When

- Routine and preventive maintenance for the needle wash system
- Replacing the needle wash liquid
- Replacing needle wash lines

Preparations

- Observe the guidelines for needle washing. See [Needle Wash Liquid Guidelines](#) (▶ page 147).
- Purge the needle wash system to fill the wash port with fresh needle wash liquid, for example after replacing the needle wash liquid. In the chromatography data system, select the **Purge Needle Wash** button on the ePanel for the autosampler.

Follow these steps

To wash the needle manually using the wash speed and wash time that are currently defined in the chromatography data system, for example between sample sequences, perform one of the following options:

- On the keypad, select the WASH button.
- In the chromatography data system, perform the **Wash** parameter.

With dual split samplers, select the injection unit first using the SELECT button before you perform any actions on the injection unit.

After the needle wash cycle has been completed, the needle moves back to the needle seat.

7.7.3 Replacing Needle Wash Lines

When

If a needle wash line is clogged or damaged

Parts and additional items required

- Fresh needle wash liquid

- Replacement needle wash line as required:
 - ◆ Needle wash reservoir line
 - ◆ *Single split sampler only:* Interconnecting needle wash inlet line
 - ◆ Needle wash outlet line
- Tubing connectors
Use the same tubing connector types that were used on the old connections.

Tools required

Tubing cutter (optional)

TIP If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.

Preparations

1. Prepare fresh needle wash liquid. Observe the guidelines for the needle wash liquid in [Needle Wash Liquid Guidelines](#) (▶ page 147).
2. Empty the needle wash system:
 - a) Unscrew the cap of the needle wash reservoir.
 - b) Together with the cap, remove the needle wash line from the reservoir.
 - c) When you remove the needle wash line from the tubing guides, be careful not to pull on other tubing in the guides.
 - d) Place the needle wash line in a waste reservoir to empty it.
3. *VC-A12 and dual split samplers only:* Remove the insulation loop cover. See [Removing the Insulation Loop Cover](#) (▶ page 95).

Follow these steps

Depending on the needle wash line to replace, follow the steps in the respective sub-sections:

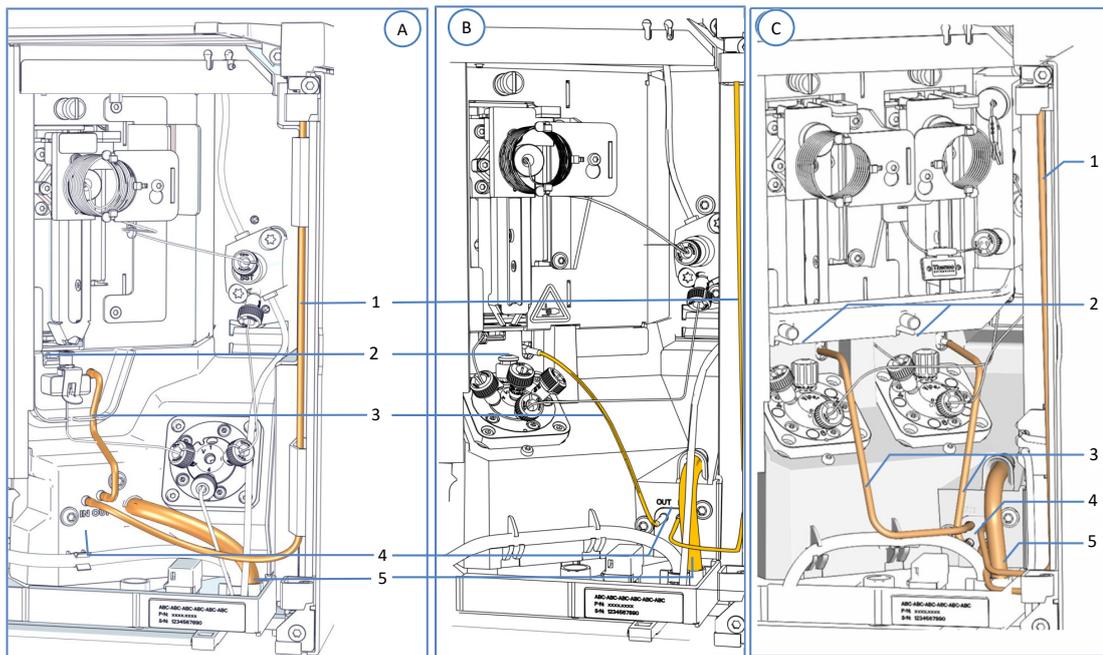


Figure 51: Needle wash components

No.	Description	Replacement Instructions
A	<i>VC Single split sampler:</i> Needle wash system	--
B	<i>VF/VH Single split sampler:</i> Needle wash system	--
C	<i>Dual split sampler:</i> Needle wash system per injection unit	--
1	Needle wash line to needle wash reservoir The wash line may be routed differently in some autosamplers.	See Needle Wash Reservoir Line (▶ page 151).
2	Wash port	--
3	Needle wash line from wash port to needle wash pump outlet	See Needle Wash Outlet Line From Needle Wash Pump (▶ page 153).
4	Needle wash pump	--
5	Needle wash waste line	--

7.7.3.1 Needle Wash Reservoir Line

To replace the needle wash line from the needle wash inlet port of the autosampler to the needle wash reservoir in the solvent rack:

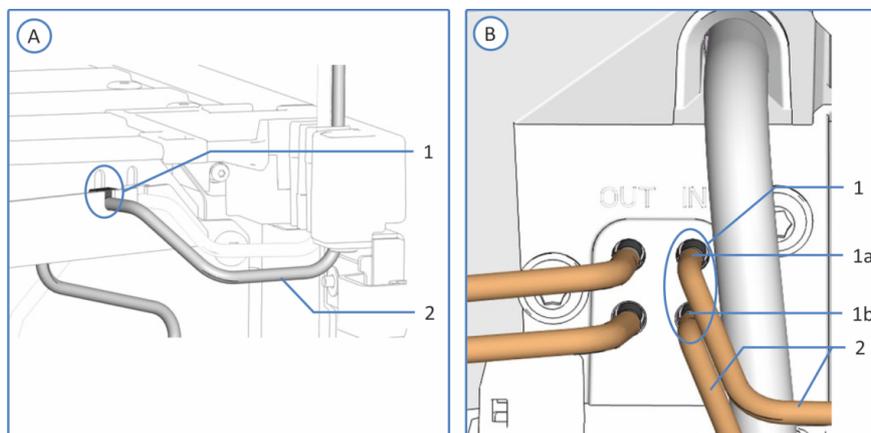


Figure 52: Needle wash inlet port connections

No.	Description
A	Single split sampler: Needle wash inlet on the top enclosure frame. Routing of the needle wash line might be different in your sampler and not through the inlet port.
B	Dual split sampler: Needle wash inlets on the needle wash pump
1	Needle wash inlet port:
1a	<i>Dual split sampler only:</i> Top needle wash inlet port for left injection unit
1b	<i>Dual split sampler only:</i> Bottom needle wash inlet port for right injection unit
2	Needle wash line to reservoir

1. Perform any preparations and preceding steps in [Replacing Needle Wash Lines](#) (▶ page 148).
2. Disconnect the line from the needle wash reservoir:
 - a) Remove the retaining guide from the needle wash line.
 - b) Pull the needle wash line out of the reservoir cap.
3. Disconnect the needle wash line from the autosampler:
 - ◆ *Single split sampler:* Disconnect the wash line from the needle wash inlet port of wash pump.
 - ◆ *Dual split sampler:* Disconnect the needle wash line that is to be replaced from the needle wash inlet port on the needle wash pump.

4. Connect the new needle wash line on the autosampler:
 - ◆ *Single split sampler:* Connect the needle wash line to inlet port of the wash pump and route the needle wash line from the wash pump
 - ◆ *Dual split sampler:* Connect the new needle wash line to the free needle wash inlet port on the needle wash pump.
5. Route the needle wash line from the autosampler to the solvent rack, through the tubing guides in the autosampler and all modules above the autosampler in the system stack.
6. Route the needle wash line through the guide hole in the solvent rack and fix it in the appropriate tubing guide.

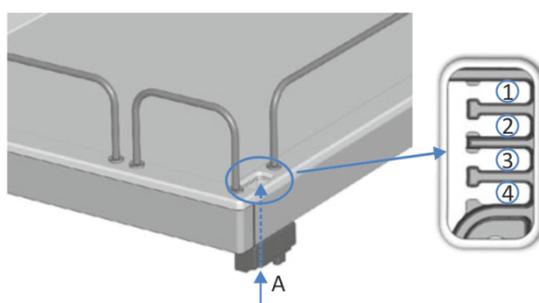


Figure 53: Guide hole and tubing guides in the solvent rack

No.	Description
A	Guide hole (solvent rack)
1+2	Not to be used for needle wash line; reserved for other tubing
3	Tubing guide for needle wash line
4	Not to be used for needle wash line; reserved for other tubing

7. Connect the needle wash reservoir to the line:
 - a) Rinse the needle wash reservoir thoroughly with a high-purity solvent.
 - b) Fill the needle wash reservoir with fresh needle wash liquid.
 - c) Feed the needle wash line through the retaining guide and through an open hole in the cap of the needle wash reservoir. The retaining guide keeps the tubing in place in the reservoir. Close any open holes in the reservoir cap with cap plugs.
8. Restart the needle wash system. See [Restarting the Needle Wash System](#) (► page 155).

7.7.3.2 Interconnecting Needle Wash Inlet Line (Single Split Sampler only)

To replace the needle wash line between the needle wash reservoir and the needle wash pump inlet in a single split sampler:

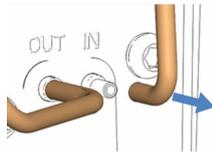


Figure 54: Interconnecting needle wash inlet line

1. Perform any preparations and preceding steps in [Replacing Needle Wash Lines](#) (▶ page 148).
2. Disconnect the wash line from the needle wash pump.
3. Connect the new needle wash line to the needle wash pump.
4. Route the wash line to the reservoir. See figure in [Replacing Needle Wash Lines](#) (▶ page 148).
5. Restart the needle wash system. See [Restarting the Needle Wash System](#) (▶ page 155).

7.7.3.3 Needle Wash Outlet Line From Needle Wash Pump

To replace the needle wash line between needle wash pump outlet and wash port:

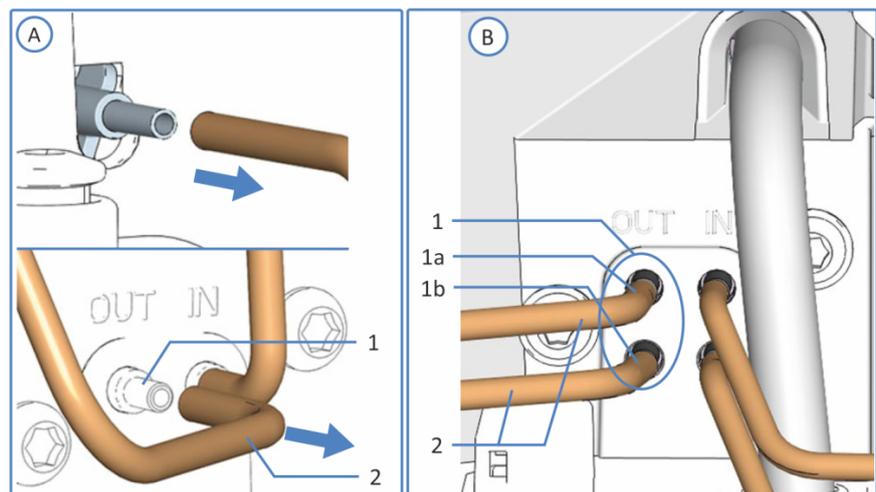


Figure 55: Needle wash outlet port connections in the VH/VF-autosampler

No.	Description
A	VH/VF single split sampler
B	Dual split sampler
1	Needle wash outlet port:
1a	<i>Dual split sampler only:</i> Top needle wash outlet port for left injection unit
1b	<i>Dual split sampler only:</i> Bottom needle wash outlet port for right injection unit
2	Needle wash line to wash port

NOTICE

In the VC-autosampler the ports are positioned in reversed order.

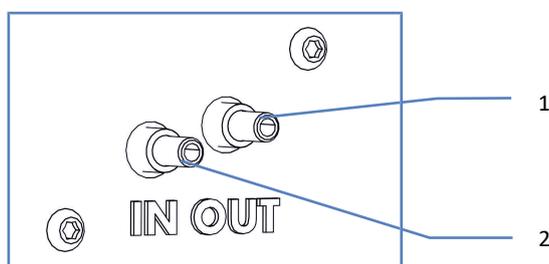


Figure 56: Needle wash outlet port connections in the VC-autosampler

1. Perform any preparations and preceding steps in [Replacing Needle Wash Lines](#) (▶ page 148).
2. *Dual split sampler only:* Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
3. Disconnect the wash line from the needle wash pump outlet and from the wash port inlet.
With dual split samplers, disconnect the wash line that is to be replaced.
4. Connect the new wash line to the free needle wash pump outlet and the free wash port inlet.
5. *Dual split sampler only:* Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
6. VC-autosamplers only: Press the wash line tube into the notch to avoid damages when the loop cover is mounted.
7. Restart the needle wash system. See [Restarting the Needle Wash System](#) (▶ page 155).

7.7.3.4 Restarting the Needle Wash System

After you have replaced one or more needle wash lines, restart the needle wash system.

Follow these steps

1. Retighten the cap to the needle wash reservoir hand-tight. Verify that the retaining guide remains in the hole in the reservoir cap. If it is not, press the retaining guide into the hole to ensure that the tubing is kept in place in the cap.
2. Check the wash lines over the entire flow path:
 - a) Make sure that no bending (kink), pinching or squeezing of the wash lines is present at any point in the flow path.
 - b) If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.
3. *VC-A12 and dual split samplers only:* Install the insulation loop cover. See [Installing the Insulation Loop Cover](#) (▶ page 95).
4. In the chromatography data system, purge the needle wash system to fill the wash port with the fresh needle wash liquid. During purging, the wash port is flushed continuously until the fresh needle wash liquid is present. See [Washing the Needle](#) (▶ page 147).

7.8 Seal Wash System

Follow the instructions for the maintenance procedure that you want to perform:

- When you replace the seal wash liquid, observe the guidelines in [Choosing the Seal Wash Liquid](#) (▶ page 74).
- To purge the seal wash system, refer to the *Vanquish Pump Operating Manual*.
- To replace seal wash lines, see [Replacing the Seal Wash Lines](#) (▶ page 156).

7.8.1 Replacing the Seal Wash Lines

TIP *Dual split sampler only:* Due to constrained component accessibility, Thermo Fisher Scientific recommends having the replacement of needle seats, sample loops and flow connections on the metering device heads performed by the Thermo Fisher Scientific Technical Support.

When

If a seal wash line is clogged or damaged

Parts and additional items required

- Fresh seal wash liquid
- Replacement seal wash lines as required (for easier identification, see the image in the *Follow these steps* section further down):
 - ◆ Seal wash reservoir line
 - ◆ Seal wash inlet line
 - ◆ *Dual split sampler only:* Seal wash line between the two metering device heads
 - ◆ *Dual split sampler only:* Interconnecting seal wash outlet line on the bottom metering device head
 - ◆ Seal wash outlet line to the peristaltic tubing in the pump
 - ◆ Seal wash lines for the seal wash components in the pump
 - ◆ Peristaltic tubing of the seal wash pump in the pumpFor an overview of the seal wash system, see the picture in [Setting Up the Seal Wash System](#) (▶ page 75).
- Tubing connectors
Use the same tubing connector types that were used on the old connections.

Tools required

Tubing cutter (optional)

Preparations

1. Empty the seal wash system:
 - a) Unscrew the cap of the seal wash reservoir.
 - b) Together with the cap, remove the seal wash line from the seal wash reservoir.
 - c) To empty the seal wash line, press down the lever of the seal wash pump in the Vanquish pump. Release the lever when the line is empty.
2. When you have to remove a wash line from the tubing guides, be careful not to pull on other tubing in the guides.
3. *VC-A12 and dual split sampler only:* Remove the insulation loop cover. See [Removing the Insulation Loop Cover](#) (► page 95).

TIP *Dual split sampler only:* To facilitate access to the sample loop connections on the metering device heads additionally, the slide-in unit can be removed. Keep in mind that this requires disconnecting outgoing flow connections from the autosampler. For instructions on removing the slide-in unit, see [Removing the Slide-In Module](#) (► page 223).

Follow these steps

Depending on the seal wash line that you want to replace, follow the steps in the respective sub-sections:

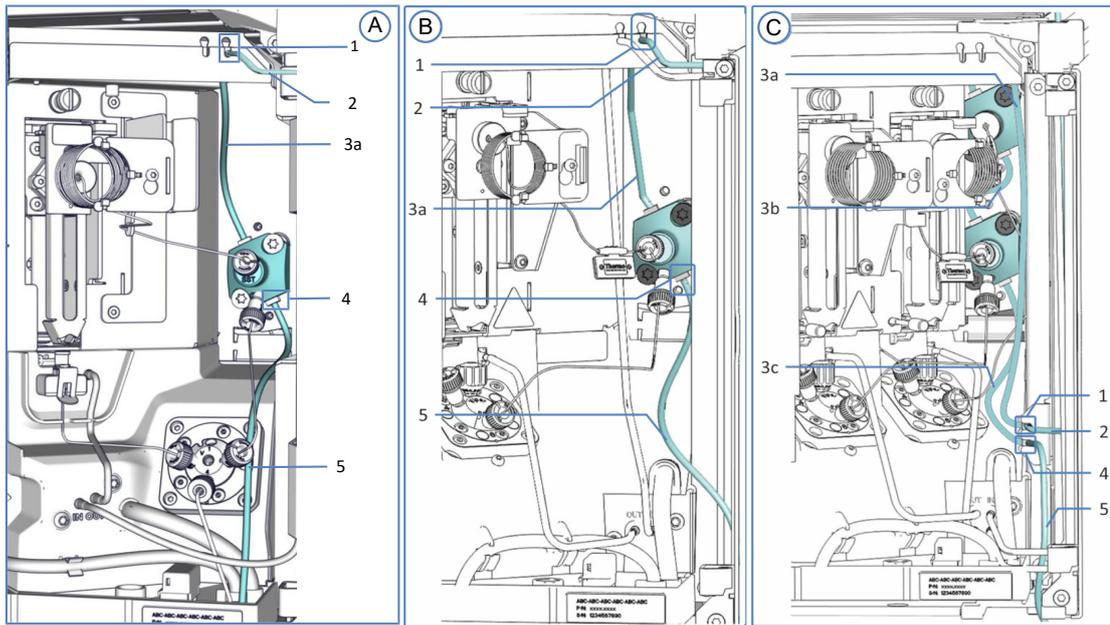


Figure 57: Seal wash components in the Autosampler

No.	Description	Replacement Instructions
A	VC-Single split sampler: Seal wash system	--
B	VF/VH Single split sampler: Seal wash system	--
C	Dual split sampler: Seal wash system per injection unit	--
1	<i>Single split sampler only:</i> Seal wash inlet port	--
2	Seal wash reservoir line	See Seal Wash Reservoir Line (▶ page 159).
3	Seal wash on the metering device head:	
3a	Seal wash inlet line to metering device head	See Seal Wash Inlet Line to Metering Device Head (▶ page 162).
3b	<i>Dual split sampler only:</i> Seal wash line between metering device heads	See Wash Line Between Metering Device Heads (Dual Split Sampler only) (▶ page 164).
3c	<i>Dual split sampler only:</i> Seal wash outlet line from metering device head	See Interconnecting Seal Wash Outlet Line (Dual Split Sampler only) (▶ page 165).
4	Seal wash outlet	--
5	Seal wash outlet line to seal wash pump	See Seal Wash Outlet Line to Seal Wash Pump (▶ page 167).

For seal wash lines in the pump, follow the instructions in the *Vanquish Pump Operating Manual*.

TIP If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.

