Contacting Us

There are several ways to contact us:

*Ordering Information*

For ordering information or sales support for HPLC products, contact your local Thermo Fisher Scientific sales organization. For contact information, go to Contact Us on http://www.thermofisher.com.

*Technical Assistance*

For technical support for HPLC products, contact your local Thermo Fisher Scientific support organization. For contact information, go to Contact Us on http://www.thermofisher.com.
## Contents

### 1 Using this Manual

1.1 About this Manual .......................................................... 10
1.2 Conventions ........................................................................ 11
  1.2.1 Safety Messages .......................................................... 11
  1.2.2 Special Notices and Informational Notes ...................... 11
  1.2.3 Typographical Conventions .......................................... 12
1.3 Reference Documentation .................................................. 13

### 2 Safety

2.1 Safety Symbols and Signal Words ........................................ 16
  2.1.1 Safety Symbols and Signal Words in This Manual ............. 16
  2.1.2 Observing this Manual ............................................... 16
  2.1.3 Safety Symbols on the System ....................................... 17
2.2 Intended Use ...................................................................... 18
2.3 Safety Precautions ................................................................ 19
  2.3.1 General Safety Information .......................................... 19
  2.3.2 Qualification of the Personnel ....................................... 19
  2.3.3 Personal Protective Equipment ..................................... 21
  2.3.4 General Residual Hazards ......................................... 22
  2.3.5 In Case of Emergency ............................................... 24
2.4 Solvent and Additive Information ........................................ 25
  2.4.1 General Compatibility .............................................. 25
  2.4.2 Allowed pH Ranges ................................................. 26
  2.4.3 Allowed Concentrations ............................................ 26
  2.4.4 Further Information ................................................. 27

### 3 System Overview

3.1 System Description (Standard Configuration) ...................... 30
  3.1.1 Solvent Rack .......................................................... 31
  3.1.2 System Base .......................................................... 32
3.2 Operation ....................................................................... 33

### 4 Unpacking

4.1 Unpacking ................................................................. 36
4.2 Scope of Delivery .......................................................... 37
5 Installation

5.1 Safety Guidelines for Installation ................................................................. 40
5.2 Installing the System .................................................................................. 41
5.3 Site Requirements ...................................................................................... 43
  5.3.1 Workbench ............................................................................................ 43
  5.3.2 Power Considerations ........................................................................... 44
  5.3.3 Power Cord ........................................................................................... 44
  5.3.4 Condensation ........................................................................................ 45
  5.3.5 Operating Conditions ............................................................................ 45
5.4 Setting Up the Hardware ............................................................................ 46
  5.4.1 System Stack Setup ............................................................................... 46
  5.4.2 Signal Cable Connections ..................................................................... 54
  5.4.3 Power Connections .............................................................................. 59
  5.4.4 Cable Clips ............................................................................................. 60
  5.4.5 System Base Lock ................................................................................ 61
5.5 Setting Up the Flow Connections ............................................................... 64
  5.5.1 General Information and Guidelines ..................................................... 64
  5.5.2 Flow Connections Overview ................................................................. 65
  5.5.3 Guiding Capillaries and Tubing Through the System ......................... 66
  5.5.4 Connecting Fittings, Capillaries, and Tubing ....................................... 68
  5.5.5 Connecting the Waste Lines ................................................................. 70
5.6 Turning On the System ............................................................................... 78
5.7 Setting Up the System in the Software ...................................................... 79
5.8 Flushing the System .................................................................................... 81

6 Operation

6.1 Introduction to this Chapter ...................................................................... 84
6.2 Safety Guidelines for Operation .................................................................. 85
6.3 Power On/Off Control ................................................................................ 86
6.4 Preparing the System for Operation ......................................................... 87
6.5 Use of Solvents and Additives ................................................................... 89
6.6 Operating the System from the Software ............................................... 92
  6.6.1 Starting the Instrument Controller and Client .................................... 92
  6.6.2 Controlling the System from the ePanel Set ...................................... 93
  6.6.3 Monitoring the Baseline ...................................................................... 94
  6.6.4 Running Automated Sample Analysis .............................................. 95
6.7 Shutting Down the System ......................................................................... 97
7 Maintenance and Service .......................................................... 101
  7.1 Introduction to Maintenance and Service .................................. 102
  7.2 Safety Guidelines for Maintenance and Service ....................... 103
  7.3 General Rules for Maintenance and Service ............................. 105
  7.4 Routine and Preventive Maintenance ...................................... 106
    7.4.1 Maintenance Plan ......................................................... 106
    7.4.2 Cleaning or Decontaminating the System ......................... 106
  7.5 Transporting or Shipping the System .................................... 109

8 Troubleshooting ........................................................................ 113
  8.1 General Information about Troubleshooting ............................ 114
  8.2 System Troubleshooting ..................................................... 115
    8.2.1 Peak Shape ............................................................... 115
    8.2.2 Ghost Peaks, Negative Peaks and Spikes .......................... 116
    8.2.3 Peak Area Precision ................................................... 117
    8.2.4 Flow ........................................................................... 119
    8.2.5 Pressure ....................................................................... 120
    8.2.6 Retention Time Variation ............................................. 121
    8.2.7 Baseline ...................................................................... 121
    8.2.8 Temperature Control ................................................... 123
    8.2.9 Power and Communication .......................................... 124
    8.2.10 System Diagnostics .................................................... 125

9 Specifications .......................................................................... 129
  9.1 System Specifications ......................................................... 130
  9.2 Solvent Rack and System Base Specifications .......................... 131

10 Accessories, Consumables and Replacement Parts ................. 133
  10.1 General Information .......................................................... 134
  10.2 Ship Kit ............................................................................ 135
  10.3 Optional Accessories ........................................................ 137
  10.4 Consumables and Replacement Parts ................................... 138
    10.4.1 Capillaries and Tubing ............................................... 138
    10.4.2 Solvents and Wash Systems ....................................... 139
    10.4.3 Fuses and Cables ....................................................... 140
    10.4.4 Other Parts .............................................................. 140
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 provides instructions for installation, set up, start up, shut down, operation, maintenance and troubleshooting of your system.

The layout of this manual is designed to provide quick reference to the sections of interest to the user. To obtain a full understanding of your system, read this manual thoroughly.

This manual also contains safety messages, precautionary statements, and special notices that can prevent personal injury, damage to the system, or loss of data when followed properly.

Note the following:

- The descriptions in this manual refer to a standard one-stack Vanquish™ system configuration. Not all descriptions necessarily apply to your particular system.

- Illustrations in this manual are provided for basic understanding. They can vary from the actual model of the system. However, this does not influence the descriptions. No claims can be derived from the illustrations in this manual.
1.2 Conventions

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

1.2.1 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 and Informational Notes

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.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highlights information necessary to prevent damage to the system or invalid test results.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highlights information of general interest or helpful information that can make a task easier or optimize the performance of the system.</td>
</tr>
</tbody>
</table>
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 **Start > All Programs > Thermo Chromelon 7 > Services Manager > Start Instrument Controller**.

**References and Messages**

- References to additional documentation appear in *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 system from the front.

**Particularly Important Words**

Particularly important words in the main flow of text appear in *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), for example, to sections and figures
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 modules of the Vanquish system
  A printed version of the manual is shipped with each device.
- *Instrument Installation Qualification Operating Instructions*

**TIP** Electronic versions of these manuals are available as PDF (Portable Document Format) files. To open and read the PDF files, Adobe™ Reader™ or Adobe™ Acrobat™ is required.

**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 system.
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 system.

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 system and this manual. The manual contains important information with regard to user safety as well as use and care of the system.

- Always keep the manual near the system 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 System

For a list of the safety symbols that appear on a Vanquish system module or on labels affixed to a module, refer to the Operating Manual of the module. Follow the safety notices in these manuals to prevent the risk of operator injury or damage to the system.

Safety Symbols on the System Base

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Warning Symbol" /></td>
<td>Indicates a potential hazard. Refer to this manual to avoid the risk of personal injury and/or to prevent damage to the device.</td>
</tr>
<tr>
<td><img src="image" alt="Power Button Symbol" /></td>
<td>Indicates a power button that switches the system between on and off states.</td>
</tr>
</tbody>
</table>
2.2 Intended Use

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

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

The Vanquish system and its modules 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 system.

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

- Operate the system only within its technical specifications.
- Use only the replacement parts and additional components, options, and peripherals specifically authorized and qualified for the system by Thermo Fisher Scientific.
- Perform only the procedures that are described in this operating manual and in supporting documents for the system. Follow all instructions step by step and use the tools recommended for the procedure.
- Open the enclosure of the system 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 system. If there is any question regarding appropriate usage, contact Thermo Fisher Scientific before proceeding.

2.3.2 Qualification of the Personnel

Observe the information below on the proper qualification of the personnel installing and/or operating the system.
**Installation**

**System configuration without Charger**

Only skilled personnel are permitted to install the system 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 system, the installer is responsible for ensuring the safety of the system.

**System configuration with Charger: Installation by Service Engineer only**

Service personnel certified by Thermo Fisher Scientific must perform the installation (for brevity, referred to as Thermo Fisher Scientific service engineer).

**Operation**

**General Operation**

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

All users must know the hazards presented by the system 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 General Residual Hazards

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

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.
- Do not operate the system 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 system in the presence of flammable gases or fumes.

CAUTION—Escape of Hazardous Substances from PEEK Capillaries
In the Vanquish system, capillaries made of PEEK may be used. Swelling or attack by acids can cause PEEK capillaries to start leaking or to burst. Certain chemicals, for example, trichlormethane (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 Vanquish 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.

2.3.5 In Case of Emergency

WARNING—Safety Hazard

In case of emergency, disconnect the system 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 VC-pumps and the VC-autosamplers are modified with the components from the Normal-Phase (NP) kit. Refer to the Operating Manuals for the pumps and autosamplers.

**NOTICE**
If the system flow path includes a Vanquish charged aerosol detector, observe the specific solvent and additive information for this detector. Refer to the Operating Manual for the Vanquish charged aerosol detector.
2.4.2 Allowed pH Ranges

Allowed pH ranges (standard system configuration):

<table>
<thead>
<tr>
<th>System (Standard Configuration)</th>
<th>Allowed pH ranges</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanquish Core</td>
<td>1-13</td>
<td>• pH values of 2 or less: The application time should be as short as possible. Flush the system thoroughly after these applications.</td>
</tr>
</tbody>
</table>
| Vanquish Horizon Vanquish Flex  | 2-12             | • pH values higher than 9.5 with optical detectors: 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.  
• pH values higher than 12: May affect electrochemical detection. Before using highly alkaline solvents for flushing the system, disconnect the detector from the system.  
• Mobile phases containing ammonium hydroxide: 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. |

2.4.3 Allowed Concentrations

Allowed concentrations (standard system configuration):

<table>
<thead>
<tr>
<th>System (Standard Configuration)</th>
<th>Chloride</th>
<th>Buffer</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Vanquish Core                   | 0.1 mol/L or less | 1 mol/L or less | • High chloride concentration: The application time should be as short as possible. Flush the system thoroughly after these applications.  
• Mobile phases containing ammonium hydroxide: 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. |
| Vanquish Horizon Vanquish Flex  | 1 mol/L or less | -      |         |
2.4.4 Further Information

- For information about the materials that are used in the flow path of the Vanquish system, see *System Specifications* (page 130).

- Follow any specific recommendations presented in other sections of this manual. Refer also to the *operating manuals* for all modules in the Vanquish system. They may provide additional guidelines and information.

- Observe the general guidelines and recommendations on the use of solvents and additives in the chromatography system (see *Use of Solvents and Additives* (page 89)).
3 System Overview

This chapter introduces you to the system and the main components.
3.1 System Description (Standard Configuration)

The Vanquish system is designed for use in high performance liquid chromatography (HPLC) and ultra-high performance liquid chromatography (UHPLC) applications. The table shows the standard configurations of three Vanquish systems as an example:

<table>
<thead>
<tr>
<th>Module</th>
<th>Core system</th>
<th>Flex system</th>
<th>Horizon system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent rack</td>
<td>Vanquish solvent rack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detector¹</td>
<td>VC-D40</td>
<td>VF-D40</td>
<td>VH-D10</td>
</tr>
<tr>
<td>Column compartment²</td>
<td>VC-C10</td>
<td>VH-C10</td>
<td>VH-C10</td>
</tr>
<tr>
<td>Autosampler</td>
<td>VC-A12</td>
<td>VF-A10</td>
<td>VH-A10</td>
</tr>
<tr>
<td>Pump</td>
<td>VC-P20</td>
<td>Quaternary: BF-P20</td>
<td>Binary: BF-P10</td>
</tr>
<tr>
<td>System base</td>
<td>Vanquish system base</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ The appropriate flow cell has to be ordered separately.

² In the standard configuration, the Vanquish system includes one column compartment, installed to the right side of the system. For other configurations, see System Stack Setup (page 46).

For a description of the solvent rack and system base, see further down in this chapter. For a description of the other modules, refer to the Operating Manuals for these modules.

**TIP**

If your system configuration is a non-standard system configuration including modules other than those listed in the table, for example, a fluorescence detector or a charged aerosol detector, refer to the Operating Manual for the module.
3.1.1 Solvent Rack

The solvent rack provides a secure location for placing solvent reservoirs. It can store, for example, 6 x 1 L of solvent and 2 x 0.25 L of wash liquid as shown in the figure. The maximum volume for an individual reservoir should not exceed 5 L.