7.8.1.1 Seal Wash Reservoir Line

To replace the seal wash line from the seal wash inlet port of the autosampler to the seal wash reservoir in the solvent rack:

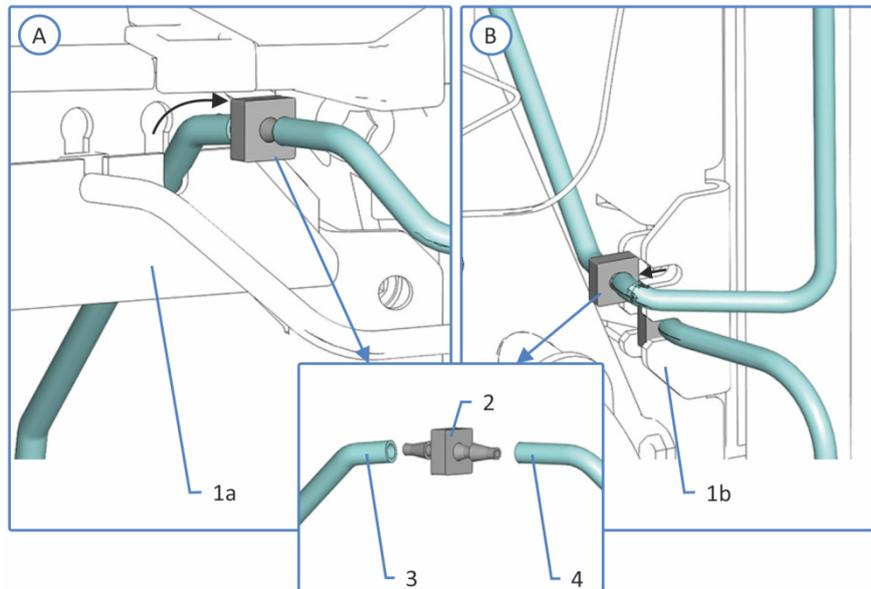


Figure 58: Seal wash reservoir line connection

No.	Description
A	Single split sampler
B	Dual split sampler
1	Seal wash inlet port, position depending on autosampler:
1a	<i>Single split sampler:</i> Top enclosure frame, recess for tubing connector, right port
1b	<i>Dual split sampler:</i> Right enclosure frame, bracket for tubing connectors, top port
2	Tubing connector
3	Seal wash inlet line
4	Seal wash reservoir line

1. Perform any preparations and preceding steps in [Replacing the Seal Wash Lines](#) (▶ [page 156](#)).
2. Pull the seal wash line with the tubing connector out of the seal wash inlet port (see image further up). Disconnect the seal wash reservoir line, the tubing connector, and the seal wash inlet line. The seal wash line on the metering device head can remain connected.

3. Disconnect the line from the seal wash reservoir:
 - a) Remove the retaining guide from the seal wash line.
 - b) Pull the seal wash line out of the reservoir cap.

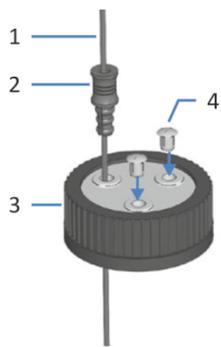


Figure 59: Wash line and reservoir cap

No.	Description
1	Wash line
2	Retaining guide
3	Reservoir cap
4	Cap plugs

4. Connect the seal wash line with a new tubing connector to the seal wash inlet line. Push the tubing connector with the lines into the seal wash inlet port (see the image on the seal wash line reservoir connection further up).
5. Route the seal wash line from the autosampler to the solvent rack through the tubing guides in the autosampler and all modules above the autosampler in the system stack.
6. Route the seal wash line through the guide hole in the solvent rack and fix it in the appropriate tubing guide.

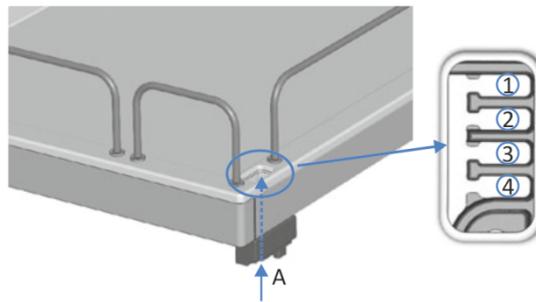


Figure 60: Guide hole and tubing guides in the solvent rack

No.	Description
A	Guide hole (solvent rack)
1+2	Not to be used for seal wash line; reserved for other tubing
3	Tubing guide for seal wash line
4	Not to be used for seal wash line; reserved for other tubing

7. Connect the seal wash reservoir to the line:
 - a) Rinse the seal wash reservoir thoroughly with a high-purity solvent.
 - b) Fill the seal wash reservoir with fresh seal wash liquid.
 - c) Feed the seal wash line through the retaining guide and through an open hole in the cap of the seal wash reservoir. The retaining guide keeps the tubing in place in the reservoir. Close any open holes in the reservoir cap with cap plugs.
8. Restart the seal wash system. See [Restarting the Seal Wash System](#) (▶ page 168).

7.8.1.2 Seal Wash Inlet Line to Metering Device Head

To replace the seal wash line between seal wash inlet port and the seal wash inlet of the metering device head:

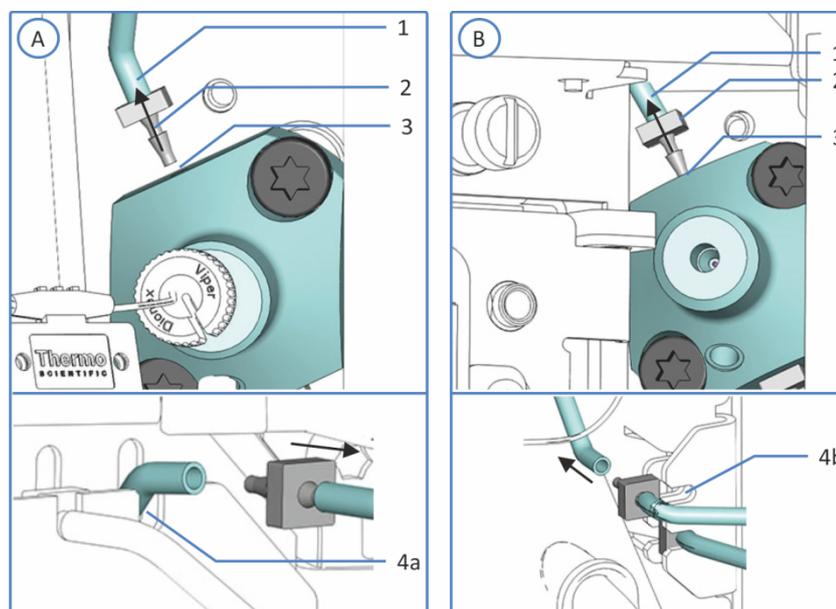


Figure 61: Seal wash inlet line connection

No.	Description
A	Single split sampler
B	Dual split sampler, top metering device head
1	Seal wash inlet, position depending on autosampler: <i>Single split sampler:</i> Top tubing connector on metering device head <i>Dual split sampler:</i> Top tubing connector on top metering device head
2	Tubing connector
3	Seal wash inlet line
4	Seal wash inlet port, position depending on autosampler:
4a	<i>Single split sampler:</i> Top enclosure frame, recess for tubing connector, right port
4b	<i>Dual split sampler:</i> Right enclosure frame, bracket for tubing connectors, top port

Additional items required

Dual split sampler only: Tweezers

Follow these steps

1. Perform any preparations and preceding steps in [Replacing the Seal Wash Lines](#) (▶ page 156).

2. *Dual split sampler only:*
 - a) Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
 - b) Remove the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
3. Pull the seal wash inlet line with the tubing connector out of the seal wash inlet on top of the metering device head (see image). With dual split samplers, use tweezers for better grip of the tubing connector. If the seal wash line is fixed to any tubing holders on the interior of the autosampler, release the line from them.
4. Pull the seal wash line with the tubing connector out of the seal wash inlet port (see image). Disconnect the seal wash inlet line from the tubing connector. The seal wash reservoir line on the other side of the tubing connector can remain connected.
5. *Dual split sampler only:* Assemble the new seal wash inlet line according to the setup of the old seal wash inlet line. Cut the new line pieces to the same length as the old line pieces. Interconnect the new line pieces with a tubing connector.
6. Connect the new seal wash line with a new tubing connector to the metering device head (see image). With dual split samplers, use tweezers for better grip of the tubing connector.
7. Guide the seal wash inlet line to the seal wash inlet port. Connect the seal wash inlet line to the tubing connector. Push the tubing connector with the lines into the seal wash inlet port (see image).
8. Secure the seal wash line in the tubing holders on the interior panel.
9. *Dual split sampler only:*
 - a) Install the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
 - b) Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
10. Restart the seal wash system. See [Restarting the Seal Wash System](#) (▶ page 168).

7.8.1.3 Wash Line Between Metering Device Heads (Dual Split Sampler only)

To replace the seal wash line between the metering device heads in dual split samplers:

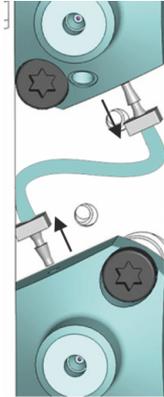


Figure 62: Interconnect seal wash line between metering device heads (dual split sampler)

Additional items required

Tweezers

Follow these steps

1. Perform any preparations and preceding steps in [Replacing the Seal Wash Lines](#) (► page 156).
2. To enable access to the metering device heads:
 - a) Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (► page 144).
 - b) Remove the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (► page 145).
3. Pull the two tubing connectors with the interconnecting seal wash line out of the metering device heads using tweezers.
4. Connect new tubing connectors on both ends of the new seal wash line.
5. Connect the new tubing connectors to both metering device heads using tweezers.
6. To reinstall the frame parts:
 - a) Install the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (► page 145).
 - b) Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (► page 144).
7. Restart the seal wash system. See [Restarting the Seal Wash System](#) (► page 168).

7.8.1.4 Interconnecting Seal Wash Outlet Line (Dual Split Sampler only)

To replace the seal wash outlet line on the bottom metering device head in dual split samplers:

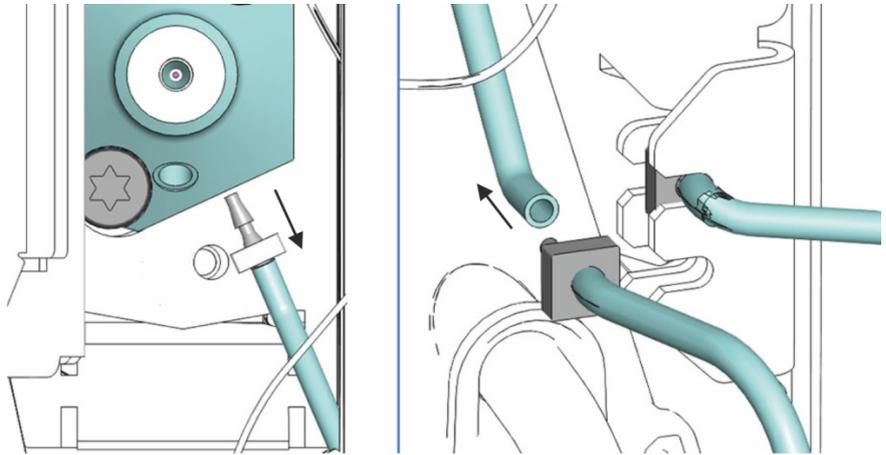


Figure 63: Interconnecting seal wash outlet line

Additional items required

Tweezers

Follow these steps

1. Perform any preparations and preceding steps in [Replacing the Seal Wash Lines](#) (▶ page 156).
2. To enable access to the metering device heads:
 - a) Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
 - b) Remove the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
3. Pull the tubing connector with the interconnecting seal wash outlet line out of the bottom metering device head using tweezers.
4. Pull the tubing connector out of the seal wash outlet port on the right enclosure frame (see image). Pull off the seal wash outlet line that leads to the metering device head from the tubing connector. The seal wash line on the other end of the tubing connector can remain connected.
5. Connect the new seal wash line with the tubing connector to the bottom metering device head using tweezers.

6. Connect the seal wash line from the metering device head to the free end of the tubing connector (seal wash outlet port) on the right enclosure frame. Push the tubing connector with the lines into the bracket (see image)
7. To reinstall the frame parts:
 - a) Install the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
 - b) Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
8. Restart the seal wash system. See [Restarting the Seal Wash System](#) (▶ page 168).

7.8.1.5 Seal Wash Outlet Line to Seal Wash Pump

To replace the seal wash line between the seal wash outlet and seal wash pump:

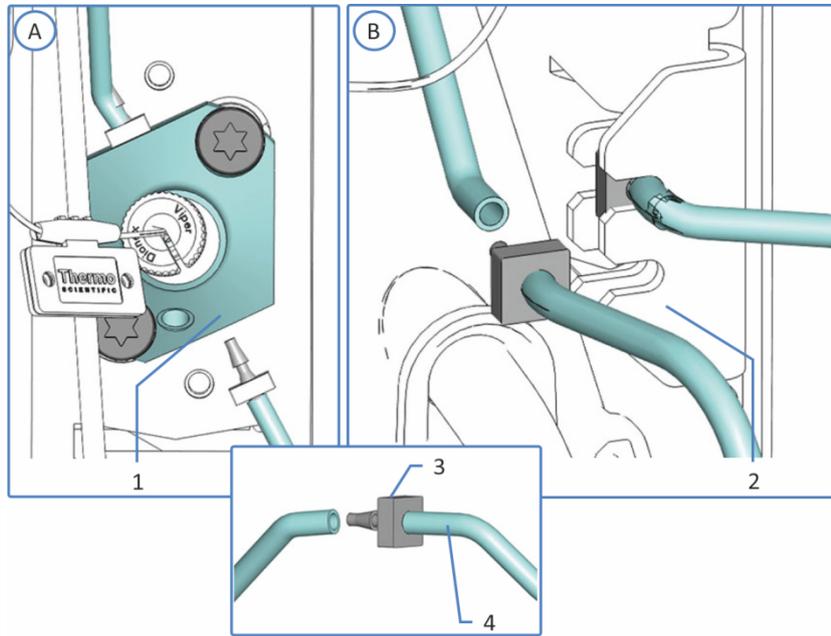


Figure 64: Seal wash outlet line connection

No.	Description
A	Single split sampler
B	Dual split sampler
1	<i>Single split sampler:</i> Seal wash outlet port on bottom port on the metering device head
2	<i>Dual split sampler:</i> Seal wash outlet port on right enclosure frame, bracket for tubing connectors, bottom port
3	Tubing connector
4	Seal wash outlet line to pump

1. Perform any preparations and preceding steps in [Replacing the Seal Wash Lines](#) (▶ [page 156](#)).
2. Pull the tubing connector with the seal wash outlet line out of the seal wash outlet port (see image).
3. Disconnect the seal wash outlet line from the peristaltic tubing on the seal wash pump in the Vanquish pump.
4. Connect a new tubing connector to the new seal wash outlet line.

5. Connect the new seal wash outlet line in the autosampler (see image).
 - ◆ *Single split sampler:* Connect the line to the seal wash outlet on the metering device head.
 - ◆ *Dual split sampler:* Connect the seal wash line from the metering device head to the free end of the tubing connector (seal wash outlet port) on the right enclosure frame. Push the tubing connector with the lines into the bracket.
6. Connect the seal wash outlet line to the peristaltic tubing on the seal wash pump.
7. Restart the seal wash system. See [Restarting the Seal Wash System](#) (▶ page 168).

7.8.1.6 Restarting the Seal Wash System

After you have replaced one or more seal wash lines, restart the seal wash system.

Follow these steps

TIP *Dual split sampler only:* If you removed the slide-in module for easier access to the metering device heads, reinstall the slide-in module. See [Installing the Slide-In Module](#) (▶ page 226).

1. Check the wash lines over the entire flow path:
 - a) Make sure that no bending (kink), pinching or squeezing of the wash lines is present at any point in the flow path.
 - b) If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at right angle to the length of the line.
2. *VC-A12 and dual split samplers only:* Install the insulation loop cover. See [Installing the Insulation Loop Cover](#) (▶ page 95).
3. Flush the seal wash system (refer to the *Vanquish Pump Operating Manual*).

TIP The Vanquish pump starts and controls the seal wash system. Whenever you turn on power to the pump, the pump starts operation with a seal wash cycle. Before turning on the pump, check the liquid level in the seal wash reservoir.

7.9 Sample Loop

- For removal and installation of the sample loop in a single split sampler, see [Replacing the Sample Loop in a Single Split Sampler](#) (▶ page 170).
- For removal and installation of the sample loops in a dual split sampler, see [Replacing Sample Loops in a Dual Split Sampler](#) (▶ page 173).

7.9.1 Components of the Sample Loop Unit

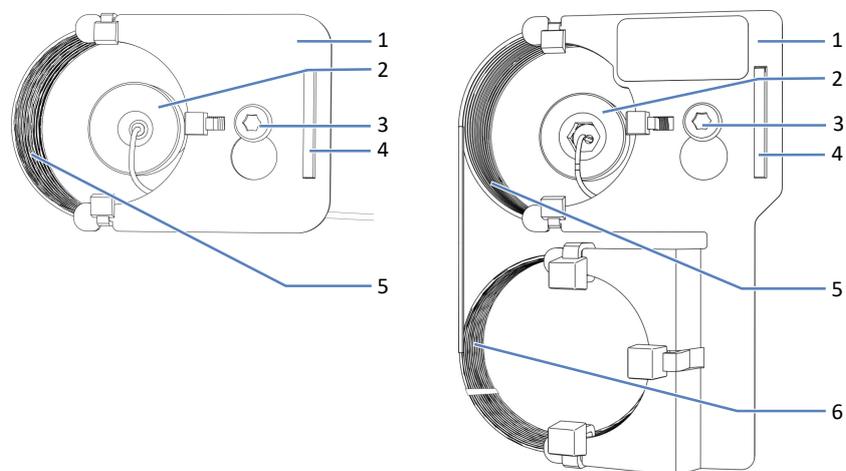


Figure 65: Components of the sample loop unit (left: 10/25/100 μL , right: 250/1000 μL)

No.	Description
1	Sample loop plate
2	Sample loop fitting on the needle unit
3	Attachment screw of the sample loop plate
4	Recess in the sample loop plate for alignment at the device
5	Sample loop
6	Extended part of larger sample loops

7.9.2 Replacing the Sample Loop in a Single Split Sampler

When

If the sample loop is clogged or damaged

Parts required

Replacement sample loop

Follow these steps

1. Remove the sample loop.
2. Install the replacement sample loop.
3. Complete the replacement procedure and adapt the sample loop parameters.

7.9.2.1 *Removing the Sample Loop*

Tools required

Screwdriver, Torx T10

Preparations

1. Prepare the autosampler for maintenance, move the needle unit into service position and secure the needle unit. See [Before Maintenance](#) (► page 140).
2. Turn off the autosampler with its main power switch.

Follow these steps

1. Slightly loosen the attachment screw of the sample loop plate with the screwdriver. The screw can remain loosely screwed on the holder for the sample loop unit.
2. Disconnect the sample loop fitting from the needle unit.
3. Disconnect the sample loop fitting from the metering device head.
4. Push the sample loop unit slightly upward so that the screw matches the large recess in the sample loop plate. Remove the sample loop unit from the needle unit.

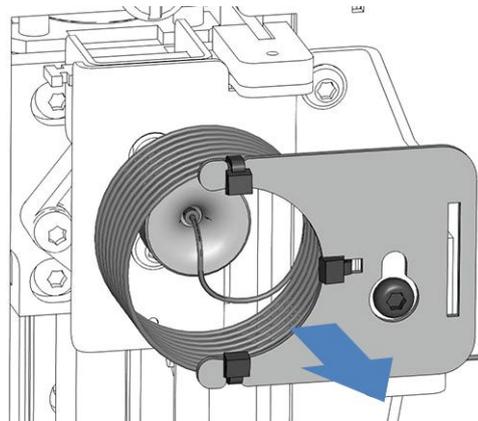


Figure 66: Removing the sample loop unit

5. *If the sample loop is removed due to other maintenance procedures and will be reinstalled again:* Protect open sample loop fittings with a cap.

7.9.2.2 Installing the Sample Loop

Parts and tools required

- *If the sample loop is to be replaced:* Replacement sample loop
- Screwdriver, Torx T10

Follow these steps

1. Remove any caps from the sample loop fittings.
2. Connect the sample loop fitting to the metering device head.
3. Connect the sample loop fitting to the needle unit.

4. Hang the sample loop plate to the holder for the sample loop unit:
 - a) Hook the screw hole of the sample loop plate onto the attachment screw. Make sure that the screw is loosened.
 - b) Align the long recess in the plate with the holder.
5. Position the sample loop capillary coming from the needle unit connection so that the capillary leaving the connector points to 6 o'clock.
6. Tighten the attachment screw for the sample loop plate with the screwdriver.

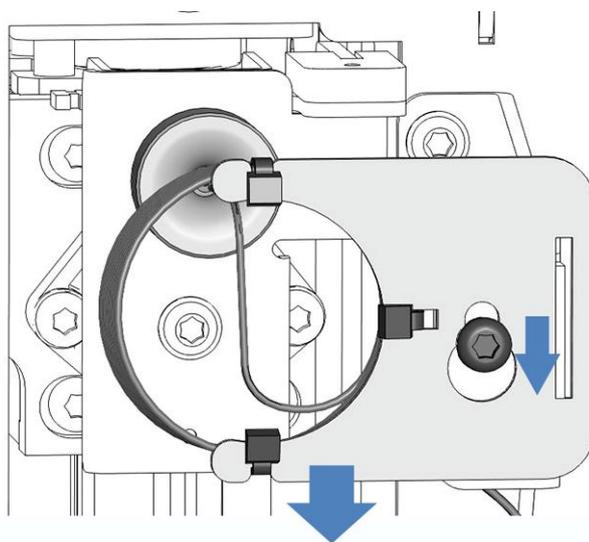


Figure 67: Aligning the sample loop unit to the screw

NOTICE

VC-autosampler only: Guide the capillary from the sample loop through the notch to the metering device head.