Figure 1: Solvent rack (front view)

The front side of the solvent rack is magnetic. Here, you can attach a magnetic label holder, for example, to show a user-specific system name. Labels are included in the system ship kit.
3.1.2 System Base

The system base is a mandatory part of the Vanquish system. It is the bottom part of the system stack and carries the pump, autosampler, and detector in a standard configuration. It provides:

- A power button for power on/off control of all modules
- An integrated drawer to store tools and small system parts
- A drain port for connecting a system waste line
- Locks to toggle between moveable and stationary mode

![System base (front and rear view)](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1   | Blind cap/Vanquish System Controller power button  
If a Vanquish system controller is installed, the power button allows power on/off control of the system controller. |
| 2   | System power button  
Allows power on/off control for all modules of the system that are connected to the system base via the System Interlink port. |
| 3   | Drawer for tools  
Allows storing any tools that are necessary to install or maintain the Vanquish system. Push the drawer front to open or close the drawer. |
| 4   | Detector waste outlet  
For guiding the waste line from the detector to waste. |
| 5   | System drain port  
For connecting the system waste line. |
| 6   | Locks - on the left and right side of the system base  
Allows toggling between moveable and stationary. |
| 7   | System Interlink port  
Allows connecting the other modules for power on/off control from the Vanquish system base. |
| 8   | VSC port  
Allows connecting the optional system controller. |
3.2 Operation

The system 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, see Operating the System from the Software (page 92).

**TIP** The system 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.

Keypads are available inside the standard system modules, allowing you to perform certain basic functions directly from each module.
4 Unpacking

This chapter provides information for unpacking the system 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 system for any signs of mechanical damage that might have occurred during shipment.

If you suspect that the system 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 Solvent Rack and System Base

To unpack the solvent rack and system base, follow these steps:

1. Place the shipping container on the floor and open it.
2. Remove the ship kit.
3. Carefully remove the solvent rack and liquid reservoirs from the shipping container.
4. Place the solvent rack on a stable surface.
5. Carefully remove the system base from the shipping container.
6. If applicable
   Remove any additional packing material.
7. Place the system base on a stable surface.

**TIP** Keep the shipping container and all packing material. These items will be needed if the system is transported to a new location or shipped.

Unpacking the System Modules

For details on unpacking and moving the system modules, refer to the Operating Manual of each module.
4.2 Scope of Delivery

The following items are included in the delivery:

- System base
- Solvent rack
- Solvent reservoirs
- Ship Kit
  For details about the kit content, see Ship Kit (page 135).
- Printed system operating manual
5 Installation

This chapter specifies the requirements for the installation site and describes how to set up, install, and configure the system.
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 19).

- Observe all warning messages and precautionary statements presented in the Safety Guidelines for Installation section in the Operating Manual for the individual modules of the Vanquish system.
5.2 Installing the System

The Vanquish system is installed and set up by a Thermo Fisher Scientific service engineer, 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.

The following description refers to the standard system configuration, see System Description (Standard Configuration) (page 30).

If your system configuration is a non-standard system configuration and includes, for example, a fluorescence detector or a charged aerosol detector, refer to the Operating Manual for the module for installation and operation details.

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

1. Pay attention to the safety guidelines and observe all site requirements.
   For the safety guidelines when installing the system, see Safety Guidelines for Installation (page 40). For the site requirements, see Site Requirements (page 43).

2. Set up the system hardware. See Setting Up the Hardware (page 46).

3. Set up the flow connections. See Setting Up the Flow Connections (page 64).

4. Turn on the system. See Turning On the System (page 78).

**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.

5. Set up the system in the software. See Setting Up the System in the Software (page 79).

6. Flush the system. See Flushing the System (page 81).
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 system 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.
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:

- Make sure that the installation site has enough power outlets for all devices in the system.
- Operate the system only under appropriate laboratory conditions
- For specifications, see Specifications (page 129).

5.3.1 Workbench

The Vanquish system is designed to be placed on a workbench. If the workbench shall carry a complete Vanquish system and possibly other instruments, the bench must be capable to bear the weight of all devices and instruments, including solvents.

For dimensions and weight, see System Specifications (page 130).

Workbench Requirements

<table>
<thead>
<tr>
<th>Part</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workbench</td>
<td>• Sturdy&lt;br&gt;• A height that ensures convenient access to the interior of each device in the system. &lt;br&gt;• The bench top must be dry, clean, and resistant to chemicals.</td>
</tr>
<tr>
<td>Site for the workbench</td>
<td>The workbench must stand in a secure and level position that is free of vibrations.</td>
</tr>
</tbody>
</table>

System Clearance Requirements

<table>
<thead>
<tr>
<th>Side</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the sides</td>
<td>• Allow sufficient free space for electrical connections and for proper air circulation&lt;br&gt;• At least 5 cm of clearance on each side&lt;br&gt;• If the system includes a Charger, allow at least 10 cm of clearance on the left side</td>
</tr>
<tr>
<td>On the rear</td>
<td>• Allow sufficient free space for electrical connections and for proper air circulation&lt;br&gt;• At least 15 cm of clearance</td>
</tr>
<tr>
<td>Top</td>
<td>At least 30 cm of clearance above the top</td>
</tr>
</tbody>
</table>

TIP

Make sure that the power switch and power cord can be easily reached at any time.
5.3.2 Power Considerations

**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.

5.3.3 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.
5.3.4 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.

5.3.5 Operating Conditions

When operating the system, make sure that the installation site meets these general environmental and operating conditions. For specified ambient temperature and humidity, see Specifications (page 129).

**Temperature**

Temperature fluctuations can affect the performance of the system. Avoid locations with significant changes in temperature and strong air drafts. For example, do not place the system in the direct sunlight, near heating or cooling sources, or under an air duct.

**Humidity**

The relative humidity of the operating environment is important for the performance of the system. Operate the system in the specified humidity range, with no condensation.

When the humidity is too high, condensation may occur, causing damage to the electronic components in the system. When the humidity is too low, static electricity may accumulate and discharge, shortening the life of the electronic components.

**Ventilation**

Make sure that the installation site is well ventilated at any time to avoid potential health hazards and safety risks, which may be caused by handling hazardous substances, volatiles or gases.

**Vibration**

Vibrations may affect the performance of the system. Therefore, the installation site should be free of vibrations. Avoid placing the system in locations where vibrations are caused by other instruments.
5.4 Setting Up the Hardware

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

1. Set up the system stack. For details, see System Stack Setup (page 46).

2. Connect the required signal cables. For details, see Signal Cable Connections (page 54).

3. Connect power cords to the power-inlet connectors of all modules. For details, see Power Connections (page 59).

5.4.1 System Stack Setup

⚠️ CAUTION—Heavy Load, Bulky Device

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

- Physical handling of the modules, including lifting or moving, requires a team effort of two persons.
- A team effort is in particular required when lifting the modules into the system stack or when removing them.
- **Modules with carrying handles:** Use the carrying handles that were shipped with the modules to move or transport the modules. Never move or lift the modules by the front doors. This will damage the doors or the modules.
- **Modules without carrying handles:** To lift or move the modules, grasp the modules by the sides. Do not move or lift the modules by the front door. This will damage the door or the modules.

The system modules are arranged in a system stack. The arrangement depends on the system configuration. The descriptions below refer to the standard Vanquish system (one-stack configuration). The one-stack configuration is the standard configuration, as it optimizes the flow path for minimum delay volume.
Figure 3: Vanquish system, standard configuration (example)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solvent Rack</td>
</tr>
<tr>
<td>2</td>
<td>Detector</td>
</tr>
<tr>
<td>3</td>
<td>Autosampler</td>
</tr>
<tr>
<td>4</td>
<td>Pump</td>
</tr>
<tr>
<td>5</td>
<td>System Base</td>
</tr>
<tr>
<td>6</td>
<td>Column Compartment</td>
</tr>
</tbody>
</table>
5.4.1.1 Installing the System Stack

NOTICE
Moving the Vanquish system stack after installation even over short distances on the workbench can damage and impair the functionality of the system base.

- Therefore, install the system stack at the final location.
- If you have to move the system after installation, see Moving the System Stack after Installation (page 53).

! WARNING—Risk of tilting system stack
A one-stack configuration including the solvent rack and system base and more than 4 stacked system modules (i.e. pump, autosampler, and detectors) exceeds the maximum allowed height. If the system configuration does not include a Charger, the system stack poses a tilting risk which can entail personal injury.

If your system configuration includes more than 4 stacked modules but no Charger, you need to stabilize the stack with one of the following safety measures:

- IonBench with stack mounting kit
- Stack stabilizer kit
- Build up the system in two separate stacks

1. Place the system base on the workbench.

2. If necessary, unlock the system base (see Unlocking the System Base (page 61)) to be able to shift the system base slightly for better access to all system parts.

3. Only if you intend to guide the waste line of the system drainage toward the system's rear:
Press the clips as shown in the left image and attach them onto the system base at the positions shown in the right image.

![Figure 4: Clip (left) and attaching the clips onto the system base (right)](image)

4. Lift the pump by its carrying handles. Place the pump on the system base approximately 5 cm before the end of the rails. Push the pump towards the rear until the pump clicks into place.
5. Loosen the screws on the carrying handles, using a screwdriver (Torx™ T20). Do not remove the screws from the carrying handles completely.

![Figure 5: Carrying handles](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carrying handles</td>
</tr>
<tr>
<td>2</td>
<td>Attachment screw (one on each carrying handle)</td>
</tr>
</tbody>
</table>

6. Remove the two carrying handles by sliding them off the rails toward the rear.

![Figure 6: Sliding off the carrying handle from the left rail](image)

7. Repeat the previous three steps for the autosampler and detector by placing the autosampler on the pump, and the detector on the autosampler.

8. Place the solvent rack on the detector approximately 5 cm before the end of the rails. Push the solvent rack towards the rear until it clicks into place.

**TIP**

System modules on the system stack have protective caps on the rear bottom edges. Remove them after installing the system stack and before attaching the column compartment to the system stack.
9. Connect the waste lines (see Connecting the Waste Lines (page 70)).

10. Attach the column compartment to the system stack (see next section).

**NOTICE**

Some modules have shipping locks. To avoid damage to the system when the system is turned on, loosen them or remove them properly. Refer to the Operating Manual for each module for information on shipping locks that need to be removed.

### 5.4.1.2 Attaching the Column Compartment to the System Stack

**TIP**

Before you attach the column compartment to the system, connect the waste line to the system drain port. For instructions, see Connecting the Waste Lines (page 70).

In the standard configuration, the Vanquish system includes one column compartment, installed to the right side of the system.

**TIP** An extended or left-side configuration of the column compartment is also available. Observe the following notes:

- The extended configuration on the right side can include up to three column compartments. For the extended configuration of the column compartment, up to two conversion kits are required.

- The column compartment can also be installed to the left side of the Vanquish system stack. For the left-side installation, one column compartment requires one conversion kit. Each additional column compartment on the left side requires an additional conversion kit. If a Vanquish Charger is used with the Vanquish system, the column compartment must be attached to the right side of the system.

- For ordering information, contact your local Thermo Fisher Scientific sales organization.

**Installation by Service Engineer only**

Only service personnel certified by Thermo Fisher Scientific are permitted to install the extended configuration with up to three column compartments or to perform the left-side installation of the column compartment.
For installation of the standard configuration, follow the instructions below.

**Parts required**

- 4 T-slot nuts
- 2 crosspieces
- 4 screws
- 4 spacers

**Tools required**

Screwdriver, Torx T20

**Follow these steps**

1. Align the screw holes of the two T-slot nuts, the spacers and the crosspiece.

![Figure 7: Mounting bar](image)

No. | Description
--- | ---
1 | Spacer
2 | Groove
3 | Screw
4 | T-slot nut
5 | Crosspiece

2. With the screws, fix the T-slot nuts and the spacers onto the crosspiece. The T-slot nuts must face each other, as shown above.
3. Slide the T-slot nuts of the mounting bar in the rail on the system housing and push until stop. The grooves on the mounting bars must face upwards. Make sure, that the orientation of the crosspiece is as indicated on the picture.

4. Tighten the screws on the mounting bars.

Figure 8: Installing the mounting bars on the system housing

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rail</td>
</tr>
<tr>
<td>2</td>
<td>Mounting bar</td>
</tr>
</tbody>
</table>
5. Lift the column compartment into vertical position.

6. To insert the holding knobs in the grooves on the mounting bar, grasp the column compartment by its sides and slightly lift the column compartment up.

![Figure 9: Attaching the column compartment to the system stack](image)

**5.4.1.3 Moving the System Stack after Installation**

Moving the Vanquish system stack even over short distances on the workbench can damage and impair the functionality of the system base. Observe the following:

- **Configuration with one column compartment:**
  Before moving the system stack, unlock the system base using the locking tools. For details, see Unlocking the System Base (page 61).

- **Configuration with two or three column compartments or a Charger:**
  Before moving the system stack, have the mentioned modules dismounted by a Thermo Fisher Scientific service engineer and then unlock the system base. For details, see Unlocking the System Base (page 61).
5.4.2 Signal Cable Connections

This section provides details on the cables and interfaces used to connect the system to a computer or other devices, and details on how to interlink the system modules with each other.

5.4.2.1 Connector Overview

The following connectors are provided on the system modules for power line connection and for signal connections:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1   | System Interlink port  
      Allows power on/off control for the system from the Vanquish system base and device communication  
      For details on system interlink connections, see System Interlink Connections (page 57). |
| 2   | Digital I/O ports (not available in all modules)  
      Allow exchange of digital signals with external instruments  
      For information on connection and pin assignment, see the Operating Manual for the related module. |
| 3   | USB (Universal Serial Bus) hub ("A"-type connector)  
      Allows connection to other modules in the Vanquish system |
| 4   | USB 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  
      For details on USB connections, see USB Connections (page 55). |
| 5   | Main power switch (on/off control) |
| 6   | Fuse holder |
| 7   | Power inlet connector |
5.4.2.2 USB Connections

All USB connections require standard USB A-to-B type cable.

![USB cable](image)

*Figure 11: USB cable*

The flat, rectangular end of the cable is the "A" connector. The smaller, hexagonal end is the "B" connector.

**TIP**

- The USB standard limits the USB cable length to 5 meters. Each USB device can be separated from the computer or next USB hub by no more than 5 meters.
- After connecting the USB cables and before turning on the power to a device for the first time, verify that the chromatography software is installed on the computer. When the power is turned on, the required USB drivers are automatically found and the Windows operating system can detect the device.
Connecting the USB Cables

USB Cable Overview

Figure 12: USB cable connections (example)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>USB connection:</td>
</tr>
<tr>
<td>1</td>
<td>From pump to detector</td>
</tr>
<tr>
<td>2</td>
<td>From autosampler to pump</td>
</tr>
<tr>
<td>3</td>
<td>From column compartment to detector</td>
</tr>
<tr>
<td>4</td>
<td>From detector to computer</td>
</tr>
</tbody>
</table>
Follow these steps

1. On the autosampler, pump, and column compartment, connect the "B" connector of a USB cable to the USB port.

2. Connect the "A" connector of the USB cable from the pump to the USB hub on the UV/VIS detector. Connect the "A" connector of the USB cable from the other modules to the USB hub on the UV/VIS detector or pump.

3. Connect the "B" connector of a USB cable to the USB port on the UV/VIS detector, and connect the "A" connector of the USB cable to a USB port (2.0 or higher) on the computer.

In order to control the modules that use a USB hub on another module, the module that provides the hub must be turned on.

**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 system.

5.4.2.3 System Interlink Connections

The system interlink connections require a special system interlink cable, (Cat. 6 cable).

![System interlink cable](image)
Connecting the System Interlink Cables

**System Interlink Cable Overview**

![Diagram showing system interlink cable connections](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>System interlink connection:</td>
</tr>
<tr>
<td>1</td>
<td>From system base to pump</td>
</tr>
<tr>
<td>2</td>
<td>From pump to autosampler</td>
</tr>
<tr>
<td>3</td>
<td>From autosampler to detector</td>
</tr>
<tr>
<td>4</td>
<td>From detector to column compartment</td>
</tr>
</tbody>
</table>

*Figure 14: USB and system interlink cable connections (example)*
Follow these steps

1. Connect one end of the system interlink cable to the System Interlink port on the system base, and the other end to a System Interlink port on the pump.

2. Connect one end of the system interlink cable to the free System Interlink port on the pump, and the other end to a System Interlink port on the autosampler.

3. Connect one end of the system interlink cable to the free System Interlink port on the autosampler, and the other end to a System Interlink port on the detector.

4. Connect one end of the system interlink cable to the free System Interlink port on the detector, and the other end to a System Interlink port on the column compartment.

5.4.3 Power Connections

After setting up the Vanquish system as required by the system configuration, you can connect the modules to the power source. Follow the steps below. Do not turn on the system or modules yet.

1. Verify that the power switch on each device is set to OFF.

2. Connect the power cord to the power-inlet connector on each device.

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.

3. Connect the free end of the power cords to an appropriate power source.

4. Insert the signal and power cables into the cable clips (see Cable Clips (page 60)).

5. If necessary, move the system to its final position.

6. Lock the system base against moving (see Locking the System Base (page 63)).
5.4.4 Cable Clips

The cable clips can be used to guide signal and power cables in an orderly fashion. The pump and the detector each have one cable clip on each side and the autosampler has two cable clips on each side. The location of the cable clips/cutouts for the cable clips is shown below.

Figure 15: Cable clips/cable clip cutouts in the autosampler and detector

If not already done, install the cable clips in the cutouts of the housing as shown below.

Figure 16: Inserting a cable clip

To insert the cables into the clip, open the flap.
5.4.5 System Base Lock

A lock is integrated into the system base. Unlock the system base if you want to move the system base and lock it if you want to prevent it from being moved on the workbench. If your system configuration includes one column compartment, you can switch between the moveable and stationary mode using the system base locking tools shipped with the system base.

![System base locking tool](image)

*Figure 17: System base locking tool*

If your system includes two or three column compartments or a Charger, a Thermo Fisher Scientific service engineer must dismount the mentioned modules before you can (un)lock the system base with the locking tools.

5.4.5.1 Unlocking the System Base

1. Have all but one column compartment and the Charger dismounted by a Thermo Fisher Scientific service engineer.

2. Insert one locking tool into another.

![Extended locking tool](image)

*Figure 18: Extended locking tool*

3. Insert the combined locking tools into the lock port on the side of the system base where the column compartment is installed. If the column compartment is installed on the right side, insert the combined locking tools into the right lock port as shown in the figure below.
4. Insert one locking tool into the lock port on the other side of the system base.

![Figure 19: Inserting locking tools into the system base (top view)](image)

5. Unlock the system base by turning the locking tools as shown below. In the unlocked position, the locking tools cannot be removed from the system base.

![Figure 20: Unlocking the system base](image)

6. Move the system to the final position.

7. Lock the system base according to Locking the System Base (page 63).

8. Have the additional column compartments and the Charger mounted by a Thermo Fisher Scientific service engineer.
5.4.5.2  Locking the System Base

When the system base is in movable mode and one column compartment is installed, locking tools are already inserted into the system base. The following instructions and images assume that the column compartment is installed on the right side of the system.

1. Lock the system base by turning the locking tools as shown below.

![Figure 21: Locking the system base](image)

2. Remove the locking tools and store them in a safe place, for example, in the system base drawer.

3. Have the column compartment(s) and charger re-installed by a Thermo Fisher Scientific service engineer.
5.5 Setting Up the Flow Connections

5.5.1 General Information and Guidelines

This section gives an overview on the flow connections to and from the system and describes the installation of the waste lines. For details on tubing and capillary connections within and between the modules, refer to the Operating Manual of each module.

Flow connections can be filled with hazardous substances. Observe the warning messages and precautionary statements presented in Safety Precautions (page 19).

- 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.

- The system uses the Viper™ fitting system. For installation instructions and guidelines and for handling recommendations, see Connecting Fittings, Capillaries, and Tubing (page 68).
5.5.2 Flow Connections Overview

The picture illustrates the liquid flow path through the system:

Figure 22: Flow connections in the Vanquish system (example)

The Vanquish system has been designed for optimized and simple leak liquid and waste handling:

- Leak liquid from the solvent rack, detector, autosampler, and pump flows through pipes from the modules to the system base drain port.
- Seal wash and needle wash liquids from the pump and autosampler, as well as condensate from the autosampler, are also guided to the system base drain port.
- Leak liquid from the column compartment flows to the column compartment drain port.
5.5.3 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, Tubing Guide, Tubing Bracket**

To guide certain tubes and lines (solvent tubing, wash liquid tubing, detector waste line) 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 23: Tubing chase with tubing guides (left: view from inside, right: view from top)](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Use for</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solvent tubing (up to three solvent lines)</td>
</tr>
<tr>
<td>2</td>
<td>Solvent tubing (up to three solvent lines)</td>
</tr>
<tr>
<td>3</td>
<td>Wash liquid tubing (seal wash, autosampler needle wash)</td>
</tr>
<tr>
<td>4</td>
<td>Detector waste line</td>
</tr>
</tbody>
</table>

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

![Figure 24: Tubing bracket (left), tubing bracket installed (right)](image)
5.5.4 Connecting Fittings, Capillaries, and Tubing

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

5.5.4.1 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.
5.5.4.2  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.

![Viper fitting with knurl](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knurl</td>
</tr>
<tr>
<td>2</td>
<td>Capillary</td>
</tr>
<tr>
<td>3</td>
<td>Slot</td>
</tr>
</tbody>
</table>

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

TIP Note the slot in the knurl. For narrow connections, you can easily remove the knurls from neighboring capillaries through this slot and attach them again later.

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

TIP

Depending on the modules used in the system, you may also find other fitting connections. Refer to the Operating Manual for the respective module for information on how to handle these types of fittings.
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.

5.5.5 Connecting the Waste Lines

5.5.5.1 Waste Connections Overview

WARNING—Escape of Hazardous Substances

Hazardous substances can escape from waste lines and waste containers if connections and waste containers are not properly installed. Exposure to these substances can pose health and safety risks.

Verify the correct installation of connections and containers by testing the drain system (see Testing the Drain System (page 74)).

If leakage has occurred in the system, the liquid is directed to waste through the system drain port on the Vanquish system base. Waste from the detector can also be routed through the system base.
Figure 26: Overview of waste lines in the system (example)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drainage from the modules in the stack to the system base</td>
</tr>
<tr>
<td>1a</td>
<td>System drain port</td>
</tr>
<tr>
<td>1b</td>
<td>Waste line for system drainage</td>
</tr>
<tr>
<td>2</td>
<td>Module waste lines:</td>
</tr>
<tr>
<td>2a</td>
<td>Detector waste line</td>
</tr>
<tr>
<td>2b</td>
<td>Pump waste line (here in VH-P10 pump)</td>
</tr>
<tr>
<td>3</td>
<td>Drainage from the column compartment:</td>
</tr>
<tr>
<td>3a</td>
<td>Column compartment drain port</td>
</tr>
<tr>
<td>3b</td>
<td>Waste line for column compartment drainage</td>
</tr>
</tbody>
</table>
Make the following connections:

- Connect a waste line to the system drain port (see Connecting the Waste Line to the System Drain Port (Drain Tubing) (page 73)).

- When the waste line is set up, test the drain system (see Testing the Drain System (page 74)).

- Install a detector waste line that connects the flow cell outlet through the detector waste outlet to the waste. For installation instructions, see Installing the Detector Waste Line (page 75).

**TIP**

Make sure that you guide the detector waste line through the separate outlet in the system base, which is located next to the drain port in the system base.

---

**Figure 27: Funnel and waste outlets on the system base**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Funnel for system drainage</td>
</tr>
<tr>
<td>2</td>
<td>Detector waste outlet</td>
</tr>
<tr>
<td>2a</td>
<td>Detector waste line</td>
</tr>
<tr>
<td>3</td>
<td>System drain port (hidden behind the elbow connection)</td>
</tr>
<tr>
<td>3a</td>
<td>System waste line</td>
</tr>
</tbody>
</table>

- Connect a waste line to the column compartment drain port. For instructions, see the Operating Manual for the column compartment.

- If you have to cut tubing to length, use a tubing cutter. Make sure that the cut is at a right angle to the length of the tubing and that the end is free of nicks or burrs.
5.5.5.2 Connecting the Waste Line to the System Drain Port (Drain Tubing)

Parts required

- Drain tubing from ship kit
- Elbow connection piece from ship kit
- Suitable waste container

Follow these steps

1. Push an elbow connection piece into the system drain port as far as it goes in to establish a self-sealing connection.
2. Push the drain tubing into the elbow connection piece with your hand as far as it goes in to establish a self-sealing connection.
3. Route the free end of the drain tubing into a waste container.
4. Only if guiding the drain tubing toward the system's rear: Insert the drain tubing into the clips and make sure that the drain tubing does not form a siphon.

Figure 28: Inserting the drain tubing into clips

TIP
If routing the drain tubing of the column compartment also toward the system’s rear, you can insert the drain tubing of the column compartment into the clips as well.

5. Ensure proper drainage of waste (see next section).

Ensuring Proper Drainage of Waste

1. Position the waste container below the level of the system stack. To prevent solvent vapors from evaporating back into the system, make sure that the distance is sufficient.
2. Make sure the drain tubing is neither bent nor pinched.
3. To prevent liquid from flowing back into the system, the entire drain tubing must remain below the drain port. Avoid the formation of siphons.

**TIP** To allow the waste liquid flowing off properly and avoid liquid accumulation in the system base, the end of the waste line must not be submerged in waste liquid (see figure below):

- Shorten the tubing if required.
- Observe the liquid level in the waste container. Empty the waste container as necessary.

![Figure 29: Free end of waste line in waste container](image)

### 5.5.5.3 Testing the Drain System

Check the drain system for proper drainage of waste:

1. Pour water or isopropanol into the drain in the solvent rack.
2. Verify that the liquid leaves the system at the system drain port and into the waste container.
3. If a leak is visible, find and eliminate the problem.
5.5.5.4 Installing the Detector Waste Line

Parts required

- Detector waste line

**TIP** The detector waste line connects the flow cell outlet through the detector waste outlet to the waste.
- For instructions on how to connect the waste line through the detector waste outlet to the waste, follow the steps below.
- For instructions on how to connect the waste line from the flow cell outlet, refer to the *Operating Manual* for your Vanquish detector.

- Suitable waste container

Follow these steps

1. Locate the outlet for the detector waste line in the system base (see figure below).
2. Route the waste line through the detector waste outlet.