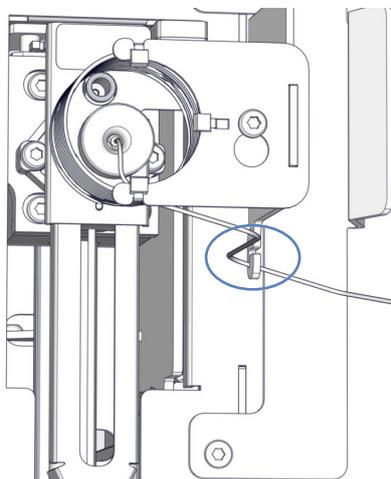


Figure 68: VC-autosampler capillary from the sample loop to the metering device head

7. Complete the replacement procedure and adapt the sample loop parameters. See [Completing the Sample Loop Replacement](#) (▶ page 179).

7.9.3 Replacing Sample Loops in a Dual Split Sampler

TIP *Dual split sampler only:* Due to constrained component accessibility, Thermo Fisher Scientific recommends having the replacement of needle seats, sample loops and flow connections on the metering device heads performed by the Thermo Fisher Scientific Technical Support.

When

If the sample loop is clogged or damaged

Parts required

Replacement sample loop dedicated for the respective injection unit (left or right) or both sample loops for both injection units

Follow these steps

1. Remove the sample loop or sample loops to be replaced.
2. Install the replacement sample loop or sample loops. Follow the instructions depending on the sample loop to be replaced (left or right).

- Complete the replacement procedure and adapt the sample loop parameters.

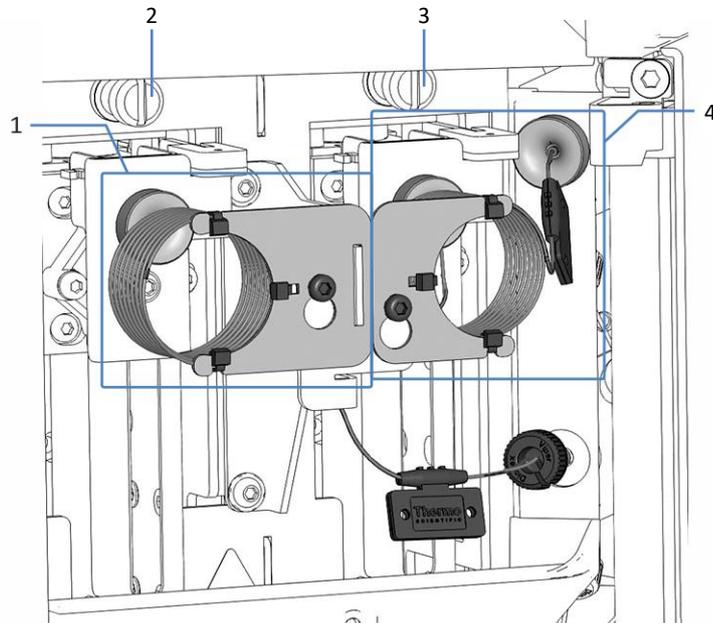


Figure 69: Sample loops in the dual split sampler

No.	Description
1	Left sample loop
2	Left shipping lock screw
3	Right shipping lock screw
4	Right sample loop

7.9.3.1 Removing One or Both Sample Loops

Tools required

Screwdriver, Torx T10

Preparations

- Prepare the autosampler for maintenance, move the needle units into service position and secure the needle units. See [Before Maintenance](#) (► page 140).
- Turn off the autosampler with its main power switch.

TIP *Dual split sampler only:* To facilitate access to the sample loop connections on the metering device heads additionally, the slide-in unit can be removed. Keep in mind that this requires disconnecting outgoing flow connections from the autosampler. For instructions on removing the slide-in unit, see [Removing the Slide-In Module](#) (▶ page 223).

Follow these steps

1. Slightly loosen the screw that attaches the sample loop plate with the screwdriver. The screw can remain loosely screwed on the holder for the sample loop unit.
If both sample loops are to be replaced at once, loosen the attachment screws of both sample loops.

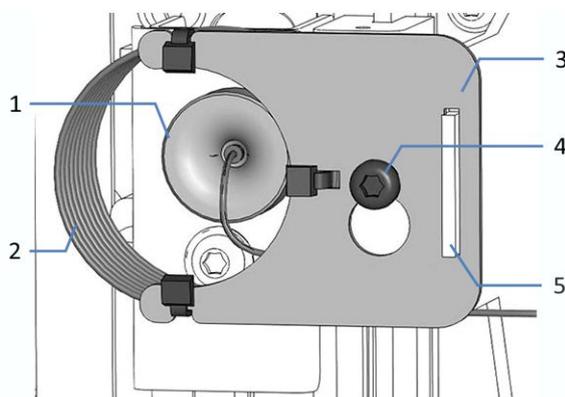


Figure 70: Sample loop unit installed to the needle unit (here: left sample loop)

No.	Description
1	Sample loop fitting on the needle unit
2	Sample loop
3	Sample loop plate
4	Attachment screw for plate
5	<i>Left sample loop only:</i> Recess in the sample loop plate

2. Disconnect the sample loop fitting from the needle unit.
If both sample loops are to be replaced at once, disconnect the sample loop fittings from both needle units.
3. *Left sample loop only:* Push the sample loop unit slightly upward so that the screw matches the large recess in the sample loop plate. Remove the sample loop unit from the needle unit.

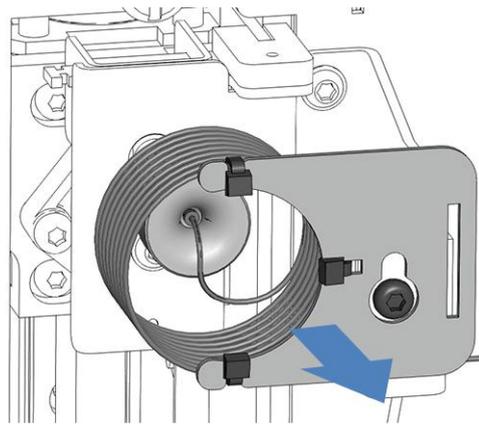


Figure 71: Removing the sample loop unit (here: left sample loop)

4. To enable better access to the vertical frame part:
 - a) Loosen the shipping lock screw above the right needle unit. See [Unlocking the Needle Unit](#) (▶ page 209).
 - b) Slightly push the right needle unit toward the sample compartment just so far that the needle unit is above the wash port.
5. Disconnect the sample loop fitting from the metering device head. If both sample loops are to be replaced at once, disconnect the sample loop fittings from both metering device heads.
6. *If one or both sample loops are removed due to other maintenance procedures and will be reinstalled again:* Protect open sample loop fittings with a cap.
7. If both sample loops are to be replaced at once, mind the installation order:
 - a) Install the right sample loop first.
 - b) Install the left sample loop.

7.9.3.2 Installing the Right Sample Loop

Parts and tools required

- *If the sample loop is to be replaced:* Replacement sample loop for the right injection unit
- Offset screwdriver, Torx T10

Follow these steps

1. Remove any caps from the sample loop fittings.
2. Connect the sample loop fitting to the top metering device head.

3. Reset the right needle unit:
 - a) Pull the right needle unit to the front so that it is above the needle seat. Using the offset screwdriver may facilitate taking hold of the needle unit.
 - b) Tighten the shipping lock screw above the right needle unit again. See [Securing the Needle Unit](#) (▶ page 140).
4. Connect the sample loop fitting to the right needle unit.
5. Hook the screw hole of the sample loop plate onto the attachment screw. Make sure that the screw is loosened.
6. Position the sample loop capillary coming from the needle unit connection so that the capillary leaving the connector points to 6 o'clock.
7. Tighten the sample loop fitting at the needle unit with the torque screwdriver.
8. Tighten the attachment screw for the sample loop plate with the screwdriver.
9. Complete the replacement procedure and adapt the sample loop parameters. See [Completing the Sample Loop Replacement](#) (▶ page 179).

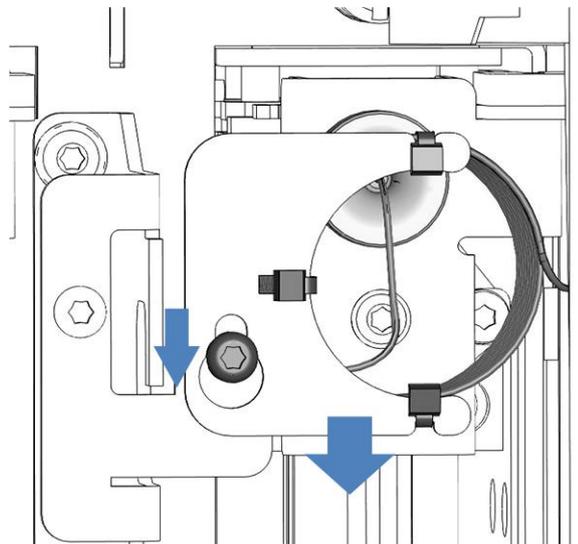


Figure 72: Aligning the right sample loop unit to the screw

7.9.3.3 Installing the Left Sample Loop

Parts and tools required

- *If the sample loop is to be replaced:* Replacement sample loop for the left injection unit
- Screwdriver, Torx T10

Follow these steps

1. Remove any caps from the sample loop fittings.
2. Connect the sample loop fitting to the bottom metering device head.
3. Reset the right needle unit:
 - a) Pull the right needle unit to the front so that it is above the needle seat. Using the offset screwdriver may facilitate taking hold of the needle unit.
 - b) Tighten the shipping lock screw above the right needle unit again. See [Securing the Needle Unit](#) (▶ page 140).
4. Connect the sample loop fitting to the left needle unit.
5. Hang the sample loop plate to the holder for the sample loop unit:
 - a) Hook the screw hole of the sample loop plate onto the attachment screw. Make sure that the screw is loosened.
 - b) Align the long recess in the plate with the holder.
6. Position the sample loop capillary coming from the needle unit connection so that the capillary leaving the connector points to 6 o'clock.
7. Tighten the sample loop fitting at the needle unit with the torque screwdriver.
8. Tighten the attachment screw for the sample loop plate with the screwdriver.

9. Complete the replacement procedure and adapt the sample loop parameters. See [Completing the Sample Loop Replacement](#) (▶ page 179).

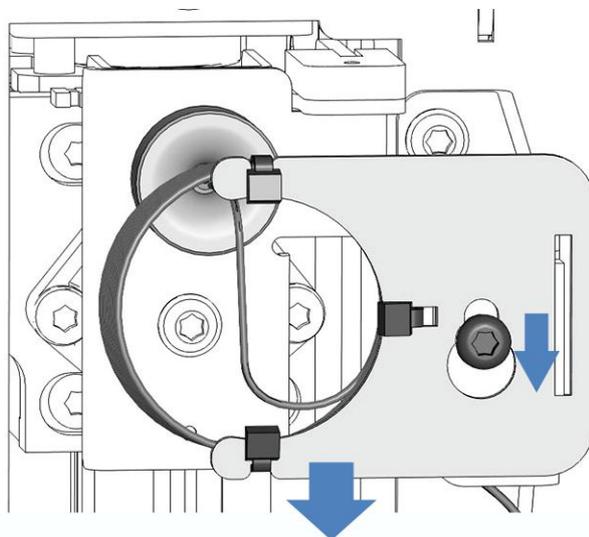


Figure 73: Aligning the left sample loop unit to the screw

7.9.4 Completing the Sample Loop Replacement

TIP *Dual split sampler only:* If you removed the slide-in module for easier access to the metering device heads, reinstall the slide-in module. See [Installing the Slide-In Module](#) (▶ page 226).

After installation of the sample loop, proceed as follows:

1. Unlock the needle unit. See [Unlocking the Needle Unit](#) (▶ page 209).
2. Check that the sample loop moves freely when pushing the needle unit into the sample compartment.
If the sample loop gets stuck on the interior panel, remove and reinstall the sample loop following the steps in this section. Make sure that you align the sample loop correctly.
3. Turn on the autosampler with its main power switch. The autosampler performs a self-test. The needle initializes and adjusts its position.
4. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207)
5. In the chromatography data system, set the **Nominal Loop Volume**, **Total Loop Volume** and **Idle Volume** parameters for the installed sample loop. Observe the volumes that are specified on the sample loop label.

VF-A10/VF-A40 and VH-A10/VH-A40:

Description	Nominal Loop Volume	Total Loop Volume	Idle Volume (factory default)
Sample Loop, 10 µL	10 µL	23 µL	10 µL
Sample Loop, 25 µL	25 µL	50 µL	25 µL
Sample Loop, 100 µL	100 µL	130 µL	75 µL
Sample Loop, 250 µL	250 µL	325 µL	75 µL
Sample Loop, 1000 µL	1000 µL	1300 µL	75 µL

TIP Idle volume can be set between 0 µL and 100 µL.

VC-A12, VC-A13:

Description	Nominal Loop Volume	Total Loop Volume	Idle Volume (factory default)
Sample Loop, 10 µL	10 µL	23 µL	25 µL
Sample Loop, 25 µL	25 µL	50 µL	25 µL
Sample Loop, 100 µL	100 µL	130 µL	25 µL
Sample Loop, 250 µL	250 µL	325 µL	0 to 230 µL
Sample Loop, 1000 µL	1000 µL	1300 µL	0 to 230 µL

TIP The idle volume can be set between 0 µL and 230 µL.

7.10 Replacing Needle Unit and Needle Seat

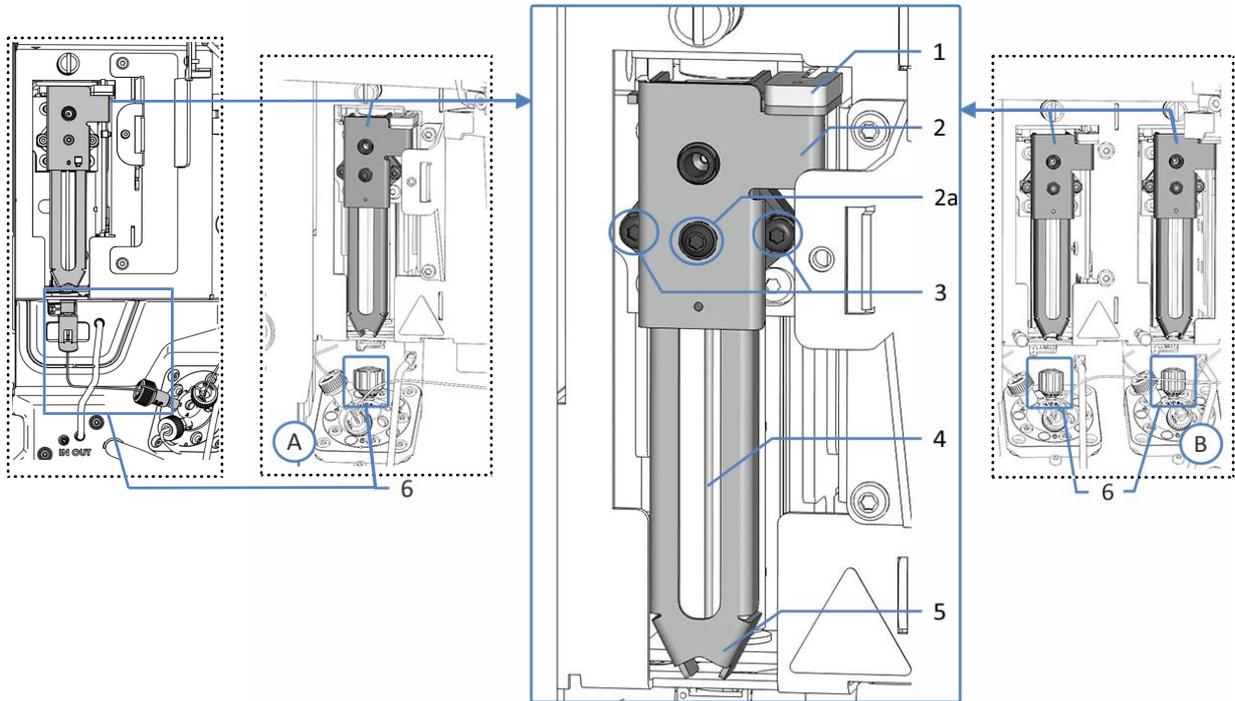


Figure 74: Needle unit components and needle seat

No.	Description
A	Single split sampler (left: VC, right VH/VF)
B	Dual split sampler
1	Lock for the vial pusher
2	Positioning sheet on the pusher of the needle unit
2a	Attachment screw for vial pusher
3	Screws attaching the needle unit to the needle carriage
4	Needle
5	Vial pusher
6	Needle seat

TIP *Dual split sampler only:* Due to constrained component accessibility, Thermo Fisher Scientific recommends having the replacement of needle seats, sample loops and flow connections on the metering device heads performed by the Thermo Fisher Scientific Technical Support.

When

- If the needle is clogged or damaged.
- If the needle seat is worn out.

TIP A damaged needle unit also causes a damaged needle seat and vice versa. For this reason, it is recommended to replace needle unit and needle seat always together.

Parts required

- Replacement needle unit
- Replacement needle seat

Tools required

- Screwdriver, Torx T10
- *Dual split sampler only, if replacing the right needle unit:*
Offset screwdriver, Torx T10

Preparations

1. Prepare the autosampler for maintenance, move the needle unit into service position and secure the needle unit. See [Before Maintenance](#) (▶ page 140).
2. Turn off the autosampler with its main power switch.
3. *Dual split sampler only:* Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).

Replacing the Needle Seat in the VF/VH-autosampler

TIP For better access to the needle seat, disconnect the capillaries from the injection valve.

1. Loosen the needle seat from the injection valve counterclockwise and remove it.
2. Locate and unpack the replacement needle seat.
3. Install and tighten the needle seat clockwise and hand-tight.

NOTICE

Tools can damage the needle seat.

- Turn the needle seat only by hand.
- Do not use tools.

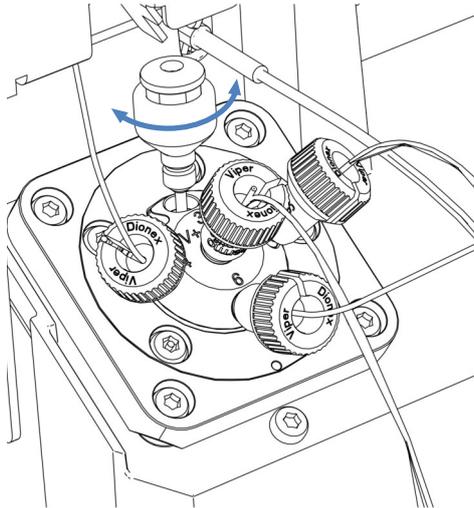


Figure 75: Needle seat VF/VH-autosampler

Replacing the Needle Seat in the VC-autosampler

1. Press the **SERVICE** button and wait until the needle is in the first service position.
2. Press the **SERVICE** button a second time to set the needle in the second service position over the washport.
3. Unscrew the needle seat capillary.
4. Take the clip of the needle seat and pull the complete needle seat assembly up.

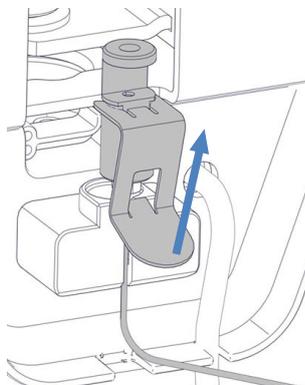


Figure 76: Needle seat with holder, clip and capillary, VC-autosampler

5. Unpack the replacement needle seat.
6. Mount the needle seat by pushing down the clip until it snaps into the mounting.

NOTICE

Tools can damage the needle seat. Do not use tools to remove the needle seat with needle seat holder.

Replacing the Needle Unit

1. To enable access to the needle unit:
Single split sampler: Remove the sample loop. Follow the corresponding removal steps in section [Sample Loop](#) (► [page 169](#)). Position the sample loop unit in the bottom right corner of the autosampler so that you can access the needle unit screws.
Dual split sampler: Remove the sample loop carrier plate. See [Removing the Sample Loop Carrier Plate \(Dual Split Samplers only\)](#) (► [page 142](#)).
2. Loosen the two screws that attach the needle unit to the needle carriage with the screwdriver.
Dual split sampler only, if the right needle unit is replaced: Loosen the left screw first and then the right screw.
3. Pull the needle unit slightly to the front and remove it from the needle carriage.

NOTICE—The opening for the positioning sheet is sensitive to dust and debris.

Prevent any dust and debris from entering the interior of the autosampler.

4. Unpack the replacement needle unit.
5. Remove the protection tube from the needle.
6. Position the replacement needle unit on the needle carriage. Observe the following:
 - ◆ The protruding edge on the rear of the needle unit must fit properly in the opening on the needle carriage (see image).
 - ◆ The ridge on the rear side of the needle unit must match the recess on the needle carriage.

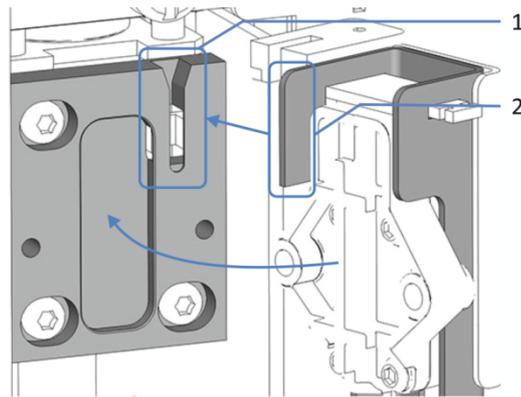


Figure 77: Installing the needle unit to the needle carriage

No.	Description
1	Opening on the needle carriage
2	Protruding edge on the needle unit for alignment in the needle carriage

7. Attach and tighten the two screws on the needle unit.
8. Check if the needle unit is positioned correctly:
Move the lock for the vial pusher slightly upward. If the lock and the vial pusher move upward easily, the needle unit sits correctly in place.