*Figure 30: Routing the waste line through the outlet*
3. Route the free end of the waste line into a waste container.

4. Ensure proper drainage of the waste from the detector. You may need to cut the waste line to length.

5. Ensure proper drainage of waste (see next section).
Ensuring Proper Drainage of Waste

1. Position the waste container below the level of the system stack. To prevent solvent vapors from evaporating back into the system, make sure that the distance is sufficient.

2. Make sure the drain tubing is neither bent nor pinched.

3. To prevent liquid from flowing back into the system, the entire drain tubing must remain below the drain port. Avoid the formation of siphons.

**TIP** To allow the waste liquid flowing off properly and avoid liquid accumulation in the system base, the end of the waste line must not be submerged in waste liquid (see figure below):

- Shorten the tubing if required.
- Observe the liquid level in the waste container. Empty the waste container as necessary.

![Figure 32: Free end of waste line in waste container](image)
5.6 Turning On the System

NOTICE
Before turning on power to the Vanquish system, verify that any shipping locks have been properly loosened or removed to avoid damage to the system. Refer to the Operating Manual for each module for information on shipping locks that need to be removed.

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 system, 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 each module with its main power switch. Verify that the autosampler is turned on before the pump flow is on and pressure builds up.

Turn a module off 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 module completely.

See also

- Power On/Off Control (page 86)
5.7 Setting Up the System in the Software

This section describes the basic steps for operating the Vanquish system with the Chromeleon 7 software. For additional information, refer to the Help and documents provided with the software.

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

**TIP** In order to start the Chromeleon Instrument Controller, you must log on under Windows with local administrator privileges, or as a member of the Windows Chromeleon Operators user group.

---

**Loading the USB Drivers**

1. Turn on the power to the data system computer if it is not yet already on.

2. Turn on the power to all system modules.
   Windows will automatically detect the new devices and perform the USB installation. If Windows fails to detect the devices and launches a wizard instead, this indicates that you connected the devices to the computer and turned on the power for the first time before you installed the Chromeleon software. In this case, cancel the wizard, install the software, and then repeat the steps.

**Starting the Instrument Controller and Instrument Configuration Manager**

1. Start the Chromeleon Instrument Controller.
   Right-click the Chromeleon tray icon on the Windows taskbar (the icon is crossed out in red) and click Start Chromeleon Instrument Controller. The icon changes to gold, indicating that the Instrument Controller Service is starting. The icon changes to gray when the Instrument Controller Service is running (idle).

   If the Chromeleon tray icon is not available on the Windows taskbar, click Start > All Programs (or Programs, depending on the operating system) > Thermo Chromeleon 7 > Services Manager > Start Instrument Controller.

2. Start the Chromeleon 7 Instrument Configuration Manager.
   Click Start > All Programs (or Programs, depending on the operating system) > Thermo Chromeleon 7 > Instrument Configuration Manager.
Adding the Vanquish System

1. On the Edit menu, click Add Instrument to add a new instrument (system).

2. Select the new instrument and click Add Module on the Edit menu to add the first module.

3. In the Add module to instrument dialog box, on the Manufacturers list, select Thermo Scientific HPLC: Vanquish and on the Modules list, select the module you want to add, for example, Vanquish Binary Pump. Repeat this step for each module of the system.

4. On the General configuration page for each module, make sure that simulation mode is deactivated and click Browse to select the module address.

   The Chromeleon software connects to the module and transfers the settings from the device firmware to the software. Check and change the settings on the other configuration pages if necessary. For information about the settings, click Help or press the F1 key.

   ![Connection settings](image)

   **Figure 33: Software configuration: select module address (here: pump)**

5. On the File menu, click Save Installation and then close the Instrument Configuration Manager.
5.8 Flushing the System

This section describes how to flush the Vanquish system after installation. As certain system components are filled with isopropanol during shipment, flushing is required before the system can be operated.

**Flushing the System without Column**

Follow these steps:

**NOTICE**

To avoid damage to other modules in the Vanquish system, verify the following before you begin:

- The detector is not connected to the flow path.
- No column is installed in the column compartment.

1. Purge the pump.
2. Have the pump deliver the solvent used for purging for a short time.

**Flushing the System with Column Installed**

Flush the system again for a short time after connecting the column with a solvent suitable for your application. Follow these steps:

1. Verify that the detector is not connected to the flow path.
2. Have the pump deliver the solvent for a short time. Observe the pressure limit and other properties of the column.

**Flushing the System with Column and Flow Cell Installed**

Flush the system again for a short time after connecting the flow cell with a solvent suitable for your application. Observe the guidelines for flow cells in the *Operating Instructions* of the detector.

**NOTICE**

- When the charged aerosol detector is connected in the system flow path, flush the detector only when the detector gas flow is turned on.
- Flush the detector with flow from the pump.
6 Operation

This chapter 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 system has already been completed. If this is not the case, refer to the instructions in Installation (page 39).

Software descriptions in this manual refer to Chromeleon 7. Terminology may be slightly different with other software versions.
6.2 Safety Guidelines for Operation

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

⚠️ Observe all warning messages and precautionary statements presented in Safety Precautions (page 19).

⚠️ Observe all warning messages and precautionary statements presented in the Safety Guidelines for Operation section in the Operating Manual for the individual modules of the Vanquish system.

NOTICE
Pay attention also to the following guidelines:

- When operating the chromatography system, always set the lower pressure limit for the pump. This prevents damage resulting from leakage or from running the pump dry.
- 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 Power On/Off Control

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.
6.4 Preparing the System for Operation

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

Before Operating the System for the First Time

Prepare the system 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. Follow the instructions in Flushing the System (page 81).
- Some components of the system are filled with isopropanol when the system is shipped from the manufacturing site. When operating the system for the first time, use solvents that are miscible with isopropanol. If they are not, use an appropriate intermediate solvent.
- Verify that any air bubbles are completely flushed out of the system flow path.

Refer to the Operating Manual for each system module for any steps that may be required before initial operation.

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.
- Verify that the doors of all modules in the Vanquish system are closed.
- 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 thermostatting 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*. 
6.5 Use of Solvents and Additives

Particles entering the chromatography system can block capillaries and valves, increase wear, and damage the column or system. Especially with aqueous solvents, algae and other microorganisms can grow and deposit in the chromatography system and block the solvent line filters. Blocked capillaries or filters can cause increased or unstable system pressure.

For optimum performance of the chromatography system, observe the following guidelines:

• Be sure that the substances you are using are compatible with all parts in the flow path.

• Use high-quality high-purity solvents (filtered) and additives as required by the application, for example, UHPLC-grade or LC/MS-grade. If a fluorescence detector is used in the system, consider using fluorescence-grade solvents. Filtered high-purity solvents are usually labeled accordingly by the vendor.

• When preparing salt solutions or buffers and preparation is complete, use membrane filtration (0.2 µm) to remove any particulate matter and to reduce microbial growth.

• When using water, use high-quality water for example, UHPLC-grade or LC/MS-grade (0.2 µm filtered). When you use water from water purification systems, keep in mind that polymeric contamination may occur if the purification system is not maintained properly.

• Before filling a solvent reservoir, always rinse the reservoir thoroughly with a high-purity solvent.

• Use fresh solvents at regular intervals. Avoid adding up (refreshing) solvents. With premixed solvents, be especially sure that they are properly prepared and fresh.

• Before changing from a buffer or salt solution to organic solution, flush the pump thoroughly with de-ionized water.

• When changing to a different type of solvent, make sure that the new solvent is miscible with the previous solvent. If the solvents are not miscible, flocculation may occur. Mix immiscible solvents with an intermediate solvent to replace them step by step. For example, use isopropanol.

• Always use the appropriate solvent line filters as recommended by Thermo Fisher Scientific. Check the filter frits for permeability at regular intervals and replace them as necessary.
• The pumps are shipped with the following piston seals:

<table>
<thead>
<tr>
<th>Pump</th>
<th>Piston Seals</th>
</tr>
</thead>
<tbody>
<tr>
<td>VC-pumps except VC-P21 and VC-P33</td>
<td>The pumps are shipped with UHMW-PE piston seals. Using tetrahydrofuran, ketones, or ammonium hydroxide as solvents can damage the seals. Under harsh conditions, consider replacing the UHMW-PE piston seals with carbon-fiber filled PTFE piston seals (part no. 6040.0306). In this case, also install new pistons. Exchanging the piston seals but keeping the pistons that were used with the UHMW-PE piston seals may impair the seal life of the PTFE seals. In addition, note that slightly increased abrasion may be observed with these seals, depending on the application. Consider testing the permeability of the static mixer regularly at short intervals.</td>
</tr>
<tr>
<td>VC-P21 and VC-P33 pumps</td>
<td>The pumps are shipped with carbon-fiber filled PTFE piston seals. Slightly increased abrasion may be observed with these seals, depending on the application. Consider testing the permeability of the static mixer regularly at short intervals.</td>
</tr>
</tbody>
</table>
| VF-pumps              | The pumps are shipped with UHMW-PE piston seals. Using tetrahydrofuran, ketones, or ammonium hydroxide as solvents can damage the seals. Under harsh conditions, consider replacing the UHMW-PE piston seals with carbon-fiber filled PTFE piston seals (part no. 6040.0306). In this case, also install new pistons. Exchanging the piston seals but keeping the pistons that were used with the UHMW-PE piston seals may impair the seal life of the PTFE seals. In addition, note the following:  
  • Slightly increased abrasion may be observed with the PTFE seals, depending on the application. Consider testing the permeability of the static mixer regularly at short intervals.  
  • The pump should not be operated with pressures higher than 70 MPa.  
  • The pump is no longer biocompatible.  |
| VH-pumps              | The pump is shipped with UHMW-PE piston seals. Using tetrahydrofuran, ketones, or ammonium hydroxide as solvents can damage the seals.                                                                                                                                                                                                                                                                   |

• For best seal performance, do not recycle or recirculate solvents. Avoid using methanol from aluminum reservoirs.

• To reduce the growth of algae, consider using amber glassware or using appropriate additives, for example, formic acid.

• After operation, flush out buffers and solutions that form peroxides.
• Never leave buffers, salt solutions, or aggressive solvents in the system for a longer period without flow.

• Note the special properties of the solvents, such as viscosity, boiling point, or UV absorption.

• *If a charged aerosol detector is connected in the system flow path:* Observe the specific mobile phase guidelines for the detector in the *Vanquish Charged Aerosol Detector Operating Manual.*

**TIP** In a Vanquish Core system, normal-phase (NP) compatible solvents and additives may be used if the VC-pumps and the VC-autosamplers are modified with the components from the Normal-Phase (NP) kit. Refer to the *Operating Manuals* for the pumps and autosamplers.
6.6 Operating the System from the Software

This section describes the basic steps for operating the Vanquish system with the Chromeleon software. For additional information, refer to the Help and documents provided with the software that you are using.

6.6.1 Starting the Instrument Controller and Client

1. Start the Chromeleon Instrument Controller.
   Right-click the Chromeleon tray icon on the Windows taskbar (the icon is crossed out in red) and Click **Start Chromeleon Instrument Controller**. The icon changes to gold, indicating that the Instrument Controller Service is starting. The icon changes to gray when the Instrument Controller Service is running (idle).

   If the Chromeleon tray icon is not available on the Windows taskbar, click **Start > All Programs** (or **Programs**, depending on the operating system) > **Thermo Chromeleon 7 > Services Manager > Start Instrument Controller**.

2. Start the Chromeleon 7 client.
   Click **Start > All Programs** (or **Programs**, depending on the operating system) > **Thermo Chromeleon 7 > Chromeleon 7**.
6.6.2 Controlling the System from the ePanel Set

When the chromatography system is not running an automated analysis, you can control the system modules from the ePanel Set. Use the ePanel Set to view status information and perform commands.

To access the ePanel Set:

1. On the Console, click the Instruments Category Bar.

2. In the Navigation Pane, click the instrument that you want to control.

The Chromeleon software connects to the instrument and displays the ePanel Set.

The ePanel Set opens to the Home panel, which shows basic status information about each module in the system and provides access to the instrument Audit Trail.

Figure 34: Chromeleon 7 ePanel for a Vanquish system (example)
3. On the ePanel Set, click the tab for a module.

4. Use the controls (for example, buttons, sliders) to perform commands.

5. If a function that you want to perform is not available on a panel, press the F8 key to open the Command window. From this window, you can access all commands that are available for the system.

**TIP**
The commands and parameters that are available in the Command window may vary, depending on the user level in the Command window (Normal, Advanced, or Expert). To change the user level, right-click in the commands list and select a different user level.

### 6.6.3 Monitoring the Baseline

When an instrument is idle, you can monitor the baseline signals without starting a sequence. During baseline monitoring, the monitored signals are displayed on the real-time signal plot on the ePanel for the module. You may have to add the signal to the plot in the Plot Properties (for details, refer to the Help).

To monitor the baseline signals:

1. Open the ePanel Set.

2. On the toolbar above the ePanel Set, click Monitor Baseline.

3. In the Select Channels to Monitor dialog box, select the signals that you want to monitor.

4. To stop monitoring the baseline, click Stop on the toolbar.

**TIP**
Monitor baseline data is overwritten each time baseline monitoring is started. If you want to save the data permanently, define the location in the Monitor Baseline Save Preferences dialog box. For details, refer to the Help.
6.6.4 Running Automated Sample Analysis

Automated sample analysis with the chromatography system involves creating and running a sequence. In a sequence, you determine how the injections of a sample are analyzed and in which order they are processed. Each injection of a sequence is processed by using an instrument method, which defines the property values and timed control commands for each module. For details how to create an instrument method using the Instrument Method Wizard, refer to the Help.

Chromeleon 7 supports two methods for creating a new sequence:

<table>
<thead>
<tr>
<th>TIP</th>
<th>If no eWorkflows are available, you can create a new eWorkflow as described in the Help. As an alternative, use the Sequence Wizard to create the sequence.</th>
</tr>
</thead>
</table>

- eWorkflows (preferred method)
  eWorkflows provide a set of predefined templates and rules for creating a new sequence.

- Sequence Wizard

Creating a Sequence via eWorkflows

1. On the Console, click the eWorkflows Category Bar.
2. In the Navigation Pane, click the eWorkflow name.
3. In the Work Area, click the instrument name, and then click Launch.
4. The eWorkflow Wizard guides you through the process. Complete the steps in the wizard. For detailed information about a wizard page, click the Help icon.
   After you finish the wizard, the sequence is displayed in the Data view of the Console.

Creating a Sequence via Sequence Wizard

1. On the Console menu bar, click Create.
2. The Sequence Wizard guides you through the process. Complete the steps in the wizard. Specify the number of samples and/or standards, the instrument method, processing method, and report template that you want to use. For detailed information about a wizard page, click the Help icon.
   After you finish the wizard, the sequence is displayed in the Data view of the Console.
Starting the new sequence

1. On the **Sequence Control Bar**, click **Start**.

2. The sequence is appended to the queue and a Ready Check is performed.
   If the Ready Check passes and if the instrument is not currently running another sequence, the sequence is started.
6.7 Shutting Down the System

If the system will not be operated for some time, observe the general guidelines outlined below.

Interrupting Operation of the System for a Short Period

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

- For your Vanquish detector, note the following:

<table>
<thead>
<tr>
<th>Detector Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charged aerosol detector</td>
<td>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.</td>
</tr>
<tr>
<td>UV/VIS detectors</td>
<td>The lamp(s) in the detector can remain turned on. Variable wavelength detector and VH-D10 diode array detector only: The shutter can be moved to a closed position for protection of the flow cell.</td>
</tr>
<tr>
<td>Fluorescence detector</td>
<td>Turn off temperature control for the flow cell.</td>
</tr>
</tbody>
</table>

- 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.

**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.
**Interrupting Operation of the System for a Longer Period**

To interrupt operation for a longer period, follow the instructions below. Also observe the instructions and guidelines for the long-term shutdown of the in the Operating Manual for each module.

1. Remove the column.
2. 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, see the information about the flushing liquid in the *Considerations with Normal-Phase Compatible Solvents and Additives* section in *Operating Manual* for the pump.

<table>
<thead>
<tr>
<th>Situation after Shutdown</th>
<th>If no additive is used</th>
<th>If an additive is used</th>
</tr>
</thead>
<tbody>
<tr>
<td>System remains in the laboratory after shutdown</td>
<td>Flush the system, for example with methanol. 100% acetonitrile should not be used.</td>
<td>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.</td>
</tr>
<tr>
<td>System shall be transported or shipped after shutdown</td>
<td>Flush the system with isopropanol.</td>
<td>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.</td>
</tr>
</tbody>
</table>
3. Turn off the system with the system power button on the system base.
   If one of the modules shall be removed from the system stack, turn off all 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.

   If the system shall be transported or shipped after shutdown, follow the instructions in Transporting or Shipping the System (page 109).
7 Maintenance and Service

This chapter gives general guidelines on maintenance and transport of the system.
7 • Maintenance and Service

7.1 Introduction to Maintenance and Service

This chapter describes the routine maintenance that the user may perform for the system.

⚠️ 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).
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 19).

**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—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—Hot Surfaces
Surfaces inside the system may become hot during operation. Touching hot parts might cause burns.
Allow hot surfaces to cool down before starting replacement or maintenance procedures.

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.
7.3 General Rules for Maintenance and Service

For successful maintenance and service procedures, follow these rules and recommendations:

- Use only the replacement parts specifically authorized and qualified for the device by Thermo Fisher Scientific.

- 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.

- If you need to return a system module for depot repair, follow the instructions in section Transporting or Shipping the System (page 109).

See also

Consumables and Replacement Parts (page 138)
7.4  Routine and Preventive Maintenance

Optimum system performance, maximum uptime of the system, and accurate results can be obtained only if the system 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 system.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>What you should do...</th>
</tr>
</thead>
</table>
| Daily     | • Inspect the flow connections for signs of leakage or blockage.  
           | • When you use buffers or salt solutions, flush the system thoroughly after use with an appropriate solvent that does not contain buffers or salts. |
| Regularly | • Solvent line filter frits: regularly check the filter frits for permeability. Replace the filter frits at regular intervals. This is especially important when using aqueous solvents. Aqueous solvents may contaminate the filters with algae and other microorganisms that deposit on the filter frits. Therefore, also replace the solvents at regular intervals. Rinse the reservoirs thoroughly before refilling them.  
           | • Empty the waste container or containers.  
           | • Inspect the flow connections for damage, such as cracks, nicks, cuts, or blockage.  
           | • Check the drain system for blockage (see Testing the Drain System (page 74)). If a leak alarm is triggered or if a leak is visible, find and eliminate the blockage.  
           | • Clean the system (see Cleaning or Decontaminating the System (page 106)).  
           | • Check that all warning labels are still present on the system and clearly legible. If they are not, contact Thermo Fisher Scientific for replacement. |
| Annually  | Have Thermo Fisher Scientific service personnel perform preventive maintenance once a year. |

7.4.2 Cleaning or Decontaminating the System

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 system. Use a suitable cleaning detergent or disinfectant to ensure that the treatment renders the system 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. Turn off the power to the system and disconnect the power cord from the power source.

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.
7.5 Transporting or Shipping the System

NOTICE
Moving the Vanquish system stack even over short distances on the workbench can damage and impair the functionality of the system base. Observe the following:

- **Configuration with one column compartment**: Before moving the system stack, unlock the system base using the locking tools.
- **Configuration with two or three column compartments or a Charger**: Before moving the system stack, dismount the system stack (for instructions, see below).

Dismounting the system stack

**Preparations**

1. Turn off all modules with their main power switch.
2. Remove the solvent reservoirs and solvent lines from the solvent rack.
3. Remove all flow connections between the modules within the Vanquish system and all waste lines.
4. Remove all signal cables and power cords.
5. Grasp the system by its sides and slightly lift the column compartment up and out of the grooves on the mounting bars.
6. Lift the front part of the solvent rack and remove the solvent rack by pulling it towards the front.
7. Remove the detector, autosampler, and pump as described in the next section.
Removing the System Modules

1. Slide the carrying handles that were installed when the system was shipped on the rails at the right and left of the module from the rear as shown in the figure below. The final position of the handles must match the foam spacers used for transport (about 15 cm from the rear of the module to the center of the handle).

![Figure 35: Sliding the carrying handle on the left rail](image)

2. Fix the attachment screws on the carrying handles as shown below.

![Figure 36: Carrying handles attached](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carrying handles</td>
</tr>
<tr>
<td>2</td>
<td>Attachment screw (one on each carrying handle)</td>
</tr>
</tbody>
</table>

**CAUTION—Risk of Injury and Device Damage**

Handles can slide off the device if the attachment screws are not fixed properly. Also, the slide-in module can fall out if not fixed properly. This could cause personal injury and damage to the device. Verify the following before lifting a device:

- The handles are fixed properly and cannot slide off the device.
- The four screws on the slide-in module are tightened and the slide-in module cannot fall out (see Operating Manual of the detector, for example).

3. Lift the front part of the module by using the carrying handles. Remove the module from the stack towards the front and carefully place it on a stable surface.
Shipping the Solvent Rack and System Base

To ship the solvent rack and/or system base, 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 solvent rack or system base to Thermo Fisher Scientific, contact your local Thermo Fisher Scientific support organization for the appropriate procedure.

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.

Transporting or Shipping other System Modules

For details on transporting or shipping the other system modules, refer to the Transporting or Shipping section in the Operating Manual of each module.
8 Troubleshooting

This chapter is a guide to troubleshooting issues that may arise during operation of the system.
8.1 General Information about Troubleshooting

This section gives information about operating issues that might occur during the operation of a Vanquish system.

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 (Light Emitting Diodes) on the front side of each module and the STATUS LED on the keypad inside each module provide quick visual feedback on the operational status of the module. If the firmware detects a problem, the status indicators are red.

Chromeleon Audit Trail Messages

If the device firmware detects a problem, the problem is reported to the Chromeleon software.

The Chromeleon software logs information about all events related to instrument operation for the current day in an Audit Trail. The Audit Trail is named with the current date, using the format yyyymmdd. For example, the 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 Console Data view, in the folder of the Instrument.

Messages in the Chromeleon Audit Trail are preceded by an icon. The icon identifies the seriousness of the problem (refer to the Chromeleon Help). For possible causes and recommended remedial actions, see the Messages section in the Operating Manual of the module that is in error state.
8.2 System Troubleshooting

This section is a guide to troubleshooting issues that may arise during operation of the Vanquish system. Locate the table for the type of symptom you have, find the possible cause, and use the description of the solution to help you solve your problem quickly.

TIP
For information on troubleshooting issues that may arise during operation with the Vanquish charged aerosol detector and the Vanquish fluorescence detector, refer to the respective Operating Manual for the detector.

Note that this section provides information on symptoms and causes directly related to the Vanquish system modules and connections between the modules only. For information about general chromatography and application troubleshooting, refer to the technical literature.

8.2.1 Peak Shape

Peak tailing

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra column volume too large</td>
<td>Use short capillary connections with a suitable inner diameter. Use appropriate Viper capillaries.</td>
</tr>
<tr>
<td>Improper capillary connections</td>
<td>Check fittings for correct placement. Loosen and retighten Viper fittings (refer to the Viper Installation and Operation Guide). Use only the appropriate fittings (see Connecting Fittings, Capillaries, and Tubing (page 68)).</td>
</tr>
</tbody>
</table>

Peak broadening

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow cell volume too large</td>
<td>Use a smaller volume flow cell.</td>
</tr>
<tr>
<td>Extra-column volume too large</td>
<td>* If early peaks are broader than later eluting ones, check the capillary I.D. and length, sample loop size, flow cell, for example. * Use a capillary with a smaller volume for the connection between column compartment and detector.</td>
</tr>
<tr>
<td>Temperature gradient in column</td>
<td>* Use a pre-heater. * If forced air mode is used, consider switching to still air mode (refer to Column Compartment Operating Manual).</td>
</tr>
<tr>
<td>Detector response time too long and/or data collection rate too low</td>
<td>Select a suitable response time and/or data collection rate.</td>
</tr>
</tbody>
</table>
8 • Troubleshooting

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillaries clogged</td>
<td>Replace the capillaries.</td>
</tr>
<tr>
<td>Sample loop clogged</td>
<td>Replace the sample loop (refer to Split Sampler Operating Manual).</td>
</tr>
<tr>
<td>Solvent selector/proportioning valve defective</td>
<td>Contact Technical Support.</td>
</tr>
</tbody>
</table>

8.2.2 Ghost Peaks, Negative Peaks and Spikes

Ghost peaks

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination (typically injector or column)</td>
<td>Flush the system using an appropriate solvent.</td>
</tr>
<tr>
<td>Improper reference wavelength</td>
<td>The sample must not absorb in the range of the reference wavelength. Consider using a method without reference wavelength.</td>
</tr>
<tr>
<td>Selected bandwidth too high</td>
<td>Select a lower bandwidth.</td>
</tr>
<tr>
<td>Degassing channels contaminated</td>
<td>Purge the pump (all channels) to rinse the degassing channels (refer to Pump Operating Manual).</td>
</tr>
</tbody>
</table>

Negative peaks

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper reference wavelength</td>
<td>The sample must not absorb in the range of the reference wavelength. Consider using a method without reference wavelength.</td>
</tr>
<tr>
<td>Wrong polarization of analog output</td>
<td>If you are using analog output, check the analog output polarization.</td>
</tr>
</tbody>
</table>

Spikes

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
</table>
| Air trapped in flow cell                     | • Check all fluid connections for tightness, in particular in the intake path.  
• Degas the mobile phase.                    |
• Install a restrictor at the flow cell outlet, observing the pressure specification of the respective flow cell and the general guidelines for the flow cell.  
**Note:** Excessive backpressure will destroy flow cells! |
| Particles in flow cell                       | • Flush the system (see Flushing the System (page 81)). If you suspect that a capillary is contaminated with particles, in particular between the column and the flow cell, replace the capillary.  
• Flush the flow cell with different flows if particles are trapped in flow cell.  
• Check if the column is defective.         |
| UV/VIS lamp old, defective, or not properly installed | Check if the lamp is properly seated. Replace the lamp (refer to Detector Operating Manual). |
### 8.2.3 Peak Area Precision

**Contamination or carry-over**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination in the system</td>
<td>Flush the system using an appropriate solvent.</td>
</tr>
<tr>
<td>Autosampler carry-over</td>
<td>The needle may be contaminated. Wash the needle in the wash port. If carry-over persists, replace the needle seat (refer to Split Sampler Operating Manual).</td>
</tr>
</tbody>
</table>