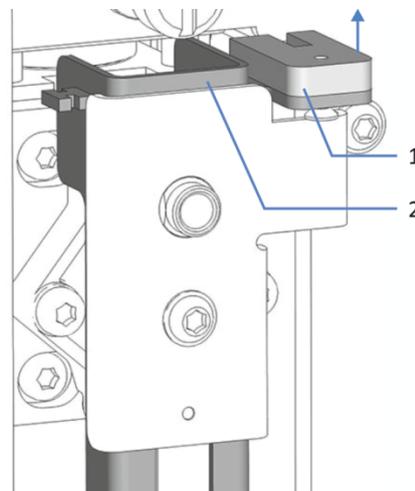


Figure 78: Moving lock for vial pusher upward

No.	Description
1	Lock for the vial pusher
2	Vial pusher

9. Reset the sample loop installation:
 - ◆ *Single split sampler:*
Reinstall the sample loop. Follow the corresponding installation steps in section [Sample Loop](#) (▶ page 169).
 - ◆ *Dual split sampler:*
Install the sample loop carrier plate. See [Installing the Sample Loop Carrier Plate \(Dual Split Samplers only\)](#) (▶ page 208).

Completing the Replacement

1. *Dual split sampler only:*
Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
2. Turn on the autosampler with its main power switch. The autosampler performs a self-test. The needle initializes and adjusts its position.
3. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207).
4. In the chromatography data system, reset the Predictive Performance counters for the needle seat and needle unit by performing the **NeedleSeatChanged** and **NeedleChanged** commands.

7.11 Metering Device Head

TIP *Dual split sampler only:* Due to constrained component accessibility, Thermo Fisher Scientific recommends having the replacement of needle seats, sample loops and flow connections on the metering device heads performed by the Thermo Fisher Scientific Technical Support.

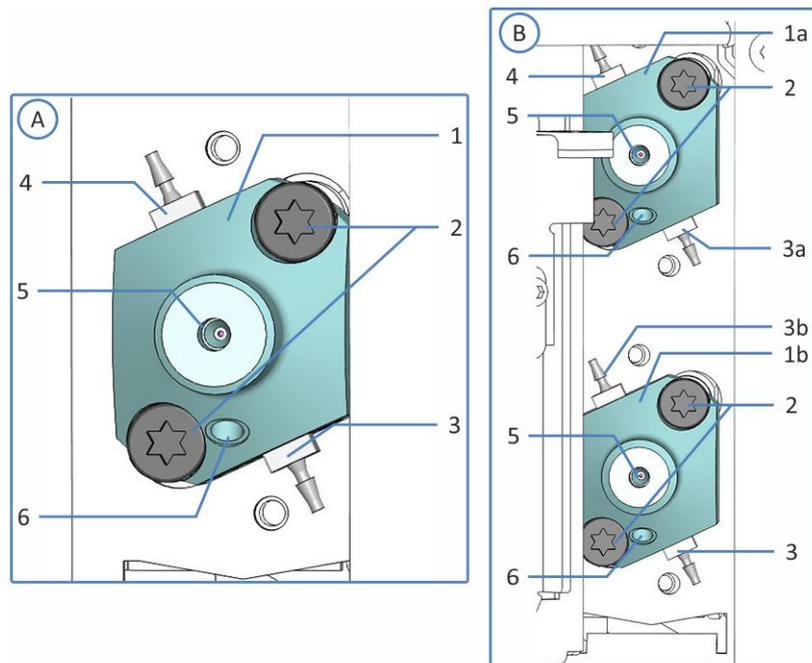


Figure 79: Overview of the metering device head

No.	Description
A	Single split sampler
B	Dual split sampler
1	Metering device head:
1a	<i>Dual split sampler only:</i> Top metering device head for right injection unit
1b	<i>Dual split sampler only:</i> Bottom metering device head for left injection unit
2	Attachment screws
3	Seal wash outlet:
3a	<i>Dual split sampler only:</i> Interconnecting seal wash outlet line connection on top metering device head
3b	<i>Dual split sampler only:</i> Interconnecting seal wash outlet line connection on bottom metering device head
4	Seal wash inlet
5	Sample loop connection
6	Injection valve connection

7.11.1 Disconnecting and Connecting Metering Device Head Capillaries

Disconnecting the capillaries from the metering device head

TIP *Dual split sampler only:* To facilitate access to the sample loop connections on the metering device heads additionally, the slide-in unit can be removed. Keep in mind that this requires disconnecting outgoing flow connections from the autosampler. For instructions on removing the slide-in unit, see [Removing the Slide-In Module](#) (▶ page 223).

1. Prepare the autosampler for maintenance, move the needle unit into service position and secure the needle unit. See [Before Maintenance](#) (▶ page 140).
2. *Dual split sampler only:*
 - a) Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
 - b) Remove the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
As part of the vertical frame part removal, disconnect the sample loop fittings from the metering device heads.
3. *Single split sampler only:*
Disconnect the sample loop capillary from the metering device head.
4. Disconnect the injection valve capillary from the bottom port on the metering device head.
Dual split sampler: If required, disconnect the injection valve capillaries from both metering device heads.
5. If capillaries are to be reinstalled, protect the open ends of the capillaries with caps.

Connecting the capillaries to the metering device head

1. Connect the injection valve capillary to the bottom port on the metering device head.
Dual split sampler: If capillaries were disconnected from both metering device heads, connect the injection valve capillaries as follows:
 - ◆ From the left injection valve to the bottom metering device head
 - ◆ From the right injection valve to the top metering device head

2. *Dual split sampler only:*
 - a) Install the vertical frame part. See [Removing and Installing the Vertical Frame Part](#) (▶ page 145).
As part of the vertical frame part installation, connect the sample loop fittings to the metering device head fronts.
 - b) Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
3. *Single split sampler only:* Connect the sample loop capillary to the inlet on the metering device head front.
4. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207).

TIP *Dual split sampler only:* If you removed the slide-in module for easier access to the metering device heads, reinstall the slide-in module. See [Installing the Slide-In Module](#) (▶ page 226).

7.11.2 Replacing the Metering Device Head

TIP *Dual split sampler only:* Due to constrained component accessibility, Thermo Fisher Scientific recommends having the replacement of needle seats, sample loops and flow connections on the metering device heads performed by the Thermo Fisher Scientific Technical Support.

When

If a damage on a metering device head occurred.

Parts required

Replacement metering device head. Use the appropriate metering device head (100 µL or 250 µL).

Tools required

- Screwdriver, Torx T30
- Tweezers (optional)

Preparations

1. In the chromatography data system, perform the **UndockMeteringHead** command to prepare the metering device head for replacement.
Dual split sampler: Perform the command for the metering head that is to be replaced.

TIP On the ePanel for the autosampler, a separate dialog may be available with buttons for the corresponding replacement commands for the metering device head.

2. Prepare the autosampler for maintenance, move the needle unit into service position and secure the needle unit. See [Before Maintenance](#) (▶ page 140).
3. Empty the seal wash system:
 - a) Unscrew the cap of the seal wash reservoir.
 - b) Together with the cap, remove the seal wash line from the seal wash reservoir.
 - c) To empty the seal wash line, press down the lever of the seal wash pump in the Vanquish pump. Release the lever when the line is empty.
4. Disconnect the capillaries from the metering device head. See [Disconnecting and Connecting Metering Device Head Capillaries](#) (▶ page 188).
5. Disconnect the seal wash lines from the metering device head.

Follow these steps

1. Loosen the two screws that attach the metering device head to the autosampler with the screwdriver.
2. Remove the metering device head:
 - a) Take the metering device head by its front. Carefully move the metering device head to the left and the right a few times to detach the piston from the metering device.
 - b) Check that the metering device head stands out by approximately 5 mm from the front panel of the autosampler.
 - c) Carefully push the front of the metering device head downward and pull the metering device head away from the front panel.
 - d) Check that the metering device head is removed with the piston.

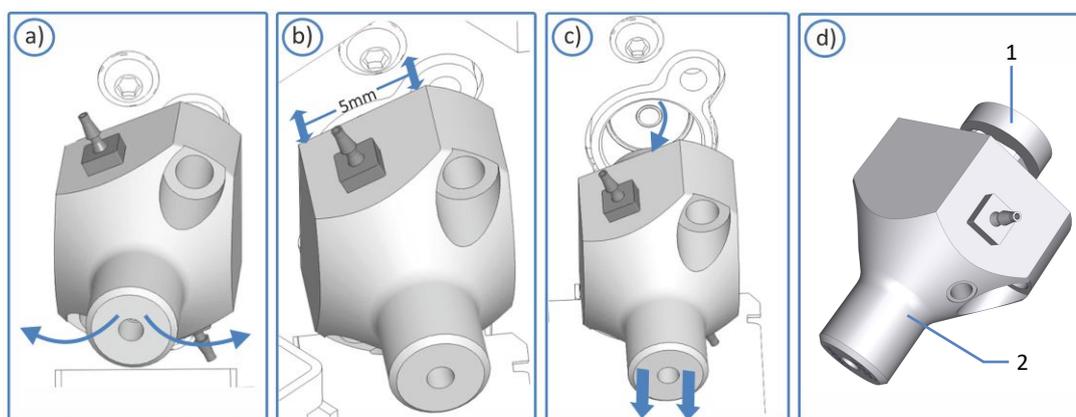


Figure 80: Detaching the metering device head

No.	Description
1	Piston
2	Metering device head

TIP If the piston is stuck in the metering device, remove the piston first before you continue with the replacement procedure. See section [Piston Gets Stuck Upon Metering Device Head Removal](#) (▶ page 193).

3. Unpack the replacement metering device head. Leave the fitting plugs installed and the seal wash lines interconnected on the replacement metering device head.
4. Insert the metering device head in the opening in the front panel.
5. Tighten the two screws on the metering device head with the screwdriver (Torx T30) until they cannot be turned further.

6. Remove the fitting plugs from the metering device head.
7. Disconnect the interconnected seal wash lines from the interconnecting tubing connector. The seal wash lines can remain connected to the metering device head.
8. Connect the seal wash lines of the new metering device head in the seal wash system. Follow the corresponding installation steps for the seal wash lines to install in [Replacing the Seal Wash Lines](#) (▶ page 156).
9. Connect the capillaries on the metering device head. See [Disconnecting and Connecting Metering Device Head Capillaries](#) (▶ page 188).

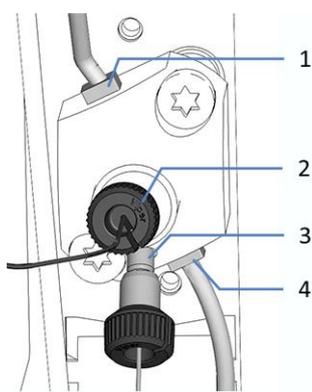


Figure 81: Flow connections on the metering device head (here: VF- and VH single split sampler)

No.	Description
1	Seal wash inlet
2	Sample loop capillary
3	Capillary to injection valve
4	Seal wash outlet

10. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207).
11. In the chromatography data system, follow these steps:
 - a) Perform the **DockMeteringHead** command. The autosampler prepares the metering device head for operation.
 - b) Perform the **MeteringHeadChanged** command.
12. Flush the seal wash system (refer to the *Vanquish Pump Operating Manual*).

7.11.3 Piston Gets Stuck Upon Metering Device Head Removal

When

The piston remains attached to the metering device upon removal of the metering device head.

Parts required

Metering device head

Follow these steps

NOTICE

The metering device can get damaged or contaminated when removing the piston. When handling the piston, observe the following:

- Handle the piston carefully to avoid damages of the metering device.
- Do not use tools to remove the piston.
- Avoid touching the metal edges of the metering device with the piston.
- Never touch the piston or the tip of the piston with your hands. Always use gloves when this is required.
- Never remove the piston manually out of the metering device head.

1. Take the piston with the gloved hand. Position the forefinger under the piston on the panel and the thumb on piston.
2. Push the piston carefully downward until it undocks from the metering device. Put a finger under the piston to prevent the piston from touching the edge below it.
3. Pull the piston out of the metering device.
4. Install the replacement metering device head (see [Replacing the Metering Device Head](#) (▶ page 189)).

7.12 Injection Valve

7.12.1 Guidelines for Handling the Injection Valve

To ensure optimum operation of the injection valve, observe the following guidelines:

NOTICE

- Tighten or loosen Viper capillaries *only* with your fingers. Do not use tools other than the knurl that comes with the capillary.
- To avoid damage to the capillary or connection, tighten and loosen the Viper capillaries *only* when the system pressure is down to zero.
- Operating, storing, or shipping the valve below 0 °C with water in the fluid passages may cause failure of the sealing surfaces.
- Clean the valve by flushing all lines with an appropriate solvent. The nature of the solvent to be used depends on the samples and the mobile phases that are used.

7.12.2 Inspecting the Injection Valve for Leakage

TIP This section refers to injection valves with **V+** label. Injection valves labeled with **Viper Only** require different instructions. Always refer to the operating manual delivered with your device. If it is not available, contact Thermo Fisher Technical Support.

When

- Liquid droplets appear at the drain hole
- Liquid droplets appear at a valve port

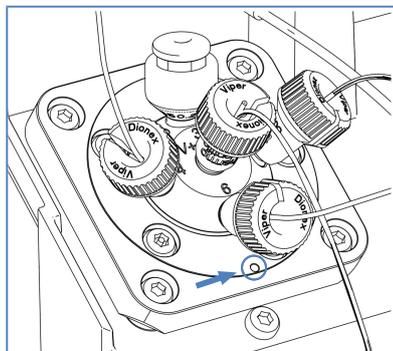


Figure 82: Drain hole on the injection valve (shown here VF-/VH-autosampler injection valve)

Follow these steps

NOTICE

- Tighten or loosen Viper capillaries *only* with your fingers. Do not use tools other than the knurl that comes with the capillary.
- To avoid damage to the capillary or connection, tighten and loosen the Viper capillaries *only* when the system pressure is down to zero.

1. As leakage usually occurs at a connection, visually inspect all connections in the flow path.
2. Depending on the location of the liquid drops, proceed as follows:

Observation	Action
Liquid droplets appear at a port of the injection valve	<ol style="list-style-type: none"> 1. Loosen the capillary connections at the affected valve port and re-tighten it. Do not overtighten the capillary connections. 2. If liquid droplets still appear at the valve port, replace the capillary.
Liquid droplets appear at the needle seat	<ol style="list-style-type: none"> 1. Loosen the needle seat and re-tighten it. Do not overtighten the needle seat. 2. If liquid droplets still appear, replace the needle unit and the needle seat. See Replacing Needle Unit and Needle Seat (▶ page 181).
Liquid droplets appear at the drain hole	<ol style="list-style-type: none"> 1. Wipe the droplet away and observe the valve. 2. If liquid droplets still appear at the drain hole, replace the injection valve. See Replacing the Injection Valve (▶ page 196).

TIP For dual split sampler only:

for easier access to the injection valve connections, remove the horizontal frame part. Make sure that you reinstall the horizontal frame part after inspection. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).

7.12.3 Replacing the Injection Valve

When

If the valve is still leaking after the checks in section [Inspecting the Injection Valve for Leakage](#) (▶ page 194).

Parts required

Replacement injection valve

Tools required

Screwdriver, Torx T10

Preparations

1. Update the Autosampler firmware to the latest available firmware (at least version 2.04). See [Updating the Device Firmware](#) (▶ page 214).
2. Shut down and prepare the autosampler for maintenance. See [Preparing the Autosampler for Maintenance](#) (▶ page 140).
3. Turn off the autosampler with its main power switch.
4. *Dual split sampler only:* Remove the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).

Follow these steps

1. Disconnect the capillaries from the injection valve.
2. Unscrew the needle seat from the injection valve and remove it.
3. Loosen the screws of the injection valve with the screwdriver. Remove the screws from the injection valve. Keep the screws for installation of the replacement injection valve.

4. Lever the injection valve from the opening by the left bottom notch on the injection valve.

TIP Use a screwdriver to lever the valve easier.

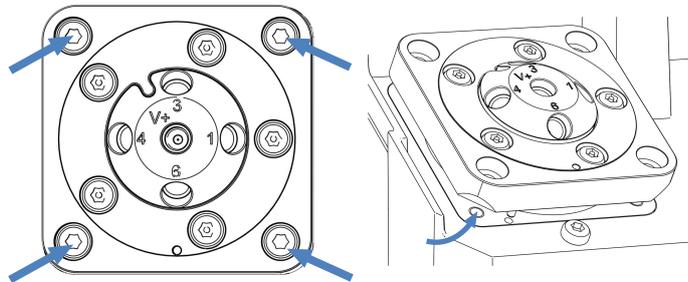


Figure 83: 4 Screws fixing the injection valve at the VF- and VH-autosampler (left); levering up the injection valve (right)

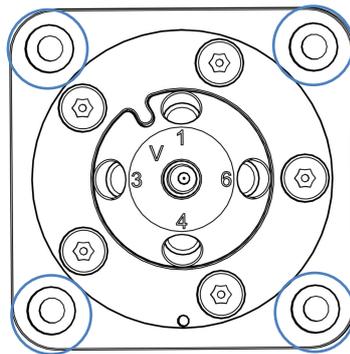


Figure 84: 4 Screws fixing the injection valve at the VC-autosampler

5. Carefully pull out the injection valve until the rear side of the injection valve drive is accessible.

6. Push the two clips on the injection valve connector outward to open them.

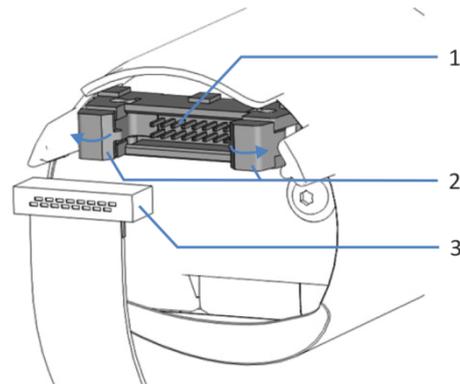


Figure 85: Connector and cable on the rear side of the injection valve drive

No.	Description
1	Injection valve connector
2	Clips for the cable
3	Injection valve cable

7. Disconnect the cable from the connector.
8. Unpack the replacement injection valve. Do not remove the foil around the injection valve drive.

NOTICE

The foil around the valve drive serves as a protection for the drive. Do not remove this foil. Install the valve with the foil on the drive.

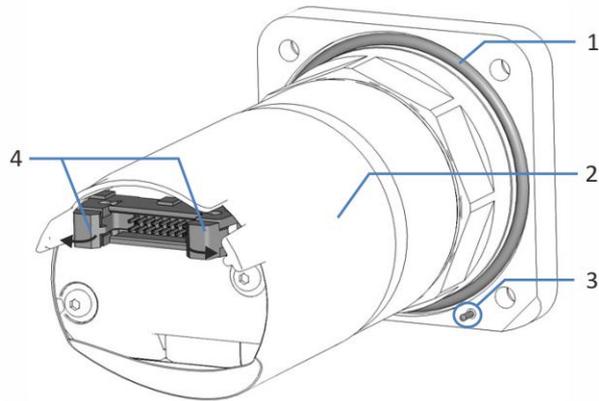


Figure 86: Rear side of the injection valve

No.	Description
1	Sealing ring
2	Injection valve drive
3	Alignment pin
4	Mounting clips for the cable

9. Check that the sealing ring sits properly on the rear side of the injection valve.
10. Push the two clips on the injection valve connector outward to open them (see the image on the connector and cable on the rear side of the valve further up in this section).
11. Check the orientation of the cable. The alignment pin in the middle of the connector on the cable should point downward.
12. Connect the cable to the connector on the rear side of the injection valve.
13. Close the clips on the connector on the rear side of the injection valve. The clips hold the cable.

14. Insert the injection valve into the designated opening in the autosampler.
Before pushing the injection valve completely into the opening, check that it is properly aligned:
 - ◆ The alignment pin on the injection valve must match the designated opening on the autosampler.
 - ◆ The borings for the screws must match.

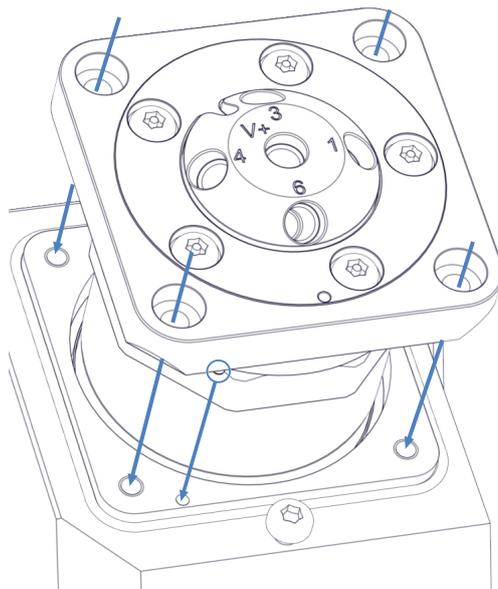


Figure 87: Aligning the injection valve (shown here: VF- and VH-autosampler)

15. Install the four screws in each corner of the injection valve.
Tighten the screws in several steps with the screwdriver, equally crosswise and hand-tight.