**Environmental conditions**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstable environmental conditions</td>
<td>Make sure that the temperature and air humidity are constant. Use column thermostatting. Avoid draft. Use insulation on the capillary from the column compartment to the detector.</td>
</tr>
</tbody>
</table>

**Capillary problems**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary connections not installed properly or not tight, dead volumes in capillary connections</td>
<td>Properly install the capillary connections. Tighten the capillary connections. Replace capillary.</td>
</tr>
</tbody>
</table>
### Pump problems

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston seals in pump leaking</td>
<td>Replace the seals (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Air trapped in pump head</td>
<td>Purge the pump (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Baseline fluctuations</td>
<td>See &quot;Periodic baseline fluctuations&quot; in <em>Baseline (page 121)</em>.</td>
</tr>
<tr>
<td>Pump pulsation or flow fluctuations</td>
<td>See &quot;Pressure pulsation or inconstant pressure&quot; in <em>Pressure (page 120)</em>.</td>
</tr>
<tr>
<td>Irreproducible gradient</td>
<td>Change the gradient. Check the solvent line filters for permeability. Replace the filter frits if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
</tbody>
</table>

### Inappropriate detector settings

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper wavelength, e.g., in a UV spectrum flank</td>
<td>Choose a detection wavelength that is located near the apex of the spectrum.</td>
</tr>
<tr>
<td>Detector response time too short</td>
<td>Select a longer response time.</td>
</tr>
<tr>
<td>Detector response time too long</td>
<td>Peaks are eventually not separated any more. Select a shorter response time.</td>
</tr>
</tbody>
</table>

### Injection volume variation

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autosampler draws air from vial</td>
<td>There is not enough amount of sample in the vial, the needle height setting is incorrect, or there are too many replicates.</td>
</tr>
<tr>
<td>Air trapped in autosampler flow path</td>
<td>Perform a wash cycle. Check that the injection valve is in Inject position and the flow components of the autosampler are flushed with solvent.</td>
</tr>
<tr>
<td>Draw speed too high</td>
<td>Select a lower draw speed.</td>
</tr>
<tr>
<td>Gas content of sample too high or saturated</td>
<td>Reduce the draw speed. Degas the sample if possible.</td>
</tr>
<tr>
<td>Injector needle clogged or needle tip deformed</td>
<td>Replace the needle (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
<tr>
<td>Piston seals in autosampler metering device leaking</td>
<td>Replace the metering device head (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
<tr>
<td>Injection valve or other autosampler components leaking</td>
<td>Inspect the autosampler and the connections on the injection valve. Tighten leaking connections. Replace leaking parts (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
<tr>
<td>Needle seat worn out</td>
<td>Replace the needle seat (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
</tbody>
</table>
### 8.2.4 Flow

#### No flow

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak in system</td>
<td>Find and eliminate the leak.</td>
</tr>
<tr>
<td>Inlet and/or outlet check valve contaminated or defective</td>
<td>Clean the inlet check valve or outlet check valve, and replace the check valve if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Air trapped in pump heads</td>
<td>Purge the pump (refer to <em>Pump Operating Manual</em>) and check in the Chromeleon software whether the degasser has reached the operating vacuum (Degasser Vacuum = OK).</td>
</tr>
<tr>
<td>Air trapped in autosampler flow path</td>
<td>Perform a wash cycle (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
<tr>
<td>Column temperature too high – eluent evaporating</td>
<td>Select a lower column temperature (refer to <em>Column Compartment Operating Manual</em>).</td>
</tr>
</tbody>
</table>

#### Flow fluctuations

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump inlet path clogged</td>
<td>Check the solvent inlet lines, solvent line filters, and solvent selectors/proportioning valve, for example, for signs of clogging.</td>
</tr>
</tbody>
</table>
| Air trapped in pump inlet path                         | • Purge the pump.  
• Inspect the degasser for indications for leakage. Check in the Chromeleon software whether the degasser has reached the operating vacuum (Degasser Vacuum = OK). Degassing may not work properly if the flow rate is too high.  
• Inspect the capillary and solvent line connections for leakage; tighten loose fitting connections. |
| Inlet and/or outlet check valve contaminated or defective | Clean the inlet check valve or outlet check valve, and replace the check valve if necessary (refer to *Pump Operating Manual*). |
| Piston seals not sealing tightly                       | Replace the piston seals (refer to *Pump Operating Manual*).                                                                               |
8.2.5 Pressure

Pressure pulsation or inconstant pressure

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air trapped in the system</td>
<td>Purge the pump (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Inlet and/or outlet check valve contaminated or</td>
<td>Clean the inlet check valve or outlet check valve, and replace the check valve if</td>
</tr>
<tr>
<td>defective</td>
<td>necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Pump inline filter (or static mixer) clogged</td>
<td>Check the permeability of the inline filter (or static mixer). Replace the inline</td>
</tr>
<tr>
<td></td>
<td>filter (or static mixer) if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Solvent line filter clogged</td>
<td>Check the solvent line filters for permeability. Replace the filter frits if</td>
</tr>
<tr>
<td></td>
<td>necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Pump head compression values not reached</td>
<td>Check the compression values and take remedial action (refer to *Pump Operating</td>
</tr>
<tr>
<td></td>
<td>Manual*).</td>
</tr>
<tr>
<td>System clogged with particles</td>
<td>Samples and insufficient solvent purity are frequently the source for particles</td>
</tr>
<tr>
<td></td>
<td>clogging the system. Follow the instructions for resolving clogging in the</td>
</tr>
<tr>
<td></td>
<td>autosampler (refer to <em>Split Sampler Operating Manual</em>).</td>
</tr>
</tbody>
</table>

High backpressure

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>One or more capillaries in the system clogged or</td>
<td>Check the capillaries in the system systematically from the detector to the pump.</td>
</tr>
<tr>
<td>damaged by bending</td>
<td>Replace the capillaries as needed.</td>
</tr>
<tr>
<td>Pump inline filter (or static mixer) clogged</td>
<td>Check the permeability of the inline filter (or static mixer). Replace the inline</td>
</tr>
<tr>
<td></td>
<td>filter (or static mixer) if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td>Pre-heater clogged</td>
<td>Rinse the pre-heater capillary in reverse direction, using an appropriate solvent. If</td>
</tr>
<tr>
<td></td>
<td>necessary, replace the pre-heater (refer to *Column Compartment Operating</td>
</tr>
<tr>
<td></td>
<td>Manual*).</td>
</tr>
<tr>
<td>Column switching valve clogged</td>
<td>Check the valve for indications of blockage. Replace the valve if necessary (refer</td>
</tr>
<tr>
<td></td>
<td>to <em>Column Compartment Operating Manual</em>).</td>
</tr>
<tr>
<td>Post-column cooler clogged or defective</td>
<td>Rinse the post-column cooler capillary in reverse direction using an appropriate solvent. If necessary, replace the post-column cooler (refer to <em>Column Compartment Operating Manual</em>).</td>
</tr>
<tr>
<td>Flow cell clogged</td>
<td>Clean the flow cell. Replace the flow cell if necessary (refer to <em>Detector Operating Manual</em>).</td>
</tr>
<tr>
<td>Contamination in the system</td>
<td>Flush the system with an appropriate solvent.</td>
</tr>
</tbody>
</table>

Low backpressure

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak in system</td>
<td>Find and eliminate the leak.</td>
</tr>
</tbody>
</table>
8.2.6 Retention Time Variation

*Decreasing retention times*

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improper mobile phase composition</td>
<td>Check premixed mobile phase. Perform an OQ gradient accuracy test. A solvent selector/proportioning valve may be defective. Contact Technical Support.</td>
</tr>
<tr>
<td>Increasing flow rate</td>
<td>Check flow rate settings. Perform OQ flow precision test.</td>
</tr>
</tbody>
</table>

*Increasing retention times*

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreasing flow rate</td>
<td>Check capillary connections for leaks. Check flow rate settings.</td>
</tr>
<tr>
<td>Piston seal leakage</td>
<td>Check the pump for piston seal leakage (refer to <em>Pump Operating Manual</em>).</td>
</tr>
</tbody>
</table>

*Scattering retention times*

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imprecise solvent proportioning</td>
<td>• Perform an OQ eluent proportioning test.</td>
</tr>
<tr>
<td></td>
<td>• Clean the inlet check valve or outlet check valve, and replace the check valve if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td></td>
<td>• A solvent selector/proportioning valve may be defective. Contact Technical Support.</td>
</tr>
<tr>
<td>Pressure fluctuations from pump</td>
<td>• Purge the pump.</td>
</tr>
<tr>
<td></td>
<td>• Check the compression values and take remedial action (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td></td>
<td>• Check the pump for piston seal leakage (refer to <em>Pump Operating Manual</em>).</td>
</tr>
<tr>
<td></td>
<td>• Check the solvent line filters for permeability. Replace the filter frits if necessary (refer to <em>Pump Operating Manual</em>).</td>
</tr>
</tbody>
</table>

8.2.7 Baseline

*High baseline drift*

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>System not sufficiently equilibrated</td>
<td>Flush the system until equilibration. Usually, a volume of 5–10 times the column volume will be sufficient.</td>
</tr>
<tr>
<td>Unstable environmental conditions</td>
<td>1. Make sure that the temperature and the humidity are constant. You can determine temperature fluctuations by recording the temperature channels.</td>
</tr>
<tr>
<td></td>
<td>2. Verify on the detector that the lamp house cover is properly installed and that the front doors are closed. Avoid draft.</td>
</tr>
<tr>
<td>Flow cell contaminated</td>
<td>Clean the flow cell. Replace the flow cell if necessary (refer to <em>Detector Operating Manual</em>).</td>
</tr>
</tbody>
</table>
### Troubleshooting

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV/VIS lamp not stable</td>
<td>Allow the lamp and optics to warm up for at least 60 minutes. If the lamp is old, you may need to replace the detector lamp (see Detector Operating Manual). A new lamp may need burn-in time before the first analysis. For details, refer to the Detector Operating Manual.</td>
</tr>
<tr>
<td>Absorption of eluent changes when gradient is run</td>
<td>Absorbing additives may change the absorption spectrum, depending on the solvent. Consider varying additive concentrations to level the drift.</td>
</tr>
</tbody>
</table>

### Non-periodic baseline fluctuation, high noise

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure fluctuations from pump</td>
<td>Purge the pump; check general function (refer to Pump Operating Manual).</td>
</tr>
<tr>
<td>Air trapped in the system</td>
<td>Purge the system as necessary (refer to Pump Operating Manual).</td>
</tr>
<tr>
<td>UV/VIS lamp old or not properly installed</td>
<td>Check that the lamp is correctly installed. Replace the lamp (refer to Detector Operating Manual).</td>
</tr>
<tr>
<td>Improper reference wavelength</td>
<td>The sample must not absorb in the range of the reference wavelength. Consider using a method without reference wavelength.</td>
</tr>
<tr>
<td>Detector response time too short</td>
<td>Select a suitable response time.</td>
</tr>
<tr>
<td>Improper wavelength or optical bandwidth</td>
<td>Select an appropriate wavelength. Select a higher bandwidth in particular with critical conditions (low absorption, few light).</td>
</tr>
<tr>
<td>Flow cell not properly installed</td>
<td>Check that the flow cell is installed properly (refer to Detector Operating Manual).</td>
</tr>
<tr>
<td>Detector defective</td>
<td>Contact Technical Support.</td>
</tr>
<tr>
<td>Optical transmission of the flow cell too low (Vanquish system with VH-D10 detector only)</td>
<td>Check the lamp age and replace the lamp, if necessary. Use the Cell Transmission Check / Flow Cell Wash button on the ePanel for the module and follow the instructions. For this procedure, a diagnostic cell for the VH-D10 is required. If you do not have a diagnostic cell, compare the cell transmission (light intensity) values of the flow cell before and after a wash procedure and check whether the cell transmission (light intensity) has increased. If it has not increased, perform an extended wash cycle and check whether the cell transmission (light intensity) has increased.</td>
</tr>
</tbody>
</table>

### Periodic baseline fluctuation, pulsation

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure fluctuations from pump</td>
<td>Purge the pump; check general function (refer to Pump Operating Manual).</td>
</tr>
<tr>
<td>Air trapped in the system</td>
<td>Purge the system (refer to Pump Operating Manual).</td>
</tr>
<tr>
<td>Improper reference wavelength</td>
<td>The sample must not absorb in the range of the reference wavelength. Consider using a method without reference wavelength.</td>
</tr>
</tbody>
</table>
### 8.2.8 Temperature Control

*Column compartment temperature does not change although the set point has not been reached*

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature too high or setpoint lower than the specified difference to the ambient temperature</td>
<td>Reduce the ambient temperature (for example, by ventilating the room).</td>
</tr>
<tr>
<td>Temperature control turned off</td>
<td>Check the setting for TempCtrl in the Chromeleon software (<em>TempCtrl=On</em>) turns temperature control on).</td>
</tr>
<tr>
<td>Ventilation grid obstructed</td>
<td>Make sure that the ventilation grids of the column compartment are not obstructed in any way.</td>
</tr>
</tbody>
</table>
| Ambient air enters column chamber                   | • Improper sealing of the column chamber may impair the heating and cooling performance of the column compartment and lead to a considerable amount of condensed water.  
  • When guiding capillaries through the column chamber cover seal, make sure that the cover seals properly. If the chamber cover seal is damaged, replace the chamber cover (refer to *Column Compartment Operating Manual*).  
  • Also, make sure that the front door is properly closed. |
| Column compartment defective                        | Contact Technical Support.                                                                                                                       |