NOTICE

Loosening the five screws along the ports can damage or even destroy the valve.

Do not loosen the five screws along the ports.

16. Remove the fitting plugs from the ports of the injection valve.

17. Connect the needle seat and the capillaries to the injection valve.
Observe the port assignment:

Port	Connected Component
1	Inlet capillary from the pump
2	Outlet capillary to the column
3	Needle seat
4	Wash port
6	Metering device

18. *Dual split sampler only:* Install the horizontal frame part. See [Removing and Installing the Horizontal Frame Part](#) (▶ page 144).
19. Turn on the autosampler with its main power switch. The autosampler performs a self-test. The needle initializes and adjusts its position.
20. Restart the autosampler after maintenance. See [After Maintenance](#) (▶ page 207).

7.13 Drain Pump Tubing

The drain pump (peristaltic pump) removes any condensation from the sample compartment that may occur during sample cooling and drains it through a separate drain port to waste.

Upon shipment, the components of the drain pump are connected within the autosampler.

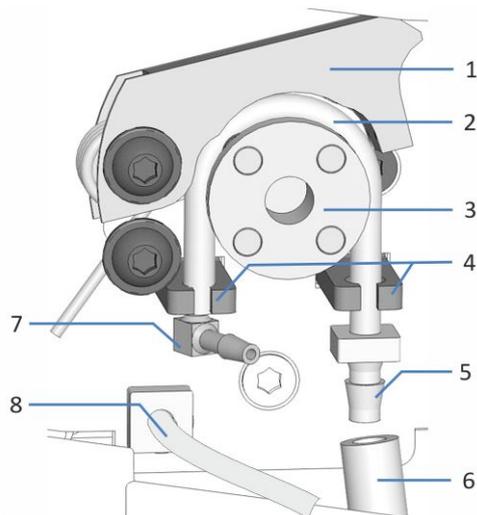


Figure 88: Tubes disconnected from the drain pump, example view from VF-/VH-autosampler.

No.	Description
1	Pump lever
2	Peristaltic tubing
3	Drain pump rotor
4	Tubing holders
5	Straight tubing connector. Note: Depending on the device this can also be an elbow tubing connector.
6	Waste tubing
7	Elbow tubing connector
8	Condensation tubing

7.13.1 Testing the Drain Pump Tubing for Blockage

When

At regular intervals

Items required

Syringe (12 mL)

Follow these steps

1. Check that the drain pump is turned off.
2. Draw air into the syringe.
3. Disconnect the waste tubing (no. 6) and the straight tubing connector (no. 5) from the peristaltic tubing (no. 2) (see image in [Drain Pump Tubing](#) (► page 202)).
4. Insert the syringe into the open end of the peristaltic tubing.
5. To allow the liquid to travel easily through the drain pump tubes, push the pump lever on the drain pump upward, and hold it in that position with one hand.
6. Push the syringe plunger to push the air into the tubing.
7. Observe if a resistance of the plunger is present when pushing the syringe plunger:

Observation	Remedial Action
Resistance is present	Remove the syringe and replace the peristaltic tubing. See Replacing the Drain Pump Tubing (► page 205).
No resistance is present	Test for leakage. See Testing the Drain Pump Tubing for Leakage (► page 203).

7.13.2 Testing the Drain Pump Tubing for Leakage

When

At regular intervals

Items required

Syringe (12 mL)

Follow these steps

1. Check that the drain pump is turned off.
2. Draw air into the syringe.

3. Disconnect the waste tubing (no. 6) and the straight tubing connector (no. 5) from the peristaltic tubing (no. 2) (see image in [Drain Pump Tubing](#) (▶ page 202)).
4. Insert the syringe into the open end of the peristaltic tubing.
5. To allow the liquid to travel easily through the drain pump tubes, push the pump lever on the drain pump upward, and hold it in that position with one hand.
6. Push the syringe plunger to push the air into the tubing.
7. Observe if a pressure builds up when pushing the syringe plunger:

Observation	Remedial Action
No pressure is present	The peristaltic tubing may be leaking. Remove the syringe and replace the peristaltic tubing. See Replacing the Drain Pump Tubing (▶ page 205).
Pressure is present	Remove the syringe and reconnect the straight tubing connector and waste tubing.

7.14 Replacing the Drain Pump Tubing

When

- Every six months as preventive maintenance for the drain pump
- If the drain pump tubing is blocked (see [Testing the Drain Pump Tubing for Blockage](#) (▶ page 203)).
- If the drain pump tubing is leaking or damaged

Parts and additional items required

- Replacement peristaltic tubing for the drain pump
- Tubing connectors:
 - ◆ Elbow tubing connector for condensation tubing
 - ◆ Straight tubing connector for waste tubing

Tools required

Tubing cutter (optional)

Preparations

1. Check that the drain pump is turned off.
2. Disconnect the waste tubing and the condensation tubing from the tubing connectors on the drain pump tubing (peristaltic tubing). Leave the tubing connectors connected to the peristaltic tubing.
3. Unpack the replacement peristaltic tubing, one elbow tubing connector and one straight tubing connector.
4. Connect tubing connectors to both ends of the replacement peristaltic tubing:
 - ◆ On the left tubing end, connect an elbow tubing connector.
 - ◆ On the right tubing end, connect a straight tubing connector.

Follow these steps

1. Push the pump lever on the drain pump upward, and hold it in this position with one hand.
2. With your other hand, unwind the installed peristaltic tubing from the drain pump rotor and remove the peristaltic tubing from the drain pump. Release the pump lever.
3. Check that the replacement peristaltic tubing has the same length as the installed tubing. If required, cut the replacement peristaltic tubing to length with the tubing cutter.

4. Push the replacement peristaltic tubing into the tubing holders. Check that the tubing is properly inserted in the holders.
5. Push the pump lever on the drain pump upward. Insert the replacement peristaltic tubing between the pump lever and the drain pump rotor and wind it around the rotor (see image further down).
6. Release the pump lever.
7. Connect the waste tubing and the condensation tubing to the tubing connectors on the drain pump tubing.

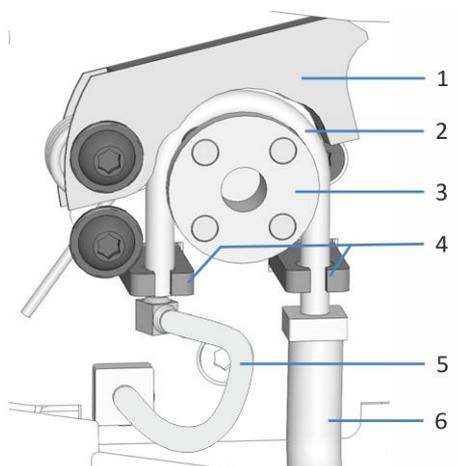


Figure 89: Drain pump

No.	Description
1	Pump lever
2	Peristaltic tubing
3	Drain pump rotor
4	Tubing holders
5	Condensation tubing to sample compartment
6	Waste tubing to drain port

8. In the chromatography data system, perform the **DrainPumpTubeChanged** command.
9. Turn on the drain pump to check proper functionality.

7.15 After Maintenance

This section describes how to restart the autosampler after respective maintenance procedures.

7.15.1 Restarting the Autosampler after Maintenance

When

See the steps in the respective maintenance section to obtain if restarting the autosampler after maintenance is required for the procedure.

Follow these steps

1. Unlock the needle unit. See [Unlocking the Needle Unit](#) (▶ page 209).
2. *VC-A12 and dual split samplers only:* Install the insulation loop cover. See [Installing the Insulation Loop Cover](#) (▶ page 95).
3. Perform the required parameter updates or adjustments. Follow the instructions in the respective maintenance procedure.
4. Prepare the autosampler for operation. See [Preparing the Device for Operation](#).

7.15.2 Installing the Sample Loop Carrier Plate (Dual Split Samplers only)

When

If a needle unit was replaced

Tools required

Screwdriver, Torx T10

Follow these steps

1. Position the carrier plate on the interior panel of the autosampler.
2. Tighten the 2 screws that attach the carrier plate to the interior panel of the autosampler with the screwdriver.
3. Connect the sample loop fittings to both needle units and both metering device heads.

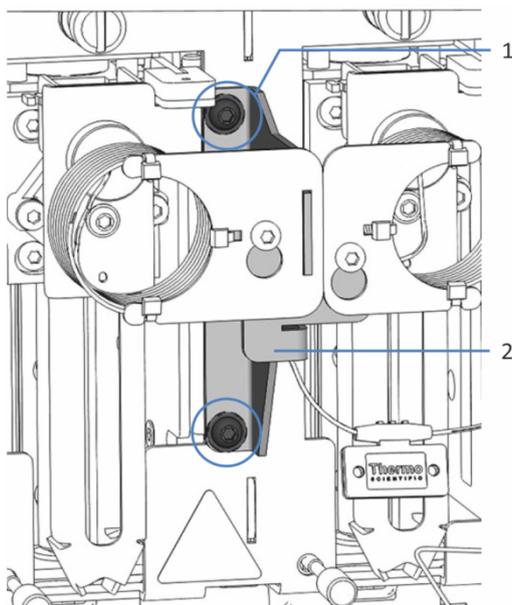


Figure 90: Carrier plate for the sample loops in the dual split sampler

No.	Description
1	Attachment screws
2	Carrier plate

7.15.3 Unlocking the Needle Unit

Tools required

Slotted screwdriver (optional)

Loosening the Shipping Lock Screw

NOTICE

If the shipping lock screw is not properly loosened, the autosampler may be damaged. Always ensure that the shipping lock screw is completely loosened before you turn on the autosampler.

Loosen the shipping lock screw above the needle unit: Turn the captive screw counterclockwise with your fingers until it hangs loosely in its spring. The use of a slotted screwdriver may facilitate turning the screw.

Dual split sampler: If both shipping lock screws are tightened, loosen the shipping lock screws above both needle units.

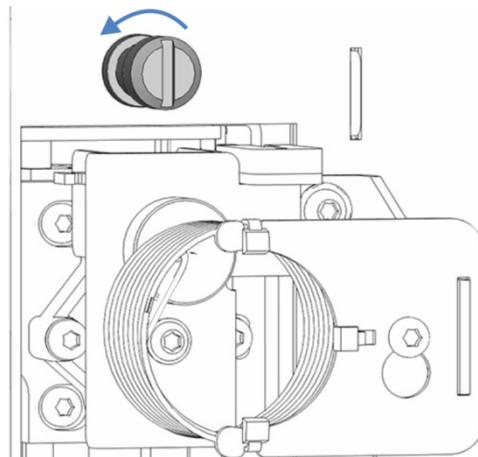


Figure 91: Loosening the shipping lock screw

Checking the Needle Unit

As required:

Autosampler state	Actions
Autosampler was turned off during the maintenance procedure	Check that the needle unit can be moved freely: Push the needle unit along the horizontal needle drive into the sample compartment. See image below. If the needle unit moves easily, the shipping lock screw is loosened properly. <i>Dual split sampler:</i> If both shipping lock screws were tightened, move both needle units.

Autosampler state	Actions
Autosampler remained turned on during the maintenance procedure	Press the SERVICE button to move the needle unit into the compartment.

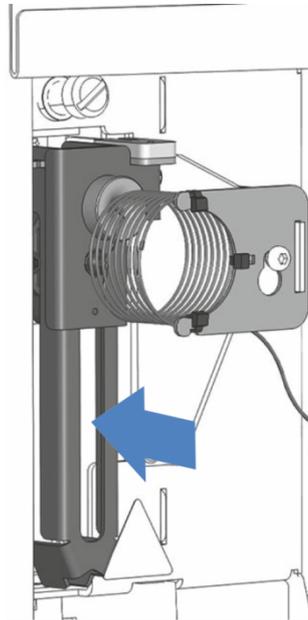


Figure 92: Moving the needle unit (autosampler turned off)

Restarting the Needle Unit after Service Position

If the autosampler remained turned on during the maintenance procedure, as required by the autosampler type:

Autosampler Type	Actions
Single split sampler	Depending on which service position was used before: <ol style="list-style-type: none"> 1. Press the SERVICE button on the keypad and wait until the needle is in the first service position (needle up). 2. Press the SERVICE button again and wait until the needle is in the second service position (needle over wash port). 3. Press the SERVICE button a third time to initialize the needle unit after the service position. During needle movement check that the sample loop can move freely.

Autosampler Type	Actions
Dual split sampler	<ol style="list-style-type: none">1. Select the respective needle unit with the SELECT button on the keypad of the autosampler. <p>Depending on which service position was used before:</p> <ol style="list-style-type: none">1. Press the SERVICE button on the keypad and wait until the needle is in the first service position (needle up).2. Press the SERVICE button again and wait until the needle is in the second service position (needle over wash port).3. Press the SERVICE button a third time to initialize the needle unit after the service position. During needle movement check that the sample loop can move freely. <p>If both needle units were secured, repeat the two steps also for the other needle unit.</p>

If the autosampler was turned off during the maintenance procedure:
Upon turning on power to the autosampler, the needle unit initializes automatically.

7.16 Replacing the Main Power Fuses

When

Blown fuses

Parts required

Fuses (2 fuses, 5 AT, 230 V AC, slow-blow, 5 x 20 mm) from Fuses Kit

Tools required

Slotted screwdriver, any size between 3.3 mm and 5.5 mm is appropriate

Preparations



WARNING—Electric Shock

High voltages are present inside the device that could cause an electric shock or damage to the device.

- Turn off the device with its main power switch. Disconnect the power cord from both the power source and the device.
- Use only the fuses of the type and current rating specified for the device by Thermo Fisher Scientific.
- Do not use repaired fuses and do not short-circuit the fuse holders.

Follow these steps

The fuse holder is located next to the main power switch.

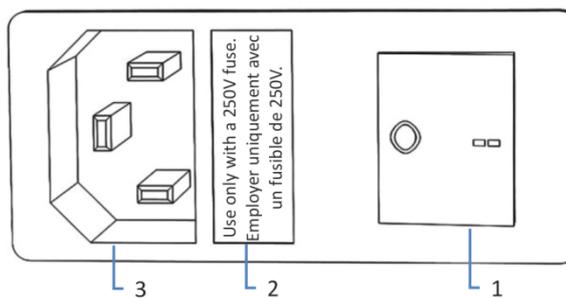


Figure 93: Fuse holder

No.	Description
1	Main power switch (on/off control)
2	Fuse holder
3	Power-inlet connector

1. Use the screwdriver to remove the fuse holder.
2. Replace the two fuses with new fuses of the specified type and current rating. Always replace *both* fuses.
3. Reinstall the fuse holder.
4. Reconnect the power cord to the power source and to the device.
5. Turn on the device with the main power switch.

7.17 Updating the Device Firmware

The description in this section refers to the Chromeleon 7 Chromatography Data System.

When

Updating the device firmware might be required, for example, when a new firmware version is released that adds functionality or solves problems of a previous version.

Items required

Firmware version/Chromeleon version as appropriate

TIP When a new firmware version is released, the new version will be included in the next available Chromeleon version. The new firmware will *not* be transferred automatically to the device when you install the Chromeleon version.

Preparations

1. Read the release notes provided with the firmware and/or Chromeleon version.
2. Connect the device in the Chromeleon software.
3. Stop all operations on the Instrument that includes the device.
4. Wait until the Instrument is idle.

Follow these steps

1. Start the Instrument Configuration Manager program.
2. Perform a firmware update from the **General** tab page in the configuration dialog box for the device. For details, refer to the *Chromeleon Help*.

The firmware update may take several minutes.

NOTICE

A firmware downgrade or incomplete firmware update may result in loss of functionality or malfunctioning of the device.

- Do not interrupt communication between the Chromeleon software and the device at any time during the procedure.
- At the beginning of the update process, a message appears showing the firmware version currently installed in the device and the version that will be transferred from the Chromeleon software. If the firmware installed in the device is a later version than the version in the Chromeleon software, cancel the download.

3. Monitor the Audit Trail of the Instrument Configuration Manager program to see whether the firmware update was successful or failed.

4. Depends on the situation:

Situation	Action
Firmware update successful	Requalification of the device may be required. Refer to the release notes.
Firmware update failed	Turn the device off and on again. Repeat the firmware update.
Firmware update fails repeatedly	Contact Thermo Fisher Scientific Technical Support.

7.18 Replacing the Doors

When

Damage of door

TIP The maintenance procedures do not require that you remove the doors. If this should ever be required for a specific reason or procedure, follow the steps in this section.

Parts required

Replacement door

Preparations

If the door to be replaced is located directly below the solvent rack, remove all reservoirs from the solvent rack.

If the display is installed next to the door to be replaced, consider loosening the fastening block of the display to push the display toward the system rear.

Follow these steps

NOTICE

To avoid damage to the door hinges, be careful when performing the following sequence of steps and do not apply force.

1. If the door is located directly below the solvent rack, lift the solvent rack slightly on the front edge.
2. To remove a door, push the door upward while opening. Open the door to a position in which the two hinges on the housing are aligned in the grooves on the door. You can remove the door only when the hinges are in the grooves.

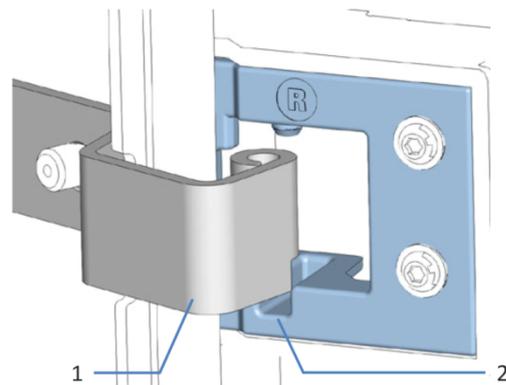


Figure 94: Unhinging a door

No.	Description
1	Hinge on the housing
2	Reception groove on the door

3. Slightly tilt the door to the outside, away from the housing, and remove the door.
4. To install the door, align the door with the hinges on the housing. Do not clamp tubing or capillaries between the door and the enclosure.
5. Insert the hinges in the groove, by pushing up and slightly turning the door.
6. Push the door downward to lock it in place.
You can close the door only when it is properly installed.

7.19 Transporting or Shipping the Device

If you want to transport the device to a new location or if you need to ship the device, first prepare the device for transport, and then move or ship the device as required. Follow the instructions in this section.

Observe the following safety guidelines:



CAUTION—Heavy Load, Bulky Device

The device is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the device, observe the following guidelines:

- Physical handling of the device, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the device into the system stack or when removing it.
- Use the carrying handles that were shipped with the device to move or transport the device. Never move or lift the device by the front doors. This will damage the doors or the device.

Follow these steps

1. Prepare the device for transport. See [Preparing the Device for Transport](#) (▶ page 218).
2. The step depends as follows:
 - ◆ To transport the device to a new location, follow the instructions in [Transporting the Device to a New Location](#) (▶ page 221).
 - ◆ To ship the device, follow the instructions in [Shipping the Device](#) (▶ page 222).

7.19.1 Preparing the Device for Transport

To prepare the device for transport, follow these steps:

1. Perform a long-term shut down of the device (see [Long-Term Shutdown](#) (▶ page 126)).
2. Verify that the shipping lock screw for the needle unit is tightened properly. With dual split samplers, check the shipping lock screws of both needle units.
3. Turn off the device with its main power switch and disconnect the power cord.

4. Remove all cables and flow connections to other devices.
5. Empty the seal wash system:
 - a) Unscrew the cap of the seal wash reservoir.
 - b) Together with the cap, remove the seal wash line from the seal wash reservoir.
 - c) To empty the seal wash line, press down the lever of the seal wash pump in the Vanquish pump. Release the lever when the line is empty.
6. Empty the needle wash system:
 - a) Unscrew the cap of the needle wash reservoir.
 - b) Together with the cap, remove the needle wash line from the reservoir.
 - c) When you remove the needle wash line from the tubing guides, be careful not to pull on other tubing in the guides.
 - d) Place the needle wash line in a waste reservoir to empty it.
7. When you have to remove a wash line from the tubing guides, be careful not to pull on other tubing in the guides.
8. Disconnect the seal wash outlet line from the peristaltic tubing on the seal wash pump in the Vanquish pump.
9. Disconnect the seal wash reservoir line from the seal wash inlet port in the autosampler. Leave the tubing connector connected to the interconnecting seal wash line in the autosampler (see [Seal Wash Reservoir Line](#) ► [page 159](#))).

10. Use the seal wash outlet line to interconnect the two tubing connectors of the seal wash inlet port and outlet in the autosampler.

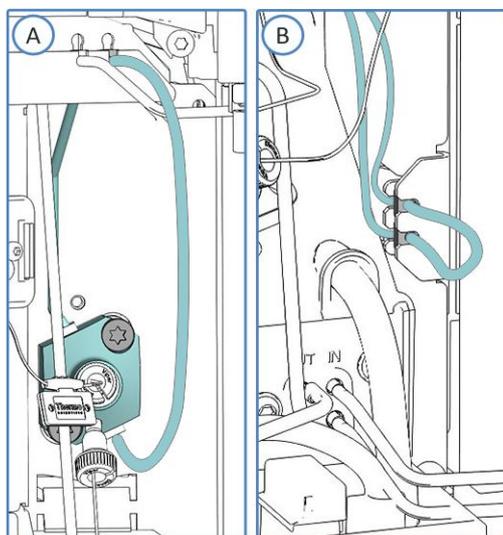


Figure 95: Closing the seal wash path in the autosampler (A: single split sampler, B: dual split sampler)

11. Disconnect the needle wash reservoir line in the autosampler (see [Needle Wash Reservoir Line](#) (▶ page 151)).

- ◆ *Single split sampler:* Disconnect the wash line from the needle wash inlet port of wash pump.
- ◆ *Dual split sampler:* Disconnect the two needle wash reservoir lines directly from the two needle wash inlets on the needle wash pump.

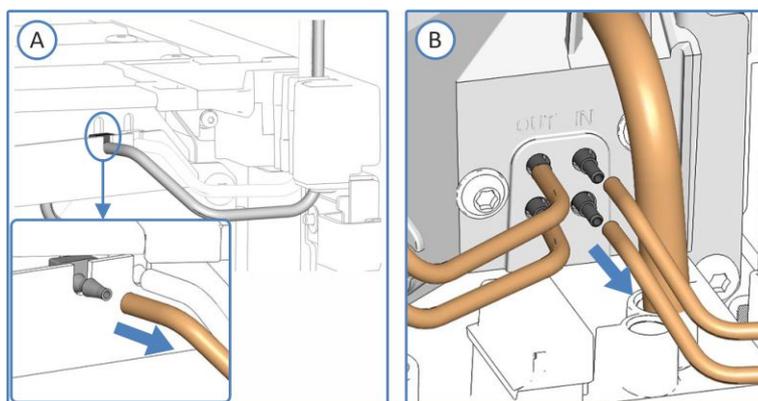


Figure 96: Disconnecting the wash line to the needle wash reservoir (A: VF-/VH-single split sampler, B: dual split sampler)

Note: In the VC-autosampler in and out ports are positioned in reversed order.

12. Check the leak tray and drain port for liquid. If liquid is present, absorb the liquid with a tissue.
13. On the injection valve, disconnect the capillary to the pump outlet and the capillary to the column compartment. Remove the capillaries from the guide holes to the pump and the column compartment.
14. Close open flow connections with appropriate plugs or caps.

NOTICE

Flow connections and capillary connectors are highly sensitive to contamination. Dust and debris can contaminate these connections.

Always install caps onto capillaries and plugs to open flow connections to protect them from contamination.

15. *If additional shipping protections were installed upon shipment*
Install the shipping protection(s) as they were installed upon shipment.
16. Remove the device or slide-in module from the system stack as required:
Install the carrying handles and remove the device from the Vanquish system. Follow the instructions on dismantling the system stack in the *Transporting or Shipping the System* section of the *Vanquish System Operating Manual*.

-or-

Remove the slide-in module from the device enclosure in the system stack (see [Removing the Slide-In Module](#) (▶ page 223)).

7.19.2 Transporting the Device to a New Location

Preparations

Prepare the device for transport. See [Preparing the Device for Transport](#) (▶ page 218).

Follow these steps

1. Observe the notes for handling and lifting the device safely.
2. Transport the device to the new location.
3. Install and set up the device in the system stack. Follow the instructions on mounting the system stack in the *Vanquish System Operating Manual*.

4. Set up the device:
 - a) Connect the device and set up flow connections (see [Installation](#) (▶ page 57)).
 - b) Prepare the device for operation (see [Preparing the Device for Operation](#) (▶ page 109)).
5. Before starting an analysis, let the device equilibrate and be sure that it is ready for operation.

7.19.3 Shipping the Device

Preparations

Prepare the device for transport. See [Preparing the Device for Transport](#) (▶ page 218).



CAUTION—Possible Contamination

Hazardous substances may have contaminated the device during operation and may cause personal injury to service personnel.

- Decontaminate all parts of the device that you want to return for repair.
- Fill in and sign the Health and Safety Form. Thermo Fisher Scientific refuses to accept devices for repair if the Health and Safety Form is missing, incompletely filled in, or unsigned.

Follow these steps

1. Follow the unpacking instructions in this manual in the reverse order.
Use only the original packing material and shipping container. If the original shipping container is not available, appropriate containers and packing material can be ordered from the Thermo Fisher Scientific sales organization.
2. If you need to return the device to Thermo Fisher Scientific for depot repair, contact your local Thermo Fisher Scientific support organization for the appropriate procedure.

Restarting the Device after Shipping

To install the device after shipping, follow the instructions on mounting the system stack in the *Vanquish System Operating Manual*.

7.20 Replacing the Slide-In Module

You can remove the slide-in module from the enclosure of a module for transporting or shipping purposes. The enclosure remains in the system stack. To return a defective module to the factory, install the slide-in module in the enclosure of the replacement module.

7.20.1 Removing the Slide-In Module



CAUTION—Heavy Load, Bulky Device

The device is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the device, observe the following guidelines:

- Physical handling of the device, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the device into the system stack or when removing it.

Tools required

Screwdriver, Torx T20

Preparations

1. Prepare the device for transport. See [Transporting or Shipping the Device](#) (▶ page 218).

Follow these steps

1. Loosen the four captive screws on the front left and front right of the device.

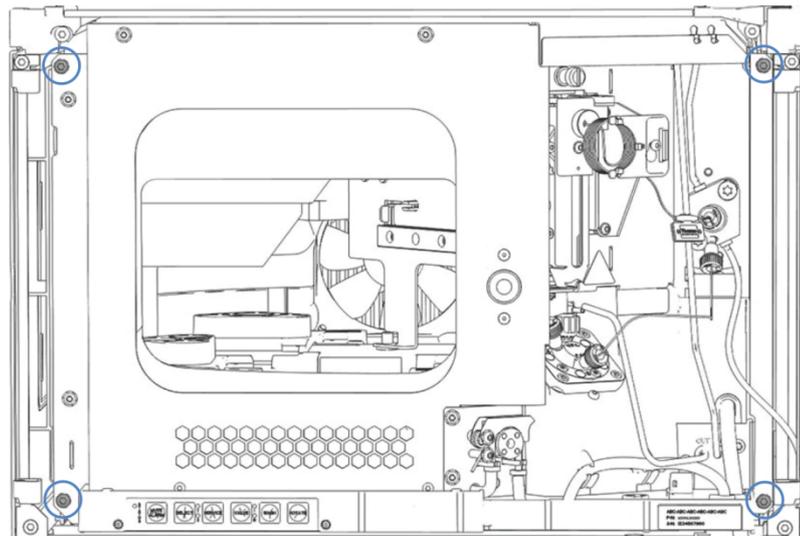


Figure 97: Captive screws on the slide-in module

2. Push all tubing and capillaries, which are present in the tubing chase of the Vanquish system modules, into the tubing chase. Otherwise, you will not be able to remove the slide-in module properly from the enclosure in the next step.
3. Grasp the slide-in module by the middle frame where the door lock is placed and pull the module out of the enclosure by approximately 10 cm.

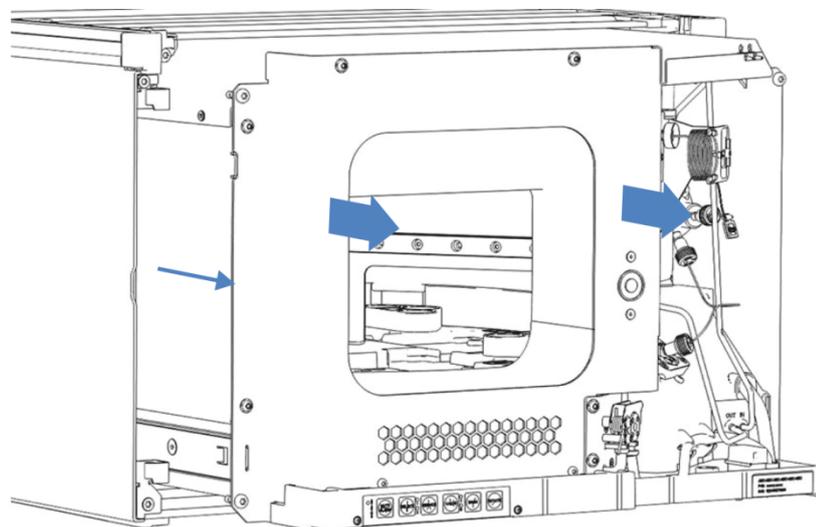


Figure 98: Pulling out the slide-in module

NOTICE

The slide-in module can fall down when pulling it out of the enclosure too far.

Pull out the slide-in module just far enough so that you can grasp it on both sides from below.

4. Remove the slide-in module from the enclosure. The following steps require a team effort:
 - a) Take the slide-in module on both sides from below.
 - b) Pull the slide-in module from the rails towards the front.
 - c) Place the slide-in module on a clean and stable surface.

7.20.2 Returning the Slide-In Module

**CAUTION—Possible Contamination**

Hazardous substances may have contaminated the device during operation and may cause personal injury to service personnel.

- Decontaminate all parts of the device that you want to return for repair.
- Fill in and sign the Health and Safety Form. Thermo Fisher Scientific refuses to accept devices for repair if the Health and Safety Form is missing, incompletely filled in, or unsigned.

Preparations

Remove the slide-in module from the enclosure. See [Removing the Slide-In Module](#) (▶ page 223).

Follow these steps

1. Install the slide-in module to the enclosure of the replacement device. Follow the steps for inserting the slide-in module in the enclosure and tightening the captive screws in [Installing the Slide-In Module](#) (▶ page 226).
2. Follow the instructions in [Shipping the Device](#) (▶ page 222).

NOTICE

Shipping the slide-in module improperly leads to damage to the device. Always ship the slide-in module as described in this operating manual.

7.20.3 Installing the Slide-In Module

**CAUTION—Heavy Load, Bulky Device**

The device is too heavy or bulky for one person alone to handle safely. To avoid personal injury or damage to the device, observe the following guidelines:

- Physical handling of the device, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the device into the system stack or when removing it.

Tools required

Screwdriver, Torx T20

Preparations

1. Unpack the replacement device. Remove the slide-in module from its enclosure as described in [Removing the Slide-In Module](#) (▶ page 223).
2. Verify that the device enclosure into which the slide-in module shall be installed is clean. If required, clean the inner and outer surfaces of the enclosure. See [Cleaning or Decontaminating the Device](#) (▶ page 137).
3. When installing the slide-in module to an enclosure in the system stack, check that the enclosure is placed correctly in the stack.

Follow these steps

1. Push all tubing and capillaries, which are present in the tubing chase of the Vanquish system modules, into the tubing chase. Otherwise, you will not be able to insert the slide-in module properly into the enclosure in the next step.
2. On the slide-in module, check that you can move the captive screws back and forth with your fingers. If you cannot, screw them in until you can.

3. Insert the slide-in module in the enclosure. The following steps require a team effort:
 - a) Take the slide-in module on both sides from below.
 - b) Lift the slide-in module to the height of the enclosure.
 - c) Place the slide-in module in the enclosure so that the module sits in the enclosure by approximately 25 cm.
 - d) Push the slide-in module onto the rails and into the enclosure until the slide-in module sits completely in the enclosure.

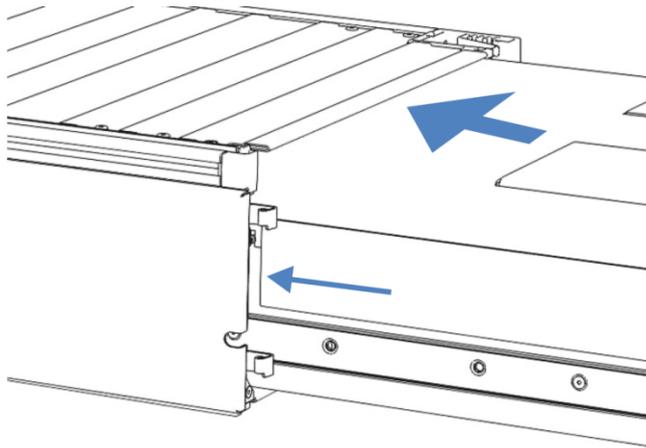


Figure 99: Inserting the slide-in module

4. To facilitate tightening the slide-in module in the enclosure, pull out the module a few millimeters (approximately 2 to 5 mm).
5. With the screwdriver, move each captive screw back and forth while pressing inward until the screw slips into the thread.
6. Push the slide-in module back into the enclosure as far as it goes in.
7. Gradually and evenly, tighten the four captive screws on the slide-in module hand-tight.

NOTICE

- Verify that the screws are tightened. Pull the slide-in module by the leak tray towards the front and check whether the screws move. If they do not move, the slide-in module is installed properly.
- If the screws move, tighten the screws further. With a torque wrench, the recommended torque is 1.2 Nm.

8. Set up and restart the module.

7.20.4 Setting Up the Slide-In Module

After you have installed the slide-in module in the enclosure, set up and restart the device.

Follow these steps

1. Set up the slide-in module:
 - a) Connect the slide-in module and set up flow connections (see [Installation](#) (► page 57)).
 - b) Prepare the slide-in module for first-time operation (see [Preparing the Device for Operation](#) (► page 109)).
 - c) If you installed a replacement slide-in module, update the instrument configuration in the chromatography data system accordingly.
2. Prepare *all other* modules of the Vanquish system for operation and restart them. Refer to the *Operating Manuals* for the modules.
3. Before starting an analysis, let the chromatography system equilibrate and be sure that it is ready for operation.
4. In the Chromeleon software, run the autosampler-specific **Performance Qualification (PQ)** tests (= **Autosampler and Flow Precision** test and **Autosampler Linearity** test).
5. When the test is completed, update the **QualificationDone** parameter.

8 Troubleshooting

This chapter is a guide to troubleshooting issues that may arise during operation of the device.

8.1 General Information about Troubleshooting

The following features help you to identify and eliminate the source for problems that may arise during operation of the device.

TIP For information about operating issues that might occur during the operation of a Vanquish system, refer to the *Vanquish System Operating Manual*.

If you are unable to resolve a problem following the instructions given here or if you experience problems that are not covered in this section, contact Thermo Fisher Scientific Technical Support for assistance. See the contact information at the beginning of this manual.

To facilitate device identification, have the serial number and technical name available when communicating with Thermo Fisher Scientific.

Status Indicators

The status indicator LED bar on the front side of the device and the **STATUS** LED on the keypad inside provide quick visual feedback on the operational status of the device. If the device firmware detects a problem, the status indicators are red.

Alarms

Leaks are a potential safety issue. Therefore, if a leak sensor detects leakage, beeping starts to alert you in addition to the message in the Instrument Audit Trail and the status indicators changing to red. Follow the instructions in this manual to find and eliminate the source for the leakage.

Instrument Audit Trail Messages

If the device firmware detects a problem, the problem is reported to the chromatography data system.

The data system logs information about all events related to instrument operation for the current day in an Instrument Audit Trail. The Instrument Audit Trail is named with the current date, using the format `yyyymmdd`. For example, the Instrument Audit Trail for May 15, 2019, is named 20190515.

The Instrument Audit Trails can be found on the ePanel Set (Audit ePanel). In addition, Audit Trails for each instrument are available in the Chromeleon 7 Console Data view, in the folder of the Instrument.

Messages in the Instrument Audit Trail are preceded by an icon. The icon identifies the seriousness of the problem. For possible causes and remedial actions, see [Messages](#) (▶ [page 232](#)).

Firmware Failure

If a firmware failure occurred during operation of the module, an exception log has been created about the processes during the firmware failure. The firmware sends the exception log to the Instrument Audit Trail when the module is connected in the chromatography data system.

In this case, observe the following:

- Send the Instrument Audit Trail as **.cmbx** file to the Technical Support before you clear the log.
- To clear the exception log and continue operation of the module, perform the command **ExceptionLogClear**.

For more information, refer to the *Chromeleon Help*.

8.2 Messages

The table lists the most frequently observed messages for the device and provides troubleshooting assistance.

Each message consists of a code number and a text. The code number is the unique identifier for the problem while the wording may change. Note the following:

- To facilitate finding a message, the table lists the messages sorted by code.
- If you cannot find the code you are looking for, check the message text. The two messages "Unexpected module behavior" and "Module malfunction detected" can be assigned to different codes. See the beginning of the table for more information.

TIP If you are unable to resolve the problem following the instructions in this manual, or if you encounter a message not listed in the table, write down the code and wording of the message and contact us. For details, see the *Contacting Us* section at the beginning of this manual.

Dual split sampler only: For easier identification of the source for a problem, an injection unit information may appear in front of certain messages.

Message and Code	Description and Remedial Action
Unexpected module behavior. Code xx	xx = Two-digit to four-digit code number. When the message appears, write down the message code and turn off the module. Wait for 5 seconds and turn on the module again. TIP If the message appears with <i>code 103</i> , additional remedial actions are available. See further down this table. If the message appears again, contact Technical Support.
Module malfunction detected. Code xx	xx = two-digit to four-digit code number When the message appears, write down the message code. Turn off the module and contact Technical Support.
Code 33 Leak detected – eliminate within approx. xx seconds.	xx = the number of seconds within the leak must be resolved Find and eliminate the source for the leakage (see Resolving Liquid Leaks (▶ page 237)).
Code 34 Leak detected.	Find and eliminate the source for the leakage (see Resolving Liquid Leaks (▶ page 237)).
Code 36 Download failed.	The firmware download has not been successful. Repeat the download.
Code 52 Module software incomplete. Download firmware (again).	The firmware is incomplete, for example, because the communication between the chromatography data system and the module was interrupted during the firmware download. Repeat the download.

Message and Code	Description and Remedial Action
Code 53 Module software malfunction occurred. Diagnostic information available. Please send daily audit trail to service hotline.	A firmware failure occurred during operation of the module and an exception log has been created about the processes during the firmware failure. For details, see General Information about Troubleshooting (▶ page 230).
Code 89 Liquid leak sensor missing or defective.	Contact Thermo Fisher Scientific Technical Support for assistance. To operate the device nevertheless, you can disable the leak sensor functionality in the chromatography data system by setting Leak Sensor Mode to Disabled .
Code 90 Download firmware mismatch – invalid version.	You tried to download an incompatible firmware with an earlier version number than the firmware that is currently installed in the module. Downgrading the firmware may result in loss of functionality or malfunctioning of the module. If required, repeat the download with a firmware version later than the version currently installed in the module.
Code 91 Data changed during read.	<ul style="list-style-type: none"> • This may be a temporary error. Turn off the module. Wait for 5 seconds and turn on the module again. • The firmware may be defective. Update the firmware. See Updating the Device Firmware (▶ page 214). • Check the Audit Trail for additional messages for the injection valve. • Replace the injection valve. See Replacing the Injection Valve (▶ page 196).
Code 92 Data verification failed.	<ul style="list-style-type: none"> • This may be a temporary error. Turn off the module. Wait for 5 seconds and turn on the module again. • The firmware may be defective. Update the firmware. See Updating the Device Firmware (▶ page 214). • Check the Audit Trail for additional messages for the injection valve. • Replace the injection valve. See Replacing the Injection Valve (▶ page 196).
Code 103 Unexpected module behavior – limited features available.	The firmware may be defective or a firmware downgrade has been performed. Update the firmware to the current revision. See Updating the Device Firmware (▶ page 214).
Code 118 USB Buffer Overflow.	This is a software problem. The module produces data faster than the computer on which the chromatography data system is running reads the data. <ol style="list-style-type: none"> 1. In the chromatography data system, disconnect and reconnect the module. 2. If this does not solve the problem, update the firmware or the chromatography data system version. 3. If the problem persists: Also, third-party software on the computer, for example, virus scanners or poor computer performance can cause the problem. Contact the onsite IT department.
Code 120 System interlink request timed out.	Communication with the module failed. The module did not respond in time. For the module for which the message appears: <ol style="list-style-type: none"> 1. Turn on the module if it is not yet turned on. 2. Check the system interlink connections to the module. Verify that all system interlink cables are connected at both ends. 3. If the message persists, replace the system interlink cables.