### Pre-heater does not reach set temperature

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-heater not installed correctly</td>
<td>The performance may be impaired if the thermal contact is imperfect, or if the pre-heater inlet and outlet are exchanged. Reinstall the pre-heater (refer to <em>Column Compartment Operating Manual</em>).</td>
</tr>
<tr>
<td>Pre-heater defective</td>
<td>Replace the pre-heater (refer to <em>Column Compartment Operating Manual</em>).</td>
</tr>
</tbody>
</table>
### Troubleshooting

#### Post-column cooler does not reach set temperature

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-column cooler not</td>
<td>Verify that the post-column cooler screws are tightened and the post-column</td>
</tr>
<tr>
<td>installed correctly</td>
<td>cooler is seated properly.</td>
</tr>
</tbody>
</table>

#### Autosampler does not reach set temperature

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature or</td>
<td>Reduce the ambient temperature (for example, by ventilating the room), and/or</td>
</tr>
<tr>
<td>humidity too high</td>
<td>ambient humidity.</td>
</tr>
</tbody>
</table>

#### 8.2.9 Power and Communication

**Entire system has no power (all LED status bars unlit)**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>System power button turned off</td>
<td>Turn on the system with the power button on the front left of the system base.</td>
</tr>
</tbody>
</table>

**Single module has no power (LED status bar unlit)**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module power turned off</td>
<td>Turn on the module with its main power switch.</td>
</tr>
<tr>
<td>Module not connected to the</td>
<td>Connect the power cord.</td>
</tr>
<tr>
<td>mains</td>
<td></td>
</tr>
<tr>
<td>Fuse has blown</td>
<td>Replace the fuses (refer to Operating Manual of the module).</td>
</tr>
<tr>
<td>Error in electronic system</td>
<td>Contact Technical Support.</td>
</tr>
</tbody>
</table>

**One or more modules cannot be turned off from the power button on the system base**

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>System power connection</td>
<td>Check the system interlink connections between the system base and the system</td>
</tr>
<tr>
<td>interrupted</td>
<td>modules, see Signal Cable Connections (p. page 54).</td>
</tr>
</tbody>
</table>
Module cannot be operated from the chromatography software

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedial Action</th>
</tr>
</thead>
</table>
| No connection between module and computer          | • Check the USB connections from the system to the computer, see Signal Cable Connections (page 54). If the module uses a USB hub on another module, check that the module that provides the hub is turned on.  
• Check the USB port on the computer. USB standard 2.0 is required. |
| Repeated unexpected disconnects in the Chromeleon software | Install a USB Isolator. For ordering information, see Optional Accessories (page 137). |

8.2.10 System Diagnostics

For the Vanquish system modules, diagnostics features are supported in the Chromeleon software. With these features, the user can check and monitor the performance and reliability of certain components.

Manual Testing

You can run the following tests from Chromeleon:

<table>
<thead>
<tr>
<th>Test</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Tightness Test</td>
<td>Depending on the Vanquish system configuration, the available tests may vary. If a test is grayed out in the Chromeleon software, the test is currently not available.</td>
</tr>
<tr>
<td>Grating Motor Test</td>
<td></td>
</tr>
<tr>
<td>Intensity Test</td>
<td>When a test is running, the LED bar on the module shows a blue running light.</td>
</tr>
<tr>
<td>Shutter Motor Test</td>
<td></td>
</tr>
</tbody>
</table>

Automatic Testing

You can set up a schedule in Chromeleon for automatic testing. Automatic testing is possible only for tests and functions that can run unattended, without further user interaction, for example the Basic Tightness Test.

Test Failed

To ensure that you run sequences only on fully operational modules, the Chromeleon software prevents you from starting a sequence if a diagnostic test has failed. If a test failed, take remedial action and repeat the test. A user with special control privileges in the Chromeleon software can override the failed test result. Refer to the Chromeleon Help.

See also

- Basic Tightness Test (page 126)
- Grating Motor Test (page 126)
- Intensity Test (page 127)
- Shutter Motor Test (page 127)
8.2.10.1 Basic Tightness Test

The Basic Tightness Test checks the tightness of the pump and autosampler.

*Follow these steps*

1. Run the test from the Chromeleon software. Refer to the Chromeleon Help.
   The test runs automatically without further user interaction.

2. If the test fails, check the Chromeleon Audit Trail for a message. For remedial actions refer to the Troubleshooting section in the Operating Manual for the module for which the test failed.

8.2.10.2 Grating Motor Test

The Grating Motor Test checks the mechanical stability of the grating drive. The test is available for the variable wavelength detector.

*Follow these steps*

1. Install the diagnostics cell in the detector.

2. Run the test from the Chromeleon software. Refer to the Chromeleon Help.

3. Depends on the test result:

<table>
<thead>
<tr>
<th>Test result</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>Reinstall the flow cell of your application.</td>
</tr>
<tr>
<td>Failed</td>
<td>Contact Thermo Fisher Scientific Technical Support.</td>
</tr>
</tbody>
</table>
8.2.10.3 Intensity Test

The **Intensity Test** is a test to measure the intensity of the detector lamp and the transmission performance ("intensity") of the optics. The test is available for the diode array detector and for the variable wavelength detector.

*Follow these steps*

1. Install the diagnostics cell in the detector.
2. Turn on the detector lamps (one or both) that you want to test.
3. Run the test from the Chromeleon software. Refer to the *Chromeleon Help*.
4. Depends on the test result:

<table>
<thead>
<tr>
<th>Test result</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>Reinstall the flow cell of your application.</td>
</tr>
</tbody>
</table>
| Failed      | 1. *Diode Array Detector only*: Check the diagnostics cell for indications of contamination that prevent the light to pass the cell unhindered. Repeat the test with a clean cell. If the test fails again, replace the lamp.  
2. Replace the lamp. Refer to the *Operating Manual* for the detector.  
3. If the test fails with the new lamp, the optics may be defective. Contact Thermo Fisher Technical Support. |

8.2.10.4 Shutter Motor Test

The **Shutter Motor Test** checks the mechanical stability of the shutter motor and filter paddle. The test is available for the variable wavelength detector.

*Follow these steps*

1. Install the diagnostics cell in the detector.
2. Turn on the detector lamps (one or both).
3. Run the test from the Chromeleon software. Refer to the *Chromeleon Help*.
4. Depends on the test result:

<table>
<thead>
<tr>
<th>Test result</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed</td>
<td>Reinstall the flow cell of your application.</td>
</tr>
<tr>
<td>Failed</td>
<td>Contact Thermo Fisher Scientific Technical Support.</td>
</tr>
</tbody>
</table>
9 Specifications

This chapter provides important system specifications.
9.1 System Specifications

The physical conditions of a standard system are specified as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials in the flow path</td>
<td>For materials in the flow path, refer to the Operating Manuals for the modules in your system. For solvent and additive information, see Solvent and Additive Information ( page 25).</td>
</tr>
<tr>
<td>Biocompatibility</td>
<td>Core system in the standard configuration: No Horizon/Flex system in the standard configuration: Yes</td>
</tr>
<tr>
<td>Control</td>
<td>System base power button Chromeleon 7 The system can be operated also with other data systems. For details, contact the Thermo Fisher Scientific sales organization.</td>
</tr>
<tr>
<td>Good Laboratory Practice (GLP) features</td>
<td>Predictive Performance functions for scheduling maintenance procedures based on the actual operating and usage conditions of the system. All system parameters logged in the Chromeleon Audit Trail.</td>
</tr>
<tr>
<td>Safety features</td>
<td>Leak detection and safe leak handling</td>
</tr>
<tr>
<td>Range of use</td>
<td>Indoor use only</td>
</tr>
<tr>
<td>Ambient operating temperature</td>
<td>5 °C - 35 °C</td>
</tr>
<tr>
<td>Ambient storage temperature</td>
<td>-20 °C - 45 °C</td>
</tr>
<tr>
<td>Ambient operating humidity</td>
<td>20% - 80% relative humidity, non-condensing</td>
</tr>
<tr>
<td>Ambient storage humidity</td>
<td>Maximum 60% relative humidity, non-condensing</td>
</tr>
<tr>
<td>Operating altitude</td>
<td>Maximum 2000 m above sea level</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Emission sound pressure level</td>
<td>System with one column compartment, without Charger: Typically approx. 55 dB(A), max. approx. 75 dB(A)</td>
</tr>
<tr>
<td>System dimensions (height x width x depth)</td>
<td>System with one column compartment, without Charger: 82 cm x 55 cm x 62 cm</td>
</tr>
<tr>
<td>System weight</td>
<td>Vanquish Core Approx. 80 kg Vanquish Flex: Approx. 90 kg Vanquish Horizon: Approx. 110 kg</td>
</tr>
</tbody>
</table>
9.2 Solvent Rack and System Base Specifications

The physical conditions of the solvent rack and system base are specified as follows. For specifications of the other modules in the Vanquish system, refer to the Specifications section in the Operating Manual for each module.

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Interlink</td>
<td>2 System Interlink ports (RJ45-8 connectors)</td>
</tr>
<tr>
<td>Max. volume of an individual</td>
<td>5 L</td>
</tr>
<tr>
<td>solvent reservoir</td>
<td></td>
</tr>
<tr>
<td>Solvent rack dimensions</td>
<td>12 cm x 42 cm x 60 cm</td>
</tr>
<tr>
<td>(height x width x depth)</td>
<td></td>
</tr>
<tr>
<td>Solvent rack weight</td>
<td>4 kg</td>
</tr>
<tr>
<td>System base dimensions</td>
<td>6 cm x 42 cm x 42 cm</td>
</tr>
<tr>
<td>(height x width x depth)</td>
<td></td>
</tr>
<tr>
<td>System base weight</td>
<td>5 kg</td>
</tr>
<tr>
<td>System base user input</td>
<td>System base power button</td>
</tr>
</tbody>
</table>
10 Accessories, Consumables and Replacement Parts

This chapter describes the standard accessories that are shipped with the system and the accessories that are available as an option. This chapter also provides information for reordering consumables and replacement parts.
10.1 General Information

The system 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.
10.2 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. See the content list included in the kit for the most recent information about the kit content at the time when the system is shipped.

For reordering information, see Consumables and Replacement Parts (page 138).

Ship Kit for Vanquish Core system

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity in shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuses kit, Vanquish system</td>
<td>1</td>
</tr>
<tr>
<td>The kit includes the appropriate fuses for the Vanquish system modules.</td>
<td></td>
</tr>
<tr>
<td>Viper union</td>
<td>1</td>
</tr>
<tr>
<td>Tubing connector, straight, for tubing I.D. 1.0 – 2.0 mm, set of 5</td>
<td>1</td>
</tr>
<tr>
<td>Tubing connector, tapered, I.D. 1/16&quot;</td>
<td>5</td>
</tr>
<tr>
<td>Viper capillary kit, Vanquish Core system, including:</td>
<td>1</td>
</tr>
<tr>
<td>• Capillary pump-autosampler, SST, I.D. x length 0.18 x 350 mm length</td>
<td></td>
</tr>
<tr>
<td>• Passive pre-heater, SST, I.D. x length 0.18 x 530 mm</td>
<td></td>
</tr>
<tr>
<td>Drainage kit, Vanquish system, including:</td>
<td>1</td>
</tr>
<tr>
<td>• L piece (elbow, pack of 4, different sizes)</td>
<td></td>
</tr>
<tr>
<td>• Drain tubing, 6.25 m length</td>
<td></td>
</tr>
<tr>
<td>• Clip (set of 2)</td>
<td></td>
</tr>
<tr>
<td>Paper label for magnetic label holder</td>
<td>1</td>
</tr>
<tr>
<td>System interlink cable</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Torx T10</td>
<td>1</td>
</tr>
<tr>
<td>Reservoir cap</td>
<td>6</td>
</tr>
</tbody>
</table>
### Ship Kit for Vanquish Flex and Horizon system