Message and Code	Description and Remedial Action
Code 131 System interlink bus not operable.	A system interlink cable may be disconnected from the module or defective. 1. Check the system interlink connections to the module. Verify that all system interlink cables are connected at both ends. 2. If the message persists, replace the system interlink cables.
Code 136 Lock request rejected – already locked by X.	X = lock holder ID, with USB address referring to the chromatography data system or system interlink address referring to the system controller or a module The module is already locked by another software (system controller or chromatography data system). Wait until the module is released from the locked state.
Code 145 Lock holder X lost.	X = lock holder ID, with USB address referring to the chromatography data system or system interlink address referring to the system controller or a module The lock was released automatically since its holder disappeared from system interlink. Check the system interlink connections to the module.
Code 152 Assignment or command rejected – device locked.	Module is not ready to accept command or property assignment since locked by another software (system controller or chromatography data system). Wait until module is released by the current software (system controller or chromatography data system).
Code 5002 Command rejected – module is in error state.	An internal error has occurred. Perform a self-test.
Code 5010 Horizontal needle drive blocked. Loosen transport lock completely.	Loosen the shipping lock screw above the needle unit. See Unlocking the Needle Unit (▶ page 209). Check that the horizontal needle drive can be shifted easily. If obstacles are present in the way of the needle drive, remove the obstacles.
Code 5011 Vertical needle drive blocked. Check for correct installation of sample loop.	Check that the sample loop is installed correctly. See the steps for installation of the sample loop in Sample Loop (▶ page 169).
Code 5012 Selftest failed.	The autosampler failed the self-test. Check for additional messages that specify the issue. Contact Thermo Fisher Scientific Technical Support for assistance.
Code 5013 Carousel blocked. Check for obstructions with racks or sample containers.	Rotate the carousel and check that it can be moved easily. If obstacles are present in the way of the carousel, remove the obstacles.
Code 5014 Rack not found. Check for correct rack position in the carousel and sample sequence.	Check if a sample rack or well plate is installed in this segment in the carousel. Check that it is placed correctly (see Loading the Carousel) and correct the position, if required.
Code 5015 Vial not found. Check for correct vial position in the rack and sample sequence.	Check if a vial or well plate is present at the specified position. Place a sample container at the specified position (see Loading the Carousel). Check the sample positions defined in the sample sequence. Specify a different position, if necessary.
Code 5016 Needle seat not found. Install needle seat.	Verify that the needle seat is installed. Install or replace the needle seat and needle unit, if necessary (see Replacing Needle Unit and Needle Seat (▶ page 181)).

Message and Code	Description and Remedial Action
Code 5017 Needle hit an unexpected object due to incorrect sample rack or well plate configuration.	Check if the correct sample rack or well plate is configured, and the correct sample position is defined in the sequence. Consider the number of positions of the configured sample rack or well plate as well as the respective well plate height.
Code 5018 Vial pusher hit an object that is higher than expected. Check the rack and/or well plate configuration.	Verify that the correct sample rack or well plate is configured. Consider the height of the sample rack or well plate.
Code 5019 Inject process refused. Pressure too high for installed components. Reduce pressure to value specified in manual.	The operating pressure is above the specified pressure range for the autosampler. Reduce the operating pressure and restart the run. Observe the pressure specifications in Performance Specifications (▶ page 246).
Code 5021 Insulation cover removed while temperature control is on. Replace cover or temperature control will shut down in X.X minutes.	With X.X = the number of minutes With autosamplers that come with an insulation (loop) cover, the cover must be installed to use sample compartment thermostating. If the cover is not installed properly, thermostating cannot be enabled or will be turned off automatically to protect the interior components from high humidity and extensive condensation when thermostating the sample compartment. If the message appears although the cover is installed, verify that the upper part of the cover where the magnet is located is firmly installed. You can monitor in the Instrument Audit Trail if the cover is detected properly as you remove and install it.
Code 5022 Temperature control shut down due to missing loop cover.	With autosamplers that come with an insulation (loop) cover, the cover must be installed to use sample compartment thermostating. If the cover is not installed properly, thermostating cannot be enabled or will be turned off automatically to protect the interior components from high humidity and extensive condensation when thermostating the sample compartment. If the message appears although the cover is installed, verify that the upper part of the cover where the magnet is located is firmly installed. You can monitor in the Instrument Audit Trail if the cover is detected properly as you remove and install it.
Code 5023 Horizontal part of Mounting Frame for Loop Cover removed while temperature control is on. Replace frame or temperature control will shut down in X.X minutes.	With X.X = the number of minutes The horizontal mounting frame part has been removed while the temperature control was turned on. The insulation loop cover must be installed to use sample compartment thermostating with the dual split sampler and the VC-A12. If the cover is not installed properly, thermostating cannot be enabled or will be turned off automatically to protect the interior components from high humidity and extensive condensation when thermostating the sample compartment. Reinstall or replace the horizontal mounting frame part as described in Mounting Frame (Dual Split Samplers only) (▶ page 143) and install the insulation loop cover, described in Installing the Insulation Loop Cover (▶ page 95).

Message and Code	Description and Remedial Action
Code 5024 Horizontal part of Mounting Frame for Loop Cover missing.	<p>The horizontal mounting frame part has been removed while the temperature control was turned on.</p> <p>Reinstall or replace the horizontal mounting frame part as described in section Mounting Frame (Dual Split Samplers only) (▶ page 143) and install the insulation loop cover as described in section Installing the Insulation Loop Cover (▶ page 95).</p>
Code 5099 The device is busy.	<p>The autosampler is not ready because, for example, a self-test is running or the autosampler is still busy processing a previous command.</p> <p>Retry when the autosampler is ready. Observe the autosampler status in the Instrument Audit Trail.</p>

8.3 Operating Issues

This section gives an overview of possible operating issues and remedial actions.

8.3.1 Resolving Liquid Leaks

When

The leak sensor is wet. The leak sensor reports leakage.

Parts and additional items required

- Replacement part as required
- Cloth or tissue

Preparations

When resolving leakage, observe the safety guidelines and general rules for maintenance and service as presented in [Maintenance and Service](#) (▶ page 131).

Follow these steps

1. Locate the source of the leak.
As leakage usually occurs at a connection, visually inspect all components and connections in the flow path.
2. Tighten or replace the connection or component as required.
3. With a cloth or tissue, thoroughly absorb all liquid that has collected in the leak tray and under the leak sensor. Be careful not to bend the sensor.
4. Allow the sensor to adjust to the ambient temperature for a few minutes.
5. If leakage is no longer reported, you can resume operation.

8.3.2 Resolving Clogging in the Autosampler

When

Components in the autosampler flow path are clogged

Dual split sampler: Perform the procedure for the affected sample loop.

Preparations

Turn off the pump flow to the autosampler. Wait until the system pressure is down to zero. Be sure that no backpressure from other modules in the system is present.

Follow these steps

1. Move the needle unit into service position and secure the needle unit. See [Securing the Needle Unit](#) (▶ page 140).
2. Slightly loosen the screw that attaches the sample loop plate with the screwdriver. The screw can remain loosely screwed on the holder for the sample loop unit.

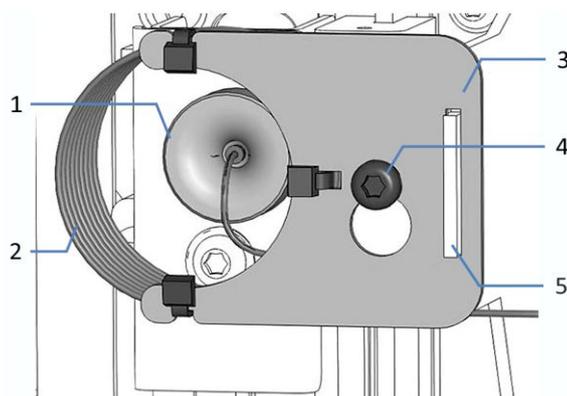


Figure 100: Sample loop unit installed to the needle unit

No.	Description
1	Sample loop fitting on the needle unit
2	Sample loop
3	Sample loop plate
4	Attachment screw for plate
5	Recess in the sample loop plate

3. Disconnect the sample loop fitting from the needle unit.

4. Push the sample loop unit slightly upward so that the screw matches the large recess in the sample loop plate. Remove the sample loop unit from the needle unit.

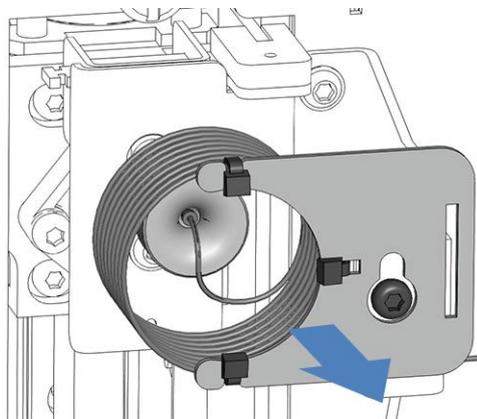


Figure 101: Removing the sample loop unit

5. Disconnect the sample loop fitting from the metering device head.
6. Place the open connector of the sample loop unit into the waste reservoir.
7. Set the injection valve to **Inject** position if the valve is not yet in this position.
8. Set the pump flow rate to the maximum pump flow rate.
9. Turn on the pump flow and flush the sample loop to waste at the maximum pump flow rate for approximately 1 minute. Afterward, turn off the pump flow.
10. Connect the sample loop fitting to the metering device head.
11. Connect the sample loop fitting to the needle unit.
12. Hang the sample loop plate to the holder for the sample loop unit:
 - a) Hook the screw hole of the sample loop plate onto the attachment screw. Make sure that the screw is loosened.
 - b) Align the long recess in the plate with the holder.
13. Position the sample loop capillary coming from the needle unit connection so that the capillary leaving the connector points to 6 o'clock.
14. Slightly tighten the attachment screw for the sample loop plate with the screwdriver. Do not fully tighten the screw yet.

15. Tighten the attachment screw for the sample loop plate with the screwdriver.

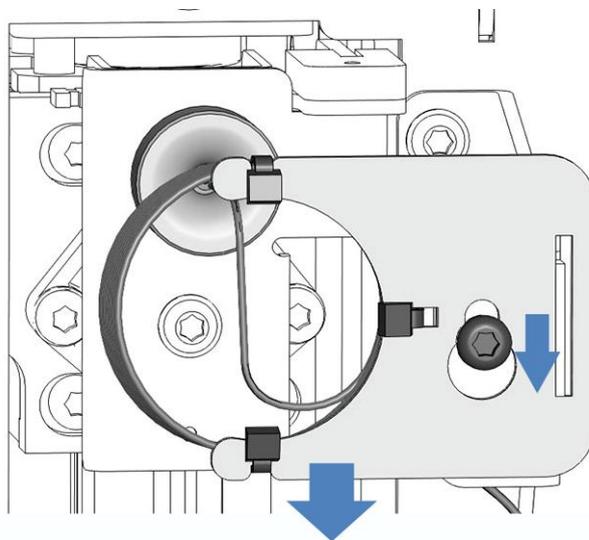


Figure 102: Aligning the sample loop unit to the screw

16. Loosen the shipping lock screw above the needle unit:
Turn the captive screw counterclockwise until it hangs loosely in its spring. The use of a slot screwdriver may facilitate turning the screw.

NOTICE—Fixed shipping lock screw may damage autosampler

If the shipping lock screw is not properly loosened, the autosampler may be damaged.

Always ensure that the shipping lock screw is completely loosened before you turn on the autosampler.

17. Push the **SERVICE** button and wait until the needle moves up.
18. Push the **SERVICE** a second time to move the needle unit slightly along the horizontal needle drive into the sample compartment until it is positioned above the wash port.

19. Turn on the pump flow and flush the needle unit into the wash port at the maximum pump flow rate for approximately 1 minute. Afterward, turn off the pump flow.
20. Push the **SERVICE** button a third time. The needle will move into the carousel and back until it descends back into the needle seat.

NOTICE

Observe whether the sample loop can move freely.

If it does not move freely:

Readjust the sample loop by positioning the sample loop capillary coming from the needle unit connection so that the capillary leaving the connector points to 6 o'clock. Repeat the test until the loop moves freely.

21. On the column or column pre-heater, disconnect the capillary. The capillary remains connected only to the injection valve.
22. Flush the needle seat, injection valve and capillary to the column or column pre-heater to waste at the maximum pump flow rate for approximately 1 minute.
23. Afterward, turn off the pump flow.

8.3.3 Additional Operating Issues

This section contains information on autosampler-related problems that may occur during operation.

Temperature Setpoint Cannot Be Achieved

Causes

- The ambient temperatures may be out of specified range.
- The sample compartment may not be insulated sufficiently.

Remedial Action

- Check if the door is closed properly.
- If the Charger was removed from the Charger opening, close the Charger opening on the autosampler properly with foam part and metal sheet cover. See [Closing the Charger Extension Opening](#) (► [page 123](#)).

9 Modifying the Autosampler for Specific Applications

9.1 Normal-Phase Compatible Solvents and Additives

This section applies to Vanquish Core system modules.

In a Vanquish Core system, normal-phase (NP) compatible solvents and additives may be used if the system modules have been modified for NP applications. Refer to the *Vanquish System Operating Manual*.

10 Specifications

This chapter provides the physical and performance specifications, including information about the materials used in the flow path of the device.

10.1 Performance Specifications

The autosampler performance is specified as follows:

Type	Specification*
Injection method	Split-loop injection method
Number of injection units	VC-A12, VC-A13: 1 VF-A10, VH-A10: 1 VF-A40, VH-A40: 2
Pressure range	VC-A12, VC-A13: 2 - 70 MPa (20 - 700 bar, 290 - 10100 psi) VF-A10, VF-A40: 2 - 103 MPa (20 - 1034 bar, 290 - 15000 psi) VH-A10, VH-A40: 5 - 151 MPa (50 - 1517 bar, 700 - 22002 psi)
Injection volume range (settable)	VC-A12, VC-A13: 0.01 µL - 100 µL, steps of min 0.01 µL VF-A10, VF-A40, VH-A10, VH-A40: 0.01 - 25 µL, steps of min. 0.01 µL
Injection volume range (optionally extendable)	VC-A12, VC-A13: 0.01 µL up to the volume of the installed sample loop (maximum 1000 µL), for volumes > 250 µL the Multidraw functionality is used automatically. VF-A10, VF-A40, VH-A10, VH-A40: 0.01 µL up to the volume of the installed sample loop (maximum 1000 µL), for volumes > 100 µL the Multidraw functionality is used automatically.
Injection volume accuracy	VC-A12, VC-A13: <ul style="list-style-type: none"> • Typically, ±1% with an injection volume of 10µL and water • Typically, ±0.5% with an injection volume of 50µL and water VF-A10, VF-A40, VH-A10, VH-A40: <ul style="list-style-type: none"> • Typically, ± 0.5% with an injection volume of 10 µL and water
Injection volume precision	VC-A12, VC-A13: <ul style="list-style-type: none"> • Area RSD < 0.25% for an injection volume of 3 µL (caffeine in Water) • Typically, area RSD < 0.5 % for injection volume 1 µL (caffeine in Water) VF-A10, VF-A40, VH-A10, VH-A40: <ul style="list-style-type: none"> • Area RSD < 0.25% for an injection volume of 1 µL (caffeine in water) • Typically, area RSD < 0.5% for an injection volume of 0.5 µL (caffeine in water)
Linearity	$r > 0.99999$ (caffeine in water)

Type	Specification*
Needle wash	Dip rinse and continuous rinse of outer needle surface Flush of inner needle surface and sample loop with mobile phase into wash port (for abort of injection)
Number of needle wash liquids	1 per injection unit
Dwell volume (contribution of the autosampler to the system gradient delay volume)	VC-A12, VC-A13: <ul style="list-style-type: none"> • 255 µL with 100 µL loop (default configuration) VF-A10, VF-A40, VH-A10, VH-A40: <ul style="list-style-type: none"> • 110 µL with sample loop volume of 25 µL (default configuration) • 83 µL with sample loop volume of 10 µL
Method Transfer capability	VC-A12, VC-A13: Sampler freely tunable contribution to gradient delay volume between 0 µL to 230 µL VF-A10, VF-A40, VH-A10, VH-A40: Sampler freely tunable contribution to gradient delay volume between 0 µL to 100 µL
Injection cycle time	Down to 8 s depending on separation conditions
Carry over	< 0.002% with caffeine Typically < 0.0004% with caffeine With run time, loop inline: 7 minutes and inject volume: 10 µL
Barcode reader	yes
Automation Features Barcode Reading	Barcode reading: <ul style="list-style-type: none"> • Empty segment detection • Rack/well plate verification • Inventory management
Liquid Handling Programming	Only VC-A12, VC-A13, VF-A10, VH-A10: Custom programming of sampler to add liquid handling steps prior to a normal injection or customize complete injection procedure
Sample compartment thermostating: Temperature range	4 - 40 °C, cooling ≥ 23 K below ambient at < 80% relative humidity Note: VC-A13 does not support sample compartment thermostating.
Temperature accuracy	-2 °C and +4 °C
Temperature stability	± 1 °C
Sample capacity	4 segments useable for sample racks or well plates with SBS footprint format; plus support vial holders with a capacity of 12 x 22.5 mm O.D. vials
Vial capacity	<ul style="list-style-type: none"> • 54 x 12 mm O.D. vials • 96 x 6 mm O.D. vials • 96 x 7 mm O.D. vials • 96 x 8 mm O.D. vials • 16 x 15 mm O.D. vials • 9 x 22.5 mm O.D. vials

Type	Specification*
Well plate capacity	96- and 384-position well plates with SBS footprint
Minimum sample required	2 µL at 1 µL injection volume
Biocompatibility	VC-A12, VC-A13: no VH-A10, VF-A10, VH-A40, VF-A40: yes
USB Communication	1 USB port (USB 2.0, "B" type connector) 1 USB hub with 3 ports (USB 2.0, "A" type connectors)
I/O Interface	2 digital I/O ports (mini DIN), each providing one digital input, and one relay output
System Interlink	2 system interlink ports (RJ45-8 connectors)
Control	Chromeleon 7 The autosampler can be operated also with other data systems. For details, contact the Thermo Fisher Scientific sales organization. Keypad with 6 buttons for performing certain functions directly from the autosampler
Materials in the analytical flow path	VC-A12, VC-A13: Titanium, ceramics, PEEK, Stainless Steel, DLC, sapphire, PE-UHMW With NP-Kit applied: Titanium, PEEK, Stainless Steel, DLC, sapphire, PE-UHMW VF-A10, VF-A40, VH-A10, VH-A40: Titanium, ceramics, PEEK, MP35N, DLC, sapphire, fluoropolymers Note: For information about the seal wash liquid to be used, see Choosing the Seal Wash Liquid (▶ page 74). For information about the chemical resistance of materials refer to the technical literature.
Materials in the needle wash flow path	Silicone, PP (polypropylene), PE, FFKM (perfluoro-elastomer), FFKM, PEEK, PA (polyamides), PK (polyketone), TPE (thermoplastic elastomer) VC-A12 and VC-A13 with NP-Kit applied: PP, PE, FFKM, FFKM, PEEK, PA, PK, TPE, PTFE
Materials in metering device rear seal wash	VC-A12, VC-A13: Titanium, PEEK, UHMW PE, PP, PTFE, silicone With NP-Kit applied: Titanium, PEEK, UHMW PE, PP, Viton VF-A10, VF-A40, VH-A10, VH-A40: Titanium, ceramics, PEEK, UHMW PE, PP, PTFE, silicone
Solvent and additive information	See Solvent and Additive Information (▶ page 27).
Safety features	Leak detection and safe leak handling

Type	Specification*
Good Laboratory Practice (GLP) features	Predictive Performance functions for scheduling maintenance procedures based on the actual operating and usage conditions of the autosampler. All system parameters are logged in the Chromeleon Audit Trail.
<p>*Typical operating conditions for measurable specifications: Flow rate: 1.2 mL/min, Sample: Caffein, Mobile phase: Water VF-A10/VF-A40 at 900 bar, VH-A10/VH-A40 at 1300 bar, VC-A12/VC-A13 at 630 bar</p>	

10.2 Physical Specifications

The physical conditions of the device are specified as follows:

Type	Specification
Range of use	Indoor use only
Ambient operating temperature	5 °C - 35 °C
Ambient storage temperature	-20 °C - 45 °C
Ambient operating humidity	20% - 80% relative humidity (non-condensing)
Ambient storage humidity	Maximum 60% relative humidity (non-condensing)
Operating altitude	Maximum 2000 m above sea level
Pollution degree	2
Power requirements	100 – 240 V AC, ± 10 %; 50/60 Hz; max. 525 W / 550 VA
Overvoltage category	II
Emission sound pressure level	< 70 dB(A), typically < 50 dB(A)
Dimensions (height x width x depth)	29 x 42 x 62 cm
Weight	VC-A12: 24 kg; VC-A13: 22 kg; VH-A10, VF-A10: 25kg; VH-A40, VF-A40: 29 kg

11 Accessories, Consumables and Replacement Parts

This chapter describes the standard accessories that are shipped with the device and the accessories that are available as an option. This chapter also provides information for reordering consumables and replacement parts.

11.1 General Information

The device must be operated only with the replacement parts and additional components, options, and peripherals specifically authorized and qualified by Thermo Fisher Scientific.

Accessories, consumables, and replacement parts are always maintained at the latest technical standard. Therefore, part numbers are subject to change. If not otherwise stated, updated parts will be compatible with the parts they replace.

11.2 Ship Kit

The ship kit includes the items listed in the table. The kit content is subject to change and may vary from the information in this manual. Refer to the content list included in the kit for the most recent information about the kit content at the time when the device is shipped.

For reordering information, see [Consumables and Replacement Parts](#) (▶ page 256).