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity in shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuses kit, Vanquish system</td>
<td>1</td>
</tr>
<tr>
<td>The kit includes the appropriate fuses for the Vanquish system modules.</td>
<td></td>
</tr>
<tr>
<td>Viper inline filter</td>
<td>1</td>
</tr>
<tr>
<td>Viper union</td>
<td>1</td>
</tr>
<tr>
<td>Tubing connector, straight, for tubing I.D. 1.0 – 2.0 mm, set of 5</td>
<td>1</td>
</tr>
<tr>
<td>Tubing connector, tapered, I.D. 1/16”</td>
<td>5</td>
</tr>
<tr>
<td>Viper capillary kit, Vanquish Horizon and Flex system, including:</td>
<td>1</td>
</tr>
<tr>
<td>• Capillary pump-autosampler, MP35N, I.D. x length 0.1 x 350 mm length</td>
<td></td>
</tr>
<tr>
<td>• Active pre-heater, MP35N, I.D. x length 0.1 x 380 mm</td>
<td></td>
</tr>
<tr>
<td>• Passive pre-heater, MP35N, I.D. x length 0.1 x 530 mm</td>
<td></td>
</tr>
<tr>
<td>Drainage kit, Vanquish system, including:</td>
<td>1</td>
</tr>
<tr>
<td>• L piece (elbow, pack of 4, different sizes)</td>
<td></td>
</tr>
<tr>
<td>• Drain tubing, 6.25 m length</td>
<td></td>
</tr>
<tr>
<td>• Clip (set of 2)</td>
<td></td>
</tr>
<tr>
<td>Paper label for magnetic label holder</td>
<td>1</td>
</tr>
<tr>
<td>Screwdriver, Torx T10</td>
<td>1</td>
</tr>
<tr>
<td>System interlink cable</td>
<td>1</td>
</tr>
<tr>
<td>Reservoir cap</td>
<td>6</td>
</tr>
</tbody>
</table>
10.3 Optional Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IonBench including stack mounting kit</td>
<td>6036.1720</td>
</tr>
<tr>
<td>Stack stabilizer kit</td>
<td>6036.1710</td>
</tr>
<tr>
<td>Manual injection valve</td>
<td>6230.1600</td>
</tr>
<tr>
<td>Method Transfer Kit</td>
<td>6036.2100</td>
</tr>
<tr>
<td>Contains a loop capillary kit to adjust the system gradient delay</td>
<td></td>
</tr>
<tr>
<td>volume to the desired HPLC method.</td>
<td></td>
</tr>
<tr>
<td>Vanquish Solvent Monitor</td>
<td></td>
</tr>
<tr>
<td>To actively monitor the liquid level in solvent reservoirs and waste</td>
<td></td>
</tr>
<tr>
<td>containers in real time. Monitoring is based on real physical</td>
<td></td>
</tr>
<tr>
<td>measurement.</td>
<td></td>
</tr>
<tr>
<td>Solvent monitor, 4-channel version</td>
<td>6230.1320</td>
</tr>
<tr>
<td>Solvent monitor, 8-channel version</td>
<td>6230.1310</td>
</tr>
<tr>
<td>Stack stabilizer kit</td>
<td>6036.1710</td>
</tr>
<tr>
<td>USB isolator</td>
<td>6287.0540</td>
</tr>
<tr>
<td>The USB Isolator improves the reliability of the USB connection</td>
<td></td>
</tr>
<tr>
<td>between the USB port of an HPLC system module and the data system</td>
<td></td>
</tr>
<tr>
<td>computer.</td>
<td></td>
</tr>
<tr>
<td>Vanquish User Interface</td>
<td></td>
</tr>
<tr>
<td>Can be used to display and monitor the vital parameters of the</td>
<td></td>
</tr>
<tr>
<td>overall system and of attached modules. It consists of the Vanquish</td>
<td></td>
</tr>
<tr>
<td>System Controller and the Vanquish Display (optional). Can be used</td>
<td></td>
</tr>
<tr>
<td>for the Vanquish Flex systems and Vanquish Core systems.</td>
<td></td>
</tr>
<tr>
<td>Vanquish System Controller (Vanquish User Interface without</td>
<td>6036.1130</td>
</tr>
<tr>
<td>Vanquish Display)</td>
<td></td>
</tr>
<tr>
<td>Vanquish User Interface including the Vanquish Display</td>
<td>6036.1170</td>
</tr>
<tr>
<td>Vanquish Display</td>
<td>6036.1180</td>
</tr>
</tbody>
</table>
## 10.4 Consumables and Replacement Parts

### 10.4.1 Capillaries and Tubing

#### Single Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capillary pump-autosampler, SST, I.D. x length 0.18 x 350 mm (for Core systems)</td>
<td>6040.2375</td>
</tr>
<tr>
<td>Capillary pump-autosampler, MP35N, I.D. x length 0.1 x 350 mm (for Horizon and Flex systems)</td>
<td>6042.2340</td>
</tr>
<tr>
<td>Active pre-heater, MP35N, I.D. x length 0.1 x 380 mm</td>
<td>6732.0110</td>
</tr>
<tr>
<td>Passive pre-heater, SST, I.D. x length 0.18 x 530 mm (for Core systems)</td>
<td>6732.0170</td>
</tr>
<tr>
<td>Passive pre-heater, MP35N, I.D. x length 0.1 x 530 mm (for Horizon and Flex systems)</td>
<td>6732.0174</td>
</tr>
<tr>
<td>Vanquish system drainage L pieces, set of 4, different sizes</td>
<td>6036.0003</td>
</tr>
<tr>
<td>Viper inline filter</td>
<td>6036.1045</td>
</tr>
<tr>
<td>Viper union</td>
<td>6040.2304</td>
</tr>
</tbody>
</table>

#### Drainage Kit

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage kit, Vanquish system, including:</td>
<td>6036.1120</td>
</tr>
<tr>
<td>• L piece (elbow, pack of 4, different sizes)</td>
<td></td>
</tr>
<tr>
<td>• Drain tubing, 6.25 m length</td>
<td></td>
</tr>
<tr>
<td>• Clip (set of 2)</td>
<td></td>
</tr>
</tbody>
</table>
10.4.2 Solvents and Wash Systems

**Reservoirs for solvents and wash liquids**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir, 1 L, including cap</td>
<td>2270.0012</td>
</tr>
<tr>
<td>Reservoir, 0.25 L, including cap</td>
<td>2270.0026</td>
</tr>
<tr>
<td>Cap for reservoirs, screw-cap (pack of 4)</td>
<td>6270.0013</td>
</tr>
<tr>
<td>Plugs and retaining guides for reservoir caps, kit including</td>
<td></td>
</tr>
<tr>
<td>- Cap plug to close open holes in the reservoir cap (pack of 10)</td>
<td>6030.9101</td>
</tr>
<tr>
<td>- Retaining guide to keep the liquid line in place in the reservoir cap (pack of 5)</td>
<td></td>
</tr>
<tr>
<td>Cap plug to close open holes in the reservoir cap (pack of 20)</td>
<td>6000.0047</td>
</tr>
<tr>
<td>Retaining guide to keep the liquid line in place in the reservoir cap (pack of 5)</td>
<td>6000.0042</td>
</tr>
</tbody>
</table>

**Solvent Lines and Solvent Line Filters**

For information about the solvent lines and solvent line filters, refer to the *Consumables and Replacement Parts* section in the Operating Manual for the pump.
10.4.3 Fuses and Cables

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuses kit, Vanquish system</td>
<td>6036.0002</td>
</tr>
<tr>
<td>The kit includes the appropriate fuses for the Vanquish system modules.</td>
<td></td>
</tr>
<tr>
<td>System interlink cable</td>
<td>6036.0004</td>
</tr>
<tr>
<td>USB cable, type A to type B, high-speed, USB 2.0</td>
<td>6035.9035</td>
</tr>
<tr>
<td>Cable length: 1 m</td>
<td></td>
</tr>
<tr>
<td>USB cable, type A to type B, high-speed, USB 2.0</td>
<td>6911.0002</td>
</tr>
<tr>
<td>Cable length: 5 m</td>
<td></td>
</tr>
</tbody>
</table>

10.4.4 Other Parts

<table>
<thead>
<tr>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base module (system base), (all Vanquish systems)</td>
<td>6036.1100</td>
</tr>
<tr>
<td>Packing material</td>
<td>6036.7005</td>
</tr>
<tr>
<td>Solvent rack</td>
<td>6036.1350</td>
</tr>
<tr>
<td>System base locking tool</td>
<td>6036.1160</td>
</tr>
</tbody>
</table>
11 Appendix

This chapter provides additional information about compliance.
11.1 Compliance Information

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations.

For details on compliance, also see the Compliance Information section in the Operating Manual for each module in the Vanquish system.

11.1.1 Declarations of Conformity

CE Declaration of Conformity

The device has satisfied the requirements for the CE mark and is compliant with the applicable requirements.

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:

<table>
<thead>
<tr>
<th>Logo</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Green Logo" /></td>
<td>The green logo marks items that do not contain the hazardous substances identified by the regulations.</td>
</tr>
<tr>
<td><img src="image" alt="Orange Logo" /></td>
<td>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 <a href="http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html">http://www.thermofisher.com/us/en/home/technical-resources/rohs-certificates.html</a></td>
</tr>
</tbody>
</table>
11.1.2  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:

![WEEE symbol](image)

Figure 37: 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.

11.1.3  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.

11.1.4  Manual Release History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Covering</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>Vanquish Core system with system base VC-S01-A-02, Vanquish Flex system with system base VF-S01-A-02, Vanquish Horizon system with system base VH-S01-A-02</td>
</tr>
<tr>
<td>3.0a</td>
<td>Vanquish Flex system with system base VF-S01-A-02, Vanquish Horizon system with system base VH-S01-A-02</td>
</tr>
<tr>
<td>3.0</td>
<td>Vanquish Flex system with system base VF-S01-A-02, Vanquish Horizon system with system base VH-S01-A-02</td>
</tr>
<tr>
<td>2.0</td>
<td>Vanquish Flex system (103 MPa) with system base VF-S01, Vanquish system (151 MPa) with system base VH-S01</td>
</tr>
<tr>
<td>1.0</td>
<td>Vanquish system (151 MPa) with system base VH-S01</td>
</tr>
</tbody>
</table>

The instructions were prepared in English (original instructions). Other language versions are translations based on the English original instructions.
Index

A
accessories ........................................... 37, 133
additives .................................................. 25
  information ........................................... 25
  use ..................................................... 89
algae ...................................................... 89
audit trail .................................................. 114

B
buffer use .................................................. 89
buffers ..................................................... 25
  concentration ........................................ 25
  information ........................................... 25
  use ..................................................... 89

cable connections ....................................... 54
capillaries
  guide ..................................................... 66
  install .................................................. 68
  Viper ................................................... 69
CE mark .................................................... 142
charged aerosol detector ............................. 30, 41
chloride concentration .................................. 26
chromatography troubleshooting ..................... 115
Chromeleon .............................................. 33, 92
  audit trail .............................................. 114
  instrument configuration ............................. 79
  Smart Shutdown ..................................... 97
  Smart Standby ....................................... 97
  Smart Startup ....................................... 88
  system setup ......................................... 79
Chromeleon 7 ............................................. 92
  automated module control ............................ 95
  client .................................................. 92
ePanel Set ............................................... 93
eWorkflow ............................................... 95
Instrument Configuration Manager ................. 79
Instrument Controller ................................ 79, 92
module control ......................................... 93
monitor baseline ....................................... 94
Sequence Wizard ...................................... 95
  cleaning ............................................. 106
condensation ............................................ 45, 59
connectors ............................................... 54
consumables ........................................... 133, 138

d
decontamination ........................................ 106, 107
delivery ................................................... 37
  Diagnostics .......................................... 125
digital I/O .............................................. 54
drainage ................................................... 70

e
ePanel Set ................................................. 93
equilibration ............................................ 88
eWorkflow ............................................... 95

f

FCC ......................................................... 143
flow connections
  drain system .......................................... 70
  overview ............................................. 65
  waste lines .......................................... 70
  fluorescence detector ............................. 30, 41
  flushing ............................................. 81


g
gloves ...................................................... 21
guide hole ............................................... 66
guidelines
  installation .......................................... 40
  maintenance ......................................... 103
  operation .......................................... 85

i
installation
  capillaries and tubing ............................... 66
  flow connections .................................... 64
  flushing ............................................. 81
  hardware setup ..................................... 46
  power connections .................................. 59
  power up ........................................... 78
  safety guidelines .................................. 40

Index
site requirements ........................................ 43
condensation ........................................... 45, 59
operating conditions .................................. 45
power considerations .................................. 44
power cord ............................................... 44
workbench ............................................... 43
Smart Shutdown ......................................... 97
Smart Standby ........................................... 97
Smart Startup ........................................... 88
solvent
  chloride concentration ................................ 26
  information ............................................ 25
  pH range ............................................... 26
  use ..................................................... 89
solvent rack .............................................. 31
  ship .................................................... 109
  transport ............................................. 109
specifications .......................................... 129
  solvent rack ......................................... 131
  system .................................................. 130
  system base .......................................... 131
startup ................................................... 88
status indicator
  LED bar .................................................. 114
  STATUS LED .......................................... 114
  STATUS LED .......................................... 114
system
  configuration ......................................... 30
  dismount .............................................. 109
  installation .......................................... 48
  locking ................................................ 63
  preparing for operation ............................. 87
  troubleshooting ..................................... 115
  unlocking ............................................. 61
system arrangement .................................... 46
system base ............................................. 32
  installation .......................................... 48
  safety symbols ...................................... 17
  ship .................................................... 109
system base lock ....................................... 61
system equilibration .................................. 88
System Interlink ........................................ 32, 54

T
transport .................................................. 109
troubleshooting ........................................ 113
  baseline ............................................. 121
  communication ...................................... 124
  flow .................................................. 119
general information .................................. 114
  ghost peaks .......................................... 116
  negative peaks ...................................... 116
  peak area precision ................................ 117
  power .................................................. 124
  pressure ............................................. 120
  retention time variation ............................ 121
  spikes ............................................... 117
  temperature control ................................ 123
tubing .................................................... 68
tubing bracket .......................................... 66
tubing chase ........................................... 66
tubing guides .......................................... 66

U
Universal Serial Bus .................................... 54
unlocking the system .................................. 61
unpack .................................................... 36
USB ....................................................... 54
USB drivers ............................................ 79

V
Viper fitting system .................................... 69

W
waste container ......................................... 73
waste lines ............................................. 70
WEEE ..................................................... 143