11.2.1 Single Split Samplers (VC-A12 and VC-A13)

Item	Quantity in shipment
Fitting plug, Viper	1
Flow Scheme Single Split Sampler	1
Plugs and retaining guides for reservoir caps, kit including <ul style="list-style-type: none"> • Cap plug to close open holes in the reservoir cap (pack of 5) • Retaining guide to keep the liquid line in place in the reservoir cap (pack of 2) 	7
Reservoir, 0.25 L, with reservoir cap <i>Note:</i> The reservoir may be included in the shipment outside the ship kit packing.	1
Sample rack, for 54 x 12 mm O.D. vials <i>Note:</i> The sample racks provide a 2D barcode for Vanquish rack type identification.	4
Screwdriver, Torx T30	1
Silicone tubing	3 m
System interlink cable (RJ45), 0,5 m	1
Tubing bracket	2
USB cable, type A to type B, high-speed, USB 2.0, cable length: 1 m	1
Vial septum kit, including vials and caps with pre-assembled septa	1

11.2.2 Single Split Samplers (VH-A10 and VF-A10)

Item	Quantity in shipment
Flow Scheme for Single Split Sampler	1
Plugs and retaining guides for reservoir caps, kit including <ul style="list-style-type: none"> • Cap plug to close open holes in the reservoir cap (pack of 5) Retaining guide to keep the liquid line in place in the reservoir cap (pack of 2) 	7
Reservoir, 0.25 L, with reservoir cap <i>Note:</i> The reservoir may be included in the shipment outside the ship kit packing.	1
Sample rack, for 54 x 12 mm O.D. vials <i>Note:</i> The sample racks provide a 2D barcode for Vanquish rack type identification.	4
Screwdriver, Torx T30	1
Silicone tubing	3 m
System interlink cable (RJ45), 0,5 m	1
Tubing bracket	2
USB cable, type A to type B, high-speed, USB 2.0, cable length: 1 m	1
Vial septum kit, including vials and caps with pre-assembled septa	1

11.2.3 Dual Split Samplers (VH-A40 and VF-A40)

Item	Quantity in shipment
Offset screwdriver, Torx T10	1
Plugs and retaining guides for reservoir caps, kit including <ul style="list-style-type: none"> • Cap plug to close open holes in the reservoir cap (pack of 5) • Retaining guide to keep the liquid line in place in the reservoir cap (pack of 2) 	7
Reservoirs, 0.25 L, with reservoir cap <i>Note:</i> The reservoirs may be included in the shipment outside the ship kit packing.	2
Sample rack, for 54 x 12 mm O.D. vials <i>Note:</i> The sample racks provide a 2D barcode for Vanquish rack type identification.	4
Screwdriver, Torx T30	1
Silicone tubing	3 m
System interlink cable (RJ45), 0,5 m	1
Tubing bracket	2
USB cable, type A to type B, high-speed, USB 2.0, cable length: 1 m	1
Vial septum kit, including vials and caps with pre-assembled septa	1

11.3 Optional Accessories

Item	Part No.	Remarks
Protective cover for single split samplers VH-A10 and VF-A10 Note: The cover will not work with VC-A12	6850.1627	To protect the interior components behind the right front door of the autosampler from high humidity and condensation. For installation instructions, see Installing the Protective Cover (Optional for VH-A10 and VF-A10) (▶ page 92).

Sample loops for installation in VH- and VF-autosamplers:

Autosampler	Item	Part No.
<ul style="list-style-type: none"> • VH-A10 • VF-A10 • Left injection unit of VH-A40 and VF-A40 	Sample loop, biocompatible, MP35N, volume: 10 µL	6850.1915
	Sample loop, biocompatible, MP35N, volume: 25 µL	6850.1911
	Sample loop, biocompatible, MP35N, volume: 100 µL	6850.1913
	Sample loop, biocompatible, MP35N, volume: 250 µL	6850.1970
	Sample loop, biocompatible, MP35N, volume: 1000 µL	6850.1980
<ul style="list-style-type: none"> • Right injection unit of VH-A40 and VF-A40 	Sample loop, biocompatible, MP35N, volume: 10 µL	6850.1919
	Sample loop, biocompatible, MP35N, volume: 25 µL	6850.1917
	Sample loop, biocompatible, MP35N, volume: 100 µL	6850.1918
	Sample loop, biocompatible, MP35N, volume: 250 µL	6850.1975
	Sample loop, biocompatible, MP35N, volume: 1000 µL	6850.1985

Sample loops for installation in VC-autosamplers:

Autosampler	Item	Part No.
<ul style="list-style-type: none"> • VC-A12 • VC-A13 	Sample loop, stainless steel, volume: 10 µL	6851.1960
	Sample loop, stainless steel, volume: 25 µL	6851.1940
	Sample loop, stainless steel, volume: 100 µL	6851.1950
	Sample loop, stainless steel, volume: 250 µL	6851.1970
	Sample loop, stainless steel, volume: 1000 µL	6851.1980

11.4 Consumables and Replacement Parts

For ordering information of sample racks and well plates for the autosampler, refer to the re-ordering information that is included in the ship kit.

Capillaries

Description	Part No.
Capillary, injection valve to wash port waste for VH/VF-A10, VH/VF-A40	6850.1930
Capillary, injection valve to wash port waste for VC-A12, VC-A13	6851.1930
Capillary, injection valve to metering device head for: <ul style="list-style-type: none"> • VH-A10 • VF-A10 • Left injection unit of VH-A40 and VF-A40 	6850.1920
Capillary, injection valve to metering device head for: <ul style="list-style-type: none"> • Right injection unit of VH-A40 and VF-A40 	6850.1922
Capillary, injection valve to metering device head for: <ul style="list-style-type: none"> • VC-A12 • VC-A13 	6851.1920
Fitting plug, Viper, titanium	6040.2303
For system capillaries, refer to the <i>Vanquish System Operating Manual</i> .	

Flow components

Description	Part No.
Injection valve for VH/VF-A10 and VH/VF-A40 autosamplers	6036.2510
Injection valve for VC-A12 and VC-A13 autosamplers	6230.1510
Normal-phase compatible injection valve for VC-A12 and VC-A13 NOTICE: Use this injection valve only with VC autosamplers that have been modified for normal-phase compatible solvents and additives.	6230.2510
Only for normal-phase compatible injection valve for VC-A12 and VCA13: Stator for the NP compatible autosampler valve, NP injection valve	6230.2515
Only for normal-phase compatible injection valve for VC-A12 and VCA13: Rotor for the NP compatible autosampler valve, NP injection valve	6230.2517
Needle seat for VH/VF-A10 and VH/VF-A40 autosamplers	6850.2430
Needle seat for VC-A12 and VC-A13 autosamplers	6851.2430
Needle unit for VH/VF-A10 and VH/VF-A40 autosamplers	6850.1100B
Needle unit for VC-A12 and VC-A13 autosamplers	6851.1130A

Description	Part No.
Metering device head, volume 100 µL for VH/VF-A10 and VH/VF-A40 autosamplers	6850.1743
Metering device head, volume 250 µL for VC-A12 and VC-A13 autosamplers	6851.1714

Interface cables

Description	Part No.
Digital I/O signaling cable, 6-pin, cable length: 5 m	6036.0006
System interlink cable (RJ45), 0.5 m	6036.0004
USB cable, type A to type B, high-speed, USB 2.0 Cable length: 1 m	6035.9035A
USB cable, type A to type B, high-speed, USB 2.0 Cable length: 5 m	6911.0002A

Miscellaneous

Description	Part No.
Front door kit, including right door and left door	6850.0100
Fuses kit, Vanquish system The kit includes the appropriate fuses for the Vanquish system modules. For the autosampler, use only 5 AT 230 V AC, slow-blow fuses.	6036.0002
Insulation loop cover kit for dual split samplers, including <ul style="list-style-type: none"> • Insulation loop cover • Mounting frame with horizontal and vertical frame parts and screws 	6850.1647
Insulation loop cover kit for VC-A12, including <ul style="list-style-type: none"> • Insulation loop cover 	6851.1647
Packaging material for autosampler	6850.7002

Power cords

Description	Part No.
Power cord, Australia	6000.1060
Power cord, China	6000.1080
Power cord, Denmark	6000.1070
Power cord, EU	6000.1000
Power cord, India, SA	6000.1090
Power cord, Italy	6000.1040
Power cord, Japan	6000.1050
Power cord, UK	6000.1020

Description	Part No.
Power cord, USA	6000.1001
Power cord, Switzerland	6000.1030

Reservoirs for solvents and wash liquids

Description	Part No.
Reservoir, 1 L, including cap	2270.0012
Reservoir, 0.25 L, including cap	2270.0026
Cap for reservoirs, screw-cap (pack of 4)	6270.0013
Cap plug to close open holes in the reservoir cap (pack of 20)	6000.0047
Retaining guide to keep the liquid line in place in the reservoir cap (pack of 5)	6000.0042
Plugs and retaining guides for reservoir caps, kit including <ul style="list-style-type: none"> • Cap plug to close open holes in the reservoir cap (pack of 10) • Retaining guide to keep the liquid line in place in the reservoir cap (pack of 5) 	6030.9101

Sample racks and well plates

Description	Part No.
Sample rack, for 54 x 12 mm O.D. vials With 2D barcode for Vanquish rack type identification	6850.1023
Sample rack, for 96 x 6 mm O.D. vials With 2D barcode for Vanquish rack type identification	6850.1026
Sample rack, for 96 x 7 mm O.D. vials With 2D barcode for Vanquish rack type identification	6850.1030
Sample rack, for 96 x 8 mm O.D. vials With 2D barcode for Vanquish rack type identification	6850.1034
Sample rack, for 16 x 15 mm O.D. vials With 2D barcode for Vanquish rack type identification	6851.1030
Sample rack, for 9 x 22.5 mm O.D. vials With 2D barcode for Vanquish rack type identification	6851.1020
For well plates and additional sample racks, refer to the ordering information that is included in the ship kit.	

Tubing and wash components

Description	Part No.
<p>Peristaltic and wash tubing kit</p> <p>The kit includes peristaltic tubing (PharMed), silicone tubing, and tubing connectors for use in</p> <ul style="list-style-type: none">• Seal wash system in the pump and in the autosampler• Needle wash system in the autosampler• Drain pump in the autosampler <p>NOTICE: Use the thick silicone tubing (and related tubing connectors) in the autosampler. Use the thin silicone tubing (and related tubing connectors) in the pump. Use the screwable connectors for the pump head. The screwable tubing connectors are not used with the VC-pumps and VF-pumps.</p> <p>NOTE: For a Vanquish Core system that has been modified for NP applications, order the Normal-Phase (NP) tubing kit. For ordering details and kit content, refer to the <i>Vanquish System Operating Manual</i>.</p>	6044.1150

12 Appendix

This chapter provides additional information about compliance and the use of the digital I/O ports.

12.1 Compliance Information

12.1.1 Declarations of Conformity

CE Declaration of Conformity

The device has satisfied the requirements for the CE mark and is compliant with the applicable requirements.

EAC Declaration of Conformity

The device has satisfied the requirements for the EAC mark and is compliant with the applicable requirements.

RoHS Compliance

This product complies with the RoHS (Restrictions of Hazardous Substances) directives:

- *European RoHS Directive*
Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The CE mark on the device indicates that the product is compliant with the directive.
- *China RoHS regulations*
Measures for Administration of the Pollution Control of Electronic Information Products

One of the following logos may be present on the device if applicable:

Logo	Description
	The green logo marks items that do not contain the hazardous substances identified by the regulations.
	The orange logo including a one-digit or two-digit number marks items that contain hazardous substances identified by the regulations. The number indicates the environment-friendly use period (EFUP) of the item. During this period, the item (when used as intended) will not cause serious damage to human health or environment. For more information, go to http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html

UKCA Declaration of Conformity

The device has satisfied the requirements for the UKCA mark and is compliant with the applicable requirements.

UL/CSA 61010-1 Compliance

The label of the NRTL Lab on the device (for example, cTUVus or CSA mark) indicates that the device has satisfied the requirements of the applicable standards.

12.1.2 WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive. It is marked with the following symbol:



Figure 103: WEEE symbol

Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. For further information, contact Thermo Fisher Scientific.

12.1.3 FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the U.S. FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his expense.

12.1.4 Manual Release History

Revision	Covering
4.0 and 5.0	VC-A12, VC-A13, VF-A10-A-02, VF-A40-A-02, VH-A10-A-02, VH-A40-A-02
3.0	VH-A10-A-02, VF-A10-A-02, VH-A40-A-02, VF-A40-A-02
2.1a	VH-A10, VF-A10
2.1	VH-A10, VF-A10
2.0	VH-A10, VF-A10
1.0	VH-A10

The instructions were prepared in English (original instructions). Other language versions are translations based on the English original instructions.

12.2 Digital I/O

The digital I/O ports (Dig I/O) can be used to exchange digital signals with external devices. Each port provides:

- one digital input
- one relay output

Pin Assignment

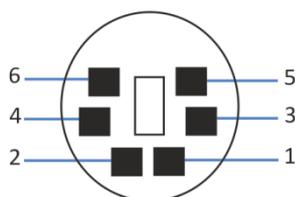


Figure 104: Digital I/O port

Pin	Description — Signal Name
1	Not used
2	Relay output — Relay_NC (Normally Closed contact)
3	Ground — GND
4	Digital input — Input
5	Relay output — Relay_COM COM is the common contact for NO and NC. If the relay is not activated or if the device is turned off, the connection is between COM and NC. If the relay is activated, the connection is between COM and NO.
6	Relay output — Relay_NO (Normally Open contact)

The next table lists the functions assigned to the connector pins and the color of the cable wire connected to each pin.

Pin	Wire Color	Signal Name	Signal Level	Remarks
1	Pink			Not used
2	Gray	Relay output — Relay_NC	Potential free 0-24 V, 0-100 mA	Opening contact
3	Green	Ground — GND	Ground	Reference potential

Pin	Wire Color	Signal Name	Signal Level	Remarks
4	Yellow	Digital input — Input	Input (low active): On: 0-0.4 V Off: 2.2-5 V Pull-up resistor: 47 kΩ to 5 V	Digital input; reference potential is ground. Note the following: <ul style="list-style-type: none"> • The maximum input voltage at the input must not exceed +5 V with reference to ground. • The minimum input voltage must not be lower than the ground potential.
5	White	Relay output — Relay_COM	Potential free	Common contact for NO and NC
6	Brown	Relay output — Relay_NO	Potential free 0-24 V, 0-100 mA	Closing contact

Prerequisites

To use the digital I/O functionality, the following must be fulfilled:

- The digital I/O port is connected to the external device with the digital I/O signaling cable.
- The inputs and outputs that you want to use are selected in the Instrument Configuration Manager.

Connecting a Digital I/O Port

1. Plug the 6-pin connector of the cable into the digital I/O port that you want to use.
2. For each relay output or digital input to be used, connect the appropriate signal wire and ground wire to the corresponding connectors on the external device. For details, refer to the documentation provided with the external device.

Selecting the inputs and outputs in the chromatography data system

1. In the dialog box for the device, on the **Inputs** and **Outputs** pages, select the inputs and outputs that you want to use. The numbering in the dialog box corresponds to the numbers on the port.

Inject Response Synchronization

The autosampler uses relay output no. 2 (**Sampler_Relay_2**) by default for inject response synchronization: A signal is sent to indicate that injection has taken place to automatically synchronize the time of injection with start of an external device, such as a mass spectrometer.

If relay output no. 2 is assigned for a different use or device and the checkbox is enabled to control the output in the Instrument Configuration Manager, the automatic inject response synchronization is disabled. In this case, the **Inject Response Signal Time** can be configured to define for how long the relay is to indicate that the injection takes place.

With dual split samplers, additional options for the inject response relay link are available in chromatography data system:

- By default, the inject response relay link is set, and for both injection units the autosampler uses relay output no. 2 (**Sampler_Relay_2**) to send inject response signals. This configuration is not available if relay output no. 2 is assigned for a different use or device.
- Optionally, the right injection unit can be configured to send the inject response signal via relay output no. 1 (**Sampler_Relay_1**). This configuration is not available if relay output no. 1 is assigned for a different use or device.

For further information, refer to the Chromeleon Help.

Index

A

accessories	251
ship kit	253
additives	27
information	27
audit trail	230
Audit Trail messages	232

B

barcode (Vanquish)	46, 112, 115
buffers	27
concentration	27
information	27

C

capillaries	
guide	69
install	71
Viper	71
carousel	44, 45
change rack (parameter)	117
color code	45
inventory scan	115
load	112
rack type settings	115
rotate	114
Rotate (button)	106
support vial holder	45
CE mark	262
Charger	122
carousel use	122
close extension opening	123
disable operation (Chromeleon)	123
extension opening	46
chloride concentration	28
Chromeleon	49
audit trail	230
device setup	98
module setup	98
Predictive Performance	139
Smart Shutdown	125
Smart Standby	125
Smart Startup	111
cleaning	137

clogging of flow components	238
condensation	62, 67
connection	
power cord	67
connectors	65
consumables	251
cTUVus mark	263

D

decontamination	137
delivery	55
device	
preparing for operation	109
restart after long-term shutdown	129
shutdown	125
Dig I/O	65, 265
digital I/O	65, 265
door	63
open	63
opening mechanism	63
remove	132
replace	216
unhinge	132, 216
drain ports	73
drain pump (parameter)	119
drain pump pause / interval (parameter)	119
drain pump tubing	202
DrainPumpTubeChanged	139
replace	205
test tubing	203
drain system	73

E

EAC mark	262
equilibration	110
ExceptionLogClear (Chromeleon)	231

F

FCC	263
features overview	32
firmware failure	231
firmware update	214
flow connections	68
drain pump tubing	202

- drainage 73
 needle wash system 82
 setup order 69
 fuses 212
- G**
- gloves 23
 guide hole 69
 guidelines
 installation 58
 maintenance 133
 operation 101
- I**
- idle volume (parameter) 119
 inject wash mode (parameter) 120
 injection
 prepare next injection (parameter) 118
 prepare this injection (parameter) 118
 injection valve 87
 column compartment connection 91
 guidelines 194
 inspect 194
 ports 87
 pump connection 89
 injection volume (parameter) 118
 installation 57
 capillaries and tubing 69
 safety guidelines 58
 site requirements 61
 system 59
 Instrument Audit Trail 230
 insulation loop cover (dual split sampler)
 install 96
 remove 95
 intended use 20
 interior view
 dual split sampler 42
 single split sampler 40
 Interlink 65
 inventory scan 115
- K**
- keypad 104
 Rotate 106
 SERVICE 105
 Valve 105
- Wash 106
- L**
- leak detection 48, 121
 leak sensor 193, 237
 leak sensor mode 121
 leak tray 73
 leakage 237
 LED bar 104, 107, 230
 liquid leaks 237
 long-term shutdown 126
 loop cover status (Chromeleon) 120
- M**
- main power fuses 212
 maintenance 131, 136
 cleaning 137
 decontamination 137
 doors 216
 firmware update 214
 fuses 212
 general rules 135
 interval 136
 introduction 132
 predictive performance 139
 preparing 140
 restart 207
 safety guidelines 133
 messages 232
 metering device head
 capillaries replace 188
 dock 119
 MeteringHeadChanged 139
 replace 189
 undock 119
 mounting frame (dual split sampler) 143
 move 60
 Mute Alarm 105
- N**
- needle height (parameter) 117
 needle seat
 NeedleSeatChanged 139
 replace needle unit and needle seat 182
 needle unit
 NeedleChanged 139
 replace needle unit and needle seat 182

settings.....	111	information.....	27
sample loop		pH range	27
replace (dual split sampler).....	173	specifications	245
replace (single split sampler)	170	performance	246
sample position (parameter).....	118	physical.....	250
sample rack	45	split-loop principle.....	34
barcode	46	startup	110
install.....	112	status indicator	
orientation	114	LED bar	104, 107, 230
SBS footprint	112	Status LED.....	104, 107, 230
scope of delivery	55	STATUS LED.....	104, 107, 230
seal wash system.....	74	SyncWithPump	116, 118
replace lines	156	system arrangement.....	64
seal wash liquid.....	74	system equilibration	110
setup	75	System Interlink.....	65
Select (button).....	105		
Select LEDs	105	T	
service	131	temperature control (parameter)	120
leak sensor	193	temperature nominal (parameter).....	120
Service (button).....	105	total loop volume (parameter).....	118
ServiceDone	139	transport.....	218
setup		troubleshooting.....	229
hardware.....	64	general information.....	230
software	98	messages	232
system arrangement.....	64	operating issues.....	237
ship	218	tubing.....	71
slide-in module.....	225	tubing bracket	69
ship kit.....	253	tubing chase	69
shipping lock screw		tubing guides	69
loosen.....	54, 209	type label	19
tighten.....	141		
short-term shutdown	125	U	
shutdown	125	UKCA mark.....	263
long-term	126	UL/CSA compliance.....	263
short-term	125	Universal Serial Bus	66
signal words	18	unpack	52
site requirements	61	USB	66
condensation.....	62, 67		
power considerations.....	61, 62	V	
slide-in module.....	223	Valve (button).....	105
install.....	226	Viper fitting system	71
remove	223		
return	225	W	
Smart Shutdown.....	125	Wash (button).....	106
Smart Standby.....	125	wash (parameter)	120
Smart Startup	111	wash pump (parameter).....	121
solvent			
chloride concentration.....	28		

WEEE 263
well plate 45
 barcode 46
 install 112
 orientation 114

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